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Kramer, J. (23,750), 640
Krebs, L. (16,024), 200

LAGUS, R. (21,351), 320
Laidlaw, E. A., and Siemens Bros. and Co. (25,673), 940

Lake, W. E. (24,343), 120; (17,752), 320; (20,560), 400; (18,444), (20,357), 440; (19,514), 560; (23,669), 812; (24,154), 896
Lambert, W. R. (18,275), 160
Lancashire Dynamo & Motor Co., R. S. McLeod, and J. H. Wild (18,777), 320
Landis, and Gyr (22,592), 120; (22,591), 768
Lange, G. (18,479), 440
Langston, H. L., Electrical Power Storage Co., and W. H. Hanson (22,738), 728
Latham, H. R., and Graham & Latham, Ltd. (17,539), 360
Lawrence, B. (14,324), 120
Lee, G. P. M., and W. A. Brame (16,475), 240; (13,746), 320; (26,765), 728; (23,096), 768; (26,504), 984
Leiser, H. (22,041), 728
Leitner, H. (16,174), 40; (23,273), 360; (23,430), 768
Ljungstrom, F. (24,484), 240
Lodge, Sir O. J., and L. Lodge (29,268), 1,064
Loewenthal, J. (27,651), 360
Longford, H. G., and W. A. Clark (20,775), 200
Lowe, W. H. (27,634), 728
Ludwig Macho & Co. (16,900), 320
Lyons, W. J. (10,911), 80

McCALLUM, M., and W. Richardson (29,328), 684
McLean, M. A. (17,391), 40
McLeod, R. S., J. H. Wild, and Lancashire Dynamo & Motor Co., Ltd. (18,777), 320
McPherson, A. (20,464), 200
McQuade, A. K. (23,639), 768
Mackley, A. H., Adams Manufacturing Co., and A. H. Curtis (22,747), 768
Major, C. G., and Smith, Major, and Stevens, Ltd. (26,935), 896; (29,778), 984
Malcolm, J. A. (10,542), 40
Marino, P. (20,180), 560
,, Q. (12,642), 560
Markham, W. J., and H. H. Berry (22,118), 728
Marks, E. C. R., (18,109), 40; (23,150), 160; (15,961), 200; (15,958), 440; (12,592), 520
,, F. C. R. (22,258), 684
Marlor, L. H., T. G. Hann, and J. T. Foster (23,607), 812
Marr, A. (21,664), 640; (23,240), 768
Martin, J. (21,641), 684
Maschinenbau- Anstalt Humboldt (9,147), 120; (24,643), 200
Mascord, G. W. (19,661), 560
Maurice, G., and L. G. Byng (17,247), 160
,, G., and H. Hirst (29,350), 940
Mayer, L. H. (29,569), 40
McBerty, F. R. (25,174), 684
Meckel, A. (13,615), 80
Michaud, G., and E. Delasson (20,557), 240
Miller, J., and W. H. Ell (28,228), 120
,, H. P. E., and E. Tetlow (24,238), 896
Miram, K. (27,922), 200
Moller, E. (17,840), 360
,, E. C. (27,530), 640
Mollett, J. N., and E. E. Edwards (19,621), 80
Moretti, R. (16,164), 320
Morgan, D. J. (13,463), 240
,, Crucible Co., and C. W. Spiers (24,626), 684
Morisot, E. (29,176), 1,064
Morrison, W. (21,612), 684
Mort, J. E., and E. Warren (22,696), 400
Mountfort, L. F., and A. Bryan (19,203), 480
Moyes, J., and C. A. Stevenson (13,910), 40
Mueller, R. H., and G. Ellison (22,959), 240
Muir, F., and Etchells, Congdon and Muir (27,482), 728
,, J. M., and A. J. W. Munden (14,225), 40
Muller, A. R. (27,738), 560
Munden, A. J. W., and J. M. Muir (14,225), 40
Murray, J., and I. T. Nelson (27,911), 940

NASH, H. R. (23,451), 768
Nathan, J. (24,131), 600
Nehmer, F. (18,799), 240
Nelson, I. T., and J. Murray (27,911), 940
Neuburger, H. (23,887), 852
Nicholson, A. M. (24,136), 812
Noble, A. G. (25,487), 728
Nolon, A. L. C., 240
North, G. (16,730), 200

O'[illegible]HERTY, D. H. (25,531), 812
Oldham, O. (24,438), 600
Olsen, O. R., and S. K. Thoresen (24,691), 728
Ormrod, J. H., W. J. Purdue, and A. E. Otway (23,520), 440
O'Toole, J. J. (29,735), 320
Otway, A. E., J. H. Ormrod, and W. J. Purdue (23,520), 440

PAKENHAM, W. L. (24,361), 200
Palmer, F. (23,344), 600
Parker, W. J. (21,115), 440; (21,274), 560
Parkes, F. (20,805), 640
Pasqualine, L. (13,680), 40
Paxton, A. (14,547), 320
Pehrsson, C. E. (18,482), 400
Pensabene, N., and Electric Construction Co. (7,651), 200
Petithory, E. A., and Siemens Bros. and Co., Ltd. (25,237), 896
Pickard, T. B. (29,736), 40
Pinkerton, C. B., and A. E. Wason (21,974), 896
Pinney, H. A., and A. H. Taylor (19,921), 560
Pintsch, Akt-Ges., Julius (15,485), 160; (15,486), 200; (23,854), 812
Piper, H. J., and R. A. Bridgwater (19,064), 440
Plaisant, G. (26,177), 896
Plecher, A. (13,157), 240
Plohl, M. (18,893), 400
Pollak, A. (16,782), 480
,, J. E. (20,446), 320
Pollard, J. T., and R. Emmott (25,195), 940
Pope's Electric Lamp Co. (22,548), 768
Porak, I. (16,671), 160
Porter, H., G. Schaible, and F. Darragon (19,593), 560
Poulton, G. (22,209), 600
Prentice, H. B., and H. Atlay (23,014), 768
Price, S. L. (19,345), 728
,, W. A. (22,524), 768
Prim, A. W., and F. W. Roper (16,317), 240
Purdue, W. J., A. E. Otway, and J. H. Ormrod (23,520), 440
Purvis, W. B., and A. D. Gritman (26,344), 560

QUAIN, J. R. (22,854), 768; (26,548), 1,064

RAILING, A. H., and A. E. Angold (21,411), 80
,, M. J., and J. H. Collings (27,503), 896
,, A. H., and C. C. Garrard (21,120), 320
,, H. J., J. Strachan, and E. E. Hoadley (23,917), 360
Read, E., T. Gibson, and G. A. Farmer (22,494), 80
Renouf, E. de F. (29,453), 812
Reyrolle, A., & Co., and F. Coates (18,210), 400
,, A., & Co., and W. A. Harriman (13,997), 120
Richardson, S. T. (20,580), 320
,, W., and M. McCallum (29,328), 684
Riley, A. J. (23,404), 480
Roberts, A. E., and P. S. Turner (30,060), 440
Robin, J. T. (26,186), 984
Robinson, R., and A. Turpin (25,499), 896
Rolfe, A. (14,056), 640
Roothaan, J., and Ferranti, Ltd. (17,980), 360
Roper, F. W., and A. W. Prim (16,317), 240
Rose, A., W. Bellamy, and J. Dolphin (17,102), 160
Rosenberg, P. (28,772), 984
Rothwell, J. H., and W. Thomson (14,202), 120
Routin, J. L. (24,751), 360
Rouzet, L. (12,687), 560
Rushton, G., and H. G. Coventry (28,979), 896

ST. Croix Watson, A. H., and British Thomson-Houston Co. (26,597), 480
Samaia, D. (9,637), 160
Saqui, E., and S. A. Farrell (15,279), 200
Sarel, C. (26,639), 896
Schaible, G., F. Darragon, and H. Porter (19,593), 560
Schofield, L. (21,209), 1,064
Scholes, W. (13,401), 80
Scholler, L. (24,954), 120
Schreiber, H. P., and H. B. Van Daalen (17,306), 360
Schuler, L. (18,184), 320
Schwarzkopf, Dr. P., and Dr. S. Burgstaller (13,282), 600
Scott, E. K. (14,871), 360
Seropian, S. B. (26,603), 1,064
Severy, M. L., and G. B. Sinclair (19,870), 480; (19,869), 560; (19,868), 728
Sheen, S., and W. W. Timewell (20,295), 600
Shepherd, W. H., and A. E. McKechnie (11,479), 440
Sibley, J. T. (18,422), 440
Siemens Bros. & Co. (28,645), 80
,, Bros. & Co., and W. H. Grin[illegible]
,, [illegible]
[illegible] (25,673), 240
,, Bros. & Co., [illegible] Corney (28,646), 200
,, Bros. & Co., and E. A. Petithory (25,237), 896
,, Bros. Dynamo Works (18,013), 360
,, Bros. Dynamo Works, and R. A. R. Bolton (27,874), 480
Siemens Bros. Dynamo Works, and J. W. Howard (15,057), 40
,, Bros. Dynamo Works, and E. O. Kieffer (21,822), 684
,, and Halske Akt-Ges. (23,650), 120; (28,751), (29,891), 320; (18,498), 640
,, -Schuckertwerke Ges. (25,238), (25,831), 320; (20,439), 560
,, Schuckertwerke G. m. b. H. (28,483), 80
Simms, F. R., and Simms Magneto Co. (9,924), 360
Simplex Conduits, Ltd., and F. G. Taylor (24,586), 896
,, Conduits, Ltd., and L. M. Waterhouse (15,275), 80
Sinclair, G. B., and M. L. Severy (19,870), 480
Smith, C. (24,360), 768
,, C. C. (26,651), 360
,, H. (29,311), 600
,, Major & Stevens, Ltd., and C. G. Major (26,935), 896
Smits, J. M. (21,832), 440
Snook, H. C., and E. W. Kelby (24,046), 480
Sokoll, W. (15,216), 80; (15,404), 160
Somerville, J. M., and South Metropolitan Gas Co. (26,156), 896
South Metropolitan Gas Co., and J. M. Somerville (26,156), 896
Spiers, C. W., and Morgan Crucible Co. (24,626), 684
Statter, J. G. (25,606), 600
Staunton, R. C. (28,469), 896
Sterling Telephone & Electric Co. (22,450), 160
,, Telephone & Electric Co., and F. G. Bell (24,439), 896
Stern, G. B. (21,725), 160
,, S., and the British Ever-Ready Electrical Co. (29,302), 120; (19,451), 480; (19,318), 480
Stevenson, C. A., and J. Moyes (13,910), 40
Stockdale, R. H. (15,548), 200
Stone & Co., J., and A. H. Darker (13,785), 80
Stout, A., and M. J. Hoppock, Junr. (22,231), 40
Strachan, J., E. E. Hoadley, and H. J. Railing (23,917), 360
Stubling, A. C. (28,846), 320
Sunderland Forge and Engineering Co., Ltd., H. D. Wright, and W. Blair (13,797), 80
Suter, F. W. (25,536), 600

TAYLOR, A. M. (16,830), 120
,, A. H., and H. A. Pinney (19,921), 560
,, F. G., and Simplex Conduits, Ltd., (24,586), 896
,, J. D. (26,351), 360
Terry, F. H., H. M. Bigwood, and Brotherton Tubes & Conduits, Ltd. (26,953), 1,064
Tetlow, L. J. (16,549), 480
,, E., and H. P. E. Miller (24,238), 896
Thomas, G. E. (26,396), 728
,, J. G. P., and Thomas Transmission, Ltd., (17,130), 360; (24,618), 896
,, Transmission, Ltd., and H. F. Haworth (14,396), 120
Thommel, G. (24,165), 812
Thompson, W. P. (26,323), 560
,, W. A., H. W. Burbery, and E. N. Hillier (24,596), 240
Thomson, W., and J. H. Rothwell (14,202), 120
Thoresen, S. K., and O. R. Olsen (24,691), 728
Timar, L., and O. Denes (24,647), 360
Timewell, W. W., and S. Sheen (20,295), 600
Tirrill, A. A. (22,419), 440
Truss, H. F. J. (23,453), 200
Tucker, J. H. (19,642), 360
Tullett, A. H. (20,671), 400
Turner, H. S. (22,807), 120
,, P. S., and A. E. Roberts (30,060), 440
Turpin, A., and R. Robinson (25,499), 896

VAN Daalen, H. B., and H. P. Schreiber (17,306), 360
Vandervell, C. A., and A. H. Midgeley (17,838), 80
Vassberg, G. A. (24,550), 896
Venner, R. F. (12,569), 40; (23,082), 768

W[illegible]-Ges. "Wesp" (14,269), 120
Wall, G., and Ferranti, Ltd. (22,339), 684
Wallace, R. W., and E. Wassmer (18,449), 984; (18,450), 984
W[illegible] (22,830), 768
[illegible] 896
(18,449), 984; (18,450), 984
Waterhouse, L. M., and Simplex Conduits, Ltd. (15,275), 80
Watson, A. H. St. C., British Thomson-Houston Co., and E. Garton (27,758), 896; (27,235), 984
Welsh, A. (24,722), 768
Western Electric Co. (17,858), 160; (15,952), 240; (25,342), 940
Westinghouse Machine Company Gesellschaft (26,285), 100
Welsh, A. C. (23,429), 1,064
White, C. Grahame, and H. Fothergill (16,302), 320
,, W., P. Dawson, and R. H. Houghton (14,142), 400
White, W. D. (25,625), 40
Wicker, C., and L. J. Aron (9,174), 200
Wight, H. D., W. Blair, and Sunderland Forge and Engineering Co., Ltd. (13,797), 80
Wild, J. H., Lancashire Dynamo and Motor Co., Ltd., and R. S. McLeod (18,777), 320
Wilkie, J. (18,060), 160
Wilkinson, F. A. (24,953), 940
,, G. (19,543), 940
,, A. H., G. W. Beech, and J. F. Beech (24,211), 812
Williams, S. D. (25,642), 440
Wilson, D. H. (26,752), 1,064
Winterhalder, R. (19,164), 80
Wortmann, W. (20,185), 560
Wyche, E. M. (29,597), 1,064

YOUNG, P. (22,852), 728
,, A. P., and British Thomson-Houston Co., Ltd. (14,378), 40

ZIVNOSTENSKA Banka v. Praze (16,374), 120

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ACHENBACH, J. A. E. (832), 728
Akt-Ges. Brown, Boveri et Cie (6,036), 940
,, für Anilin Fabrikation (13,901), 600
Aktiebolaget L. M. Ericsson & Co. (11,658), 520
Allard, A. J. (6,185), 600
Allcock, W., and Sterling Telephone and Electric Co. (15,566), 1,064
Allgemeine Elektricitäts Ges. (3,680), 280; (14,048), 440; (6,934), 520; (14,433), 520; (7,896), 728; (16,391), 940
Ambrose Shardlow & Co., and W. H. Moore (3,487), 984
Anderegg, G. A., and O. B. Blackwell (2,508), 200
Anderson, V. (2,507), 440
Andrews, D. H., and E. C. Ketchum (17,725), 1,064
Angus, A. R. (6,330 and 6,652), 200
Aron Elektricitatszahlerfabrik Ges. (11,277), 360; (16,753), 940
Arpin, C. (10,403), 940
Ash, B. F. (19,496), 940
,, Claudius & Sons & Co., Ltd., A. B. Jones, and W. G. Lee (2,697), 200

BAKER, T. T., and G. E. Heyl (3,057), 940
Bally, J. (16,011), 768
Balsillie, J. G. (15,674), 940
Banes, A., and J. Weiss (1,285), 120
Baudisch, J. (17,563), 728
Becker, F. A. (19,029), 560
Beckmann, E. (130), 200
Bergmann Elektricitäts Werke Akt-Ges. (5,317), 280; (2,778), 320
Betulander, G. A. (4,792), (6,465), 684
Biquard, R., H. Cheron, and H. Dominici (13,822), 940
Blackwell, O. B., and G. A. Anderegg (2,508), 200
Blake, F. R. (4,381), 280
Block, L. (411), 80; (2,215), 600
Bloxham, A. G. (6,551), 940; (16,709), 1,024
Booth, E., and N. R. Booth (1,002), 600
Bosch, R. (4,692), 320; (9,264), 1,064
Bourne, C. W. D., F. Whipp, and S. Whipp (2,233), 280
Boutard, H. C. E. (5,546), 640
Bowden, J. H., and H. F. J. Thompson (1,496), 200
Boyd, W. B., and J. B. Tannahill (19,551), 1,024
Brimsdown Lamp Works, Ltd., and G. Ludecke (6,952), 320
British L. M. Ericsson Manufacturing Co., and A. G. Rogers (5,626), 684
,, Thomson-Houston Co. (148), 560; (9,985), 684; (4,945), 896; (5,961), 984
,, Thomson-Houston Co. and E. B. Wedmore (6,807), 560
[illegible] W. H. (15,585), 940
Brooks, W. Holt, and Brolt, Ltd. (15,585), 940
Brown, A. W. (178), 80
Brunke, F. (7,275), 960
[illegible] 896
[illegible] 896

CAHUCITWERKE Nürenberg (14,870), 940
Cerebotani, L. (9,833), 360
Chabeault, E. (1,444), 360

Chapman, W. C. S. (7,575), 360
Charles, W. J. (16,151), 768
Cheron, H., H. Dominici, and R. Biquard (13,822), 940
Chetwynd, L. W. P., and Dent & Co., and Johnson, Ltd. (6,702), 560
Chiger, S. (10,559), 728
Chubb, L. W. (2,146), 320
Clark, E. J., and Hart Accumulator Co. (2,908), 280
Clemens, J. G., and Monarch Refillable Fuse Co. (3,573), 520; (3,574), 560
Clerk, H. E., and W. H. Gwynn (10,153), 896
Close, J. (2,546), 560
Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston (5,020), 80
,, pour la Fabrication des Compteurs et Materiel d'Usines a Gaz and Brocq (8,601), 280
,, pour le Traitement des Metaux et des Minerais par Electricité (12,444), 940
Conner, M. S. (3,987), 1,064
Conrad, F. (12,471), 896
Cooke, H. S., and F. Westwood (13,140), 280
Cortez-Leigh, F. A., and G. Broughall (7,996), 440
Creighton, E. E. F. (5,662), 768
Crompton & Co., and H. Burge (3,227), 600
,, and Co., and C. Crompton (237), 40
Cunnington, J. H. (7,755), 560

DECKER, O. (8,878), 440
Declere, J. J., A. L. E. Gresy, and G. Pascalis (13,109), 768
Dekker, N. H. M. (7,328), 360
Despessailles, F. (11,850), 896
Displayer Co., and T. C. Walter (12,218), 560
Dodson, L., and C. G. Nobbs (8,584), 984
Dominici, H., R. Biquard, and H. Cheron (13,822), 940
Dos Santos, M. C. (11,243), 940
Doughty, J. M. (10,422), 812
Dubilier, W. (16,917), 520
Du Bois, H. M. (1,420), 360; (1,439), 360
Duddell, W., H. W. Handcock, and A. H. Dykes (1,395), 400; (6,772), 520
Dunne, P. (10,900), 1,064
Dykes, A. H., W. Duddell, and H. W. Handcock (1,395), 400; (6,772), 520

EARL, H. D. (9,278), 984
Eckmann, S. (9,174), 280
Eichert, F. (17,922), 940
Electric and Ordnance Accessories Co. and E. Howell (5,836), 896
Elektrizitatswerk Lonza Akt., Ges. (3,575), 40
Electromechanische Industrie Ges. (5,646), 120
Electromotor Equipment Co., and A. J. Barlow (11,069), 940
Electrotechnische Fabrik Schaffer & Co. (12,813), 940
Ellison, G. (12,710), 896
,, G. and M. H. R. Mueller (12,882), 768
Elster, J. (4,847), 440; (3,466), 560
Engle, G. S. (3,861), 280
Evans, H. and St. Helens Cable and Rubber Co. (6,242), 560
,, U. R. and E. K., Rideal (1,776), 984

FAIRBURN, C. E., Siemens Bros. Dynamo Works, and F. Lydall (15,149), 940
Ferguson, A. and J. A. Gardener (13,793), 940
Ferranti, Ltd., and R. Weaving (12,935), 560
Forster, H. (10,085), 280
Fowler, J. V. (3,266), 896
Franklin, C. S., and Marconi's Wireless Telegraph Co. (4,514), 984
Franz, R. (15,502), 520
Freitag, E. (14,306), 1,024
Fried., Krupp, Akt.-Ges. (1,407), 640; (17,925), 1,264

GALLOWAY, C. D., Junr. (2,402), 684
Gambrell, T. E. (4,862), 896
Gardener, J. A., and A. Ferguson (13,793), 940
Garretson, E. (7,288), 280
Geb. Siemens & Co. (7,932), 520; (7,108), 768
Ges. für Chemische Industrie in Basel (11,872), 640
,, für Elektro-Osmose and G. B. Schwerin (10,873), 280
Giles, C. (15,951), 940; (6,359), 1,064
Goodwin, A., and C. A. Vandervell (14,942), 940
Gordon, W. W., and J. Wright (13,694), 560
Gorton, W. E. (608), 280
Graeger, A. C., and M. Heinig (4,957), 560
Graham, E. A. (4,197), 200; (2,022), 812
,, E. A., and W. J. Rickets (2,610), 360; (1,049), 560
Grant, R. W., and Knowles Oxygen Co. (1,812), 940
Grasme, F. C. (4,665), 120
Gresy, A. L. E., G. Pascalis, and J. J. Declere (13,109), 768
Grigsby, B. J. (3,014), 684
Grissinger, E. (2,930), 280
Gruneberg, F. (6,156), 440
Guiterman, K. S. (8,352), 600
Gwynn, W. H., and H. E. Clerk (10,153), 896

HANCQ, J. (7,570), 440
Handcock, H. W., A. H. Dykes, and W. Duddell (1,395), 400; (6,772), 520
Hansen, F., and W. F. Mohr (3,525), 120
Harden, T., and Metal Jointing Co. (9,752), 984
Hart Accumulator Co., and E. J. Clark (2,908), 280
Hartmann and Braun Akt.-Ges. (6,570), 440; (8,602), 560
Haskell, C. O. (8,395), 280
Heaton, T. (4,707), 728
Hedlund, M. (16,262), 940
Heinig, M., and A. C. Graeger (4,957), 560
Helbronner, A., V. Henri, and M. von Recklinghausen (13,490), 940
Helfenstein, A. (2,577), 1,064
,, Elektro-Ofen-Ges. (9,590), 1,064
Henderson, J. C. A. (1,156), 640
Henri, V., M. von Recklinghausen, and A. Helbronner (13,490), 940
Heinze, J. O. (10,894), 684
Herrmann, C. B. (8,198), 280
Heyl, G. E., and T. T. Baker (3,057), 940
Hill, R. N. (2,612), 728
Hirst, H., and J. Strachan (2,636), 728
Hitzelberger, G. F., and New British Everready Co. (13,175), 1,024
Hodgson, F. (6,901), 984
Holland, F. (15,116), 1,064
Holt, W., Brolt, Ltd., and Brooks (15,585), 940
Horne, W. C. (764), 812
Hovland, A. N. (10,472), 728
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THE

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SCIENCE AND INDUSTRY.

IN opening the new buildings at the National Physical Laboratory last week, Mr. Balfour laid aside the politician and assumed once more the rôle of the philosopher, a part for which, by temperament and erudition, he is most admirably adapted. He declared that measuring was the very life blood of physical science, and lay at the root not only of all great discoveries, but also of their application to practice; it followed, therefore, that such work as that of the Laboratory was essential to the prosperity of a great manufacturing country. It could not be done by the manufacturers themselves, as the institution must act in a judicial and absolutely impartial capacity, and, moreover, it was of the greatest advantage that a manufacturer should have at command the services of a staff of the very highest scientific attainments and a first-class equipment without excessive outlay. Further, the objects of the Laboratory included original research, and he wished that a larger proportion of its energies could be devoted to that purpose, for it was to the results of pure scientific investigation, without an eye to the practical applications of its fruits, that mankind was most deeply indebted for all great advances in industrial knowledge and practice.

We have no doubt that there are many who will quarrel with the latter part of Mr. Balfour's address. It is, indeed, impossible to generalise on so complex a subject without over-running the bounds of accurate statement.

For example, it cannot be suggested that such inventions as the steam engine or the spinning jenny were due in the remotest degree to scientific research. They were produced by men of modest attainments to cope with urgent needs, and, like some similar inventions, have exercised a fundamental influence upon the industries of this country in particular, and the world in general. But, on the other hand, it cannot be denied that many modern industries and conveniences are based entirely upon the work of men whose sole purpose was to investigate the hidden mysteries of nature and science for their own sake alone, who sought no profit or material advancement, and who in most cases, to our shame be it said, received no adequate reward for their single-minded and unselfish labours. Such men were Newton, Faraday and Maxwell, to name but three of our most eminent investigators. We of the electrical world in particular are most deeply indebted to pure science, for our whole industry is founded upon it; the dynamo, the telegraph, wireless telegraphy, the Röntgen rays, the electric lamp, were all the direct offspring of pure physical research, and to these might be added many other examples, such as radium and the fixation of nitrogen, all of which have had, or will have, an immense influence upon the future of the human race.

We may, in fact, divide the field into two great areas—that of discovery, on the one hand, which is the object of pure research; and that of invention on the other, which often in the past has been, and still more frequently in the future will be, the indirect result of the former.

We do not doubt that every real advance in physical science will sooner or later bear fruit in applications for the use and convenience of man, and this is the true justification for the prosecution of research. We therefore cordially join with Mr. Balfour in the hope that as times goes on the public will come to realise the enormous importance of pure science, and will provide such an institution as the National Physical Laboratory with ample means not only to carry on its invaluable commercial work, but also to extend its researches freely into every department of pure physics.

Lead.

Some very sharp fluctuations have been seen in lead lately, which were impelled by the heavy selling of an important firm of dealers, and from close upon £22 a ton for early delivery on June 19th, the price collapsed to £19 a ton on June 28th. The cause of the selling on the scale witnessed, fully 3,000 tons having been disposed of on the open market on Thursday and Friday of last week, is something of a mystery, but there were vague and unconfirmed rumours that the Mexican position had been much straightened out. In the absence, however, of definite assurances to this effect, it would appear that there was something behind the selling of which people generally are ignorant. There is, however, just a suspicion that the sales were merely of a "hedging" variety in connection with certain large German producing interests, though it must be granted that the theory is not entirely satisfactory. Rather more lead has become available of late owing to arrivals from Spain, but for all this there is no sign of any accumulation of material, and the overseas demand remains quite good, while large quantities of metal are yet required to complete old contracts. As was pointed out in a recent article, however, the present price of lead is high, and it gives consumers no encouragement to purchase ahead of actual needs.

Trade demand naturally remains restrained under the circumstances, but may possibly awaken, provided the adverse elements which have been weighing upon metals generally be removed. The fact of it is, that at high prices, every commodity sooner or later becomes vulnerable to selling pressure, whether the pressure be warranted by the actual condition of affairs or not. A heavy fall has lately been witnessed in all metals, regardless of merits, and lead has suffered in sympathy with others. Intrinsically there seems to be nothing really amiss, but at the same time, as was pointed out before, "when the news comes that the political troubles in Mexico are over, one of the first things will be a readjustment of lead prices in consonance with the altered position." In the long run high prices are an impediment to trade, and the present tendency is towards a lower level, but all the same for this, so far as lead is concerned, a long view does not encourage high hopes of a very important extension of supplies from producing countries, the world's material coming to a great extent from well-known and well-defined mineral areas, the development of new grounds being comparatively insignificant.

The Broken Hill Proprietary Co. for this year up to June 4th produced 38,149 tons of lead against 35,436 tons last year, and the Sulphide Corporation up to April 17th, 4,720 tons against 7,022 tons in 1911. For the whole of last year the Penarroya Co., of Spain, which for the last half of the year included also the output of the mines and smelters of the Escombrera-Bleyberg Co. turned out 70,595 tons, the joint output of the now amalgamated properties in 1911 being 67,074 tons, while that of the Malfidano Co. in France was 6,709 tons against 7,832 tons, and that of the French Laurium Co. 11,039 tons against 10,253 tons in 1911. The British imports for the five months ended May 31st were 91,417 tons compared with 91,221 tons last year, and 86,467 tons in 1910. The total exports of English and foreign lead for the five months were 26,817 tons against 21,937 tons in 1911, and 28,199 tons in 1910. The following figures show some of the more important movements in respect of supplies this year, so far as they are at present available.

British imports from Mexico, five months, 8,033 tons, against 9,315 tons in 1912 (decrease 1,282 tons); Spain, five months, 31,755 tons, against 37,659 tons in 1912 (decrease 5,904 tons); Australia, five months, 29,904 tons, against 23,627 tons in 1912 (increase 6,277 tons); U.S.A., five months, 11,609 tons, against 13,243 tons in 1912 (decrease 1,634 tons).

Exports from Spain, three months, 51,010 tons, against 43,695 tons in 1912 (increase 7,315 tons); Belgium, four months, 26,957 tons, against 18,475 tons in 1912 (increase 8,482 tons); U.S.A. to Europe (Mexican lead), four months, 13,972 tons, against 18,989 tons in 1912 (decrease 5,017 tons).

News now comes that the Convention for regulating the sale of soft pig lead in Europe has been renewed for a period of three years. The Convention came into being about the middle of 1909, and was to expire on June 30th, 1913, unless renewed by the parties to it. The Convention is between the Broken Hill Proprietary Co., the American Smelting and Refining Co., the Penarroya Co., the Figueira Co. and the Metallgesellschaft. The last-named concern act as selling agents, and take all the lead produced from the mines at the monthly average price given in one of the London commercial newspapers. The average selling price in London during the seven months of the Convention's operations in 1909 was £12 18s. 7d.; in 1910, £12 19s. 1d.; in 1911, £13 19s. 3d.; and in 1912, £17 15s. 10d. The Convention is understood to have been renewed for a period of three years.

Municipal Parsimony.

In a recent issue we referred briefly to the action of the Corporation of Dublin in denying to the staff of its electricity department the due reward of their labours. We make no apology for returning to the subject, for, on further investigation, we find that the decision was even more flagrantly unjust than it appeared at the time.

The chief question was the revision of the salaries of the city electrical engineer, the deputy city electrical engineer, and the chief engineer of the distribution department. It may be remembered that in 1905 the City Council decided to dispense with the services of a consulting engineer, and place the whole of the responsibility for all future work upon the chief engineer, Mr. Mark Ruddle. In spite of the additional burden thus imposed upon him in 1906, the Council only increased his salary by £150 a year, an advance which would have been fully justified by the normal growth of the undertaking, and although engineering fees were saved to the tune of some £20,000 by placing the work in Mr. Ruddle's hands, he has not received one penny in acknowledgment of his special services in a consulting capacity. Moreover, his present salary, £750, is below that paid in other cities where the undertaking is of equal magnitude.

The deputy engineer, Mr. L. J. Kettle, not only effected substantial economies in generating costs, but also assisted the chief in carrying out the extensions of plant, for which extra work he has received no payment; and the distribution engineer, Mr. G. Archer, has likewise received no increase in his modest salary since 1910, although his duties have very greatly increased.

All these and other facts were embodied in the report of the Electricity Supply Committee to the Council, justly recommending a substantial increase in each case; yet the Council decided that the matter should be deferred till December next (which practically means a flat refusal). Surely the men deputed to control the destinies of so important a city should be capable of appreciating the fact that an undertaking representing a capital outlay of £750,000—half of which has been expended under the direction of their own engineer—and requiring the highest technical skill and commercial ability for its successful management, cannot be conducted on the lines of a grocer's shop! An efficient technical staff is essential; and having such a staff, it is to the best interests of the undertaking to make it worth their while to stay. We hope the Council, on further consideration, will realise the facts of the situation, and do justice to those who have brought the undertaking into a prosperous condition.

NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Cawnpore Municipality have before them a scheme for the extension of the electric lighting of the city. They propose to accept an offer from the Electric Supply and Traction Co. to erect 800 additional street lights at a capital outlay of half a lac of rupees, the Municipality in turn to remit the track rent charged for the tramlines for a certain number of years. This proposal now awaits sanction of Government.

The Lucknow Municipality are still considering their electric lighting scheme for the city. Several schemes have been drawn up but none have yet crystallized. Years ago there was a military cantonment scheme, which was to eventually embrace the city area. Tenders were actually called for and a sum of money budgetted; but report has it that Lord Kitchener diverted the money to some other channel. Subsequently a special engineer was sent to work out another scheme for the city only; this, apparently, was pidgeonholed. A third attempt was made last year, and a company willing to take out a licence under the Indian Electricity Act was formed and its proposals were put up before Government, but as yet nothing definite has been arranged. There are several private installations within the Civil Lines, and most of the big Government officials' houses are connected up for fans and lights, hence, possibly, the half-hearted and free and easy way that the city lighting scheme, which eventually must come, is progressing. To illustrate how points are stretched to meet the convenience of high officials, it may be noted that the Chatter Munzil Club installation, which is 110 volts pressure, is about to supply current to the Nazul Offices which are at least a mile distant.

According to the *Calcutta Statesman*, the Port Commissioners are placing an order with Messrs. John Grieve and Co. for five electric cranes for the new No. 9 jetty, at a cost of £3,700, f.o.b. Glasgow. In the sanctioned estimate for the new jetty berth a sum of Rs. 60,000 was included for five hydraulic wharf cranes, but it was subsequently found that without extending the hydraulic installation there would not be sufficient power to work these cranes. Tenders were accordingly invited locally and through the London agent for five electric cranes with luffing jibs. The chief engineer recommended the acceptance of the lowest tender, that of Messrs. John Grieve & Co. This firm had already supplied the Commissioners with the three travelling electric yard cranes at berths Nos. 7 and 8, which were working very satisfactorily.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Accidents in Electric Lifts.

Mr. Harmsworth's remark that the locks manufactured by his firm "reach all the requirements of practical safety," remind one of Kant's famous philosophical breakdown! Kant, is will be remembered, threw over "pure" reason when such became inconvenient, and turned to his doctrine of "practical" reason.

Mr. Harmsworth, it appears, gives up "absolute" safety, presumably because such has been difficult of attainment, and takes up "practical" safety. It is surprising that a firm such as Messrs. R. Waygood & Co., who have been so long in the field, should be satisfied with a lock which is not, as plainly acknowledged by Mr. Harmsworth, absolutely safe. "Practically" safe is not near enough, and a good lock should not allow even of unlikely contingencies, as apparently, from Mr. Harmsworth's remarks, Messrs. R. Waygood & Co.'s lock does.

Mr. Barlow mentions the number of springs included in this lock, but the total number of parts is—well—astonishing! Mr. Barlow has already emphasised the objections against the unlocking of the gate when the cage passes. This is a real source of danger, and must not be allowed to be covered up (notwithstanding Messrs. Smith, Major & Stevens's great "umbrella" illustration!) on account of its not being taken into account by most of the locks now on the market. Many locks now fitted fail utterly when called upon to open a 400-volt circuit while the lift is running, as an arc is drawn between the contacts, with the result that the lift continues to run with the gate open.

It is to be regretted that Messrs. Smith, Major and Stevens (and others) do not realise these points, but even if they consider the unlocking of the gate as the cage passes an "irritating annoyance," one would think that one of their many improvements would include as standard practice a means to overcome this nuisance. But apart from all this, I am willing to grant that "until a few weeks back" the lock covered by patent No. 2,766 was the best on the market, and is now second only to the one which has been much referred to by myself.

W. J. F. Cooper.

London, *July* 1*st*, 1913.

The danger that appears to be so obscure to Messrs. Smith, Major & Stevens is mentioned quite clearly by Mr. Carroll and by Mr. Barlow in your last (27th inst.) issue, and arises from just that succession of gate-securing operations which Messrs. S. M. & S. claim to have pioneered eight years ago—viz., "first, latching; secondly, closing the switch; and lastly, counterlocking."

I hold that "closing the switch" should come last in order of time, for the obvious reason that if this is made rigidly subsequent to the counterlocking, and the counterlock fails to act, then the switch cannot be closed, and nothing more serious than a stoppage of the lift will result.

The opening of the landing gate when the lift is passing is certainly in itself more a nuisance than a danger, but is it not clear that a lock that allows this to happen must be of such a type that its mechanism might fail to lock the gate when the cage moved away from the landing, owing, perhaps (as Mr. Carroll points out), to a broken spring or a bent or otherwise jammed spindle?

Mr. Harmsworth mentions the nuisance of the lift being stopped by anyone pulling on the gate. His remarks on the danger referred to above would be interesting.

Helicon.

London, S.E., *June* 30*th*, 1913.

Proposed British Engineering Staff Association.

I agree with "Vertebra" in your current issue. "Box Numbers" are often an infernal nuisance. I agree with Mr. Douglas, but suggest that the proposed Association should be for defence, and not for offence. But one is bound to pause when "W. E. P." infers that the use of such an Association is questionable, for is not all evidence quite the other way? Indeed, modern life tends ever towards co-operation—religious, political, industrial. The engineering employers were not by any means the first to recognise the value of such unity, but their recently-formed B.E.A.M.A., I.M.E.A., and the Electrical Contractors' Association, are hardly monuments to its principles. Perhaps "W. E. P." is himself a manufacturer. His suggestion that our objects could be attained in the hands of the I.C.E., I.M.E. and I.E.E., almost indicates so much.

Do let us keep to our aims. The proposed Association is for the mutual *protection* of engineers—mechanical, civil, electrical—and will specially concern those gentlemen who are attached to the staffs of manufacturing firms. Such combination has been expedited by the belief that our employers have it now in their power to minimise salaries, and to dictate as to where and when, and how an engineer shall be employed. Letters in your recent issues have made that clear.

I understand it is proposed that membership of the Association be confined to those mechanical, civil and electrical engineers who, in general, have had an engineer-

ing training as pupils in some recognised college, school, or consulting office, or in an engineering or electricity works. Special cases could be considered on their merits, since there are not a few engineers in responsible positions, who have had neither a technical nor practical pupilage in the accepted sense of the term. And this latter class could very well include draughtsmen, many of whom are so closely associated with engineers, and are capable of filling good appointments. It would seem inadvisable to exclude such gentlemen solely because they have no proof of such training ; but that could be for the official committee to decide. It is the writer's personal hope that a separate section will be formed on their behalf. Honorary members who approve of, and wish to promote, the objects of the Association might also be admitted, minus the voting power of the ordinary member.

As to subscription, Mr. Douglas gives a fair rate. At present, the probable amount of this may tend to prompt certain gentlemen to withhold their support. Thus the subscription should be kept as low as possible, probably ranging downwards from a maximum of one guinea per annum. Engineering students and apprentices might even be admitted without voting power at about 5s. per annum, as the benefits they could receive from the Association later might be proportional to their length of membership.

When one considers Mr. Fletcher's suggestions, which you were good enough to print in your recent issue, the Association should soon find itself busy. Its secondary aims alone leave much to be attempted. Always, of course, it must do its utmost to maintain and to improve the status of its members. A bureau could be formed to give information free of cost to members regarding firms and working conditions at home and abroad, supplemented by a list of appointments vacant and required. Such a list should be of equal use to employers also. Free professional, legal and patent assistance should likewise prove of great benefit. There is no doubt that a patentee would welcome such help, and perhaps the wide resources of the Association could facilitate the best sale of his rights.

Whether the Association could successfully maintain remuneration proportional to the duties and responsibilities of its members remains to be seen. It should certainly try to eliminate some of the wretched salaries which are offered, often enough without justification. There might even be a written or an unwritten rule that no member should accept a position, incompatible with his knowledge and previous income, until he secures the advice of the Association. A good deal might also be done to promote social intercourse, so beneficial to certain engineers.

At first the Association could scarcely be expected to give much monetary assistance to its members. But this consideration is equally important. If possible, the funds might grant special emergency assistance at least without interest. Financial help might also be given to those who happen to be disengaged. The amount distributed in this way by Continental Associations is, I believe, appreciable ; but all such considerations will doubtless be investigated by the proper Committee.

In conclusion, I would urge all prospective members to send in their names at once, mentioning their firm, to Mr. Fletcher, the hon. secretary, at 31, Queen Victoria Street, London, E.C. Don't "wait and see." Support the movement at the outset, and make the best start. And please don't expect a reply by return. It will take some time to acknowledge all letters received.

A.M.I.E.E.

June 30th, 1913.

My attention is drawn to a short leader in Friday's *Electrician* in respect of a letter which appeared recently in your own columns. Merely by way of comment thereon, perhaps you will be good enough to let me say that what was "suggested" by a previous correspondent would now appear to have become an "allegation" of my own. I am afraid I fail to see just why it should, and presume that the misconstruction was simply an oversight. Nor can I imagine how the *Electrician* justifies its apparent contention that the score or so of gentlemen who are most keenly interested in the inception of this Association, should seek to endanger their position, prospects and private resources by "disclosing their personality," and by proof of this or that at this stage.

It is likewise noteworthy that your contemporary would appear to infer that proof of the everyday actions on the part of our industrial "rings" can be set down readily in black and white. When you yourself so obliged us by the publication of my letter, it was surely obvious that, for some time at any rate, it was desired to guard the "names and addresses" of those responsible gentlemen who are leading the movement. Perhaps you even appreciated the view that up to now our employers have not been expected to encourage such federation, and that an attempt to prove or to disprove anything at present would be altogether too risky.

With all respect, one can only hope that the *Electrician* will be patient for another month or so. At the same time, I am instructed to say that we will reply as soon as we can to all the gentlemen who have so kindly written to us.

L. H. Fletcher,
Hon. Acting Secretary Proposed Association.

31, Queen Victoria Street, London, E.C.
June 30th, 1913.

A Wiring Job.

I think the following may prove of interest to you. An electric lighting contract recently executed in the suburbs of London, under the supervision of consulting engineers, has been carried out in the following manner : Steel tubing from switch boxes is sunk in the walls and carried up into the roofs, then wood casing is used, and in order to save cable three-plate ceiling roses are fixed to the casing and used as connectors. Now can you wonder at fires occurring as long as this is allowed ? The same thing applies to work done in subways on this job. The tube is not bonded.

A. H. Marshall.

London, E., *June 27th*, 1913.

A Preposterous Requirement.

I have just completed a country house job. The voltage is 25 ; I ran V.I.R. cable from dynamo to switchboard, on porcelain cleats.

The fire insurance company concerned now require this to be put in steel conduit, and, moreover, the *conduit must be kept 2 in. clear of all woodwork.*

Considering that conduit is universally run on wooden joists throughout the country, I look on this as a piece of sheer wantonness. What do your readers think ?

I know this, that I shall carefully inquire beforehand in future as to which insurance company is concerned, and in any case in which the policy is taken with this particular company, I shall quote substantially higher than otherwise, with a clause making a good reduction should my customer change over to a more reasonable company.

A. O. G.

Electrolysed Sea-Water for Public Baths.—The water of swimming ponds which are frequented daily by many bathers becomes highly charged with bacterial organisms as a result of such use. A freshwater pond containing 100,000 gallons in use for one day only, but which had been used by 380 bathers, contained 342,400 bacteria per cubic centimetre of water at the end of the day, the average number of bacteria in the clean water used to fill the pond being less than 500 per cubic centimetre. Poplar last year produced and distributed 53,063 gallons of electrolysed sea-water, costing about £2 per 1,000 gallons, and so efficient is it in its sterilising action, that 30 gallons added to a swimming pond of 85,000 gallons capacity on first filling, together with subsequent additions at intervals of two or three days, is sufficient to keep the water clear and free from noxious bacteria. The fluid is stable, non-caustic, non-poisonous, and harmless to the fabric of clothes.—*Medical Press.*

Maturing Cheese by Electricity.—An industrial electrician of Rotterdam is reported to have discovered a method of giving age to cheese by means of electricity. He takes a fresh cheese and subjects it to an alternating current. At the end of 24 hours it is said to possess all the properties of a fine two-year-old cheese.—*Grocery.*

THE ELECTRICAL WORK AT THE NATIONAL PHYSICAL LABORATORY DURING THE YEAR 1912.

On Thursday last week the new buildings, consisting of laboratories for metallurgy and optics, and an administration building, completing the scheme planned in 1909, were formally opened by Mr. A. J. Balfour, and afterwards the visitors inspected the new buildings, and were entertained with light refreshments.

The extensions have been erected at a cost of some £35,000, of which £15,000 was contributed by the State, and £10,000 by the late Sir Julius Wernher, supplemented by further contributions from Lady Wernher, £5,000 from the Commissioners of the 1851 Exhibition, and sums received from the Drapers' Company and others. At least £5,000 is still required for the necessary equipment.

Sir Archibald Geikie, President of the Royal Society and Chairman of the General Board of the Laboratory, presided at the opening ceremony; Dr. Glazebrook, Director of the Laboratory, briefly explained the purpose of the new buildings and the necessity of further donations, remarking that from the commencement the Board had pursued a policy of faith in the future; and Lord Rayleigh added further particulars. Mr. Balfour in his speech emphasised the necessity of exact measurement, to enable our manufacturing industries to keep pace with those of our rivals; he explained also that it was essential that the Laboratory should be conducted by an entirely impartial management rather than by the manufacturers themselves, and strongly urged the importance of research in pure science, to which all great advances in industry were due. Col. Seely proposed a vote of thanks to Mr. Balfour in terms of the highest eulogy, and expressed the indebtedness of military aviation to the Laboratory for discoveries which had undoubtedly saved the lives of many brave men.

The visitors afterwards broke up into parties to inspect the various departments. Interesting work was in progress in the electrotechnical sections, to which we shall refer at a later date when the results are available for publication. In the meantime, we subjoin an account of last year's work as given in the annual report of the Director.

The Lorenz apparatus was completed during the year, and a number of resistance measurements have been made by means of it. The measurement of the dimensions of the four coils was undertaken, the results showing the coils to be very nearly circular in cross section, the maximum difference between the diameters in any one plane being about three parts in 100,000. All of the coils are slightly conical, the difference between the mean diameters of the ends amounting to about one part in 10,000. The change in the dimensions of a coil was determined when currents of 1 and 2 amperes were passed through it for a period corresponding to that employed in a measurement of resistance by means of the Lorenz apparatus. The results are of considerable interest, and show that it is necessary to take the expansion into account when precision measurements are being made. Constancy of speed is obtained by applying a variable pressure on the fly-wheel, the pressure being such as to maintain constant the position of a galvanometer spot; the galvanometer is joined across a Wheatstone bridge in one arm of which is a condenser, the latter being charged and discharged by a commutator fitted on the axle of the driving motor. Referring to the resistance measurements, in those so far made, the probable error of any single measurement appears to be of the order of two parts in 100,000, and the accuracy ultimately obtained will be considerably in advance of that hitherto reached.

Five mercury resistance tubes were constructed to serve as standards for the Japanese Government, and nine for the Laboratory, showing results consistent within two parts in 100,000. Comparisons with the resistance standards of the Bureau of Standards, the Reichsanstalt and the Laboratoire Central d'Electricité have been made during the year, the maximum difference between the standards of the four laboratories being 11 parts in 1,000,000. The results indicate to what degree electricians throughout the world may now feel certain of making resistance measurements on a common basis.

Evidence in favour of the Weston cell being slightly unstable is to hand, and old cells cannot be used as standards of E.M.F. in precision work; it is, therefore, necessary to set up cells at regular intervals and reject those in which hysteresis occurs or which are found to be decreasing in E.M.F.

During the year a full description has been published of the experiments in which the ohm was evaluated in absolute units by two A.C. methods, and it was found that the ratio of the international ohm to the true ohm was 1·00026 with a probable error of 1 part in 10,000.

In connection with an investigation on power factors of condensers, many tests were made of the variation of effective capacity with frequency, using the Carey Foster method, in which the results are referred directly to a standard mutual inductance, and are not merely relative to an air condenser. Some of the mica condensers showed only a very small change in capacity between frequencies of 100 to 2,000 cycles per second. For example, in a mica condenser presented to the Laboratory by Mr. H. W. Sullivan, the power factor at 100 cycles per second was less than 0·0001, and the capacity showed a change of less than 1 part in 10,000 for a change of frequency from 100 to 800 cycles per second.

The research on the errors in magnetic testing caused by bending test sheets was carried further, and the results have been published. Experiments were made on several different kinds of magnetic sheet material with a view to determining the direction of maximum permeability. With all the samples tried this direction was in very close coincidence with the direction in which the sheet had been rolled.

In connection with the photometrical investigation, the set of 24 tungsten sub-standards running at 1·5 watts per candle has now been satisfactorily established. The C.P. values now assigned to these lamps have been determined by a "cascade" method by six different observers, the work having been in progress for about three years. In the cascade method it has been found that mechanical errors and those due to the changes of observers from day to day have given rise to a probable error of 0·08 per cent. Assuming that the six observers may be taken as representative of persons with normal sight, the probable error of the final results is 0·25 per cent. A set of measurements in which the comparison was made of the Fleming standards with the 1·5 watts per candle tungsten standards in one set step, gave agreement with the cascade method to within 0·27 per cent., but the variations of individual observers from the mean were greater than with the cascade method.

A large number of comparisons were made with the pentane lamp burning in an atmosphere of about normal humidity, and although by reason of the absence of extreme values the correcting factor for humidity could not be accurately redetermined, the value of the unit was reproduced to a high accuracy. The result shows that the candle-power unit determined in 1904-5, and maintained constant by means of electric sub-standards, is in agreement with the newly-determined unit to within less than 0·1 per cent. This close agreement is better than was anticipated, and confirms the contention that a candle-power unit may, if proper precautions are exercised, be held constant by means of electric sub-standards over long periods of time. Comparisons with Germany and America indicate that the photometry of lights of different colours need not be liable to the errors commonly supposed to be associated with it.

In connection with the consideration by the Engineering Standards Committee of a specification for metal-filament lamps, a great number of life tests were made during the summer with a view to obtaining data regarding the life performance of present-day tungsten lamps. About 160 lamps of different ratings and makes were run at voltages which gave certain definite values of initial watts per candle. By this means it was assured that all the filaments were operating at approximately the same temperature, and the data obtained give information on two points:—(1) The rate of C.P. drop during life corresponding to the watts per candle values at which the test was run; (2) The tendency for "burn-outs" of filaments to take place before reaching the 1,000 hours. The latter of course depends considerably on the thickness of the filaments, and is greater for high than for low-voltage lamps. The investigation forms the subject of a complete report to the Engineering Standards Committee, which has since been published, together with about 80 diagrams, giving full details of the tests. The report also contains results of the tests for initial rating of about 800 lamps obtained in batches of 25 from different sources. These measurements give data as to the degree of uniformity which exists in the individual lamps in consignments from different makers supplied to customers in the usual manner.

A full description of the methods and apparatus used for precision A.C. measurements has been embodied in a paper by Messrs. Paterson, Rayner and Kinnes, which was read before the Institution of Electrical Engineers.

An investigation has been made for the Engineering Standards Committee on the heating of screw socket lampholders. Bayonet holders are not satisfactory when the watts transmitted exceed 250, and some other type of holder has to be used for larger units. The heating of a lamp socket is almost entirely due to the heat dissipated by the lamp or radiator, and has little to do with the energy lost at the contacts, the latter being a negligible quantity, unless the holder becomes defective. Screw sockets are not open to the objections of bayonet holders, and can satisfactorily transmit amounts of power up to 1,000 watts. The ordinary, as well as the Goliath, screw sockets were tested under different conditions, the temperature reached being as high as 120° C. for certain sockets. There seems to be no special objection to these temperatures as far as concerns the sockets themselves, but the effect of the heat on the insulation of incoming cables is likely to be serious. Tests made on the temperature gradients along the cables entering the sockets indicated that some modification of design is desirable where large lighting units are being dealt with.

Investigations have been made on the compressibility of micanite in connection with its use in localities where the heat is sufficient to soften the varnish. The relationship was examined between the compressibility and the amount of varnish, and experiments were made to ascertain the effect of additional heat treatment. The

investigations show generally that, to avoid an undue amount of compression, the quantity of varnish in the material should be controlled. Heat treatment above that required to give good moulding plate will tend to reduce the tenacity of the varnish and render the material liable to flaking.

The data obtained in the investigations of the electric strength of ebonite have been embodied in a paper to be published by the Institution of Electrical Engineers. The general result shows that ebonite of the best quality will withstand a voltage gradient of 125,000 volts per mm., and that comparatively simple physical tests are applicable to show whether the material is of high-grade quality.

In connection with the testing of some small electrolytic meters —a type of instrument which requires to be tested over a long period—the experiment was tried of using a small copper voltameter to integrate the current instead of the more usual methods of keeping the current steady or of taking the mean of a large number of readings as the current value. The method is, of course, well known, but little used in practice, and attention is called to it as a means of testing small house service meters where such tests have to be made in position. By observing proper conditions as to the electrolyte, the work involved in setting up and weighing the plates is very small. Determinations can be made readily to within 0·3 per cent., while the possibility of personal error in the determination is at least no greater than with the methods more generally used.

A paper was read before the Institution of Electrical Engineers giving the results of the investigation into the behaviour of D.C. watt-hour meters. The results obtained in the laboratory with all the meters, when on a rapidly fluctuating load, were in close agreement with those obtained on a steady load.

These results were confirmed by observations extending over three weeks, during which time the meters were connected in the traction circuit of the Sutton generating station. The observations under these conditions were carried on in all for a period of eight months. The latter observations indicated that some of the meters were changing ; the differences in the readings, after they had been corrected by the previously determined constants, amounted to as much as ± 3 per cent. from the mean of the six meters. On their being brought back to the laboratory for examination, it was found that while the change in three of the instruments was not greater than ± 1 per cent., one had increased in rate by 2½ per cent., another by 3 per cent., and the sixth by a further 2 per cent., making for this last meter a total change of 6 per cent. during the period covered by the whole series of tests.

A further question that arose during the above investigation, relating to the permanent change due to momentary excessive loads, was fully investigated. Very large changes were found in several of the meters as a result of subjecting them to a current approximating to that to which they would be subject when a short circuit occurred. These changes were found to be due mainly to demagnetisation of the brake magnets, or to magnetisation of parts of the meters. It was found possible to obviate them by using a shield of proper size and material. In one type of meter the shield supplied was removed and replaced by one built up in the laboratory of sheets of Stalloy iron, the result being that the change in rate due to a short-circuit current was only ½ per cent., as compared with from 2 to 9 per cent. with the original shield.

The work being carried on at the request of the Wiring Rules Committee of the Institution of Electrical Engineers to determine (*a*) the heating of flexible cords, and (*b*) the ageing with high temperatures of standard paper and rubber-insulated conductors, has progressed well during the year. Regarding (*a*), the heating due to the current flowing has been determined for a number of wires with different types of insulation and covering, extending over the whole range of flexible wires in general use. In addition, a number of tests were made in order to obtain an idea of the extent of the heating due to radiation from a lamp suspended by the flexible wire, and by conduction from the lampholder. The heating was found to vary greatly with different types of shade and methods of fixing. Regarding (*b*)—the ageing of standard insulated conductors—preliminary investigations have been made with a length of rubber-insulated cable, and with the oil and paper used for paper-insulated cable. Samples have been exposed in an oven to various temperatures, the effect on their mechanical and electrical properties being noted.

The report contains a summary of the researches to be carried out during the present year, as well as a list of the papers published during the past year.

LEGAL.

Bell *v.* Milne.

(*Continued from Vol. 72, page 1058.*)

Pursuer, in the witness box, said he had been electrical engineer of Aberdeen since 1898. He acted as adviser to the Town Council in several big schemes, and from time to time he had advised the city architect as to the wiring of public buildings. That had been done with the knowledge of the Town Council or the Convener of the Committee for the time being. In his efforts to get consumers he had reached a point where there had been a set-back to him, namely, in the wiring of houses. It was an essential and elementary requirement on the part of an electrical engineer in his position that he should have a thorough knowledge of electrical wiring. His two principal assistants were also experts in wiring. He detailed the advice which he and his assistants had given to Mr. A. B. Robertson in regard to the electrical installation at Murtle Hydro recently, and said such instances of advice given to parties might be multiplied. Witness was responsible to the Town Council for carrying out the Board of Trade, Home Office, and Cinematograph Acts Regulations, and the Town Council supposed him to be competent in regard to wiring specifications and the wiring of public buildings under the control of the Town Council. They had recently had a large number of instances in Aberdeen of installations which brought out the average wiring rate at somewhere between 10s. 6d. and 11s. 6d. per point. There were in Aberdeen 35 contractors who did electrical work and dealt with the Corporation mains. Fifteen years ago, there were only 10 doing that sort of work. The cost of wiring houses was fairly standardised throughout the country. The minimum wage in Aberdeen was 7½d. per hour. In these days it was absolutely essential for the development of the electrical department, that his department should give all assistance possible to intending consumers. The Town Council recognised that, and had opened a showroom. The contractors themselves had come and asked his advice upon matters. A large proportion of the Town Council had come to the department for advice in wiring. Referring to the incident out of which the letter arose, pursuer said that about November 22nd, 1912, Mr. A. Davidson, Broomhill Park, Aberdeen, called upon him and asked two questions—first, could he give heating and lighting in his house from the same wires and the same meter, as was common in Dundee? Secondly, would the department draw up a specification for lighting his house as was done in Dundee? Pursuer said the regulations did not permit of his complying with Mr. Davidson's first request, but he said he would accede to the second, which was quite consistent with the regulations. Mr. Davidson said he had received an offer which, in his opinion, was too high, and asked pursuer's opinion about it. Witness did not know who the offerer was, but he agreed the price was too high. He told Mr. Davidson that he had come down in a car with an Aberdeen contractor, with whom he had discussed the question of wiring rules. When Mr. Davidson told him the name of the contractor, pursuer remarked that it was a curious coincidence that he had just been talking to Mr. Robertson, jun., saying he thought it was a mistake for contractors to keep up the price of wiring. Pursuer told Mr. Davidson that wiring ought to be done for 12s. 6d. to £1 per point. Messrs. Robertson's figure worked out at above 25s. 9d. per wiring point. Pursuer told Mr. Davidson that he thought the price was excessive. In a minute of the Electrical Contractors' Association of November, 1912, it appeared that Mr. Robertson submitted a letter he had received from Mr. Davidson which contained certain imputations by Mr. Bell against the firm's honesty.

Mr. Cooper : Did you make any imputations against Mr. Robertson's honesty?—None whatever.

Continuing, Witness said Mr. Davidson asked for tenders, which were received from three contractors, as follows :—Messrs. Robertson, £1 1s. 11½d. per point; Aberdeen Electrical Engineering Co., £1 1s. 2½d.; and Mr. A. D. Gillespie, 8s. 6½d.; the last-named was accepted, and the work, when completed, was approved by the electricity department. Pursuer received a letter from Mr. Falconer, advocate, alleging that he had make certain slanderous statements against the firm of Messrs. A. B. Robertson, and threatening an action for damages. Pursuer instructed his agent to accept service of any summons, but to date he had received none. When he saw the letter of Mr. Milne he thought it was distinctly reflecting upon his business ability. He did not think his employers would keep him on if his knowledge of electrical contracting work was very elementary. He thought it was most important that he should, so far as possible, see that the cost of wiring was kept within moderate limits. That was the position he had adopted all along.

Mr. Cooper : What is your view of the letter so far as it affects you?—I consider it accuses me of incompetence in my business, and of making slanderous statements against contractors, which I did not. It also speaks to my employers of my actions being intolerable. It hurt my feelings very much.

Cross-examined by the Dean of Faculty, Pursuer said he recognised it was part of his duty not to engage in professional business of any kind unless by sanction of the Town Council.

You have no personal experience of costing work?—No.

Therefore that does not fall within your professional duty?—I suppose not.

Then when it is said you have only an elementary knowledge of contracting work, is not that quite true?—No. I take contracting work to be very much larger than that.

Have you at any time in Aberdeen done any private wiring?—I have drawn up specifications for public and private houses.

His Lordship : Allow me to put the question. Have you ever done any wiring in connection with public buildings?—I have never wired with my own hands.

A lengthy cross-examination followed on Mr. Davidson's letter to Mr. Robertson.

The Dean : Don't you think the impression conveyed to Mr. Davidson was that he was being charged 22s. when he could get the same work done in Edinburgh for 12s. 6d?—He got the same work done for about 8s. 6d.

We shall see about that. Do you suggest that this is not seriously interfering with the contractor's business?—No, I don't.

The Dean remarked that he did not agree with the pleading by pursuer that the Electrical Association was a Trade Union. Quoting

from pursuer's pleading, the Dean read :—"The members of the Association were actuated by ill-will against pursuer, who had frequently had to call attention to the extortionate charges made by Aberdeen contractors." The Dean asked : Was this of Robertson's one of the occasions when you were pointing to extortionate charges?—Yes.

Then you were representing to Mr. Davidson that Messrs. Robertson were making extortionate charges?—I said it was excessive.

Pursuer said it was the fact that tenders were taken from Aberdeen contractors for the City Hospital installation, and the lowest offer was £610. He advised the Town Council that £400 was enough for the contract. Ultimately outside tenders were taken in, with the result that they were all higher than £610, and £610 was ultimately accepted.

The Dean : What damage do you complain of having suffered? You are still in the service of the Corporation and enjoying their confidence.—The Council have not considered the letter yet.

Mr. Bell was fully three hours in the box. He was followed by—

Dr. Gordon, town clerk, Aberdeen, who said that when he saw the letter complained of, he formed the opinion that its terms were such that he could not put it before the Town Council. The meaning he took out of the letter was that Mr. Bell was making charges against contractors and threatening their honesty, and he considered that that part of the letter was libellous. He also thought the letter contained a reflection upon Mr. Bell's professional skill.

Do you say that the Town Council ever had any reason to doubt Mr. Bell's efficiency in anything relating to his work?—None.

Continuing, the Town Clerk said a meeting of the Committee was held on December 30th. He submitted the letter which he had received and explained to the Committee that proceedings had been taken by Mr. Bell since the letter had been received, and he suggested to the Committee that in the circumstances the letter should not be considered or discussed. The Committee, however, decided that the letter should be read, and after that had been done they agreed that it should be allowed to lie on the table in the meantime.

Lord Provost Maitland, who was next called, said that as far as he had been able to observe, Mr. Bell had managed the electrical undertaking very successfully. He never had the slightest reason to doubt his fitness for any branch of the work he had to do. Since pursuer came to be engineer, the output had increased from about 400,000 units, till now it was nearly 8 million units. Mr. Bell had again and again received increases in his salary. His opinion of the letter to the town clerk was that it contained very strong language about the head of the electricity department, and about a servant to his employers. Although he did not believe either of the charges, he regarded them as being very serious imputations against Mr. Bell.

I think there are certain friends of the contractors in the Town Council?—Yes.

Did you think they were likely to seize upon a letter of the sort, and use it against Mr. Bell?—I thought it quite likely.

Cross-examined by the Dean of Faculty : Who did you mean by the friends of the contractors?—One is Bailie Robertson, who is a member of one of the firms that complained of the conduct of the engineer.

Do you put it that it is the duty of a city official to say to citizens of Aberdeen about a tradesman of Aberdeen that he charged double the price for work that could be done cheaper elsewhere?—In my opinion it would be Mr. Bell's duty in the interests of the department.

Mr. Thomas Gibb, convener of the Electricity Committee, said he thought the contents of the letter were scandalous. He had spoken to Bailie Robertson about the letter. Bailie Robertson said that he would never be satisfied until he gave notice of motion to have Mr. Bell dismissed, or words to that effect.

By Mr. Wilton : Witness did not know that in June last year the Council instructed Mr. Bell to discontinue the practice of giving estimates.

Treasurer Kemp said Mr. Bell was always fair and quite disinterested in his administration of electricity affairs. One of the first things pointed out to Mr. Bell when he was appointed was that the public of Aberdeen must necessarily be dependent upon him for guidance and assistance. It was in the interests of both the Corporation and the electrical department that Mr. Bell should give such advice, and he considered this a very material part of the engineer's duty.

Mr. John Finlay Anderson, plumber, said he was president of the Electrical Contractors' Association. In December of last year Mr. Davidson, Broomhill Park, called upon him and asked him if he would tender for the job of wiring his house. He declined to tender. He assured Mr. Davidson that he knew nothing about any feeling which existed with regard to intervention by Mr. Bell in the matter. He called on Mr. Gillespie to see if he had not made a mistake in his tender for Broomhill Park.?

In cross-examination, Witness said there was never any concert between the members of the Association to keep up prices. There was no "ring," and never had been one. Detailing the circumstances which led up to the Association meeting, at which it was remitted to Mr. Milne and himself to write the town clerk, he said he approved of the letter, which expressed his honest opinion. The Association never had in their minds the Trade Disputes Act. He did not think there was any suggestion that the letter was written in the name of the Association in order to protect Mr. Robertson against a charge of slander. They all considered Mr. Bell a first-class engineer, but they maintained that he did not know about contract work. They had never any idea of reflecting upon the capacity of Mr. Bell. Witness admitted moving that a jobbing price list be made up by a committee. The object was to regulate the jobbing prices in Aberdeen.

Alex. Davidson, solicitor, Broomhill Park, Aberdeen, stated that he wrote Mr. Robertson, jun., asking him to let him know the cost of electric lighting. Mr. Robertson sent him a specification, and offered to do the work which he specified for £104. A Dundee friend who had experience said the price was too dear, and advised him to go to Mr. Bell, as that was the practice in Dundee. Mr. Bell thought the charge for wiring was too dear. He also expressed the view that it was detrimental to the interests of his department that the Aberdeen contractors should make a practice of charging high rates. Mr. Bell told him that rates were lower in the south, and were as low as 12s. 6d. per point. He undertook to draw up a specification in order that he (witness) might get tenders. In November, 1912, he wrote a letter to Messrs. Robertson, in which he reported the result of his interview with pursuer. In the course of his letter he stated that Mr. Bell spoke strongly on the cost of installation in Aberdeen, and that he (witness) did not grudge a fair price for a good job such as, he was sure, Messrs. Robertson would do for him ; but if, as Mr. Bell told him, the work was done, and well done, in Edinburgh for 12s. 6d. per point, while Messrs. Robertson's rate was 22s. per point, he had no choice but to take in competitive offers. He understood when he used the expression "moderately fair," that the price charged by Aberdeen contractors was unduly high, and that the Association was attempting to keep up the price. Mr. Davidson then detailed how he received other tenders and accepted that of Mr. Gillespie.

James A. Robertson, electrical engineer for the burgh of Greenock, said he considered a knowledge of wiring would be very necessary to the chief engineer of a burgh, in view of the fact that he had to pass the installations before connecting them with the mains.

In reply to counsel, Witness said the wiring of the City Hospital was of a simple form, and from his experience he would say that an installation of that sort could be carried out for 9s. or 10s. per point. That would give a fair profit to the contractors. At that rate the cost of the wiring of the City Hospital would be £400, £420 or £430.

Regarding Messrs. Robertson's offer for Broomhill Park, Witness said he had had 20 installations carried out in wood casing during the last 12 months, and the average cost over the whole 20 installations was 11s. 7½d. per point, including "on cost" charges of 15 per cent., allowance for profit, highest over 16s. 8d. per point and lowest 7s. 9d. In shop work the cost was less and in houses it was higher. He considered a charge of 25s. 9d. per point most unjustifiable, except under the most extraordinary conditions, which did not prevail in the case of Broomhill Park.

You know that this contract works out at about 8s. 4d. per point, excluding all fittings?—I think that it is a very low figure, considering that it is a private house, and that there is work to be carried out which cannot be accurately estimated beforehand. I think 12s. to 14s. might have been a very fair price. Taking the class of work into account, he considered that the job was fairly well done. It was above the standard for wood-casing work.

Answering the Dean of Faculty, Witness said in Greenock they claimed that they were not in competition with the contractors. There was a strong feeling in the Town Council that they were not to compete with contractors, and they made a point of not coming in to offer for free wiring in any installation where a private contractor was also tendering to fit the wiring. In Greenock they fitted up between 70 and 80 installations last year, and he should say the contractors fitted up about 200.

Asked what he had to say regarding a statement that the cost of wiring houses for electric lighting might be taken at from 12s. 6d. to £1 per light installed, that figure including ordinary plain fittings and everything else required, Witness said he agreed with that. Steel tubing work could not be done under 17s. The Corporation could not do work cheaper than contractors, for the reason that the labour question was more pronounced in the Corporation than among private contractors. The Corporation had to pay the men maximum wages, and had also questions asked as to the amount of work turned out.

Gerald Walker Crawford, consulting engineer and a member of Edinburgh Town Council, was the first witness for defender. In his opinion a knowledge of electrical contracting work was not necessary for the due discharge of the duties of one holding an office such as Mr. Bell did. His duties were of a totally different nature. He did not consider a knowledge of contracting work of any importance at all to a municipal electrical engineer. The price of wiring a house or shop in Edinburgh was from 18s. to 20s. per point. For a house such as Broomhill Park he did not consider anything under 30s. would be out of place. He never heard of work being carried out in Edinburgh at 12s. 6d. per point. He never heard of a case of a municipal electrical engineer interfering with the prices between private contractors and consumers.

Cross-examined, Mr. Crawford stated that he had never done contracting, and had never done wiring himself.

Thomas Wright, electrical engineer, Glasgow, described Mr. Robertson's price as very fair, and a little under the average.

Answering Mr. Cooper, Witness said they had jobbing price lists in the Glasgow branch of the Association.

Mr. Cooper : Is it the case that the average cost to the consumer, including the profits of wiring in wood casing, is 13s.?—13s. is about the lowest figure that ever I quoted work at.

Alex. Pratt, electrical engineer, Edinburgh, and Edward Joseph Lowdon, electrical contractor, Glasgow, concurred.

Councillor Leith, who followed, said he was present at a meeting of the Public Health Committee, when offers for the electric lighting installation for the City Hospital were considered,

and he heard a statement by Mr. Bell which conveyed the impression to his mind that Aberdeen contractors had formed a "ring." As far as he was aware, Mr. Bell's duties had nothing to do with contracting work.

Ex-Lord Provost Wilson said that in connection with the City Hospital contract, he took the matter up with Mr. Bell point by point in order to test his estimate of £300, and see if it could be justified. They had not gone two-thirds over the specification before he had raised the price to over £400. He expressed annoyance.

Did you think Mr. Bell was qualified to express a view on the costing of this work?—No, after the estimate he had given. Witness did not know that contractors in the south had been written to and asked not to compete with the Aberdeen contractors. Mr. Bell was not expected to do contracting work.

Mr. Wm. Todd, a member of the Public Health Committee in 1909, said the Committee generally thought that Mr. Bell was entirely wrong regarding the City Hospital estimate.

Alex. Bruce Robertson, electrical engineer, Aberdeen, thought it was very unfair of Mr. Bell to say that the contractors had formed a "ring" to keep up prices. It was quite untrue. He would describe Broomhill House as a costly house to wire. It was a rambling house with long, uneven runs, and he considered his price of 23s. per point for the work was not excessive. Mr. Bell said to him that the contractors were charging far too much for wiring which was done in Edinburgh at 12s. 6d. per point. Witness replied that it might be done in Edinburgh, but it was not done in Glasgow, and it certainly could not be done in Aberdeen according to the existing rules. Witness called on Mr. Milne, who advised that the matter should be considered by the Association. At the meeting the members thought that the statements in question reflected on their honesty, and Mr. Milne was instructed to send a letter to the town clerk. Witness saw a draft of the letter, and it carried out the meeting's instructions. They wished the Town Council to discuss the matter.

By Mr. Lippe: They had not sent out circulars to contractors asking them not to tender, except in the case of the City Hospital. The object was to prevent the Town Council getting free tenders for the work.

If the work at Broomhill House could be done for 8s. 2½d., don't you think that anyone is justified in saying that 25s. 9d. is excessive?—Yes, but I say it is impossible to do it for 8s. 2½d.

Archibald Gillespie, electrical engineer, Aberdeen, said he commenced business about 14 months ago, and his idea in taking the Broomhill contract was to gain a business connection.

Cross-examined: He lost about £4 on the job. He would never take on a contract like Broomhill House again at the same figure. Another £10 on his price would have wiped out the loss and given a reasonable profit. That would have worked out at about 12s. 6d. per point.

By his Lordship: He was not a member of the Contractors' Association. He had applied for membership, however, because otherwise he could not get men to do work for him.

James P. Dawson, electrical engineer, Aberdeen, said he did not think that costing fell within Mr. Bell's professional duty. There was no intention of reflecting, in the letter to the town clerk, upon Mr. Bell's professional position.

Frank Parker, electrical engineer, manager to Claud Hamilton, Aberdeen, and Walter Simpson, electrical engineer, Aberdeen, concurred.

Defender stated that he had been secretary of the Association since 1907, and never received any pay for the work. In his opinion the letter complained of, carried out the instructions which the meeting gave. The course followed in previous cases was to lay the facts before the Council, and no exception was taken to that. The Trades Disputes Act was never referred to, and it did not actuate witness or any of the members.

All your minute authorised you to do was to make a complaint and ask for protection?—Yes.

They resolved not to withdraw the letter, but to defend any action and indemnify you against damages and expenses?—Yes.

This closed the evidence, and Mr. Cooper asked for a verdict in favour of Mr. Bell on both issues. He said because a Trade Union could not be sued for damages for libel, the only thing to do was to bring an action against the individual who had to do with the issuing of the libel. After analysing the evidence, counsel pointed out that it was perfectly legitimate for people to ask whatever they could get for their work, but it was perfectly right for a person to say "You are charging a great deal more than what is ordinarily charged for that sort of work." That was all Mr. Bell said, and all that it was complained of him as having said. Mr. Bell was an official who was blocking all those contractors who were putting enormous profits upon innocent laymen, and who clubbed themselves together in order that they might get Mr. Bell into evil odour with his employers.

The Dean of Faculty, who followed, pointed out that the action was a personal one by Mr. Bell against Mr. Milne, and that they were not trying the Electrical Contractors' Association. Dealing with the evidence, the Dean said the attempt to make out that 22s., or anything like that, was extortionate, was quite out of the question. Where, he asked, was the malice on Mr. Milne's part? He was no more than a scribe. It was bad enough to say that the Trade Union were not liable, but to say that the law agent was to be liable would be carrying the thing a great deal too far and utterly beyond the law.

Lord Hunter refused to direct that the occasion was privileged. Addressing the jury, he said a man was just as much a slanderer if he repeated a statement that had been told him as if he had invented the statement for himself. The whole case turned on their interpretation of the letter. That was absolutely everything Mr. Bell was quite entitled to express his opinion on prices even on the assumption that it did not come within his ordinary duties. It was not even suggested that in giving his opinion, whether it was right or wrong, Mr. Bell was actuated by any improper motive.

The two issues the jury had to consider were (1) whether the statements in the letter falsely and calumniously imputed to the pursuer ignorance, incompetence, and want of skill in regard to his professional duties; and (2) whether the statements in the letter falsely and calumniously represented that the pursuer was guilty of slanderously charging the Aberdeen electrical contractors with dishonesty; and that he had made similar very grave and slanderous charges on a previous occasion against Aberdeen electrical contractors.

The jury, after an absence of nearly an hour, returned a unanimous verdict for pursuer on both counts, awarding £250 damages with expenses.

The Rating of Tramways.

On Thursday, June 26th, the House of Lords concluded the arguments in the appeal by the Tottenham Urban District Council against an order of the Court of Appeal in favour of the respondents, the Metropolitan Electric Tramways, Ltd. In 1910 the present appellants rated the company in respect of that portion of the company's undertaking which passed through their district, and which was originally constructed as a horse tramway, but had since been electrified, at £495 12s. 6d., and demanded payment for the first time of the full assessment. The company paid £123 18s. 2d., being one-fourth of the rate demanded, and contended that they came within the partial exemption to rates given by Sec. 211 of the Public Health Act, 1875, as they were rated as the occupier of land used as a railway constructed under the powers of an Act of Parliament, namely, the Tramways Act, 1870. The Court of Appeal held this was so, and the Council appealed on the ground that a tramway originally constructed as a tramway was not a light railway within the meaning of the Public Health Act, 1875. The question for decision is one of very considerable financial importance to electric tramway companies in London, because nearly all of them were originally constructed as horse tramways, and although it was not disputed that the partial exemption applied to the extensions of such tramways which had been made under powers given by the Light Railway Acts, the increase of rates, should the appeal be allowed, must be a serious burden to such companies.

Mr. Ryde, K.C., having replied for the appellants,

The Lord Chancellor said the question was one of importance, and their Lordships would take time to consider their judgment.

Charing Cross, West End and City Electricity Supply Co., Ltd., *v.* The London Hydraulic Power Co.

On June 25th, 26th and 27th Mr. Justice Scrutton in the King's Bench Division heard this case, which raised the question of the liability of the defendants for water bursts in the defendants' mains in the City of London, which damaged the plaintiffs' underground cables, connection boxes and other works.

Mr. McCall, K.C., and Mr. C. B. Marriott were for the plaintiffs, and Mr. John Sankey, K.C., and Mr. F. Gover for the defendants.

In opening the case, Mr. McCall said the claim was for £717 4s. 1d., the amount of repairs necessitated to plaintiffs' electric mains, &c., through the escape of water from defendants' high-pressure mains in various parts of the City of London, which damaged, and in some cases destroyed, the efficiency of plaintiffs' works. A number of bursts took place on February 4th, 5th and 13th, 1912, and on August 27th of the same year. The plaintiffs supplied electricity for lighting and other purposes to various parts of London. This was done under the powers of Acts of Parliament and Provisional Orders, and by these Acts the company were entitled to construct and maintain and use mains for the purposes of conducting the power to various places, including Water Lane, Great Tower Street, Upper Thames Street, Cannon Street and St. Swithin's Lane. The defendants supplied water pressure for the purpose of working lifts in public buildings and private houses and offices, and for that purpose they had constructed and maintained and used certain mains charged with water at high pressure. On each of the dates mentioned, the water from defendants' mains escaped in large quantities with great violence, and caused serious damage to plaintiffs' underground works. This necessitated extensive repairs, the cost of which plaintiffs now sought to recover. The defendants' case was that the plaintiffs had laid their pipes at their own risk and subject to the rights of defendants to maintain and use their own mains. They did not admit the bursts, and denied negligence, and said the bursts, if any, were caused by subsidences, and that the bursts in Water Lane, St. Swithin's Lane and Upper Thames Street were caused or contributed to by plaintiffs' own works, which impaired and disturbed the defendants' mains and the ground about them. The defendants' mains, counsel proceeded, were charged with water at an enormous pressure—some 700 lb. to the square inch, and any water that escaped was certain to do very great damage. The plaintiffs' mains were laid in 1892, and were in all cases laid under the supervision and with the approval of the engineer to the defendant company. Prior to 1912, there were a considerable number of bursts, and it would be found that there were a large number of cases in which, when a burst took place which damaged plaintiffs' mains, the defendant company recognised their liability, and paid the cost of the damages. He believed this was done in some 24 cases. The first burst now sued for was on February 4th,

1912, and was a serious one, for the main snapped and caused a great deal of damage. He should submit that the liability of the defendants in such a case as this was clearly laid down in the decided cases.

Mr. Sankey said he should submit that none of the decided cases would constitute a nuisance.

His Lordship said that might be, but if an occurrence like this was continually happening it might develop into a nuisance.

Mr. W. Thorpe, engineer to the plaintiffs, said that a number of bursts occurred between 1904 and 1912, in regard to which the defendants admitted liability and paid the damages.

Mr. Sankey said the case for the defendants was that the plaintiffs by their own works had interfered with and broken up the foundations of the defendants' mains, and had so caused the bursts complained of. They had given details of these matters.

A great deal of evidence was called on both sides, and after hearing legal arguments at great length,

His Lordship reserved his judgment.

Action against Aberdeen Corporation.

Lord Ormidale, in the Court of Session, dismissed an action against the Corporation of Aberdeen, who were sued for £400, in connection with the death of a carter, who was crushed between the front of a wagon and an electric wire standard. The standard, it was said, was a dangerous obstacle and had since been removed. His Lordship held that there was no negligence on the part of the Corporation.

Glyn *v.* Holophane, Ltd.

The hearing of this action was commenced on Friday (June 27th), before Mr. Justice Bailhache and a special jury, in the King's Bench Division. The plaintiff was Major Geoffrey Carr Glyn, a director of the defendant company, who claimed damages from the company for alleged wrongful dismissal from the position he held as managing director of the company. The action was of considerable interest, because of the remarkable allegations made by the defendants in their plea of justification.

Mr. Campbell, K.C., M.P., and Mr. Schiller (instructed by Withers, Bensons, Birkett & Davies), were for the plaintiff, and Mr. Montague Shearman, K.C., and Mr. Sylvain Mayer (instructed by Herbert Reeve & Co.), were for the defendants.

Mr. Campbell, opening the case for the plaintiff, said the case had become serious, as the defendants had put on the record a statement that the plaintiff had misconducted himself, and that the dismissal was justifiable. That would, no doubt, be an excellent defence, if it could be proved. The plaintiff, Major Geoffrey Carr Glyn, was a man in middle life, with a creditable career behind him, both in business and in the service of his country, for he was a partner in the firm of Glyn, Mills, Currie and Co., bankers, and had served his country in the South African war. He was also an aspirant to Parliamentary honours, and a candidate for the next General Election. In 1909, while travelling in France, he made the acquaintance of Mr. Mygatt, the chairman of the board of Holophane, Ltd. That business consisted of the sale of spheres and globes for covering electric light bulbs, and used principally for diffusing the light and distributing it to the best advantage, with the smallest possible amount of waste. Mr. Mygatt had worked that business up in America for some years before he came with it to London. The London business was not very successful for the shareholders. It resulted in Mr. Mygatt getting 55,000 fully paid up shares and £20,000 in cash. The business fell away and the shareholders got nothing. Mr. Mygatt bought the whole thing back with the assets for £1,000. Afterwards Major Glyn was induced to take an interest in the Holophane, as the patent shade was called, and an arrangement was made between him and Mr. Mygatt that he should go to America and see what had been done over there, and if he thought well of it he would see whether a company could be started again in England on better lines. Major Glyn went to America; he found that a company in Ohio made the glass, another company made the reflectors, and Mr. Mygatt's company did the distributing. It was understood that if Major Glyn put himself into the business here and was successful in forming a company with the necessary capital, he should be the managing director and not be disturbed from his position for five years. A company was formed, and the first directors were Mr. Mygatt, Lieut.-Col. F. J. P. Butler, Mr. R. Woodhouse, Lord Ernest Hamilton, and the plaintiff, who was appointed to be the managing director, although unfortunately the resolution appointing him did not specify the length of time he should occupy the position. Counsel, however, would submit that the appointment was for a year certain. In December, 1910, the plaintiff's salary was fixed at £600, and in March, 1912, this was raised to £800. During the years 1910-12 the plaintiff threw himself heart and soul into the business. The business was a considerable success owing, no doubt, to the fact that Mr. Mygatt attended but few of the meetings. Mr. Mygatt, the vendor of the business to the company, remained under certain pecuniary obligations to the English company, and the shareholders became weary, insisting that he should carry out those obligations, with the result that a case was submitted to Mr. Buckmaster, K.C., who advised that the company had a good claim against Mr. Mygatt for £12,000. At that time Mr. Mygatt had not a large majority on the board. In 1912 another director, Mr. Haggard, was appointed, and the voting became even, but Mr. Mygatt, as chairman, had the casting vote. In November, 1912, Mr. Mygatt introduced another gentleman, his private secretary, named Jones, and in December Mr. Mygatt proposed a resolution that no proceedings should be taken by the company against him. This resolution fell through for want of a seconder, and all Mr. Mygatt was able to arrange was that the matter should go to arbitration, and the proceedings before that gentleman were now pending. Mr. Campbell contended that it was because of the attitude Mr. Glyn took up against him in the matter of Mr. Mygatt's obligations to the board, that Mr. Mygatt decided to crush him. It appeared that the General Electric Co., of Queen Victoria Street, applied to Holophane, Ltd., to find out if there was any reason why they should not also sell Holophane fittings. This put the plaintiff's company on inquiry, and they found that the patent, which had been in the name of a man named Blondel, had run out. The plaintiff's company at once applied to the Patent Office to register the name Holophane as a trade mark, and that was refused.

Mr. Justice Bailhache: What were the grounds on which the plaintiff was dismissed from his position.

Mr. Campbell explained that Major Glyn came to an arrangement with a German firm called the Rheinische Co.—a competing body—that they should cease to carry on their business of selling globes something like Holophane, and should hand over their stock and business to the plaintiff's company. This was done to the knowledge of the firm, after many meetings; on that account Mr. Glyn was made the subject of gross charges.

His Lordship asked what the charges were.

Mr. Campbell: It was said that Major Glyn was charged with selling as Holophane some inferior article and with suppressing a number of matters from the directors. As a result, the majority of the board dismissed him. Continuing his story, Mr. Campbell said after the purchase of the competing business, the two stocks were mixed. Some of the German stock was called Dilux, under which name it had previously been sold. Mr. Mygatt, at a board meeting, said the sale of these globes as Holophane was a criminal offence. The company's solicitors were then communicated with, and Messrs. Thompson & Co., patent agents. Messrs. Thompson expressed the view that it was perfectly legal for the company to sell the German globes made from the German moulds under the trade mark of Holophane. At a future board meeting Mr. Inglis, the company's solicitor, said he was in accord with the decision of Messrs. Thompson & Co. Mr. Mygatt's own solicitor, however, told the meeting that he disagreed, and a director, Mr. Jones, said he had consulted two counsel privately, and had been told that they considered that the sale was unlawful. It was then resolved that the company should then stop selling Dilux as Holophane. At a later meeting the resolution to deprive the managing director of his office was passed by a majority.

Mr. Campbell then read some of the minutes of the company. The first he would read, he said, would show that Mr. Mygatt and the board approved of the purchase of the stock of Dilux. The minute was of September 27th, 1912, when Mr. Mygatt was in the chair, "The Dilux agreement." The managing director reported as to the position with regard to the Dilux agreement, and the chairman stated that he considered the proposals of agreement for the Rheinische manufacture of glass as highly satisfactory.

It was for carrying out the duties assigned to him by the board, said Mr. Campbell, that Mr. Glyn had been accused of criminal acts. Then came the minute in which the company apparently deprecated the sale of the Dilux ware by the managing director. The resolution was proposed by Mr. Mygatt, the man who had known about the whole thing. It ran: "The chairman also moved that the meeting records its sense of the lack of confidence in the managing director." Col. Butler and Mr. Woodhouse took strong exception to this being placed on record, and expressed their opinion that the managing director had devoted his time and ability to the company's business, and referred to the satisfactory results which had accrued from his work. Lord Ernest Hamilton expressed his opinion that the facts and figures placed before the board were not reliable, and the statement presented to the board had been previously edited, and also that he did not believe the company had made any profit. He would, therefore, support the chairman in the lack of confidence. Mr. Lawrence Jones stated that he had only been connected with the company for a short time, and was not a business man, but he held the view that there was a lack of confidence in the managing director, and he voted for the resolution. Then came the resolution in which the managing director was dismissed. Since then Major Glyn had had nothing to do with the company, except as an ordinary director.

Major Glyn, in the witness box, gave evidence in support of his counsel's opening statement. He said the turnover of the defendant company had increased from £3,000 to £34,000 during the time he held the position of managing director. Dilux consisted of shades made, he believed, on the same principles as the Holophane. There was no patent in it. The company felt the competition of the Dilux, and agreements were entered into with the German company to take over their business. He negotiated the agreements, and they were entered into with the approval of the board. Major Glyn was handed a German bowl, and said he could not distinguish it from Holophane. He said he had had the name Dilux ground off some of the German bowls and Holophane put on them. He had bought the name Dilux, and, therefore, saw no harm in doing that; in fact, he did it at the suggestion of two members of the staff, and he had consulted the company's patent agents and solicitor.

Replying to Mr. Shearman, who cross-examined, the plaintiff said he agreed that the accusation was not against Mr. Mygatt personally, but against the company.

How much money did you put into the company?—About three or four thousand pounds. My holding now is 31,000 shares, 9,000 of which were preference. Up to 1910, more of the kind in

question was not being sold under the name of Holophane, except by the English and American companies. The word Holophane was now on the register with regard to globes. He agreed that he had described competing ware as "imitation" Holophane.

Do you know of any cheap imitation except Dilux?—Yes, Stiblettos, but Dilux are not a cheap imitation.

Mr. Shearman: I hope to satisfy the jury that they are.

His Lordship: Why couldn't you sell it?

Mr. Shearman: Because people ordered the genuine Holophane, and I suggest that it would not be fair to perpetrate a fraud on the public and sell Dilux with the name ground off, as Holophane, when Dilux was a cheaper article.

Mr. Campbell said he would agree to that, but he would show that Dilux was not a cheaper imitation.

Plaintiff said he told the directors that he was selling Dilux as Holophane, and they knew exactly what he proposed. He held the opinion that Dilux were as good as Holophane.

Then, said Counsel, why didn't you sell them as Dilux?—Because we did not want to advertise that name. Witness agreed that the Dilux shades were heavier, and said they had received some complaints about the sale of Dilux.

Samples were then handed to the plaintiff, and he agreed that one was of heavier glass, and he thought one was slightly browner than the other. At the meeting where the charges were made he did not tell the directors that they had known all along what he had been doing, he was so surprised at the charges made. He told the board that he had informed the leading firms of the fact that what he was supplying was Dilux, and he did not think it was substantially untrue. He was aware that Mr. Inglis, the company's solicitor, had written repudiating, on behalf of the company, all responsibility for the way in which the Dilux ware had been sold. They had supplied Dilux to their own German Holophane Co., who had complained of its weight and its efficiency. His suggestion was that his appointment was for a year certain, and that he should have received six months' notice.

Mr. Shearman: Did you tell Siemens of the fact that you were supplying Dilux as Holophane?—Their order never came to me, but to the stock department, who dealt with it.

Did you ever tell Siemens that Dilux was supplied for Holophane?—No, not that I can recollect.

Were they told that the stuff they received was not the same stuff that they had received before, but was Dilux?—I don't believe they were.

You worked off the Dilux in your stock?—Yes. Plaintiff said he was sure he told English firms that he had purchased the Dilux stock.

Mr. Campbell: When you took over this Dilux stock did you have tests made, and did you believe that the Dilux were as good as the Holophane?—Yes.

Lieut.-Col. Butler, giving evidence, said he joined the company at its formation, and was a director. Complaints were received from the General Electric Co. about the competition of the makers of the Dilux shade, and the board went into the relative merits of the glass made by the American and Rheinische Companies. Mr. Mygatt spoke highly of the latter company's goods, and the result was that it was decided to do away with the competition by taking over the Dilux stock.

His Lordship: What were you going to do with that stock?

Col. Butler: As far as we could we were going to sell the spheres and hemispheres in England and the remainder abroad.

His Lordship: How were you going to sell the spheres, as Holophane, Dilux, or what?—Witness: That question does not seem to have arisen at that time. Replying to other questions, Col. Butler said he was of the opinion that Major Glyn worked extremely hard for the company, sparing neither time nor trouble.

Replying to Mr. Shearman, Col. Butler said he did not remember that Major Glyn said at any meeting that the word Dilux would be ground off the Dilux articles.

Did he ever say that the shades would be sold as Holophane?—He said they would be sold as Holophane.

Did he ever come to a board meeting and say that he had had the name Dilux ground off and that he would sell them as Holophane?—I don't know that he did.

Do you understand that the Dilux were as good as the Holophane?—I understood that they were.

You have since voted for stopping altogether the sale of Dilux shades as Holophane?—Yes.

Mr. R. Woodhouse, another director of the defendant company, said he understood that the stock of Dilux was so small that it was left to the discretion of the managing director to deal with it. When he heard at the board meeting that there was a suggestion that a criminal act had been committed in the sale of Dilux shades as Holophane, he was much perturbed and was relieved when Mr. Inglis, the company's solicitor, said it was alright.

Mr. Shearman: How much stock was there of Dilux shades?—About £1,200 worth.

Are you sure it was not more?—Yes.

Not £2,000 worth?—Oh no.

Prof. Silvanus Thompson, president of the Illuminating Engineering Society, and past-president of the Institution of Electrical Engineers, &c., was next called. He said he had made a special study of illuminating problems of all kinds for many years. He was familiar with the globe used for diffusing light, and he had known the Holophane idea for many years.

Mr. Campbell: Have you examined the Holophane and Dilux shades?—Yes, I have seen a number of examples of both.

How do they compare?—I think they are very much of a muchness. There is very little to choose between them except that the Dilux are the heavier.

With regard to their power of diffusing light, how do they compare?—I can give you the actual statistics. I experimented with hemispheres, as follows:—

Weights—10 in.;	Holophane,	7 lb.	13¼ oz.;	Dilux,	8 lb.	9¼ oz.
12 in.;	,,	13 lb.	1¼ oz.;	,,	13 lb.	8¼ oz.
16 in.;	,,	26 lb.	7¼ oz.;	,,	31 lb.	10¼ oz.
Loss of light—10 in.;	Holophane,	47½ %	;	Dilux,	38·2 %	
12 in.;	,,	30·5 %	;	,,	29 %	
16 in.;	,,	36 %	;	,,	37 %	

From these statistics the Court would see that the Dilux was heavier, but was the better shade from the point of view of light.

Replying to Mr. Shearman, Prof. Thompson said he was not aware what stocks the shades were taken from, nor did he know who sent them to his laboratory.

Is there more than one way of testing? asked counsel.—Yes, there are several ways.

If the National Physical Laboratory differ in their results from you, you would be inclined to think that it all depended on the samples of shades?—Yes.

Is it agreed that in the Dilux shades the prisms in the top and bottom parts are identical?—Yes, I think so.

While with regard to Holophane, the top and bottom halves are different?—I really haven't noticed, but it would not matter if they were.

Mr. W. P. Harrison, M.I.E.E., of Westminster, and vice-chairman of the Illuminating Engineering Society, said he had made a study of the illuminating question for many years, and he experimented with the shades in question at Faraday House.

Mr. Campbell: What was your conclusion as to the relative merits or demerits of these shades?—The results of my experiments showed that they were practically the same. I experimented mainly with the object of ascertaining what was the loss of light by each and found that they varied very slightly.

From the point of view of the purchasing public was there any substantial difference between the two shades?—The purchasing public would not notice the difference.

For the defence, Mr. C. C. Paterson, principal assistant in charge of the Electrotechnical Building of the National Physical Laboratory at Teddington, said he had made experiments with two different shades at the request of the defendant company. He had prepared a lot of figures, but declined to give any opinion on the relative merits of the two shades. "I am here in a semi-official capacity," he said, "and decline to express an opinion. I was asked to make experiments. I have done so, and the figures are before you."

His Lordship: Well, I can't see why you can't give an opinion, but no doubt the defendants can get an expert to work the figures out.

Mr. Shearman then addressed the jury for the defence. He said that Mr. Campbell's remark in opening his case that Mr. Mygatt had decided to get rid of the plaintiff for personal reasons was quite unfounded. The defendants' case was that Dilux—not the ware now manufactured by the German firm, but the old ware—was cheap stuff made in imitation of Holophane. He was not there to suggest that the plaintiff acted with any dishonest motive in having committed a breach of the Merchandise Marks Act; that would be a technical matter, but the suggestion was that he had taken this poor imitation of Holophane, and erasing the name Dilux, had sold it as Holophane, thus really perpetrating a fraud on the trade. The jury would hear that he did that in spite of warnings he had received from members of the company's staff. The engineering secretary had told him that if they were going to get this glass from Germany, they must send over the proper scientific moulds from which Holophane had been made. Yet the plaintiff ordered the two stocks to be mixed together and sold together, and he gave orders that some of the names on the Dilux shades should be ground off. It was absolutely *suggestio falsi* to say that he acted on the solicitor's advice. The question which he left to the jury was: Were the defendants justified in getting rid of the plaintiff as managing director, having regard to his conduct?

Prof. Charles V. Boys, F.R.S., called for the defence, said he was aware of the principle of the Holophane glass, and had known of it since the thing was invented.

You have had some figures given you which were the results of experiments at the National Physical Laboratory. What are your deductions from these figures?—They show the light being sent in various directions. It seems that a Holophane 10 in. hemisphere loses only 30·7 per cent. of the light while the Dilux loses 41 per cent. The difference between the two was between 10 and 11 per cent.

Have the Dilux any spheres?—I think they are all hemispheres.

Now to come to the glass of the Dilux shades in the possession of the defendant company as the Dilux stock, which they purchased, and the real Holophane glass; what is the difference?—The Dilux is smoky with a yellowish tint, while the Holophane is clear with a slight bluish tint.

What about the regularity of the prisms?—I found in the Dilux prisms some irregularity, while some projected more than others, showing less accurate work.

Mr. Campbell (cross-examining): Do I understand that for the purposes of your experiments you had only had one Dilux hemisphere?—The figures were worked out by the National Physical Laboratory. All the evidence I have given is on calculations I have made on the tests made at the laboratory.

Do you know whether the experiments made at the laboratory were with tops or bottoms?—I can't say.

Have you made a second test about which you have said nothing?—No. I did not make this test.

Wasn't it a fact that, in this test you are giving the result of

your calculations about, the light was half out of the hemisphere?—An electric incandescent light was put in the centre of the shade? Witness said he thought that was so.

Now, did not the other test that was made, and which you have particulars of, work out in favour of the Dilux shade?—No.

Was there not an experiment made in which the light was lowered $1\frac{9}{16}$ in. into the shade?—Yes.

Did not that work out that the loss of light by the Dilux was 7 per cent. and the Holophane 16 per cent.?—Witness did not reply.

I suppose in any glass factory for the production of these spheres it is inevitable that there should be inequality of the work?—That is self-evident.

So that even with the best regulated Holophane shades there must sometimes be a slight inequality?—Yes.

And you would not be surprised to know that even before the Holophane people had anything to do with the Dilux they received complaints about imperfect types of spheres?—I know nothing about that. There was a remarkable uniformity about the Holophane spheres I saw. Witness went on to explain that he thought Prof. Silvanus Thompson experimented with the upper halves of Holophane spheres instead of the lower. In that case his results were wrong if the percentages were attributed to lower halves. The amount of light diffused by a lower half was different from that diffused by a top half.

Mr. Campbell: Do I understand that there was a difference in the lower and upper half of a Holophane sphere?—Yes.

Mr. Shearman: The object of the Holophane patent is to deflect all the possible light downward?—Yes.

And in the Holophane careful calculations, angles, and prisms have been put together to produce the best results?—Yes, it is the Holophane system.

Is it the proper way to test a Holophane sphere by putting the lower half where the top half should be?—The proper result of that test would be obtained when the figures were put upside down.

Supposing you put two Holophane lower parts together would that be a reasonable test?—Certainly not; that should not be done in any case.

We shall conclude our report of the case next week. On Tuesday the jury, without leaving the box, found for the plaintiff, awarding him £400 damages. His Lordship decided in plaintiff's favour on the law, and entered judgment in accordance with the jury's findings, with costs.

(*To be continued.*)

The Telephone Transfer.

The matter of the National Telephone Co., Ltd., *v.* The Postmaster-General was mentioned on Tuesday in the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Kennedy and Swinfen Eady, upon the terms of the settlement which had been arrived at for the determination of the differences which had arisen between the company and the Postmaster-General as to the terms on which the business and undertaking of the National Telephone Co. should be taken over by the State.

When the case was called on, the Attorney-General stated that their Lordships would not be troubled further with the matter, as the parties had agreed on terms which had been put into writing. He thought that all it was necessary to tell their Lordships was that the appeal and cross appeal would stand dismissed on the terms agreed between the parties, and which had been handed to the Registrar.

Their Lordships assented to this arrangement.

National Telephone Co., Ltd.

A summons taken out in the voluntary winding up of this company raising a question of rent was before Mr. Justice Neville on Tuesday, July 1st, when Mr. Buckmaster, K.C., asked for an adjournment. Matters, he said, had arisen which he desired to put before his clients, and he desired that the summons should stand over for a week. Counsel on the other side consented.

His Lordship accordingly adjourned the summons until Tuesday next.

Johnson-Billington Electricity Meters, Ltd.

The petition by Mr. H. Johnson for the winding up of this company was again before Mr. Justice Neville in the Company Court on Tuesday, July 1st, and was, with the consent of all parties, adjourned for another week.

British Insulated and Helsby Cables, Ltd., *v.* London Electric Wire Co. and Smiths, Ltd.

An action was concluded at the Lancashire Chancery Court, sitting at Liverpool on Friday, before Vice-Chancellor Stewart Smith, in which plaintiffs claimed damages against defendants, of Anaconda Works, Salford, for an alleged infringement of their registered designs for overhead trolley wires for electric tramways, and asked for an injunction to restrain the defendants from further infringements of their copyright.

Plaintiffs' case was that in 1908 they registered two designs for a trolley wire showing a groove on two sides, dividing it into two sections, and described as non-fouling, and that in 1909 the defendants sold, or offered for sale, to the Corporation of Halifax and Wallasey such wire, which, it was contended, had been made in accordance with, or was an obvious or fraudulent imitation of, the said designs.

The defence put forward was that the designs adopted by the plaintiffs were not new or original designs. The defendants denied that the plaintiffs had any copyright in the said designs, or that they had infringed or threatened to infringe such copyright.

One of the representatives of the plaintiff company stated that 35 corporations in this country had been supplied with plaintiffs' wires, and that they had also supplied South Africa and Australia in large quantities.

Mr. W. M. Mordey, electrical engineer, said he was responsible for the direction of many systems of electric tramways. In his opinion the wires supplied by the defendant company were an infringement of the plaintiffs' designs. He further stated that the wires of the plaintiff company surmounted in the fullest degree the difficulties previously experienced in relation to the attachment of the trolley wires to their overhead support.

His Honour reserved judgment.

Osram Lamp Works, Ltd., *v.* David Smith & Co.

In the Chancery Division on Tuesday, July 1st, Mr. Justice Warrington had before him this case as a short cause on a motion for judgment. The action was for an injunction to restrain defendants from infringing plaintiffs' letters patent.

Mr. Hunter Gray, for plaintiffs, said it was a motion for judgment in default of defence.

His Lordship made the usual order.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Instruction Board for Motor Users.

In order to prevent any hindrance to the rapid adoption of electricity for motive power, it is most important that every possible precaution should be taken to ensure that the motors and starters are properly handled, more especially as the great majority of them are in the hands of unskilled operators. With this end in view, the Phœnix Dynamo Manufacturing Co., Ltd., have got out a new instruction board for use in connection with their installations in textile mills. The principle adopted to prevent mistakes in starting is based upon the view that every decent Englishman is familiar with the order "red, white and blue." The switches are coloured correspondingly. As the instruction board appears likely to interest a good many of our readers, containing as it does the essential instructions dictated by experience in the briefest form, we reproduce it herewith.

PHŒNIX DYNAMO MANUFACTURING CO. LTD.,

National Telephone: 3700 (Night or Day). **BRADFORD.** Telegrams: "DYNAMO, BRADFORD."

Important to Users of this Installation.

1. Only authorised persons allowed in this room.
2. See that the handles of all Starters are at the "off" position (RED) before putting current on at Main Switch (RED).
3. To start up a motor push starting handle over to starting position (WHITE).
4. When motor is up to speed as shown by meter on starter swing starting handle smartly right over to running position (BLUE). Never leave it on WHITE position.

REMEMBER THE ORDER:

RED WHITE AND BLUE

Notes for Electrician.

1. Keep a spare fuse for each size properly fitted with fuse ready to facilitate instant replacement.
2. In case of a motor fuse blowing be careful to see that its Starting Switch is in the "off" position (RED) before replacing fuse.
3. In case of the Main Switch (RED) tripping through any cause, place all Starting Switches to "off" position (RED) before making Main Switch (RED) alive again, otherwise fuses will be blown and delay possibly occur.
4. Examine all oil switches weekly to ensure level of oil being correct. Use only oil provided by the makers.
5. Dust or blow out the motors at least once every 14 days.
6. The bearings are in dust type covers; fill the Stauffers in a perfectly clean place with grease as supplied with the machines and fill the Stauffer lubricating cup once every 4 weeks.
7. If you are in doubt about any point, ring us up or come to see us. It is our business to help you.

Fig. 1.—Phœnix Motor Instruction Board.

Electric Lighting Set.

The accompanying illustration shows the latest type of Messrs. John I. Thornycroft & Co.'s petrol or paraffin-electric lighting sets combined on one bedplate. These sets are admirably adapted for ship or private house lighting, being very compact and extremely simple to operate.

The motor is a Thornycroft M/2 16-B.H.P. petrol type similar to the marine type. The motor is specially constructed to run on either petrol or paraffin ; ignition is by a Bosch high-tension magneto. The

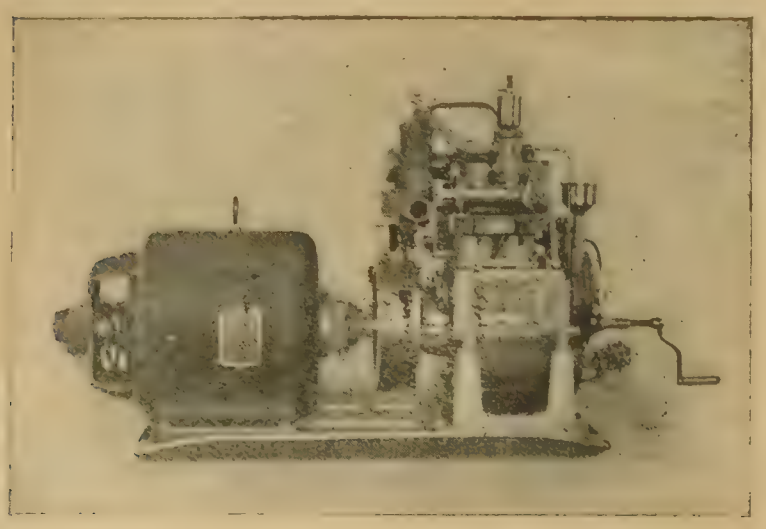


Fig. 2.—Thornycroft Petrol-Electric Set.

engine is controlled by a very sensitive enclosed centrifugal governor, by means of which the speed can be kept practically constant, no matter how much the load may vary. The generator is of the usual four-pole type, with an output of about 7 KW. when running on paraffin and 9 KW. on petrol. These sets are exceptionally well finished, and, before leaving the works, are subjected to a very severe series of tests, thus ensuring highest efficiency.

H.M.A.S. "Australia."

As our readers are probably aware, H.M.A.S. *Australia* is the battle cruiser which will be the flagship of the first unit of the Australasian squadron ; she is to be manned largely by Australian born seamen and by seamen who have sailed in Australian waters ; and the cost of her building and equipment has been borne by the Commonwealth Government. On Monday last, the King inspected her privately at Portsmouth and honoured the Australian Navy by knighting its first Commander-in-Chief, Rear-Admiral G. E. Patey, on the quarter deck. An item of interest to our readers in connection with this vessel is the fact that she carries a ring main

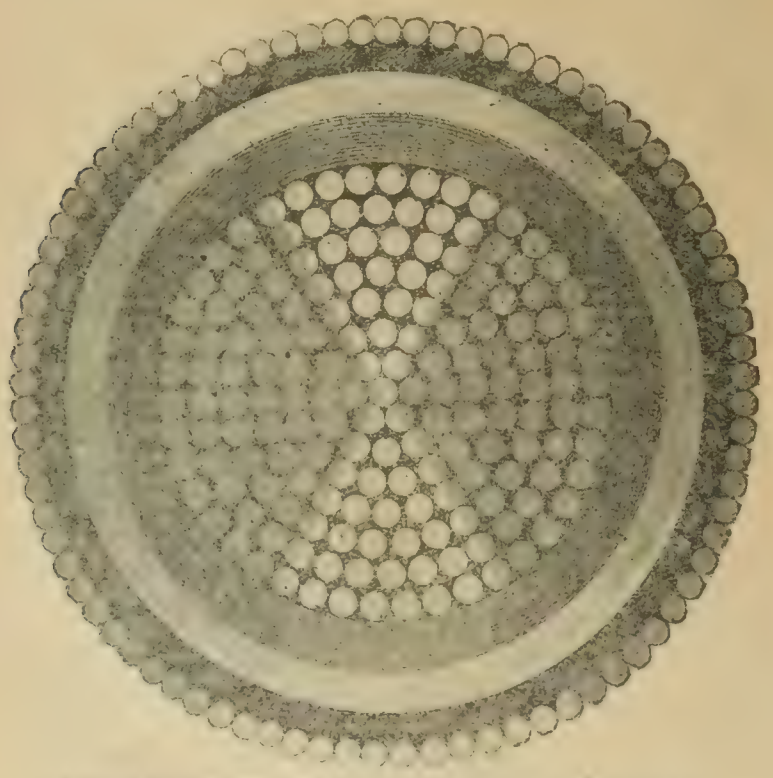


Fig. 3.—Heavy Ring-Main Cable by Henley's.

cable which is, we believe, the largest that has ever been installed on any ship. We show a full-sized illustration of this cable, and it will be observed that its diameter is nearly 3 in. Its sectional area is 2 sq. in. and its weight per thousand yards 23½ tons, the specification being as follows :—

169 H.C. tinned copper wires each '124 in diameter insulated with long fibre paper sheathed with a solid drawn tube of lead served with tarred jute yarn and armoured with galvanised steel wires, left bright.

H.M.A.S. *Australia* was built by Messrs. John Brown & Co., Ltd., of Clydebank, and the cable referred to above, as well as the whole of the cable used in the vessel, was supplied by Messrs. W. T. Henley's Telegraph Works Co., Ltd.

The Edison Miners' Electric Safety Lamp.

The latest Edison production is an electric safety lamp for miners' use, in respect of which Mr. T. A. Edison has recently been presented with the Rathenau medal by the American Museum of Safety, for the best electrical device designed to reduce the element of fatal risk to persons employed in what are considered dangerous and difficult occupations.

The lamp is made in two forms, one being of the usual self-contained and portable type—illustrated herewith—and the other having the lamp separate from the battery. In the latter case the lamp is arranged to be mounted in front of the miner's cap, and the



From *Edison Monthly.*

Fig. 4.—Edison Safety Lamp.

battery is carried from a belt on his back, his hands and arms being thus entirely free. The feature of the design consists in connecting the positive terminal of one cell to its container, and the negative terminal of the second cell to its case, the two containers being also electrically connected. It is thus possible to enclose the two cells in a steel box without the introduction of any insulation walls. The battery is securely locked, and the lens is not only of the proper optical conformation, but of the requisite mechanical strength. In the lamp arranged for use on the miner's cap, once the connecting flexible is pushed into the sockets of the battery and of the lamp, it is impossible for the miner to disconnect them, and so cause a possible spark in the mine.

PARLIAMENTARY.

Western Valleys (Monmouthshire) Railless Electric Traction.

After a four days' hearing the Select Committee of the House of Commons, presided over by Mr. Clancey, has found the preamble of the above Bill passed. The proposal is to incorporate a company with a capital of £135,000 to work trolley vehicles from Brynmawr to Newport.

Mr. Vesey Knox, who appeared for the promoters, explained that it was proposed to construct about 8 miles of trolley line through a narrow valley, which contained a mining population of 60,000, and where the railway communication was very bad. It would start at Brynmawr, which was 1,200 ft. above the sea level, and pass through Nantyglo and Blaina, Blaenau Gwent, Abertillery, Six Bells and Aberbeeg to Llanhilleth, which was 500 ft. above sea level. The Urban Councils of Abertillery and Nantyglo, and the County Councils of Breconshire and Monmouthshire were opposing for the purpose, counsel suggested, of getting as much out of the promoters as they could towards the maintenance and improvement of the road. It was also suggested that there was no assurance that the promoters would find the necessary money, but the directors were Sir James de Houghton, Sir Alex. Gibbons, Col. Harris and Mr Parry, the last two of whom were well known in the district. If a contribution of as much as ⅜d. per car-mile run was imposed on the company it would kill the scheme.

A number of witnesses having been called with regard to the existing lack of travelling facilities in the district, the Chairman intimated that the Committee were satisfied regarding the necessity for the undertaking, but required evidence on the question of contribution and of the damage likely to be done to the roads.

Mr. J. B. Hamilton, manager of the Leeds Tramways, expressed the opinion that the width of the road was sufficient to ensure the

safety of the public, and did not think a widening or a reconstruction of the present surface was necessary.

Sir Alex. Gibbons, Bt., one of the promoters, said he saw no reason why the capital of the undertaking should not be raised without difficulty. The promoters found it difficult to ascertain what they would have to pay for electric current, and hence it was difficult to say what contribution towards the maintenance of the roads would prove too burdensome. He was advised, however, that ¼d. per car-mile would be quite sufficient to kill the scheme.

In answer to the Chairman, Mr. Vesey Knox said that any purchase clause on the basis of allowing each local authority to buy small bits of the line within its own area, would absolutely bring the scheme to an end. If any purchase clause was put upon the promoters it should be the ordinary light railway clause, *i.e.*, that the whole, and not a portion or portions, of the line should be purchased.

Answering further questions by the Committee, Counsel said the professional advisers thought the scheme would carry ¼d. per car-mile as road contribution if that condition was not made to apply to cars run under the clause dealing with workmen's cheap fares morning and evening.

Mr. Talbot, K.C., for the Breconshire County Council, contended that it was essential that the Council should maintain the principle that persons who came for Parliamentary powers over public roads should not be allowed to use the roads for their own profit at the public expense.

Evidence was given by Mr. Maybury, county surveyor of Kent, that the roads were unsuitable for the proposed traffic, and similar evidence was given by Mr. W. L. Harper, county surveyor, and Mr. W. J. Davies, surveyor to the Nantyglo and Blaina U.D.C.

The Committee decided to pass the preamble of the Bill, subject to several conditions. With regard to purchase, they considered the company should have a tenure of 25 years, and that the purchase price after that period should be fixed under the terms of the Light Railways Act. The work should be commenced within 18 months of the passing of the Bill, and completed within the following year. The new company should be allowed to erect its own generating station. As to contribution for maintenance of roads, this should be at the rate of ⅜d. per car-mile, excluding cheap workmen's cars. The company should pay one-third of the cost of reconstruction of roads in the urban districts, but the sum should not exceed £500.

Hove Corporation Bill.

A Select Committee of the House of Commons, under the chairmanship of Mr. Gardner, considered the Hove Corporation Bill on June 25th and 26th, the principal proposal in which deals with the transfer of the undertaking of the Hove Electric Light Co. to the Corporation. Mr. C. J. Talbot, K.C., and Mr. Keen represented the promoters, and Mr. Rhodes represented the Local Government Board. There was no opposition to the electric lighting proposals.

Mr. Talbot explained that the local authority obtained a Provisional Order in 1890, and transferred it to the company in 1892, with the proviso that the Corporation should have power to acquire the undertaking after 21 years, or after that period had elapsed they could purchase at the end of every succeeding seven years on giving 12 months' notice. Under this agreement the Corporation had given the necessary notice. In 1898 the local authority obtained a Provisional Order for Aldrington, and had worked it themselves, taking the current in bulk from Brighton. If the Hove Corporation took over the Hove Co.'s undertaking the agreement with Brighton would be terminated. The Hove Co. had had a successful career, and placed a considerable amount to reserve, but their charges had remained higher than either Aldrington or Brighton. The basis of the agreement for purchase consisted first of paying the amount of the company's legitimate capital expenditure, and then making up their receipts available for distribution as dividend to a total amount of 7 per cent. cumulative. Practically during the whole of its existence the company had had 7 per cent. available for dividend. The amount was not agreed, but an approximate figure could be given, and if the parties did not come to terms about it, the matter would go to arbitration.

Mr. Rhodes said the company was getting a very good *quid pro quo*.

Mr. Talbot said the Corporation wanted to consolidate the whole thing into one Bill, and to show the Committee it was a reasonable thing in the interests of the town. They wished to reserve power either to work the undertaking themselves or to hand it over to the company to do so. The question before the Committee was that the Corporation asked for a longer period for the repayment of the necessary loans than the Local Government Board were prepared to give.

Ald. Marks, the Mayor of Hove, said the company's capital expenditure up to the end of 1912 was £176,298. The company's share capital was £100,000, and the debentures £44,000, and the balance was made up of the sinking and reserve fund. Last year, after paying directors' fees, which amounted to 1 per cent. on the capital of the company, they made a profit of £14,630, out of which they put 1½ per cent. into a renewals fund, 3 per cent. into the sinking fund, and they could still pay 9 per cent. on the shares. If the Corporation were granted 30 years for repayment, the actual repayment for principal and interest would be £10,937. This would leave a balance of £3,692, and if they reduced the price of electricity by ½d. per unit, a sum of £2,375 would be absorbed, and a balance of £1,317 left.

Replying to Mr. Rhodes, Witness said that if only 21 years were allowed for repayment there would be no balance and no opportunity for reducing the cost of the light. It was true they were paying the entire capital expenditure without allowance for depreciation, but, on the other hand, they were paying nothing for the goodwill of a concern making £14,000 a year profit.

Mr. Dykes, of Messrs. Handcock & Dykes, electrical advisers to the Corporation, gave evidence to the effect that in his opinion the plant was exceptionally good. In the mains there were about 150 tons of copper, the value of which had gone up very considerably.

Mr. Rhodes contended that the Corporation ought only to be allowed 21 years for the repayment of the loans, but

The Committee decided to grant a period of 30 years for the purchase loan, and 20 years for loans for extensions. The Committee also allowed the clause providing for Aldrington and Hove coming under the one set of provisions in the Bill.

Bradford Corporation Bill.—The Bradford Corporation Bill has passed Mr. Middlebrook's Select Committee of the House of Commons, the only opposition being to the improvement scheme. The Bill authorises the Corporation to spend £11,220 on trolley vehicles.

Various Bills.—In the House of Commons, on June 25th, the Richmond (Surrey) Electricity Supply Bill was read a second time. In the House of Lords, on Monday, the Kent Electric Power Bill was read a third time. In the House of Lords on July 1st, the Chesterfield Corporation Railless Traction Bill passed third reading. In the House of Commons on June 26th, the Mexborough and Swinton Tramways (Railless Traction) Bill passed third reading.

Post Office (London) Railway Bill.—In the House of Commons, on June 25th, the financial resolution in connection with this £1,100,000 scheme was passed.

ELECTRICAL ACCIDENTS IN 1912.

The Report for 1912 of H.M. Electrical Inspector of Factories and Workshops, Mr. G. Scott Ram, was issued last week and is given in abstract below :—

TABLE I.—Accidents at Electrical Generating Stations and Sub-stations in 1912.

The small figures relate to fatal accidents, and are included in the principal figures.

Description.	Public supply stations and elec. railways and tramways.	Other stations.
Non-electrical :—		
At engines, pumps and generators ...	28^2	6
At boilers and steam plant	63	2
At coal handling plant	19	2
Falls	85^7	11
Struck by falling bodies...	29	2
Miscellaneous	110^2	14
Total	334^{11}	37
Electrical :—		
At switchboards when engaged in ordinary routine work	11	2
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors	27^1	6
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead"	7	—
Adjusting brushes and cleaning commutators, and flashing at commutators	6	5
Miscellaneous	7^1	3
Total	58^4	16

The number of mechanical or non-electrical accidents is greater by 25 per cent. than last year. These accidents are very similar to those that occur in other engineering works, and call for no special comment here. The number of electrical accidents is identical with last year and the number of fatalities (four) is the same.

Ten of the accidents in the first class were due to mistakes on the part of the switchman, producing heavy arcing at the switch, with consequent burns to the hand and arm, and in one case to the face. Mistakes in switching are bound to occur occasionally, but the number of accidents from this cause is remarkably few. The injuries consequent on such mistakes would in many cases be less severe or entirely prevented if the switch handles were provided with suitable guard disks.

The next class of accidents—cleaning, repairing, &c., at switchboards—is as usual the largest, and one of the most instructive as showing the risks which are taken often unnecessarily by station engineers and attendants familiar with the dangers. The three fatal cases occurred on extra-high-tension three-phase switchboards. The first occurred to a contractor's engineer engaged in making extensions to the switchboard, who was familiar with all the details. He had not started work for the day, having only just come in, and was engaged discussing the work with the station engineer, who had previously warned him and others who were present that the whole board was live. Either in a moment of forgetfulness, or thinking despite the warning that a certain switch was dead, he touched a live terminal with fatal results. The next

case was one of cleaning dead parts of the gear, whilst adjoining conductors were live. A prosecution for breach of the regulations was instituted in this case, and the occupiers were fined £25 under Sec. 136. Notice of appeal, however, has been given. The third fatality occurred to a competent engineer when acting under the supervision of his superior officer. A compartment of the switchboard normally closed up by slate slabs held in position by bolts, and not designed or intended for use as a switchboard passage-way, was opened up by the removal of one of the slate slabs for the purpose of tracing out certain connections. One man entered through this opening, having then to crawl under various obstructions in order to see the connections at the back of the most distant panel, and the second man, who was in charge, started to follow him. The man in front touched a live conductor and was killed. How it occurred that two trained men, who apparently knew of the dangers, came to run such a risk on a matter which was apparently of no urgency is inexplicable. The investigation might have been made at the week-end, when the board could have been made entirely dead.

Of the non-fatal high-tension accidents, four occurred to men working close to apparatus which they knew to be live, apparently quite regardless of the risks which they were taking. Most of the accidents under this heading were through short circuits when working on direct-current medium-pressure switchboards for traction or general three-wire supply. A number were caused by the use of ordinary metal tools, *e.g.*, spanners, files, pliers, hack-saws, steel rules, when working at the backs of switchboards. Other short circuits were made whilst cleaning the switchboards. In one case a metal-bound brush was being used and caused the short circuit. Six accidents were due to short circuit in changing the connections of measuring instruments, either through the medium of metal tools or by the wires touching the frame direct. In many of the above accidents the injuries were very severe. In one case, following on the changing of the connections of a wattmeter, a disastrous fire occurred, completely destroying the switchboard at which the accident happened and another switchboard at a distance. Other accidents occurred when making tests at the switchboards.

Under the next heading—working on switchboards supposed to be dead—six were on high-tension switchboards. Two causing injuries to three men were due to switchgear being live through being fed back from a distant sub-station. Three occurred to men in cleaning switchgear, having omitted to make it dead by switching-off at the isolating switches. Another was due to carelessness on the part of the engineer in charge of a sub-station in not taking proper precautions to see that a man, whom he knew to be engaged on work at high-pressure isolating switches, was clear before he switched on at another part of the station. The accident would have been avoided if the two switches on the incoming mains had been locked off and the key held by the man working on the high-tension conductors.

In the next class, the accidents were due to flashing-over at commutators or slip rings when cleaning the same or when adjusting brushes.

Under the heading "Miscellaneous," the fatal accident was due to a man walking in the dark into a cable which was under test in the yard of a sub-station. The premises were in the hands of contractors at the time.

TABLE II.—Electrical Accidents in Factories other than Electrical Stations in 1912.

The small figures relate to fatal accidents and are included in the principal figures.

Arcing of switches		23
Arcing of fuses		8
Shock or burns from fuses when replacing fuse wires		27
Portable apparatus, connectors and flexible wires		61
Unprotected conductors, switches, terminals, fuses, &c.		27 [1]
Working on or near live conductors	Skilled persons	32
	Unskilled persons	33 [5*]
Miscellaneous accidents in electrical manufacturing and repair works—mostly in testing operations		32
Adjusting brushes and cleaning commutators, and flashing at commutators		9
Miscellaneous		31 [9]
Total		283 [15]

* One fatality due to fall following shock.

These accidents are slightly less in number than last year—283 as against 290—but the fatal cases are 15 as against only seven.

Of the accidents due to arcing of switches, 10 were due to flashes caused by switching on motors with the starting resistance cut out, mostly owing to defective automatic release action on the starters. Others were due to faulty D.P. switches or starting switches. The accidents from the arcing of fuses were due to the absence of proper protection of the fuse-wires.

The accidents in renewing fuses were mostly due to the replacing of fuse wires in live contacts, either directly or when held in unsuitable carriers. Except for one case of shock, the main injuries were all burns from short circuit. In some cases the terminals were short-circuited by the spanner or screwdriver which was being used. In others the short circuits were made by the fuse wires getting across the terminals. In several cases switches were provided by which the terminals could have been made dead, but they were not used. In three cases switches were provided in the same box as the fuses and without any insulating or other division, and short circuits were made across the switch blades or switch contacts. In a few cases the arcing was due to replacing the fuses on a short circuit, the fault which caused the fuse to blow in the first instance not having been remedied.

(*To be continued.*)

REVIEWS.

The Design and Construction of Steam Turbines. By Harold Medway Martin. London: Longmans, Green & Co. Price 25s. net.

Mr. Martin's substantial volume cannot fail to appeal particularly to those central-station engineers and others who are responsible for the satisfactory running of steam turbines. Many readers of the volume will be already familiar with much of the contents of this work regarding the theory of the steam turbine, as this section is based upon a series of articles contributed to the columns of our contemporary *Engineering*. In the first chapter Mr. Martin gives us a few "preliminary ideas" about turbines in general; then after having shown that a guide blade or nozzle forms an essential element of every turbine, he discusses the design of these elements, showing, in this connection, the uses of the total heat-entropy, or Mollier diagram. More theory follows, impulse buckets, the efficiency ratio and reheat factor and correction curves forming interesting and well-reasoned chapters which, like much of the book, are necessarily mathematical. Here we might say that the errata in the formulæ are distinctly numerous, though most of these appear to have been detected after the book had gone to press, and are indicated at the commencement of the volume. Doubtless this blemish will be removed in the case of later editions.

After working out fairly completely the theory of the steam turbine, Mr. Martin proceeds, about half-way through his book, to discuss the constructional details of various types of machines, and gives descriptions of representative turbines including the Parsons, De Laval, A.E.G., Rateau, Zoelly, and several others of the Parsons type. The volume is splendidly illustrated, and should take a permanent place in the library of any engineer who in any way is interested in the working of the steam turbine.—G. S. S.

A Laboratory Manual of Alternating Currents. By Prof. J. H. Morecroft. London: Longmans, Green & Co. Price 7s. 6d. net.

Prof. Morecroft has given us an interesting and useful book, which will be found to contain many ideas and suggestions of value to the somewhat limited class of readers for whom it has been specially written. The book is a laboratory manual adapted for use in connection with the advanced classes in universities and colleges, and is neither intended nor suited as a guide for the work of a commercial laboratory or test house, although there are many things in it which might well prove useful and suggestive to the experimenter who has left his college days behind.

The tone, as well as the arrangement, of the book is academic, in the best sense of that term. The object of the experimental work described in it is educational, and the measurements are not primarily directed towards securing results of immediate practical or commercial value.

In his introduction, the author explains why he does not give detailed instructions for carrying out the experiments which form the suggested course, and why he prefers to leave the student to devise his own diagrams of connections and methods of observation. Seeing that his book is intended for the use of advanced students, he is probably right in his decision on this point. He further explains that the mathematical theory is given in the case of such problems only as are to be approached experimentally, the general theory of alternating currents and alternating-current machinery being left to form the subject of the lecture courses attended by the students. While here, again, this appears to be the wisest course, the result is sometimes a little unbalanced, inasmuch as a long and full theoretical discussion on certain parts of alternating-current theory is presented, while other, and equally important, parts of the subject, which do not happen to be so easily capable of experimental illustration, are for that reason not touched upon. Further, some chapters of the book consist mainly of a somewhat lengthy theoretical investigation involving many detailed considerations, followed by a relatively simple and obvious experiment, illustrating only the more

elementary parts of the theory. This apparent want of balance was perhaps unavoidable, and is not brought forward as a defect, but rather as indicating that the book is essentially for use as a companion to the more general text-books, and that it is not intended to displace them.

Proceeding to a more detailed survey of the contents, we find that, as a rule, each experiment forms the subject of a single chapter. The treatment usually consists in a fairly complete, and sometimes a very detailed, mathematical theory of the subject to be illustrated, followed by a short general description of the test to be carried out by the student, and by some questions to be answered from the results of his observations.

We begin with a couple of experiments dealing with wave-forms and their influence on the indications of instruments —an important matter which is apt to receive too little attention. Then follow eight experiments dealing with alternating-current circuits containing resistance, inductance and capacity.

The symbolic system of notation is introduced in connection with these experiments, although little further use is made of it in the later portions of the book, and general differential equations are given. Surely the author is hardly correct in stating (page 28) that Z (representing impedance) has direction and is a vector. If Z is a vector, the product $I Z = E$ must be the product of two vectors, and should contain both scalar and vector parts.

Experiments on alternators follow next, and in connection with them a very full treatment is given of a method for predetermining the external characteristic of an alternator under load. As, however, the method depends on sending full-load current through the stationary armature from an external source, in order to determine the true armature impedance, it can hardly be regarded as a practical method for use on a commercial scale.

There follows a number of experiments on transformers, including determinations of the losses and efficiency and heat runs, also a suggestive experiment on the parallel operation of two transformers.

Next come some experiments dealing with measurements on polyphase circuits, including one dealing with the higher harmonics of a three-phase circuit.

Experiments on the synchronous motor and rotary converter, with a special study of the action of interpoles, are followed by others on the induction motor, induction generator, single-phase series motor, and the mercury vapour arc rectifier. The treatment of the induction motor and series motor is not quite as full as might have been expected, and is, perhaps, the least illuminating part of the book.

An appendix gives 27 plates of oscillograms of current, voltage and other waves, all of a very interesting and instructive character; one or two of the curves are, unfortunately, rather indistinct in the reproduction.

The book is excellently produced, and both type and diagrams are admirably clear. One is a little inclined to regret the absence of an index, although a full list of the 39 experiments at the beginning goes some way towards rectifying this omission; the fact that the work is not intended for general reference may be pleaded as a further excuse.

The book is certainly one which should be placed on the shelves of every electrical engineering college library, and which should be carefully studied by those in charge of the laboratory work.—C. F. S.

The New Steam Tables, together with their Derivation and Application. By Prof. C. A. M. Smith, M.Sc., and A. G. Warren, B.Sc. London: Constable & Co., Ltd. Price 4s. net.

Prof. Smith and his able assistant—both, by the way, now on the staff of the University of Hong-Kong—have given us in this volume a fine collection of tables that will be of undoubted value to British engineers and students. On the Continent there exists a similar work by Prof. Mollier, of Dresden, whose tables are, of course, in the metric system of units. Both sets of tables, however, have a common ancestry, being based on the researches of Prof. H. L. Callendar. The authors have been fortunate in obtaining an introduction to their work by Sir J. Alfred Ewing, K.C.B., F.R.S., to whom we are largely indebted for the existence of the present volume, seeing that it was he who first drew attention to the importance of the work done by Callendar and Mollier. The "Tables" are equally divided into two parts, the first being in Centigrade units and the second in Fahrenheit units. As Sir Alfred Ewing says, this latter feature "may be a prudent concession to national bad habits, but students cannot be too strongly urged to accustom themselves to the use of the Centigrade scale in all steam calculations. To adhere to Fahrenheit degrees and the quantities dependent on them is to maintain a wholly unnecessary and exceedingly inconvenient barrier, not only between applied science and the science of the physical laboratory, but also between the engineering of England and that of other countries," with all of which we are in the most entire agreement. In both sections the Tables give the properties of saturated steam on various bases, the specific heats of saturated steam at various temperatures and pressures, and lastly, the average specific heats of superheated steam from saturation to tabulated temperatures at various pressures. The authors describe clearly how values not included in the Tables may readily be calculated, and give a chart representing the total heat of steam on an entropy base, a graphical method of representing the properties of steam which is already largely used, especially in connection with steam turbine problems.—G. S. S.

BUSINESS NOTES.

Holiday Literature.—There have been issued from the Isle of Wight Publicity Office (29, John Street, Bedford Row, W.C.) a number of excellent booklets, dealing respectively with the attractions of the following holiday resorts:—Freshwater and Totland Bay; Bembridge, Sandown, Ventnor and Sea View and St. Helens. All of these are official publications, and copies can be obtained either from the respective town clerks or from the address given above.

"Eye-Rest" Lighting at Rugby.—One of the latest "Eye-Rest" installations is in the Temple Speech Room at Rugby School. The room is fairly lofty, and the fittings are suspended close to the ceiling, but the pictures on the lower part of the wall are excellently lighted, the light and shade effects, it is claimed, being equal to those of daylight. The installation consists of one 55-in. fitting containing nine 200-watt Mazda lamps in the centre of the room, one 36-in. fitting containing nine 100-watt Mazda lamps at each end, and one 24-in. fitting containing three 100-watt Mazda lamps in each of the transepts. The fittings are attached to the ceiling by means of contact suspension gear, so that they can be lowered to the floor for cleaning. The B.T.H. Co.'s illuminating engineers consider that the installation is one of the finest examples of interior illumination to be found in this country.

Consular Notes.—Norway.—The British Consul in Norway reports that the Hardanger works produced about 2,200 tons of pig-iron in 1912. The Tinfos works were delayed by late delivery of plant, and only got furnaces to work in 1912, each producing about 10 tons of good quality pig-iron per diem. The Ulefos works produced about 300 tons of electric pig-iron. Work progressed on the future Arendal undertaking. The Stavanger electro-steel works were nearly completed by the end of 1912, power being supplied from Ryfylke power station, at first about 1,500 H.P. The estimated production is about 6,000 tons of steel per annum. The raw material used will be old iron, not iron ore, chiefly broken-up vessels, melted in a Martin furnace and refined in an electric furnace. The Jossingfjord electric furnace has been at work periodically, and the Noes ironworks, which chiefly supply crucible steel by old methods, have worked much as usual.* At Sydvarangar, the largest Norwegian iron mine, extensions were completed, allowing of an estimated annual output of about 500,000 tons, of which 200,000 tons are briquettes and 300,000 tons "slich." Further extensions are contemplated to bring the production for 1913 up to 650,000 tons or 700,000 tons. The capital for this extension, about 3,000,000 kroner, is Norwegian, and brings the total ordinary share capital up to 15,000,000 kroner, of which about 5,000,000 kroner is thought to be in Norwegian hands. The power station will be extended with a steam turbine set of 4,000 KW.

Important fresh discoveries of silver have been made at the Kongsberg Government silver mines, and electric power has been supplied from the Kongsberg municipal electric works to the mines. The Sulitjelma copper output was a record, 123,250

* Owing to cost of production, electric iron-smelting at the Hardanger works and at Arendal has been given up since the above was written.

tons export pyrites, 14,850 tons best ore, and 11,500 tons Elmore concentrate. Most of the best ore and about half the concentrate was smelted, giving 1,024 tons Bessemer copper. The workings are said to be still very satisfactory. About 12 Elmore washing machines have been at work all the year, and refuse from old washings has been passed through the Elmore machines with profitable results. The Knudsen smelting process has progressed as before. The Wedge roasting furnace and Anaconda type flame furnace were completed in September, and are calculated to bring the annual smelting up to 40,000 tons to 50,000 tons, representing 2,000 to 2,500 tons Bessemer copper.

The following was the approximate production of the other principal Norwegian copper mines in 1912 :—

	Production.	*Tons.*
Birtavarra	Bessemer	282
Bossmo	Pyrites	23,500
Lökken	,, ...	116,000
Foldal	,, ...	72,000
Röstvangen	,, ...	26,893
Röros	Copper	587
,, ...	Pyrites	11,000
Killingdal	,, ...	25,000
Stordö	,, ...	21,100

The total estimated Norwegian production of pyrites in 1912 was about 430,000 tons, worth £530,000; of copper, 2,150 tons, value £153,000.

As regards electro-thermic products the Consul reports that the Norwegian export of calcium carbide in 1912 was about 64,208 tons, as compared with 60,593 tons in 1911. All the Norwegian manufacturers are believed to belong to the combine. Norway produces about two-thirds of the European consumption of carbide after deducting what is supplied in France. The average price per ton at Norwegian port in 1912 was about £9. The British Cyanamide Works, at Odda, which started in 1909, are stated to have exported 13,892 tons, as against 13,172 tons in 1911. The ferro-silicon exports reached 6,493 tons; zinc exports, 8,928 tons; and the aluminium exports about 1,800 tons. The total value of the exports of carbide, ferro-silicon, ferro-chrome, zinc and aluminium are calculated roughly to have reached some £1,200,000, from which some £500,000 must be deducted for raw materials purchased abroad.

The saltpetre industry prospered in 1912. Prices ruled high and demand was brisk. Practically the whole production for 1913 is thought to be sold already. The whole of the present Rjukan plant was in full working order by the end of May, and further extensions are being planned. The British Vice-Consul at Skien states that work has been begun for the reutilisation of the water power by taking the water used at Vemork Power Station through a long tunnel and down to turbines at Station No. 2 near Saaheim, thus affording two stations of 130,000 and 110,000 H.P. respectively. The product is transported by rail and lighter to Skien for shipment, but the sale is centralised at the head offices of the company at Christiania.

The British Vice-Consul at Skien reports that the town of Porsgrund, and adjoining districts, have purchased the Aarlifos waterfall, in Hiterdal, for electrical purposes. The power which will be obtained is estimated at some 10,000 H.P. The town of Skien have also contracted with a Larvik firm to rent 3,000 electrical H.P. In this connection the Vice-Consul at Larvik adds :—"The Skein municipality have lately bought from the proprietor of the Grini Farm, Laurdal, his waterfall rights in the river Laugen, for the purpose of bringing electric power to the town, but when they will commence with the project was not decided at the time of writing. Skien has also made a contract with Mr. Treschow Fritzoe for supplying power from his electric works in Slerndal. Mr. Treschow Fritzoe will also supply Sandefjord from the same works at Slerndal.

The new wireless stations on the German Telefunken system at Bergen, Ingo (near Hammerfest), and Spitzbergen, are now completed and in working order. Subject to the sanction of the Storthing, a contract has been concluded with the Marconi Co. for the erection—probably in the neighbourhood of Stavanger—of a powerful station for direct wireless communication with the United States. A coal company in Spitzbergen is also understood to possess a private wireless station for communication with the Spitzbergen station.

A number of new motor factories, especially for marine motors, were started in 1912, and the manufacture of electric machines, telephone appliances, electric tramway cars, &c., progressed steadily. The construction of the underground tube electric tramline across Christiania through rock has proceeded apace.

Dynamo Brushes.—The agency for the dynamo and motor brushes made by Messrs. Sondermann & Co. has been taken up by Mr. Archibald Campbell, of 27, Chancery Lane, W.C. These brushes are of pure graphite, and a speciality is made of brushes for large machines with high commutator or slip-ring speeds. Both soft and hard qualities are supplied, and for A.C. machines the makers recommend their bronze (metal and carbon) brushes. Particulars are given in price list No. S 5.

Canadian Companies Consolidate.—A Halifax (N.S.) newspaper says :—The Canadian General Electric Co., Ltd., who own and control, as subsidiary companies, the Canada Foundry Co., Ltd., and the more recent acquired Canadian Allis-Chalmers, have decided to consolidate the selling organisations of the two latter companies dropping the name "Canada Foundry Co., Ltd.," and conducting the selling organisations of both companies under the name of "Canadian Allis-Chalmers, Ltd." This policy has been adopted because the name Canada Foundry Co. does not appropriately cover the wide range of mechanical apparatus manufactured by that company, whereas the name Allis-Chalmers is synonymous with a very wide range of mechanical appliances and engineering works of magnitude, particularly in the manufacturing of Corliss engines, water wheels, saw mill machinery, mining machinery, cement machinery, flour mill machinery, gas engines, &c., and these lines will naturally be complementary to the products of the Canada Foundry, such as steam locomotives, hydraulic machinery, pumping machinery, structural steel work, &c. Hereafter all sales of electrical apparatus and supplies will be in the name of the Canadian General Electric Co., Ltd., and all general engineering contracts and sales of mechanical appliances in the name of Canadian Allis-Chalmers, Ltd.

Book Notices.—The July number of *The Chamber of Commerce Journal* contains a special supplement, entitled "Trade Products of the British Empire."

"Colliery Cables." By W. T. Anderson, M.I.M.E. Excerpt from the *Transactions* of the Institution of Mining Engineers. Copies can be obtained by application to Messrs. W. T. Glover & Co., Ltd., Manchester.

"Electrical Meters." By C. M. Jansky. 1913. London: Hill Publishing Co., Ltd. Price 10s. 6d. net.

"Manual of Electrical Undertakings and Directory of Officials." By E. Garcke. Vol. XVII, 1913-14. London: Electrical Press, Ltd. 21s. net.

"Report of the University of Leeds." 1911-12. Leeds: The University.

"*Proceedings* of the Physical Society of London." Vol. XXV, part IV, June 15th, 1913. London: *Electrician* Printing and Publishing Co. Price 4s. net.

"Resuscitation." By C. A. Lauffer, M.D. London: Chapman and Hall. Price 2s. net.

Fire Brigade.—A new fire brigade has been formed at the Osram Central Stores in Union Street, Southwark. At this department of the General Electric Co., the main stock of Osram drawn-wire lamps is stored, and most careful precautions must be taken to secure safety to the large staff employed and to the valuable stock. The fire brigade at the Osram Central Stores consists of 23 members, with Mr. C. Rennie as captain. Mr. W. Riley, formerly of the Metropolitan Fire Brigade, has been engaged as instructor. At present, weekly drills are being held under Mr. Riley's instruction. It has been shown that the staff can be dismissed from the premises, and the fireman be at their posts, in 30 sec.

Bankruptcy Proceedings.—A. P. Parker, electrical engineer, Burnley.—Date of release of trustee (Mr. C. H. Plant, 13, Winckley Street, Preston), January 27th, 1913.

J. Tizzard, electrical engineer, Torquay.—Date of release of trustee (Mr. A. E. Ward, 9, Bedford Circus, Exeter), January 30th, 1913.

T. Topping, electrical and mechanical engineer.—Date of release of trustee (Mr. E. D. Symond, 11, Dale Street, Liverpool), January 27th, 1913.

Liquidations.—Miners' Lamp Electric Lighting Co., Ltd.—This company is winding-up voluntarily, with Mr. J. Blackley, 42, Spring Gardens, Manchester, as liquidator.

Universal Steam Trap Syndicate, Ltd.—This company is winding-up voluntarily, with Mr. G. T. Harrap, 5, Budge Row, Cannon Street, E.C., as liquidator.

District Electric Co., Ltd.—Creditors must send particulars of debts, &c., to the liquidator, Mr. J. W. Hinks, 115, Colmore Row, Birmingham, by July 31st.

Bullough's Adjustable Rail Joint Support Co., Ltd.—A meeting is called for July 28th, at 2, 4 and 6, St. John Street, Smithfield, E.C., to hear an account of the winding-up from the liquidator, Mr. Raymond Wells.

Meeting of Creditors.—*Re* Brown & Parsons, Ltd., Leamington.—At the meeting of creditors in this matter, resolutions were unanimously passed appointing Mr. Charles Thomas Appleby, of Birmingham, voluntary liquidator of the company (in place of Mr. G. H. Butterworth), with a Committee of Inspection consisting of the Electric and Ordnance Accessories Co., Sandycrofts, Ltd., Sloan Electrical Co., and W. E. Mayo & Co., Ltd. A statement of affairs was read to the meeting by Mr. Butterworth, but the figures as regards the assets then given were merely estimates. The necessary order of the Court appointing Mr. Appleby as liquidator, with the Committee, was made on June 20th, and Messrs. Poppleton & Appleby have prepared a statement of affairs showing the liabilities at £1,576, and assets £791, leaving a deficiency of £785. In this statement of affairs they have not extended a claim alleged to be due to Mr. F. E. Brown, of £1,019, nor have they taken into consideration the debenture issued as part payment of the account only a short time ago to Mrs. Brown for £625. An offer has been made to purchase the whole of the assets of the company for £532, and in addition all claims (if any) under the debenture, or for money lent by Mr. Brown to the company, to be withdrawn. The Committee have instructed the liquidator to accept this offer, and it is anticipated that the creditors will eventually receive a dividend of about 5s. in the £.

Bankruptcy Proceedings.—Wm. Slade Olver, consulting engineer, 298, Willesden Lane, Willesden.—Receiving order made June 25th on a creditor's petition. First meeting, July 8th; public examination, August 12th; both at Carey Street, W.C.

Catalogues and Lists.—The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.—Folder illustrating the various types and sizes of Mazda drawn-wire automobile lamps, specially designed for motor-car service. In each class the lamp filaments have been constructed with the object of giving the most suitable distribution of light for the particular purpose. The Mazda headlight lamp, for example, has a very small helical coil of filament, approaching as nearly as possible the theoretical point source, so that when used in a parabolic reflector, all the light is thrown forward in a parallel beam.

Messrs. J. B. Guthrie & Son, 30, St. Mary Axe, London, E.C.—Illustrated price list of "Elasta" metal hacksaws.

Messrs. W. Geipel & Co., Vulcan Works, London, S.E.—Export price lists Nos. 134 and 135, the former dealing with Ward-Leonard rheostats, theatre dimmers and resistance units, and the latter with hand and automatic starters, switches, &c. The firm's London works have had to be extended.

The Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, London, E.C.—A set of half-a-dozen new illustrated descriptive and priced leaflets particularising the following series of Vulcan electric tools:—Single-speed electric drills; pillar drills; magnetic drill and reamer; magnetic chucks and fixing plates; electric grinders; electric drilling and grinding equipments; portable electric blowers and polishing motors.

Messrs. J. T. Niblett & Co., 183, Grove Lane, Denmark Hill, London, S.E.—Price leaflet relating to Niblett's new electric bleachers for removing stains, bleaching, disinfecting and deodorising.

British Westinghouse Electric and Manufacturing Co., Ltd., 14, Long Millgate, Manchester.—Folder with appropriate seabreeze cover, giving prices of Westinghouse electric fans for the 1913 season.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—New catalogue (Section D) of electric fans. In 20 pages are given brief illustrated particulars and prices of all types of fans suitable for domestic, office and industrial use, also the firm's special type of railway fan, such as they supply largely to Colonial and foreign railway companies. Desk and oscillating types, also a special combined fan and table lamp, and a combined fan and fruit dish, are listed. A second catalogue of 40 pages contains full information relating to Sun Holophanes, giving particulars, data, and prices of present standard Holophane glassware, and a large variety of fittings specially designed for use therewith. All recent patterns of this range of reflector are included. Copies of both of these catalogues will be forwarded on application.

Trade Announcements.—Mr. Guy Campbell, the sales manager of the Benjamin Electric, Ltd., of London, has joined the board of directors of the company as a managing director. The Benjamin Electric Manufacturing Co., of Chicago, and the Benjamin Electric Manufacturing Co., of Canada, Ltd., have large factories for the manufacture of the Benjamin electric lighting specialities for sale in their respective countries, while the Benjamin Electric, Ltd., manufacture at their London factory the material for the English and Colonial markets.

Mr. A. Golding, electrician, &c., has commenced business at Little Charles Street, Herne Bay.

Messrs. Farrar & Dyson, electricians, of Saltburn-by-the-Sea (Yorks.), announce that they are retiring from business. In consequence, the stock, &c., has been disposed of by auction this week.

Owing to the retirement of Mr. John Charles Garside, the business of Messrs. Chapman & Co., electrical engineers, of 5, Lodge Lane, Beeston, Leeds, has been taken over by Mr. Albert Ramsbottom.

The works of the Walsall Electrical Co., Ltd., will be closed to-morrow, Saturday, July 5th, for the annual outing.

Messrs. Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, E.C., announce that owing to the rearrangement of the Telephone Exchange boundaries now being carried out by the postal authorities, their telephone number has been altered to "City 6470" (8 lines).

Messrs. Electric Control, Ltd., have removed their London office to Queen Anne's Chambers, Tothill Street, Westminster, London, S.W. Telephone No. "3240 Regent."

The Crompton Reconstruction Changes.—We are informed that Crompton & Co.'s scheme of reconstruction has been successfully carried through, and the new shares allotted. The additional capital will be a help to the business, which is being carried on under the old name. The new company takes over all the assets and pays all the liabilities of the old company. There are some changes on the board. Col. Crompton retired some months ago, and it will be remembered that Mr. Trotter, the late chairman, died in May. The new board has been strengthened by the addition of Mr. A. A. Campbell Swinton and Mr. W. Churchill Hale. Mr. A. J. Hodgson, for some years works manager, and latterly joint manager of Crompton & Co., resigned his position in November last, but, at the request of the board, continued his duties until the scheme for the reorganisation of the capital had been carried through and the question of his successor settled. The directors have appointed Mr. Thos. Britten, for many years with the Electrical Construction Co., as works manager, and Mr. Hodgson will be leaving Cromptons in August, when Mr. Britten takes up his duties. Mr. E. Reeves, joint manager of the old company, now becomes managing director.

British Works in Canada.—The *Canadian Engineer* says that the big industrial corporations of Great Britain and the United States are realising the significance of the rapidly-growing markets of Canada. "The United States Steel Corporation is establishing a large branch plant in Ontario, and the Sir W. G. Armstrong-Whitworth Co., Ltd., of England, will take a similar step, although their establishment will be in Quebec province The Canadian branch of this famous company will be used solely for commercial or civil or mechanical engineering, and not for naval or military work. At no time will the company make guns, boats, or anything of that nature here. This is, at any rate, in keeping with the spirit of the celebration of 100 years of peace in North America. They will manufacture twist-drills, punches, milling cutters, cranes, drop forgings, tool steel, &c. The decision of this large English corporation to erect a branch plant in Canada is a great event in Canada's industrial history. It indicates the confidence of keen and observant business men and capitalists in Canada's future, and that confidence is welcome and gratifying to Canadians. British capital will finance the entire enterprise, and no issue will be made in Canada."

LIGHTING and POWER NOTES.

Ayr.—The T.C., at a special meeting, has approved of terms for the extension of the electric lighting area, so as to include the burgh of Prestwick and the district of Alloway under the jurisdiction of the Ayr District Committee of the County Council. Under the terms of the agreement the Prestwick T.C. has power to purchase the undertaking of the Corporation within its boundary at the end of 30 years at a mutual valuation.

Barnstaple.—The T.C. has revised the tariff for current for power as under, as from April 1st last:—Up to 4,000 units per quarter, 2d. per unit; for the first 6,000 units, 1½d.; next 6,000, 1¼d.; beyond 12,000, 1d.

Barwell.—A parish meeting has decided by a large majority to approach the Leicestershire and Warwickshire Power Co. in regard to lighting the streets electrically.

Bath.—An illumination scheme has just been carried out in the Royal Victoria Park, by the Corporation. The part which has been lighted includes the bandstand and chalet, which have been outlined by over 2,000 lamps. The chalet has also been outlined so as to give an impression of its size, while the intervening space has been linked up by means of green, red, blue and amber festoons. The main entrance has also been treated, the ridges in the stonework forming the foundation, while the two pillars have been connected by a festoon of coloured and frosted lamps, upwards of 400 being utilised on this part of the scheme alone. The work, which has been carried out at a cost of £300, has been more than justified by the result.

Bexhill.—The Council has decided to alter all the arc lamps in the borough to high c.p. metal-filament lamps. The engineer estimates the cost of alteration at £3 10s. per lamp, a total of £122, and that the annual saving in cost of current will amount to £175.

Bexley.—The U.D.C. has decided to extend the facilities for the use of arc lamps for the outside lighting of shops, so as to apply to lanterns for use with 300 and 400-watt metal-filament lamps. The charge will be £4 and £4 10s. per annum respectively.

Bispham.—At a meeting of the D.C. last week the common seal was ordered to be fixed to a statutory notice of the intention of the Council to apply for a provisional order to supply electricity to Cleveleys.

The Electricity and Public Lighting Committee has recommended that after June 30th the price of electricity for heating and cooking purposes be reduced from 2d. to 1d. per unit.

Brentford.—The Board of Guardians has requested its Engineering Committee to report on the cost of providing a complete installation of electric lighting at the Union Offices, and also on the annual cost involved by the supply of electricity. A further suggestion was made by Mr. H. Evans that the Committee might also think it desirable to report on the electrifying of the whole of the establishments.

Bromley (Kent).—The West Kent Electric Co. has informed the T.C. that after the expiration of one month from June 10th it proposes to take advantage of its powers to lay various cables through London Road, High Street, Mason's Hill, and along Hayes Lane to the limits of the borough in that direction. As stated in a recent issue of the E.R., the T.C. recently objected to the laying of the mains in the town.

Canada.—Hydro-Electric Breakdown.—On June 16th a serious breakdown occurred in the Hydro-Electric Commission's supply, and as a result Toronto and the cities and towns of Western Ontario using this supply were without electrical energy for a period of five hours. Industrial plants, traction companies and street and residence lighting were all affected, while in Toronto the water supply ran short owing to lack of pumping power. Apparently it took a considerable time to locate the faults, one of which was found at Dundas, and the other was on the main transmission line.

Colne.—The T.C. has approved a recommendation from the Electricity Committee to the effect that from July 1st the charge for electric current for heating, cooking and other domestic purposes other than lighting, and where a lighting service already exists, be reduced to 1d. per unit through a separate meter.

Continental Notes.—Spain.—What is described as the largest steam turbine and generator set in Spain is about to be installed as a reserve plant at the power station of the Sociedad de Riegos y Fuerza del Ebro, in the Province of Barcelona. It will be arranged to come automatically into operation by means of a regulator operated by compressed oil. The turbine will be of 20,000-H.P. capacity, of the Curtis type, and is being built by the A.E.G.

Cromer.—The B. of T. has fixed July 15th as the date for an inquiry into the proposed transfer by the U.D.C. of the electrical undertaking to Messrs. Edmundson's Electricity Corporation, Ltd.

Hebden Bridge.—The L.G.B. has sanctioned the application of the U.D.C. for sanction to borrow £3,250 for extensions at the electricity works, the period for repayment to be 15 years. The Council asked that the repayment be spread over a period of 25 years.

Heston and Isleworth.—The total income of the Council's electricity undertaking for the past financial year amounted to £8,878, and after meeting working expenses, repayments of principal and interest on loans, and minor capital charges, there remains a net credit balance of £218. The output of current for the year totalled 1,094.789 units (compared with 1,040,774 for the previous year), and 848,403 of these were sold, as compared with 804,202 in 1911-12. Of this amount 262,202 were used for private lighting, 367,707 for power, and 218,094 for public lighting. The engineer expresses the opinion that in view of the growing prosperity of the undertaking, there is every reasonable hope for more concessions in the direction of reductions in the charges for lighting purposes.

Horsham.—The U.D.C. has received from the L.G.B. sanction to a loan for a refuse destructor, not in connection with the E.L. scheme as desired, but under the Public Health Acts.

Hull.—Annual Report.—The report of Mr. Bell, the city electrical engineer, on the last year's working of his department, states that the total income of the undertaking increased from £67,773 to £75,287, a little over three-quarters of this increase being attributable to additional electricity sold for power, and the balance to sales for lighting consumption. The total costs of production amounted to £40,454, leaving a balance carried to net revenue account of £34,833, an increase over the previous year of slightly over £2,800. The gross profit was well maintained, in spite of the abnormal increase in the price of fuel during the year in question. The balance carried to reserve fund after payment of capital charges amounted to £7,755, an increase over the previous year of £1,254. The units sold amounted to approximately 10½ millions, being an increase of nearly 20 per cent. above those sold in 1912. The number of new consumers connected during the year amounted to 300, being considerably greater than the average of preceding years, and the cost of the necessary meters for same, all of which, in accordance with previous custom, have been purchased out of revenue, amounted to £625. During the period under review a considerable amount of renewal work was carried out, both at the power house and on the mains in the streets, in order to bring the plant generally into a safer condition to cope with the more onerous duties which electricity undertakings are now having to deal with. The motor hiring scheme, initiated by the Committee in 1905, showed a steady development, the total number of motors out on hire being 203, representing a total horse-power of 1,170. The income accruing from rentals from this source amounted to £1,040. During the year also very considerable additions were made both to the plant and mains of the department. The total works cost was '92d. per unit sold, and the maximum load 6,622 KW. Of the 10½ million units sold per meter, 8 million were for motor use, and public lamps took 85,000.

Ilford.—The electrical engineer has been directed to report upon the subject of fitting mechanical chain-grate stokers to the remaining boilers at the electricity works.

Ipswich.—The T.C. on June 25th decided to apply to the L.G.B. for a loan of £17,500 for mains, services, rental, wiring, and motors, boilers, and excess expenditure on mains. A further loan of £16,000 is to be sought for the extension of mains in the eastern suburbs of the borough, which are being rapidly developed, together with the provision of sub-stations, transformers, and switchgear.

Japan.—It is reported that the Anglo-Japanese Water Power Co. has decided to establish another electricity generating station on the Tenryu River, with a view to supplying a deficiency in the power caused by the breaches in the dam at the Oi River power station during the great flood of last autumn. When the new plant is completed, the company will have a total capacity of about 4,000 H.P.

Keighley.—The L.G.B. has sanctioned the application of the T.C. for additional borrowing powers in connection with the electricity undertaking, the periods of repayment being 11 years in connection with £1,100 for the provision of a cooling tower, and 17 years with regard to £6,800 for a new turbo-alternator.

In the annual report of the electricity department figures are given, which show that for the year ending March 31st the total number of units sold exceeded 3 millions. This year was the first during which the undertaking had been able to make a substantial profit, there being a net surplus on the year's working of £707, out of which it was proposed to discharge an outstanding debt of £355, leaving £353 to be carried forward. The outstanding debt on the undertaking is £59,296, and the return on this was an income of £12,472, equal to 20 per cent. on the capital outlay. The gross profit was increasing at the rate of £1,500 per annum, and at the present time represented 10 per cent. on the capital outstanding. The large power consumers had been the mainstay of the undertaking. The chairman of the Electricity Committee said that to meet the increasing demands on the undertaking, it would be necessary to prepare for the reception of another large generating set and auxiliary plant, and that when the Committee brought forward a proposal to ask for a further loan of £30,000 for this work, he hoped the Council would treat the matter in a broadminded manner. The report has been accepted by the Council, and it has been decided that when a consumer uses 4,000 units or over per half-year for lighting purposes, the charge shall be 2½d. per unit.

Kendal.—The general manager of the electricity undertaking reports that the total receipts for the year ending March 31st last amount to £1,480, as against an expenditure of £1,082, which leaves a gross profit for the 12 months of £398. After allowing for interest and instalment on loan, including bank interest and commission, this surplus is converted into a deficit £607. The total number of consumers now amounts to 161. The total number or equivalent of 8-C.P. lamps now connected is 9,755, representing an increase since last year of 731. The total number of units generated amounted to 101,359.

The L.G.B. has sanctioned the borrowing by the T.C. of £800 for 25 years in respect of mains; £100 for 15 years in respect of services and £100 for five years in respect of meters.

London.—Marylebone.—The L.C.C. is to be asked to advance the sum of £2,000 required in connection with the extension of the Council's electricity plant. The Finance Committee has approved the suggestion of the Electricity Committee, that the cost of meters should in future be met out of revenue surplus, instead of by means of a loan as heretofore. The Finance Committee reports having considered the statement of accounts of the electricity undertaking for the past year. The result of the year's working, the report states, shows a surplus of £4,014, which is less favourable than any year since 1909, and is about £2,800 less than was estimated for at the beginning of the year. Having regard, however, to the advance in the cost of fuel, which was beyond anticipations, and exceeded the estimates by some £4,500, and shows an increase of £6,600 in actual expenditure compared with the year 1911-12, the results achieved are a matter for congratulation. The Committee views with satisfaction the increase in sales of electrical energy, particularly as this is attributable to demands for purposes other than lighting. In regard to the special account set up dealing with apparatus on hire and its depreciation, expert opinion is that the amount (£1,500) set up as a reserve covers depreciation on a liberal scale. The conditions governing the payment of a bonus to the chief officers have been fully attained; the increase in sales has been 1½ million units, and the diminution in average price 8½ per cent., compared with the previous year, whilst the required conditions under the agreement are only ½ million, and 5 per cent. respectively.

Annual Report.—One of the most interesting annual reports is that of Mr. Seabrook, whose energetic action in developing 'other uses" is having a marked effect on the progress of the Marylebone electricity undertaking. The total income for the year was £212,564, and the expenditure £94,555, leaving a balance of £118 009, which, with interest, &c., gave a gross revenue of £118,354. Interest and sinking fund absorbed £114,350, leaving a balance for the year of £4,014. As regards the revenue, £165,770 was obtained from the sale of electrical energy, being rather less than was estimated. This reduction is attributed to the large adoption of 20-watt metal lamps in the borough, which, it is estimated, represents a loss in revenue of £7,000. Early closing has also had an effect on the output, and from this it is concluded that the largely increased output is attributable the use of electricity for domestic purposes other than lighting. The works and distribution costs amounted to £66,104, representing 1·057d. per unit sold, on 15,008,287 units, as compared with 1·009d. per unit on 13,488,698 units in 1911-12. Due to advance in price only, an additional £4,500 was paid for coal. The net cost of the sales and publicity department was £2,298, an increase which is attributed to the revised method of working introduced by which a large proportion of the orders obtained is sub-let to electrical contractors involving a lower margin of profit. The following table, dealing with connections and mains, is of particular interest in view of the rapid increase in the heating and cooking load:—

	1913.	1912.	1911.
Private lighting	15,499	15,286	14,992
Motors	3,314	2,883	2,486
Heating and cooking and other uses	6,321	3,922	2,771
Public lamps	422	397	393

The heating and other apparatus on circuit consists of 2,401 radiators of 2,820 KW, 620 cooking equipments of 2,047 KW., 605 irons of 205 KW., 524 medical equipments of 369 KW., and 973 sundry apparatus of 877 KW. The motors connected numbered 1,157, and the street lighting included 90 arc and 3,539 incandescent lamp columns with two or three lamps each. The station plant has a capacity of 12,000 KW., and the maximum load was 9,680 KW., the load factor being 17·7 per cent., and there were 9,234 consumers. The report contains some interesting curves showing the

progress of the undertaking generally, as well as statistical information.

Mexico.—All the reservoirs of the Mexican Power and Light Co. at Necaxa have now been brought into use ; the water capacity is 6,000 million cb. ft., which will be sufficient to enable hydro-electric power to be supplied all the year round, and obviate the necessity of calling on the reserve steam stations in dry weather. The plant capacity of the Necaxa station is 127,500 H.P., and the average daily load will be 120,000 H.P. The company owns several other hydro-electric plants with an aggregate capacity of 21,400 H.P.

New Caledonia.—According to the *Board of Trade Journal*, a French company is carrying out works in connection with a hydro-electric plant which is to be installed for the production of ferro-nickel and ferro-chrome. Two generating stations are to be equipped, giving 17,000 and 7,600 H.P. respectively, the larger station being for the electro-metallurgical works.

Queensferry.—A Manchester electrical firm has approached the Hawarden R.D.C. with reference to an electric light scheme for this parish, and has submitted to the Council a scheme for its consideration. The residents have for some time desired a supply of electricity.

Siam.—A new company, known as the Société des Tramways et Electricite de Bangkok, has recently taken over the working of the electric tramcars and the supply of electrical energy for Bangkok, the capital of Siam. The tramway system comprises about 12 miles belonging to the Siam Electricity Co., and 10½ miles belonging to the Siamese Tramways Co., the receipts from the same amounting in 1912 to £80,468. The generating station, which supplies the current for the tramways and for public and private lighting purposes, has a capacity of 5,000 KW. ; the output shows a steady increase, having advanced from 2,798,138 KW.-hours in 1909, to 3,942,385 last year. So far, no efforts have been made to secure clients for current for power purposes, but now that two new sets of steam turbines and generators, each of 1,200-KW. capacity have been installed, it is hoped to develop business in this direction among the rice factories and timber yards.

Skegness.—Messrs. Crompton & Co. have notified the Council of their intention to apply for a prov. order for electric supply in the area.

South Africa.—At a recent meeting of the Jagersfontein Council, the scheme for lighting the town by electricity, was discussed at considerable length. It was eventually agreed to ask for information from the various electrical companies, and to ask them to send their engineers to report on a scheme.

RAND LABOUR TROUBLES.—A serious strike has taken place on the Rand, and the strikers apparently appreciating the dependence of the mines on the Victoria Falls Power Co.'s electrical supply, have, it is reported, induced the men at the Brakpan and Simmerpan power stations to cease work, while efforts are being made to shut down the company's Rosherville station also.

Sunderland.—*Annual Report.*—The report of the Corporation electricity undertaking states that the receipts for the 12 months amounted to £69,543, made up by £17,240 for private lighting, £33,565 for power and heating, £11,267 for tramway traction and £2,876 for public lighting. After meeting all liabilities there remains a balance of £55,743 for repayment of loans, redemption of lands, superseded plant, &c. Nothing is to be applied to relief of rates.

Warrington.—*Annual Report.*—The report of the borough electrical and tramways engineer (Mr. Mathias) on the electric supply undertaking for the year ended March 31st, 1913, has just been issued, and shows that in the sales department the turnover has increased from £686 in 1912 to £1,759 in 1913, and the profit from £92 to £378. The gross revenue amounts to £21,842 and the working expenses to £12,530, leaving a balance of £9,311. Out of this has been paid interest on loans £2,667 and contribution to sinking fund £4,011, leaving a net profit of £2,944. The revenue from private lighting and power consumers is £15,514, representing 2,080,920 units, an increase of £1,022 and 230,227 units on the previous year. There are now 509 consumers connected to the mains. The average price obtained is 1·36d. per unit.

Wrexham.—The T.C. has decided to extend the mains at a cost of £100, so as to supply current to the new Miners' Rescue Station, and to supply current for lighting at 4½d. per unit and for power at 2d. As the station is outside the borough, the permission of the B. of T. and the R.D.C. to give the supply is being sought.

TRAMWAY and RAILWAY NOTES.

Australia.—According to dispatches from Perth, W.A., the Hon J. Scaddan (Premier), who favours railway electrification, to which he devoted special attention during his recent tour of Italy and England, has issued a special report, through Mr. R. P. Wilson, with reference to the proposed electrification of the Perth-Northam section of the trans-Continental line through the Darling Ranges. The electrification will cost £70,000, as against £250,000 in the case of the proposed new broad-gauge route.

Continental Notes.—AUSTRIA.—Thirty parcel delivery vans, battery-driven vehicles, have been placed in service on 15 postal routes in Vienna. It is estimated that during the year the vans will cover 496,000 km., making 182,000 journeys. Garage accommodation for 45 vehicles has been provided.

RUSSIA.—The St. Petersburg municipal authorities have placed orders for 320 (motor) tramcars and 180 trailers with various Russian and Swedish firms.

GERMANY.—In connection with the decision to electrify the Berlin Metropolitan and District Railway, the Government authorities are making experiments with lignite as a fuel for steam-raising purposes. If they prove successful, it is proposed to directly acquire mines in the lignite field, and there erect two large electricity generating stations for the supply of the necessary current for the railways. On the other hand, if lignite is found unsuitable, the stations would be established near Berlin, where water communication was possible to enable the necessary coal to be obtained from the mines in Upper Silesia.

Croydon.—*Annual Report.*—Mr. Goodyer's report on the tramways for last year was submitted to the B.C. on Monday. The traffic receipts for the year ended March 31st were £90,543, and other receipts £1,920. Working expenses were £66,218. This left a credit balance of £26,245. Subjected to interest, sinking fund and income-tax, it was reduced to £10,586. Of this sum, £3,000 went to the relief of the rates, and the remainder to the renewals fund, which amounts to £42,452, or 21·49 per cent. of the net capital expenditure. Traffic receipts decreased by £1,995, representing 345,087 passengers ; and working expenses went up £4,568. The chief cause of the decrease in receipts was motor-'bus competition, the daily services having begun in December. Mr. Goodyer shows that the "public burden" borne by each tramcar was represented by £138 15s. 6d. (licence duties, rates and road maintenance), whereas for each motor-'bus the figure was £48 18s., made up of licence duties and petrol tax, not received by the borough. In other words, while the tramways contributed £11,096 to the local revenue, the motor-'buses paid nothing. "Legislation," says the report, "in the interests of the ratepayers, and those municipal authorities in the metropolitan area who have invested £13,000,000 in their tramway undertakings, is very urgently required, so that the services provided by the community, at the cost of the community, and in the interests of the community, should not be in a less favourable position than other competitive means of transport." The question of principle having at last been determined—as in the recent cases of the Chesterfield Corporation and the Rhondda Valley Tramways—the matter obviously (adds Mr. Goodyer) should be carried a step further, and applied to the metropolitan area, where the local authorities have no control over the licensing of public vehicles. The Tramways Committee recommended a resolution asking the Government to pass legislation putting motor-'bus companies and municipal tramway authorities upon equal terms in the matter of public obligations. This was unanimously adopted, with the report, on the motion of the chairman of the Committee (Councillor F. Denning, J.P.). An amendment referring back the paragraph in which the Committee declined for the present to make any recommendation regarding the long-proposed extension of the Addiscombe section to Woodside and South Norwood, was lost by a large majority.

Little Hulton.—It was stated on Tuesday that the South Lancashire Tramways Co. expects to open its new section through Little Hulton by the end of September—possibly earlier.

London.—METROPOLITAN DISTRICT RAILWAY.—Reporting to the B. of T. on the accident which took place near Sloane Square Station on April 26th, when four vehicles of an electric train were derailed, without injury to persons, Major Pringle states that it was due to the sudden breakage of an axle in the leading truck of the third car. A right-hand wheel dropped off the rail on the inside and broke a number of chairs, at the same time forcing the rail outwards. The fracture took place close to the centre of the axle, an unusual position, and was apparently due to an internal flaw ; the axle was one of a batch of 400, and had run about 270,000 miles. No blame is attached to anyone. The last previous case of a broken axle on this railway occurred 4½ years ago.

MARYLEBONE.—The attention of the General Purposes Committee of the B.C. has been called to reports of evidence tendered to the Select Committee on motor traffic, upon the subject of the power which Borough Councils now possess to refuse consent to the laying down of tramways, &c., within their respective areas more particularly to the criticisms by important members of the L.C.C., on the manner in which the power is alleged to be exercised by B.C.'s., and as to the expediency of depriving metropolitan boroughs of the power. Being of opinion that the views of the B.C.'s upon this point should be placed before the Select Committee, the Committee has instructed the town clerk to make a representation to the clerk of the Select Committee upon the subject.

Mexboro'.—The District Council has had under consideration the decision of the House of Commons in regard to the Mexboro' and Swinton Tramways Railless Traction Bill, and has decided to appeal to the House of Lords against the decision of the Lower House.

Middlesex.—The County Council has come to an agreement with the Metropolitan Electric Tramways, Ltd., with regard to the company's Railless Traction Bill, whereby (1) the company will not oppose the County Council in its application to the Committee of the House of Lords requiring the insertion, in the Bill, of a clause giving the County Council power to purchase the undertaking in 1930 ; (2) the County Council will not oppose the removal

of the centre poles in High Road, Tottenham. The County Council has entered into an agreement with the Metropolitan Electric Tramways, Ltd., for reducing the car-mileage to be run on the route from Euston Road to Enfield, and on the route from Euston Road to Alderman's Hill.

New Zealand.—A service of electric tramway cars operated by Edison accumulators has lately been started in the town of Gisburn.

Oxford.—The Corporation Tramways Committee on June 25th had an interview with Mr. Cownie respecting a new scheme, by which it is proposed to run petrol-electric cars in High Street, Cornmarket Street and Queen Street, motor-'buses on the route now covered by horse 'buses, motor-'buses instead of tramways in St. Aldate's, and overhead traction on the Iffley Road route and the outskirts of the city. The Committee decided to recommend the acceptance of the scheme, and that Mr. Cownie's company should pay a rent of £500, instead of £300 as originally suggested.

Salford.—An estimate of £340 has been approved as the fees payable to the arbitrator and witnesses in connection with the arbitration as to the supply of electricity by the Eccles Corporation for Salford cars in Eccles. The Town Clerk reported that the reduced price of energy meant a saving (calculated on last year's consumption) of £346 per annum, or a total for the five years of £2,734.

Southampton.—The Tramways Committee has decided to appoint a general manager to take the entire control of the tramways undertaking. The commencing salary is put at £400 per annum.

Stalybridge.—At a meeting of the Stalybridge Joint Tramways Board on June 26th, it was reported that the loss on the year's working was £9,124. Alderman R. Wood pointed out that they had been stopped for a short time, during which they did not even earn interest and sinking fund. In 1905 they earned 6·57d. per car-mile, and last year, in spite of everything, they earned 7·88d. On track and overhead equipment they spent £2,000. Alderman W. E. Wood said the precepts on the four Corporations amounted to £2,281 each. He still believed that the undertaking would become a paying concern. Councillor Fowden said that to call on the ratepayers to provide £2,281 after nine years' working seemed to him to put the hallmark of failure on the concern. He thought they ought not to have agreed to increase the cost of current to the tramways undertaking, when they were selling current at such a low rate to ordinary consumers. He thought an investigation by impartial experts should be conducted. He moved that the accounts be referred back. This was defeated, and the minutes were confirmed.

Sunderland.—*Annual Report.*—The report of the Corporation tramways states that the traffic revenue for the year amounted to £68,507, compared with £67,871 for the preceding 12 months. The net balance is returned at £13,446, as against £13,063. The mileage of track totals 20·35. Working expenses totalled £38,921, leaving a balance of £29,950 to be carried to the net revenue account. It is proposed to apply £10,366 to the repayment of loans, £7,218 to reserve and renewals, and £5,000 to relief of rates. Since 1898, when the system was inaugurated, £42,027 has been allocated to relief of rates.

In order to facilitate interchange of traffic, the Corporation Tramways Committee proposed to give the Sunderland and District Tramways Co. running powers into the centre of the town to the extent of four cars per hour. The Town Clerk, however, has now informed the Corporation that it possesses no statutory power to give the permission as proposed.

Warrington.—The Tramways Committee hopes to inaugurate the new motor-'bus service in the course of the next two or three weeks.

TELEGRAPH and TELEPHONE NOTES.

A Cable Expedition.—The India-Rubber, Gutta-Percha and Telegraph Works Co.'s c.s. *Silvertown*, which had been for some time past berthed at Passage West in Cork Harbour, took her departure last Friday for the North Atlantic, there to repair the Direct New York Cable, which her sister ship, the *Dacia* (at present laid up at Passage West Docks), was engaged upon, and had to abandon owing to boisterous weather. The *Dacia* was obliged to put into Cork Harbour for safety some five weeks ago, and had subsequently to proceed to Passage West for repairs, where she is still in dock. The c.s. *Silvertown*, prior to her leaving Cork Harbour, took over the crew of the *Dacia*, numbering 191 hands, and also about 1,400 miles of cable. She had on board when leaving Cork Harbour three months' provisions, which cost about £1,500. She carried live stock in the form of bullocks and sheep to the value of £1,000. The intention in taking such a large quantity of live stock on board the *Silvertown* is that the vessel can be kept at the work of repairing the cable until it is successfully accomplished.

Betulander Automatic Telephone System.—A successful demonstration of this system, of which the Marconi Co. owns the patent rights in all countries except Sweden, was recently given by the Marquis Solari at the offices of the company in Rome, before a number of officials and engineers. The lecturer stated that Italy was almost the last of civilised nations to adopt the telephone, having only two subscribers per thousand of the population on January 1st, 1912.

Brazil.—In the *Messager de Sao Paulo* for May 31st, an account is given of the system of the Companhia Rede Telephonica Bragantina, which was founded in 1896, and having obtained various concessions and acquired a number of other companies, now possesses a network connecting more than 300 townships, with trunk lines aggregating 19,400 km., in addition to the lines of 4,500 subscribers, with 180 exchanges. The whole of the equipment was made by the Western Electric Co., Ltd.

Imperial Wireless System.—At the meeting of the Select Committee on Wednesday, Mr. Samuel, the Postmaster-General, stated that the Government did not intend to attempt to enforce the execution of the contract with the Marconi Co., which the latter repudiated in January last. No legal action, in fact, could be taken unless the contract was first ratified by Parliament, and it was questionable whether the Courts would award damages against the company, in view of the long period which had elapsed (through no fault of the company) since the contract was entered into. The Government now held themselves free to enter into a new contract. The Committee decided to report to the House of Commons that, as the contract was not to be enforced, it was unnecessary to go on with the inquiry.

Japan.—Some experiments have just been made at Yokohama under the direction of the Japanese Department of Communications with a new system of wireless telephony invented by three Japanese. Messages have been successfully exchanged at distances of 45 and 60 miles.

London-Paris Telephone.—The Postmaster-General has informed the British Chamber of Commerce in Paris that he hopes shortly to be able to introduce reduced telephone rates between London and Paris, including a night tariff of three-fifths of the ordinary day rate.

Marconi Libel Action.—An action for libel, brought against the Berlin paper *Die Welt am Montag*, by Mr. Marconi, has been settled, the journal having undertaken to print an apology and to withdraw the objectionable statements, which suggested that the complainant had admitted that his company sought to make money out of the disaster to the *Titanic*.

New Atlantic Cable.—The Portuguese Parliament has adopted a Bill for the laying of a telegraph cable from Portugal to Panama.

Norway.—The Storthing has sanctioned the agreement with the Marconi Co. for establishing a wireless telegraph service between Norway and America, and has voted the sum of 2,000,000 kroner (about £111,100) for the construction of a station near Stavanger. Marconi's Wireless Telegraph Co., Ltd., will immediately start the erection of a station in Norway, and the American Marconi Co. will commence the construction of the station on the other side of the Atlantic.

Poulsen System.—A correspondent of the *Morning Post* says that a new company is being formed in Copenhagen for the purpose of taking over all the Poulsen wireless communication between Scandinavia, on the one hand, and Greenland, Canada, the United States, the Danish West Indies, and Panama on the other. At Panama the United States Government intends to establish a powerful Poulsen station. The company is backed by a powerful financial group, including the Landmandsbank.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

Queensland.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

Western Australia.—August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" June 27th.

July 19th.—Switchgear and accessories for an electric power station at Perth. See "Official Notices" June 27th.

South Australia.—August 13th.—Common battery switchboards and telephone parts for Adelaide. See "Official Notices" to-day.

Adelaide.—July 29th. Municipal Tramways Trust. Bonding material. Specification (21s.) from Mr. W. G. T. Goodman, Hackney Road, Adelaide.

New South Wales.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s. each) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Sydney.—August 27th. Telephones, switchboards and incandescent lamps, for the P.M.G. See "Official Notices" to-day.

Belfast.—July 21st. One 3,500-ampere traction switchboard panel, for the Corporation. See "Official Notices" to-day.

Belgium.—July 7th. The municipal authorities of Romsée (province of Liége) are inviting tenders for the concession for the public and private electric lighting of the town.

July 12th.—Tenders are being invited by the Belgian telegraph authorities in Brussels (Salle de la Madeleine) for the supply and laying of a quantity of telephone cable in the town of Louvain.

The municipal authorities of Farciennes (province of Hainaut) have just invited tenders for the establishment of a central electric lighting station in the town.

Birkenhead.—July 14th. Low-tension main cable, and india-rubber lead-covered and armoured service cable for the Corporation. See "Official Notices" June 27th.

Eccles.—July 21st. Mechanical stokers for four Lancashire boilers at the electricity works, Cawdor Street, Patricroft. Borough Electrical Engineer.

India.—An announcement appears in our advertisement pages to-day from which it will be seen that the Government authorities are prepared to grant licences under the Indian Electricity Act for supply within the municipalities of Allahabad, Lucknow, and Bareilly.

Kingston-on-Thames.—The T.C. is inviting tenders for about 2,000 tons of coal for the electricity works.

London.—Hackney.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" June 20th.

H.M. Office of Works.—July 18th. Supply of electric cable and wire during one year from September 1st, 1913. See "Official Notices" to-day.

Malta.—July 10th. Arc lamp carbons. Forms of tender from Crown Agents for the Colonies, London. Tenders to Receiver-General and Director of Contracts, Valetta.

Newport (Mon.).—July 19th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" to-day.

Norway.—The Norwegian Telegraph authorities in Christiania have just invited tenders for the supply of 400,000 metres of telegraph cable.

Nuneaton.—July 15th One line booster for the Electricity Committee. See "Official Notices" to-day.

Oldham.—One 2,000-kw. steam turbine, coupled to extra-H.T. A.C. generator, also barometric condenser, pumps, &c., for the Corporation. See "Official Notices" June 20th.

Roscrea.—July 11th. Roscrea Bacon Factory, Ltd., invite tenders for buildings, gas engine and suction plant, dynamos, battery, switchboard, overhead feeders, mains and street lamps, for the electric lighting of the town. See "Official Notices" June 27th.

Rotherham.—July 8th. Tramway stores, coal, cable and meters, for the Corporation. See "Official Notices" June 20th.

Roumania.—July 25th. The municipal authorities of Roshiorude Vede are inviting tenders for the concession for the electric lighting of the town.

August 7th.—Concession for the electric lighting of the city. 409,987 fr. Particulars of the Municipality.

Salford.—July 9th. Two-phase switchgear, Scott transformers and regulators, for the Electricity Department. See "Official Notices" June 27th.

Scarborough.—July 12th. Electric light installation at the Workhouse and Infirmary, for the B.G. (about 360 lights). Tennant and Barrs, consulting engineers, Cathedral Buildings, Dean Street, Newcastle-on-Tyne (returnable deposit of £5).

Spain.—August 27th. Construction and working of an electric tramway in the town of Vigo. An option on this concession is held by the "Compañia anónima Tranvías Eléctricos de Vigo."—*Board of Trade Journal.*

July 9th.—The municipal authorities of Salvaleon (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Madrid.—August 9th. Concession for an electric tramway from Braeza to Linares. Particulars from the Ministerio do Fomento, Madrid (Department of Public Works).

Taunton.—July 7th. Extensions to boiler house, &c., and setting new boiler at the Corporation electricity works. Borough Electrical Engineer, St. James's Street

West Ham.—July 10th. Electric light installations for the Forest House branch workhouse and Forest House cottages, Leytonstone, for the Union. See "Official Notices" June 27th.

Warrington.—July 8th. The Electricity and Tramways Committee. 10,000 tons of slack for delivery at the electricity works, Howley. Mr. F. V. L. Mathias, borough electrical and tramways engineer.

CLOSED.

Atherton (near Manchester).—The U.D.C. has accepted the tender of the British Electric Transformer Co. for two 150-kw. single-phase transformers.

Belfast.—The Tramways Committee has decided to accept the tender of Messrs. Dick, Kerr & Co. for permanent way renewals.

Bispham.—The U.D.C. has accepted the tender of the National Gas Engine Co., Ltd., for additional plant at the electricity works.

Bolton.—The Electricity Committee has accepted the tender of Messrs. Newton, Chambers & Co., Ltd., for feed tanks at Back-o'-th'-Bank, and that of Messrs. Musgrave & Co., Ltd., conditionally, for condensing plant.

Canada.—Regina.—The City Commissioners of Regina, Saskatchewan, have just ordered from Messrs. Bruce Peebles & Co., Ltd., through that firm's Eastern Canadian agents, a 1,200-kw. motor converter (Peebles-La Cour patents).

Chester.—The following tenders have been accepted in connection with the extensions at the electricity works:—

Tudor Accumulator Co., Ltd.—Battery (No. 8), £7,470.
Lancashire Dynamo and Motor Co., Ltd.—Booster (No. 4), £1,145.

Croydon.—For the lighting of Thornton Heath new fire station and Public Library, for Croydon Corporation, the tender of Messrs. Hawkins & Sons, London, has been accepted at £376. Highest tender, Messrs. O. Jones & Co., Beckenham, £596 6s. 6d.

Doncaster.—Mr. W. H. Pease has received from the Corporation a contract for the telephone installation for the Racecourse.

Dover.—The *Times* states that the Corporation has accepted the tender of Messrs. Paramors, Margate, for constructing, at a cost of £15,062, the roadway and tramways on the viaduct to be built at the pier as an approach to the new marine station.

Edinburgh.—Messrs. Provincial Cinematograph Theatres, Ltd., of London, have recently accepted the following contracts in connection with their new picture house, Princes Street, Edinburgh:—

Electrical installation (exclusive of fittings).—Malcolm & Allen, £875.
Heating and ventilation plant (exclusive of fans and motors).—Mackenzie and Moncur, £1,244.
Domestic hot-water supply.—Morrison & Son, £143.

Kingston.—The T.C. has accepted the tender of the Craigpark Electric Cable Co. for the supply of 880 yd. of 7 sq. in. L.T. cable, at £198; 440 yd. of 7/18 L.T. cable, at £39 15s.; and 440 yd. of 7/16 L.T. cable, at £47 10s.

London.—Messrs. Mitchells, Ashworth, Stansfield & Co., Ltd., London, E.C., have received an order for about 1,410 sq. ft. of their "Mascolite" B.U., 1¼ in. thick, to absorb vibration and deaden sound, to be placed between the main and lower concrete foundation on which are to be erected three Diesel engines at the Flood Street generating station of the Chelsea Electricity Supply Co.

The tender of Messrs. W. J. Fryer & Co., Ltd., has been accepted by the Metropolitan Asylums Board, at £75 10s., for wiring the open-air balconies at the Brook Hospital, Shooter's Hill.

L.C.C.—The Highways Committee has received the following tenders for high and low-tension cables for the tramway undertaking, and for maintenance purposes during the current financial year:—

Western Electric Co. (recommended)	£25,410
Johnson & Phillips	26,018
Siemens Bros. & Co., Ltd.	26,169
W. T. Henley's Co.	26,187
Callender's Cable Co.	26,942
W. T. Glover & Co.	27,201
B.I. and Helsby Cables	27,338

Chief officer's estimate, £24,000

Tenders are to be invited from selected firms for 1,000 ordinary plough leads and 3,500 sliding contact leads for electric cars, owing to the large number of cars now being fitted with trolleys and plough collector gear for through running and other causes.

Melton Mowbray.—The U.D.C. has received the following tenders for the provision of a refuse destructor:—

Horsfall & Co., Ltd.	£1,691
Hughes & Stirling	1,881
Dawson & Manfield	1,950

Installations by the respective firms are to be inspected before the contract is placed.

Leyton.—Messrs. T. Bolton & Sons, Ltd., are to supply 1 mile of trolley wire to the U.D.C.. The price quoted was 8 15/16d. per lb. Other tenders received were :—

F. Espir, Ltd.—9½d. per lb.
F. Smith —9½d. per lb.
B.I. and Helsby Cables, Ltd.—9½d. per lb.
Equipment and Engineering Co., Ltd.—10d. per lb. for Phono-electric trolley wire.

The tender of Messrs. B. Thomas has been accepted, at £104, for a switchboard panel. Messrs. Johnson & Phillips quoted £110.

The U.D.C. has accepted the tender of Mr. J. T. Halsey for installing the electric light at Church Road Schools, at £376.

Peterborough.—The T.C. has accepted the tender of Messrs. Beeby & Son for from 2,000 to 2,500 tons of Seiston hard steam coal for the electricity works, at 16s. 6d. per ton.

Salford.—The following tenders have been accepted by the T.C. :—

Halliwell & Co.—Wiring the new Secondary School for boys, £342.
Brush Electrical Engineering Co., Ltd.—One double-deck single-truck tramcar body, with vestibule ends, £530; nine additional car bodies of a similar character, £500 per car body. (This price is subject to a reduction of £30 per car body if, after experiments, it is decided not to adopt vestibule ends.)
J. G. Brill & Co.—Ten Brill tramcar trucks, less wheels and axles, £548.
Walter Scott, Ltd.—1,000 tons Sandberg steel tramway rails, £7 7s. 6d. per ton. (In addition to this price, a royalty of 8s. per ton is to be paid to Mr. Sandberg.)
Buxton Lime Firms, Ltd.—Annual supply of lime for the water-softening plant at the generating station, 26s. per ton.

The following tenders have been accepted for supplies during the period ending March 31st, 1914 :—

Motor starters—H. G. Mabbs, approximate value of contract £375.
Electricity meters.—Chamberlain & Hookham, £600; General Electric Co., Ltd., £380; Ferranti, Ltd., £100.

Southampton.—The following tenders have been received by the T.C. for electrically lighting the Regent's Park School :—

I. Groves & Co.	(accepted)	£195
F. W. Cook & Co.		246
J. Davis & Co.		249
A. Kingman & Co.		263
W. Dibben & Sons		342

Stalybridge.—The Joint Tramways and Electricity Board has accepted the following :—

Goodbrand & Co.—Economisers.
Storrs.—Concrete bed for boilers.
Ed. Wood & Co.—Supply and erection of steelwork for boiler house.
Babcock & Wilcox.—Feed-water heater.
Ellis & Son.—Weighbridge.

Warrington.—For a supply of motors, the tender of Messrs. Veritys, Ltd., has been accepted by the T.C.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, July 4th. Leave London for excursion to Brussels.
Saturday, July 5th. Visit to Ghent Exhibition.
Sunday, July 6th. Excursions to Dinant, the Valley of the Meuse, the Field of Waterloo or Antwerp.
Monday, July 7th. Visit to places of interest in Brussels. Return to London in the evening.

Salford Technical and Engineering Association.—Saturday, July 5th. Visit to Central Fire Station, London Road, Manchester.

Glover's Almanac.—Messrs. W. T. Glover & Co. have sent us their twelfth almanac, which, as usual, is composed of extracts from technical publications, interesting pictures, humorous skits and sketches, &c. We cannot doubt that a vast amount of labour has been expended on this unique production year by year, and the editors, as well as Messrs. Glover's, merit our congratulations on the admirable result. We venture to print the item for to-morrow, taking the risk of an action for breach of copyright :—

DE PROFUNDIS.

The crew let fall, with a rattle and splash,
A drum of cable in Table Bay
(The captain's remarks we will print with a ——,
The captain had rather a lot to say.)

He finished with "blithering, yellow-eyed lubbers,
That insulation's tarnation wet;
Sea-water jiggers the tapes and rubbers—
What sort of test will the mainsman get?"

The bo'sun hoisted his slacks and spluttered,
"The watter don't matter," says he to him;
"There's GLOVER'S writ on the side," he stuttered,
"And DIATRINE printed round the rim."

So they hauled it back ("Heave ho! Aye, aye, sir,")
With block and tackle, as Jack'll tell;
And the consignees were never the wiser—
Glover's had covered it up too well.—H. M. L.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, July 9th to 18th.—Headquarters will be opened daily from 10 a.m. till 4 p.m.
Saturday, July 11th.—Headquarters will be opened from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

£250 Still Wanted for the Electrical Trades Benevolent Institution.—We have received the following letter for publication :—

"On my return from Australasia I was much gratified to hear of Mr. G. Byng's splendid offer, namely, to give £100 to the funds of the Electrical Trades Benevolent Institution if £1,000 could be raised in individual amounts of not less than £50 each before July 16th, 1913.

"I am, however, surprised to find that over two months have gone by and the donations are still short of the amount of £250 required to enable the Institution to obtain the benefit of Mr. Byng's offer.

"In view of the large number of wealthy persons connected with, and benefiting by, the electrical industry, this appears to me an extraordinary state of affairs.

"The main object of the Institution is to grant pensions to deserving and necessitous persons who have been on the staff of electrical firms. Such pensions, for obvious reasons, can only be paid out of the interest or dividends on invested funds; the present income from this source (about £125) is quite inadequate to meet any serious demand. The invested funds must therefore be increased without delay.

"The calls on the Institution for grants for temporary relief are increasing steadily, although the Committee has fortunately been able to keep the sum of the grants down to a low figure by its success in obtaining employment for most of those persons whom the Institution has assisted; it may interest you to know that no qualified person who has applied for assistance has failed to receive it.

"Yours faithfully,
"JUSTUS ECK,
"*Chairman of the Committee.*

"London, E.C., *June 30th*, 1913."

Correspondence Tuition.—In the columns of the ELECTRICAL REVIEW and other electrical and engineering papers advertisements frequently appear of "Tuition" by means of correspondence. Some of these are absolutely genuine, and others, unfortunately, quite the reverse. The editors will at all times be glad to hear from students and others of unfair or unbusinesslike treatment on the part of such advertisers, with a view, if possible, to eliminate from the ELECTRICAL REVIEW advertisements of the undeserving.

The "Point Five Association."—Mr. J. W. Beauchamp, West Ham, was elected a member of the "Point Fives" at the meeting on June 17th.

An Inventor Disengaged.—A correspondent writes :—"I belive there is a lot of room for inventions, would you kindly let me know one or two that are wanted, electricial or otherwise, and oblidge, yours faithfully." There are, we believe, two or three inventions that might very well be invented; such things as upward screws for shift engineers, ring-fences for consulting engineers, politician-fenders for wireless companies, and padlocks for 'oisters, leap to the imagination.

Annual Sports and Outings.—The fourth annual outing of the BRIMSDOWN LAMP WORKS was held on Saturday, June 28th, when the employés, including also the staff of the head offices in Kingsway, journeyed at an early hour to Southend-on-Sea. Glorious weather prevailed throughout the day, and the endless amusements at this popular seaside place were inundated with hundreds of "Wirumites." Luncheon was served in the "Kursaal." Mr. C. Reiss, managing director of the company, was in the chair, and on rising to give the loyal toast, he was accorded a great reception. Mr. Brunessaux proposed the toast of "The Brimsdown Lamp Works: its Managing Director and Works Manager," which was vociferously honoured. In response Mr. Reiss made a rousing speech dealing particularly with the excellent relations existing between the management and the executive staff. He mentioned that there was every indication for a very bright and prosperous future. At the conclusion of this speech the party adjourned for a photograph to be taken, after which the members were free to enjoy themselves in their own way. The outing is described as a huge success.

The ninth annual amateur athletic sports of the Croydon Corporation Tramways Athletic Club were held on Wednesday afternoon on the Brighton Railway Athletic Club Ground, West Croydon. Prizes, cups, &c., aggregating £140 in value were awarded for the different events, which included a one mile flat race (handicap) for the Tantalum

challenge cup, presented by Messrs. Siemens. This cup, competition for which is open to tramway employés in the United Kingdom, becomes the property of the man who wins it for three years in succession. The Croydon Corporation Tramways Military Prize Band was in attendance (Bandmaster, Mr. W. Ellis). We shall refer to this more fully next week.

The twenty-fourth annual cycling and athletic sports in connection with the ARC WORKS' CLUB were held on the Wood Street Ground, Chelmsford, last Saturday week. The prizes were distributed by Mrs. Carleton Tufnell, who was cordially thanked, on the motion of Mr. A. J. Hodgson. Music was rendered by the Arc Works Silver Band and the Essex Industrial School Band. In the evening there was a *fête*, with dancing, fireworks, &c. The secretarial duties were carried out by Mr. Percy G. Cheverton.

The employés of Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, went for their annual excursion on Saturday last, St. Andrew's being the place selected. The morning was occupied with the usual sports, while the afternoon was spent in visiting the many places of interest in the neighbourhood. Lunch and tea were served in the Town Hall, where the sports prizes were distributed. The whole outing proved a thorough success.

The Veritas Athletic and Social Club (Messrs. Falk, Stadelmann and Co., Ltd.) held their fifth annual athletic meeting at the Kingsdale Track, High Beech, on Saturday last.

On Saturday last the staff and employés of the Osram and Robertson Lamp Works held their annual outing, which this year extended to Ventnor, with a call at Southsea *en route*. A start was made before 8 a.m. for Portsmouth, where some time was available for local visits before lunch, the latter being served at the Central Hotel, with Mr. Chris Wilson, the general manager, who is also the president of the Works Social Club, in the chair. This was an informal function, and we only need mention the drinking of the genial chairman's health with musical honours. Subsequently a move was made to the special steamer which had been chartered to convey the party to Ventnor, and the very pleasant voyage round the sunlit shores of the Isle of Wight was most enjoyable. After tea, at the Metropole Hotel, the visitors returned by water to Portsmouth, there entraining for London, which was reached at a late hour. Delightful weather conditions prevailed; and this, coupled with the informal character of the day's proceedings, and the determination of "President Wilson" and his staff to keep things going, contributed to a very successful outing.

On June 28th the International Electric Co., Ltd., of Kilburn, N.W., held their annual outing, when upwards of 100 of the company's employés travelled to Brighton. The party dined together under the chairmanship of Mr. H. R. Roose, the managing director, who, responding to the toast of "The Firm," referred to its increasing prosperity, and urged the continued co-operation of all present. The "Intelco's" dispersed for various amusements during the afternoon, to reassemble at tea, and the return journey to town ended what was unanimously voted a most enjoyable day.

On Thursday last week the employés of the Urban Electric Supply Companies of Newton Abbot and Dartmouth held their annual outing. They journeyed to Plymouth by reserved saloon carriage, where breakfast was served, and two members were presented with pipes in recognition of services rendered. The recipients having suitably responded, a start was then made for Calstock by motor-boat. After dinner the annual cricket match between the two staffs was played. Dartmouth batted first, and, thanks to a good innings by Macey (19), made 36 runs, to which Newton Abbot responded with 44 for nine wickets, thus proving victors. The outstanding features of the game were a splendid innings for Newton by Prudence (21) and good bowling by Carpenter and Stratford, who did well considering that the pitch resembled a miniature golf links. At the dinner a presentation was made to Mr. G. E. Smith, on behalf of the subscribers, by Mr. A. C. Evans. A move was then made for Saltash, and after tea the company enjoyed the rest of the evening in divers ways.

The Strikes on the Rand.—Reuter's representative at Johannesburg states that the men employed at the Brakpan power station of the Victoria Falls Power Co. have come out at the instigation of the strikers' procession. "The company, from its three stations at Brakpan, Rosherville and Simmerpan, supplies the bulk of the industry with light and power. The paralysis of the Victoria power system would mean the paralysis of the whole industry, except the Randfontein and East Rand Proprietary Mines, who have their own power plants. . . . Urgent representations are being made to the Government for increased protection, specially in view of the vulnerability of the Victoria power system." A good deal of later information has appeared in the Press respecting the safety of the power stations. It is stated that the Victoria Falls and Transvaal Power Co. has received cabled information that the operating and maintenance employés at the Brakpan, Simmerpan and Rosherville power stations have joined the strikers. No damage, however, has been done to the property.

Batti Wallahs' Society. — About 70 members and friends enjoyed the up-river trip on Saturday last. A start was made from the Sun Hotel, Kingston, and the party reached Chertsey in time for 5 o'clock tea. Thanks are due to the ladies, the weather, and the musical friends for combining to give what is described as one of the jolliest outings the society has had.

Appointments Vacant.—An electrical inspector is required by the India Office for the United Provinces of Agra and Oudh (Rs. 600 to Rs. 800 per mensem); shift engineer for Swansea Harbour Trust (42s.); assistant shift engineer for Battersea (£2); assistant teacher of electrical engineering and teacher of telephony for Acton and Chiswick Polytechnic; driver and switchboard attendant for Stoke-on-Trent electricity works. See "Official Notices" to-day.

The L.C.C. Conciliation Boards.—The London County Council has followed up its approval of the conciliation scheme outlined in last week's issue by appointing the following gentlemen to represent it. There are four boards, and the Council has power to appoint six representatives on each, of which not more than two may be officers of the Council:—

(*a*) Traffic Conciliation Board.—Mr. H. E. A. Cotton, Mr. G. H. Hume, Mr. Cyril Jackson, Capt. A. C. H. Kennard, the chief officer of tramways and the deputy chief officer of tramways.

(*b*) Rolling-Stock Conciliation Board.—Mr. W. Hunt, Mr. W. J. Squires, Mr. R. L. Stuart, Sir Edward White, the chief officer of tramways and the tramways rolling-stock superintendent.

(*c*) Electrical Conciliation Board.—Mr. A. O. Goodrich, Mr. H. H. Gordon, Mr. Theodore Prestige, the Lord Alexander Thynne, the chief officer of tramways and the tramways electrical assistant.

(*d*) Permanent-Way and Building Conciliation Board.—The Lord Monk Bretton, C.B., Mr. A. Cooper Rawson, Mr. A. H. Scott, Mr. A. W. Yeo, the chief officer of tramways and the tramways permanent-way engineer.

The conciliation boards are already at work, as by agreement on the rolling-stock conciliation board and confirmation by the Council the pay of armature winders has been increased from 9½d. to 10d. per hour. As a further proof of their usefulness, it has been decided, on the recommendation of the sectional board, to increase the clothing allowance for shunters and travesemen by an overcoat every two years at a cost of about 21s. per coat.

A further question, dealing with the status and pay of controller repairers and light and power attendants, has been referred back for reconsideration by the rolling-stock sectional board. These matters seem small, but it is worth much to the smooth working of the undertaking to have a ready means of preventing their becoming grievances.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—On Thursday evening last week the annual conversazione of the Institution was held at the Natural History Museum; Mr. W. Duddell, F.R.S., president, with Mrs. John Smithers received the guests. The String Band of the Royal Engineers provided a musical programme, and the Royal Windsor Glee Singers gave a concert in the Shell Gallery. Amongst those who were present were General Sir R. Biddulph, Commander W. F. Caborne, Sir J. Crichton-Browne, Sir William Crookes, Sir John Gavey, Colonel Sir T. H. Holdich, Major-General Beresford Lovett, Major W. A. J. O'Meara, Sir C. H. Read, Baron de Ropp, Colonel Sir J. S. Young, and many distinguished members of the electrical and kindred institutions.

ROYAL SOCIETY OF ARTS.—The annual meeting was held on June 25th, Lord Sanderson, G.C.B. (chairman of the Council), in the chair. The report of the *Proceedings* of the Society during the past year was read, and H.R.H. the Duke of Connaught was re-elected president; 35 new members were elected, making a total of 238 elected during the session.

INSTITUTE OF MARINE ENGINEERS.—On June 14th a large party from the Institute visited the Chelmsford Works of Messrs. Marconi's Wireless Telegraph Co., Ltd. The two steel masts for the aerials, 470 ft. in height, are now a conspicuous feature of the works. They are 4 ft. 6 in. in diameter, up to a height of 450 ft., and are made of ½-in. pressed steel in sections of 15 ft., the distance between them being 700 ft. Demonstrations and explanations were given of the various instruments under working conditions, including a ½-KW. set, as used on cargo vessels.

An Emergency Plant.—Owing to breakdown and immersion of the main steam-driven pump, which was likely to cause a stoppage of the main outlet of coal of the Aberpergwm Collieries Co., Ltd., Glyn Neath, South Wales, it was decided to install a Rees-Roturbo four-stage centrifugal pump, direct driven by a 60-H.P. B.T.H. Co.'s squirrel-cage motor, with compensator starter suitable for 3,000 volts. The difficulties encountered may be realised by the fact that all the gear, having a total dead weight of 5½ tons, had to be taken down underground along an incline dipping 18 in. per yard, for a distance of over 250 yards, with 4 ft. headroom, and had to be taken down on skids to save laying a special road. The handling of the work, including erection of pump, &c., running of cables and connecting up was carried out by the company's electrical engineer. Mr. J. Glynn Williams, Vice-President of the South Wales Branch of the Association of Mining Electrical Engineers, of which he was the original founder. In recognition of the quick time in which the work was done and pumping operations commenced, he was presented with a massive gold ring by the manager, Mr. Rees Howells, and a cheque by Mr. M. Ogilvey Spence, agent to the colliery company. So successful was the installation of this pump, that last week-end was the first for some considerable time that a suspension of pumping operations from Saturday to Monday was possible, which, coupled with the electrification of the ventilating fan drive, makes a very considerable saving to the company.

The Engineering Labour Unrest.—The *Morning Post* states that the wages of 10,000 labourers engaged in the Sheffield district engineering trades have been raised by an agreement just concluded at a joint conference of the Engineering Employers' Federation and the National Gasworkers' Union.

Sentence.—At the Westminster Police Court on Tuesday, Ernest Augustus Gilles was sentenced to three months' imprisonment on each of two charges of obtaining various sums of money from the Atlas Electrical Co., Ltd., by way of commission on electric lamp and supplies orders, some of which were stated to be forged.

Getting Rid of Smoke Nuisance.—Before Blackburn Magistrates, on June 27th, the case in which Messrs. Kershaw and Co., of Crystal Dye Works, were summoned for a black smoke nuisance, again came up. Mr. Bonney said that new apparatus had been installed, which had made a material reduction in black smoke. The firm had already spent £1,500 in motors and other machinery to remedy the nuisance. All the machinery would now be worked by electric current, and the boiler would be solely used for heating purposes. Mr. S. Mills (electrical engineer) said that when the new smoke-consuming apparatus was fully installed, he believed the smoke evil would be effectively overcome. The case was further adjourned.

Inquiries.—Makers of an electric cloth-cutting machine, and the holders of an electric process for fireproofing wood, are asked for. A correspondent wishes to get into touch with anyone who has successfully carried out the lighting of a Badminton court.

Plant for Sale.—The L.C.C. is inviting tenders for the purchase of two 3,500-KW. steam alternators, 6,600 volts, 25 periods. Particulars appear in an advertisement to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. F. GOOCH, who has been for the past eight years in the Barrow-in-Furness Corporation electricity department, has resigned his position, to take up duties as engineer and manager to the Barton-on-Humber Electric Supply Co., Ltd., commencing from July 12th.

MR. WILLIAM TRAVIS has recently resigned his position as chief assistant engineer to the Hastings Corporation electricity department and joined the staff of the Brompton and Kensington Accessories Co., Ltd.

MR. ERNEST R. FERGUSON has been appointed a commercial assistant to the Corporation electric supply department, Birmingham. There were 60 applications.

The Redditch Urban District Council has appointed MR. R. N. MAYNE, deputy electrical engineer of the Erith Urban District Council electricity works, to be manager of the electricity undertaking.

MR. J. B. HOWAT, station engineer to the Southampton municipal electricity undertaking, has had his salary increased from £215 to £225 per annum. The maximum salary of the senior shift engineer (MR. HOOPER) has been fixed at £3 8s. per week, and the maximum of the shift engineers (MESSRS. AVENS and ALLEN), at £3 5s. per week.

The salary of MR. L. ROMERO, mains engineer to the Salford municipal electricity undertaking, is, subject to the usual sanction, to be advanced from £230 to £250 per annum, rising by biennial increments to a maximum of £300 per annum.

Tramway Officials.—The late tramways manager of Birkenhead, MR. W. WYLD, has received another present, this taking the form of a solid silver salver from the chief officials of the Corporation.

A Sydney newspaper says that MR. W. M. NELSON, engineer of the Christchurch (N.Z.) Tramways, has resigned that position, and he rejoins the Brisbane Co.'s service.

The Coventry T.C. has increased the salary of MR. T. R. WHITEHEAD, engineer and manager of the tramways, from £400 to £450 per annum, as from January 1st last.

The salary of MR. J. BULFIN, general manager of the Bournemouth tramways, has been raised to £700 (the maximum amount).

General.—We understand that MAJOR W. A. J. O'MEARA, C.M.G., late R.E., has now entirely severed his connection with the General Post Office, his appointment as "Engineering Special Commissioner" having terminated. At the Post Office Engineers' dinner in January last, the Postmaster-General announced that Major O'Meara had been called to the Bar, and intended to devote his attention to legal work. We believe, as a matter of fact, that he will be sharing chambers with an old friend of his—Mr. G. Phillips, of 2, Harcourt Buildings, Temple, W.C., who was Crown Prosecutor in Johannesburg during the military occupation in 1901, Major O'Meara being Mayor there at the time. As many of our readers will probably remember, the Major has filled many responsible offices in technical service, and he has accumulated a wide engineering experience, not only connected with telegraph and telephone matters, but in his younger days he was responsible for a great deal of work on the reconstruction of the Portsmouth and Cape Town defences. In that way he was brought closely into contact with civil engineering work, while he has also been employed on special duty in connection with the Service. We have no doubt that Major O'Meara's long and exceptional engineering and administrative experience, coupled to his legal knowledge, will prove a happy and very convenient combination, of which those interested in electrical and engineering undertakings will not be slow to avail themselves as occasion arises.

MR. E. M. LACEY has changed his offices to 12, Victoria Street, Westminster, S.W.

The Council of the Royal Society of Arts has awarded the Society's Silver Medal to the following readers of papers during the Session 1912-13:—DR. F. MOLLWO PERKIN, "Natural and Synthetic Rubber." MR. FRANK BAILEY, M.Inst.C.E., "Electric Supply in London." MR. F. G. OGILVIE, C.B., LL.D., "The Science Museum."

MR PAUL JOHN WEISS announces in the *Times* that henceforth he will be known by the surname of White. Mr. White is general manager of the London Electric Warehouse Co. (Brush Co.)

MESSRS. HEAP & DIGBY have removed to 48, Westminster Palace Gardens, Victoria Street, S.W.

MR. FRANCIS HUSBAND, A.M.I.E.E., has resigned his position with the London County Council tramways to take up the position of engineer and director with the Electrical Contracts and Maintenance Co., Ltd., Sanctuary House, Westminster, S.W., as from July 1st.

The Postmaster-General has appointed MR. V. M. DUNFORD to be Deputy-Controller of the Central Telegraph Office, and MR. J. BAILEY, MR. A. W. EDWARDS, and MR. A. TAPLEY to be assistant controllers.

The marriage took place at Bethel Church, Penygroes, on June 25th, of MR. RICHARD JONES O'BRIEN OWEN, electrical engineer, only son of the Rev. D. O'Brien Owen, of Carnarvon, and Miss Anne Williams.

The marriage took place at Cookham (Berks.), on June 19th, of MR. FRANCIS W. MAIN, A.M.I.E.E., to Miss Deborah Clara Buckham.

It is announced that the President of the Board of Trade has appointed Lieut.-Colonel P. G. VON DONOP, R.E., to be Chief Inspecting Officer of Railways, in succession to Lieut.-Colonel Sir Arthur Yorke, R.E., who has retired from that post under the age limit.

The *Times* states that SIR HENRY NORMAN has been elected a member of the British Association Committee of Radiotelegraphic Research, of which Sir Oliver Lodge is chairman.

MR. T. H. U. ALDRIDGE, municipal electrical engineer of Shanghai, is due in this country any day; indeed, he may have arrived before these lines appear in print. The Municipal Council has recently shown its high appreciation of Mr. Aldridge's services by advancing his salary, as from May 1st, from 11,760 taels to 13,200 taels per annum, figures equivalent to £1,560 and £1,780 respectively. It has also granted him an honorarium of £500 in recognition of the extra work involved in connection with the new Riverside power station just completed at Shanghai.

A local correspondent writes:—"MR. ARTHUR MURDOCH, who was formerly on the engineering staff of the Blackpool Corporation electricity works, and who is now the electricity and tramways engineer to the Melbourne City Tramways, is on holiday at Blackpool."

MR. A. S. E. ACKERMANN left England on 1st inst. for Egypt, for the purpose of testing and reporting upon the Shuman-Boys Sun power plant, which has been erected near Cairo. Lord Kitchener, who recently inspected this plant at work, expressed the view that it would be a great help to the development of the Sudan and Upper Egypt, and wished the promoters every success.

MR. F. C. PHILLIPS, who has for some time past represented Mr. C. M. Simpson, Bristol, in the South Wales and West of England area, has now severed his connection with this firm, having taken up the position of representative in these districts for Messrs. Friend, Windle and Co., electrical and general engineers and merchants, 8, Westgate Street, Cardiff.

A presentation of a silver rose bowl was made to MR. C. CROMPTON at the Arc Works Clubhouse on Friday last, the occasion being his retirement from the services of Messrs. Crompton & Co. Mr. A. J. Hodgson, the works manager, in making the presentation on behalf of the employés, referred to Mr. Crompton's long connection with the company, and Mr. Bickmore, as one of its oldest servants, spoke in support of Mr. Hodgson's expression of good wishes for Mr. Crompton's future success.

Obituary.—MR. T. E. BROWN.—We regret to record the death, after a long and painful illness, of Mr. Tom E. B. Brown, for many years joint managing director of Messrs. Ross, Courtney and Co., Ltd., of Ashbrook Road, Upper Holloway, London, N.

MR. JOSHUA SHAW, head of the firm of Messrs. John Shaw and Sons, Ltd., steam, hydraulic and electrical engineers, of Salford, died on Saturday, at the age of 73. He was formerly a member of the Salford Town Council, and served at one time as chairman of the Electricity Committee.

The death took place on June 26th, after a painful illness, of MR. ERNEST SYKES, A.M.I.E.E., of 7, King Cross Street, Halifax. The deceased was in his 41st year.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Buenos Ayres City and Suburban Tramways, Ltd.—Trust deed dated June 5th, 1913, to secure £500,000 first debs. at 5 per cent, charged on two concessions granted by the Provincial Government and Municipality of Buenos Ayres. Trustees: Dr. M. Lacroze, 4, Moorgate Street, E.C., and M. A. Edwards, 8, Old Jewry, E.C.

Electrical Engineering and Motor Co. (Carlisle), Ltd.—Particulars of £500 debentures, created June 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Alderley and Wilmslow Electric Supply Co., Ltd. (47,663). Return dated May 6th, 1913. Capital, £30,000 in £1 shares (10,000 pref.); 15,009 ord. shares taken up; £15,009 paid. Mortgages and charges: £15,000.

Montreal Tramways and Power Co., Ltd.—Particulars of $1,950,000 (£277,397 5s. 2d.) collateral gold notes, created February 13th, and secured by trust deed dated February 15th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: First mortgage 5 per cent. bonds of the Canadian Light and Power Co. of the aggregate par value of $1,800,000. Trustees: National Trust Co., Ltd., of Montreal, Canada.

Particulars of $5,000,000 (£1,027,327 5s. 2d.) collateral trust gold notes, created April 9th, andsecuredd by trust deed dated April 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: 60,000 shares of the 5 per cent. mortgage debenture stock of the Montreal Tramways Co., of Montreal, of the aggregate value of $6,000,000; 10,400 $100 shares of the capital stock of the said company; 39,000 $100 shares of the common capital stock of the Canadian Light and Power Co.; 875 $100 shares of the common capital stock of the Saraguay Electric and Water Co.; and 90 per cent. of the entire capital stock of the Dominion Light, Heat and Power Co. Trustees: Bankers' Trust Co., of New York.

Exchange Telegraph Co., Ltd.—A memorandum of satisfaction in full on June 20th, 1913, of charge dated January 14th, 1910, securing £5,000, has been filed.

South London Electric Supply Corporation, Ltd.—Issue on June 5th, of £1,200, and on June 17th, 1913, of £1,300 debentures, parts of a series of which particulars have already been filed.

T. W. Vaughan & Co., Ltd.—Debenture dated June 6th, 1913, to secure £3,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. C. Stark, Shoma, Malford Grove, Snaresbrook, Essex.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on June 14th, 1913, of debentures dated July 2nd, 1907, securing £175, has been filed.

Electromobile Co., Ltd.—Issue on May 9th of £151 10s. and on June 9th, 1913, of £150 15s. debs., part of a series of which particulars have already been filed.

CITY NOTES.

R. Waygood & Co., Ltd.

Mr. H. C. Walker presided at the annual meeting held on June 27th, at Cannon Street Hotel, E.C. He said that at last year's meeting it was announced that they were just completing the erection of a new factory for electrical work. This had now been finished, and the majority of their machines had been rearranged and the factories reorganised. The trading profit was less than last year, partly in consequence of the disorganisation during building operations, and partly because of the rise in price of raw materials, and while they did not adversely criticise the Government insurance scheme, this accounted for an additional expenditure of £800 during the year under review, which was at the rate of £1,200 a year. The general charges were, however, proportionately less, and the figures were as follows:—Trading profit, £77,520; dividend on investments, £951; and on the other side, general charges, &c., £50,818; depreciation on plant, &c., £2,398, leaving a balance to be carried down of £25,261, or with the balance from last year, a total of £31,541; from this are deducted directors' fees, £2,800; dividend on preference shares, £8,100; amount added to reserve, according to Article 132, £1,500, leaving a balance of £19,141. They had already paid an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, amounting to £3,375, leaving a balance available of £15,766. After referring to various lifts that had been installed by the company during the year, the chairman said that they had seen paragraphs in the Press relating to suggested arrangements with the Otis Elevator Co., of New York. He would say that negotiations did take place, and proposals were made to this company by the Otis Co., but the terms were not sufficiently attractive. The directors had been in no way responsible for the circulation of these reports, or for the dealings in shares which resulted. Further working capital was required, in order to meet the rapid development of the business, and they would at once issue the remaining shares, giving the shareholders the first opportunity of taking them up. The further dividend now recommended (9 per cent. per annum for six months) made the total dividend 7 per cent. for the year, and £9,691 was to be carried forward.

Mr. E. P. Okeden seconded the adoption of the report, and it was carried.

Chas. Churchill & Co., Ltd.—The general activity in the engineering trades is reflected by the increased profits of this company. The company's net profits amounted to £35,400, which compares with £23,000 for the previous year, and the dividend on the ordinary shares is raised from 20 to 40 per cent. A sum of £12,000 is placed to reserve, as against £10,800 a year ago, and the balance carried forward is also higher at £4,200.—*Financial Times.*

General Electric Co., Ltd.—The report for the year ended March 31st, which reached us just as we go to press, shows that the net trading profits and income from investments, &c., amounted to £145,261, compared with £133,564 for the previous year. The dividend on the ordinary shares is to be 10 per cent. for the year, as compared with 7½ per cent. for the previous year. It will be remembered that there was an issue of £150,000 6 per cent. preference shares during the year. The meeting is to be held in London on July 10th.

Sao Paulo Tramway, Light and Power Co.—A dividend of 2½ per cent. on the Common stock is announced, payable August 1st.

British Continental Electricity Co., Ltd.

The directors' report states that during the year ended April 30th 1913, 241 new installations were connected, while the number of lamps added during this period, calculated on the usual basis of 8-c.p. (carbon), has been 1,802 (motors calculated in equivalent lamps). After writing off £177 depreciation at the usual rates in respect of furniture, tools, meters, &c., and £219 depreciation of plant and stock, the balance standing to the credit of revenue account, after deducting the interim dividend paid on the 5½ per cent. cumulative preference shares for the half-year ended October 31st, 1912, and including the amount brought forward, is £1,384, out of which has been paid an interim dividend on the ordinary shares for the half-year ended October 31st, 1912, leaving a balance of £1,284. Out of this there is to be paid a final dividend at the rate of 5½ per cent. per annum on the 5½ per cent. cumulative preference shares for the half-year ended April 30th, 1913 (£275); a final dividend at the rate of 3 per cent. per annum, free of income-tax, on the ordinary shares for the half-year ended April 30th, 1913 (£150); to the reserve fund £400, leaving to be carried forward £459. During the year all arrears of dividend on the 5½ per cent. cumulative preference shares have been paid off, together with the interim dividend due to October 31st, 1912. Five per cent. debentures for £1,512 have been issued and subscribed for by the preference shareholders. £439 has been expended on capital account during the year.

Prospectuses.—*The Humphrey Pump Co., Ltd.*—The list was to close yesterday in an issue of shares in this company, which has been formed with a nominal capital of £200,000—£50,000 in 7 per cent. preference, and £150,000 in ordinary shares of £1 each. The purchase price is £125,000, £25,000 in preference, and £100,000 in ordinary shares, so that after paying preliminary expenses, the whole of the proceeds of the issue will be available for working capital and general purposes.

Georgia-Carolina Power Co.—This company is shortly to offer to the public $1,590,000 5 per cent. first mortgage bonds guaranteed unconditionally by the Augusta-Aiken Railway and Electric Corporation at the price of £90 per cent. with bonus.

Electrical Apparatus Co., Ltd.—The business, &c., of this company has been taken over by one of the same name from June 30th. Owing to continued expansion of business and in view of future extensions, the new company is making a public issue of shares (42,700 7 per cent. cumulative preference shares, £1 each) at par. The bulk, we understand, has been already applied for privately. The proceeds of the issue, if fully subscribed, will provide nearly £40,000 additional working capital. The prospectus will be found in our advertisement pages to-day. The last annual report of the old company, showing very successful trading, appeared in our issue of June 6th.

Japan.—The Kinugawa Hydraulic Electric Co. has declared a dividend of 7 per cent. for the last financial half-year and the Keihin Electric Tramway Co. one of 6 per cent.

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent.

Mexican Light and Power Co.—The directors have declared a dividend of 1 per cent. on the ordinary shares.

Shawinigan Water and Power Co.—The directors have declared a dividend of 1½ per cent. on the common shares, being at the rate of 6 per cent. per annum, for the quarter ending June 30th.

Continental.—France.—A new company has lately been formed in Paris, with a capital of £80,000 and the title La Société de l'Electricité de Reims, to establish a central electric lighting station in the town of Rheims.

La Société Francaise de Matières Isolantes et d'Applications Electrique is the name of a new company which has just been formed at Puteaux (33, Rue Voltaire), near Paris, with a capital of £19,500.

Germany.—The report of the Gesellschaft Mix und Genest. Telephon und Telegraphenwerke, of Berlin, for the last financial year, shows a net profit of £7,816, as compared with £6,501 in the preceding 12 months. Owing, however, to the unfavourable position of several affiliated concerns, special depreciations have to be made, with the result that the accounts show a total loss of £60,118. In order to re-establish the business the directors have proposed to the shareholders to write down the capital of £350,000, by reducing the shares in the proportions of from 5 to 3.

Rio de Janeiro Tramway, Light and Power Co.—The directors announce a dividend of 1¼ per cent., payable August 1st.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors announce an interim dividend for the quarter ended March 31st of 2s. 6d. per share, tax free, payable on July 15th.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the five weeks ended May 30th, 1913, amounted to 1,478,251, compared with 1,257,608 units in the corresponding five weeks of 1912.

Hobart Electric Tramway Co., Ltd.—A dividend of 1s. per share is announced, payable on July 1st.

Edmundsons' Electricity Corporation, Ltd.

THE directors' report for the year ended March 31st, 1913, states that the business of the company shows continued progress. Dividends and interest have increased by £3,488, whilst the loss on working the local authorities' undertakings is reduced by £2,029. On the other hand, administration expenses have increased by £1,145, whilst gross trading profit, owing principally to the smaller capital expenditure of the subsidiary companies, is reduced by £2,816. The net profit, after providing for interest on and redemption of debenture stocks amounts to £18,900. The directors paid in December last an interim half-yearly dividend at the rate of 6 per cent. per annum on the 6 per cent. cumulative preference shares, and they now recommend the payment of a further half-year's dividend, making up the full 6 per cent. dividend on these shares for the year ended March 31st last, and that the balance, £6,900, be carried to reserve. It is proposed that the 6 per cent. dividend on the cumulative preference shares should, in future, be paid half-yearly on January 15th and July 15th. The result of the scheme of capital reduction is shown in the balance-sheet. The ordinary share capital has been reduced by £160,000, and this amount, together with the reserve items of £136,716 and £95,705 appearing in last year's balance-sheet, has been applied in writing down the value of investments and in entirely writing off the item of goodwill. During the past year the Frome undertaking has been taken over by the company from the Frome Urban District Council.

From the schedule showing capital expenditure and gross profits of subsidiary and other companies for the years 1911 and 1912 we extract the following :—

Name.	Gross profit (before providing for capital charges and depreciation). 1912. £	1911. £	Lamps connected (equiv. 33-watt). 1912.	1911.
Alderley	2,842	2,274	24,898	22,866
Bromley	13,038	13 081	107,649	101,276
Folkestone	16,073	16,539	131,253	124,149
Guernsey	5,539	3,483	112,950	106,078
Isle of Wight	14,171	13 986	125.455	115,987
Ilfracombe	1,234	1,293	19 936	18,627
Lymington	1,896	1,789	18 610	17,043
Melton Mowbray ..	2,519	2,282	21.965	21,063
Newmarket	2 559	2,421	27 811	27,039
North of Scotland ..	6,395	5,782	76,882	71,872
Ramsgate	3,619	2,676	37,519	34,648
Scarboro' trams. ..	377	804	—	—
Salisbury	6,346	6,015	41,621	39,569
Urban Co.	54,265	47,649	677,495	589,737
Wycombe	5,730	5,432	63,505	57,901
Cromer	1,100	899	15,805	14 271
Dorking	2,290	2,117	21,908	19,743
Frome	1,499	1,208	43,745	34,253
Hamilton	3,639	3 261	58,427	52,623
Surbiton	*4,637	*4,363	*42,518	*39,525
	£149,768	£137,354	1,669,952	1,508,170

* Figures for year ended March 31st.

Total capital expenditure, 1912, £3,001,669; 1911, £2,918,161.

The meeting is called for Thursday, July 10th.

Aron Electricity Meter, Ltd.

MR. H. HIRST (chairman) presided on Tuesday, at Winchester House, E.C., over the sixteenth ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, Vol. 72, page 1078), the CHAIRMAN said the shareholders would no doubt share the satisfaction the board felt at the continued progress of the company. The year under review had not been one of continued sunshine, and many a black cloud had appeared in one or other of the territories in which they operated. The rise in the price of raw material, political troubles, and labour unrest, had all contributed to the anxiety of the board and management. Nevertheless, the result of the year's working was exceedingly pleasant, and their net profit of £32,652 was about £2,000 ahead of last year. This practically represented the exact amount of the increase in their gross profit, which was £53,000 — a proof that the same careful and conservative principles had prevailed during the past year, which had helped them in the past in lifting the company from adverse conditions into a flourishing concern with every appearance of continued progress. As regarded the balance-sheet, the items were clear, and he could not think of any necessary comments except so far as the first item on the credit side was concerned, namely, £213,298. This item he noticed from correspondence and inquiries which came to him in the course of the year was looked upon by many shareholders as if it represented goodwill and patents only. The people who complained most about insufficiency of details in balance-sheets were generally the greatest sinners in the way of reading them. This item included such solid assets as valuable freehold land in Schweidnitz, Vienna and Paris, very important and expensive buildings, modern machinery and tools. The actual hard cash spent on additions to these items since the formation of the company amounted to a grand total of £120,000. He, personally, was of the opinion that the actual amount for goodwill and patents had been, by very generous depreciation on the one side and by reserves on the other, reduced to quite a normal and unimportant figure. He doubted very much, if their property were valued to-day by a conservative valuer, whether he could debit that account with more than £50,000 for goodwill and patents. Perhaps the board, for the satisfaction of the shareholders, would arrange in the coming year for such a valuation to be made. The only other comment of utility which he could make was with reference to the appropriation of the profits. The directors had decided to recommend a payment of a dividend on the ordinary shares of 7 per cent., or 1 per cent. more than last year. No doubt there were those among them who thought they ought to pay more. He wished to assure them that the directors had given the fullest consideration to this problem ; the constant increase of business absorbed their finances to the full, and he might tell them that during the period which had elapsed since March 31st, to which date their accounts were made up, their sales had again gone up considerably, as compared with the same period of last year. Whilst the business increased, the profits did not show entirely in cash, but largely in additional outstandings and stock necessary to satisfy their customers. In addition to this, it must not be forgotten that the bulk of the business of the company was done in the Central European countries—Germany, Austria, France and Belgium. The war cloud which hung over Austria had not entirely disappeared, and whilst they had no fear of severe bad debts, they had to reckon with slower payments and increased outstandings. The present financial position in other European countries was so well known, that he was sure that if they gave that situation one minute's thought, they would agree with them that this was not a time when they should part too lightheartedly with such liquid assets as hard cash. The whole of the future welfare of the company might be seriously affected by so doing. He wished again to thank Dr. Aron and his staff for the skilful and able manner in which they had handled the business during the past year.

SIR JAMES PENDER, Bart., seconded the motion.

MR. ASHBY said it was impossible to be otherwise than satisfied with the report, and the chairman had anticipated him in regard to the point he had intended raising as to the amount of the dividend. It was obvious that the company was capable of paying more, which would increase the value of the shares, but he would have preferred to submit to the explanation of the chairman.

MR. FISHER, as one of the original subscribers, also expressed satisfaction at the report, but asked if the board could not approach the company's stockbrokers with the view of reducing the margin at which the shares were quoted.

The CHAIRMAN said he had nothing to add to what he had already said regarding the distribution of profits. They had made the profit, but the safety of the company was their first considera tion. He thought it was the business of the board to look after the business, and not to concern themselves with the quotation of the shares.

MR. H. KAHN pointed out that the bulk of the shares were in the hands of those who, having seen the progress of the company wished to hold them, and there were very few of the company's shares floating about on the market.

The report was adopted, and the retiring directors re-elected.

J. G. White & Co., Ltd.

THE annual meeting was held on June 26th at the Cannon Stree Hotel, Lord Arthur Butler presiding.

The CHAIRMAN, in moving the adoption of the report (see ELE REV., Vol. 72, p. 1075), said that it showed that the compan was maintaining its good record. The net profit for the year w £88,797, an increase of £1,691, and, with the exception of 1911, t year under review was the most successful in the company's histor After making substantial additions to the reserve accounts, t directors recommended dividends at the same rate as for the pa two years. Turning to the assets side of the balance-sheet, would be noted that the quick assets in the form of cash, loans call, and short time loans against securities, showed little chan from last year's figures, the amount of this form of asset bei still nearly equal to the whole share capital of the compan Investments now stood at £163,728, about £32,000 less than la year, which was due to the sale of certain of their securities, a at a substantial profit. The investment account included t securities of various tramway, lighting and other public utili companies in which they were interested, and also the shares several allied or subsidiary companies, the most import of which was the Municipal and General Securities C which was doing an increasing and successful financ business and had paid dividends of 10 per cent. on its capital, aft making liberal allocations to reserves. The business of that co pany had so much increased that since the date of the balan sheet its capital had been further increased by £50,000, all of whi was subscribed by this company. The Building Construction C in which the company was interested, had during the year b placed in voluntary liquidation, as it was considered that the pres conditions of the building trade were such that satisfactory pro were not likely to be earned. The result of the liquidation, ho ever, would be the repayment to the company as a shareholder an amount in excess of the cost and the balance-sheet value of shares held. In the opinion of the directors, the investments h been conservatively valued, and the interest and dividend ret received upon them was at a higher rate than last year. The ite of sundry debtors and works in progress, together amounted £229,018, an increase of nearly £157,000 over last year. T indicated a considerable amount of new business which the co pany had secured during the past year, and they had at pres more contracting, operating and engineering works in hand t for some time past. A considerable part of this increased fig was, however, due to the interest they had taken in the formati of the International Light and Power Co., Ltd., a company wh was interested in tramways, lighting and power undertaking

South America and elsewhere. The items of plant and purchase of business remained as before at the nominal valuation of £1 each. Turning to the debit side of the balance-sheet, there was no item requiring explanation other than that of sundry creditors, now standing at £141,206. This was also larger than last year, and, like the debtor item on the other side, was an indication of the increased business they were at present doing. The balance of profit available for allocation was £89,904, which was £6,691 more than the amount they had to deal with last year. With the balance brought in from last account they had £110,009 to deal with, out of which the interim dividend of £12,000 had been paid, and the percentage to staff and directors who were members of the staff in accordance with agreements, amounting to £8,105, leaving a balance of £89,904 now available. In the distribution of profits they recommended: (1) The setting aside of £20,000 to be added to the general reserve account, bringing it up to £120,000; (2) £10,000 to be added to the reserve for equalisation of dividends, making this account £50,000, or a sum greater than the 12 per cent. dividend on both classes of shares for two years. Over one-third of the profit earned in the year was thus retained in the various reserve accounts, and should enable them further to increase and develop the company's business. The remaining profit permitted them to recommend the payment of a dividend (after taking into account the interim dividend paid in January last) of 12 per cent. on the preferred shares and also 12 per cent. on the ordinary shares, and a further extra dividend of 10s. per share, or in all 62 per cent. on the ordinary shares. The amount carried forward would be increased from £21,212 to £22,904. The total of the reserve accounts and unallocated profits carried forward would amount to £192,904, or almost equal to the total share capital. As he had already told them, they had more good business in hand than last year, and the outlook appeared to them to be favourable, although the financial stringency at the present time would undoubtedly have its effect on new enterprises during the latter half of this year, and might delay their progress and defer the realisation of profits which they would ultimately earn. They could not expect in every year to be able to pay as large dividends on the ordinary shares as on this occasion, but he could say that the outlook was at present satisfactory, and they hoped that the company would continue to increase its business, strengthen its position and maintain a satisfactory rate of return to the shareholders.

MR. W. C. BURTON seconded the resolution, and the report was adopted without discussion.

Bombay Electric Supply and Tramways Co., Ltd.

THE annual meeting took place on Tuesday last week at Kingsway, when Sir Charles Ollivant, K.C.I.E., presided.

In presenting to the shareholders the directors' annual report (see ELECTRICAL REVIEW, Vol. 72, p. 994), the CHAIRMAN said that 1912 had been a gratifying year. In perusing the accounts they would observe with satisfaction that while the total revenue for the year increased by £17,394, the advance in earnings was obtained by an increased expenditure of only £2,292. The net revenue amounted to £128,682, as against £113,580 for 1911, or an increase of £15,102, which was equivalent to 13·28 per cent. The directors proposed to allocate £30,000 for payment of a dividend (free of English income-tax) at the rate of 5 per cent. per annum (as against 3 per cent. last year) to the holders of the company's ordinary shares, and to carry forward £5,072 to the next account, the dividend to be paid simultaneously in London and Bombay on July 1st. The directors had considered it proper to increase by a sum of £5,300 the provision for depreciation, the advance being mainly called for by the additional plant installed in the course of 1911 at their new Kussara power house, and by the considerable extensions made last year to their supply mains. The past year's good results were achieved in competition with a year when both the traction and supply branches of their business obtained special accretions of revenue from the Royal visit to Bombay. As was pointed out last year, that auspicious event led to a very large influx of visitors into the city during the last three months of 1911, resulting in record traffics on the tramway, while the public illuminations and fêtes brought considerable additional revenue to the electrical supply department. It was all the more satisfactory, therefore, that their electric supply branch should during 1912 have shown such substantial progress. In 1912 they delivered to consumers (exclusive of supply to the tramways) 4,364,977 units as against 3,356,184 units in 1911, or an increase of 30 per cent. The gross revenue of the branch showed an increase of £14,883, whilst the working expenses showed a decline of £2,581. The reduction in their generating costs was mainly due to the economies effected by the greater efficiency of the new power station. Therefore there seemed every reason to anticipate that, unless they were handicapped by an increase in the price of coal, their generating costs would be still further reduced as their load expanded. With regard to the traction branch, it was somewhat disappointing that he could not refer to equally encouraging returns. As they would have seen from the report, the profit, as compared with 1911, showed a small decrease of £1,254. While the gross traffic receipts increased by £3,206, the advance in working expenses more than absorbed this. The increase in expenditure was mainly occasioned by the thorough overhaul of their rolling stock last year. While they had been able progressively to extend their mains they had been unable to make any extensions of their tramway lines for five years. Several new streets were now approaching completion, and the laying of tramway lines in some of them would certainly prove an advantage to the city, which would no doubt be undertaken by the company, subject to their obtaining the consent of the Corporation to such a scale of fares as would reasonably justify the company in incurring the necessary outlay. With regard to their investments belonging to the depreciation and sinking funds, they were as usual taken in the balance-sheet at cost price. Consequent upon the acute depression which had ruled for some time past on the Stock Exchange, there had been in the case of some of the shares a slight decline in value, but as their investments had been carefully selected he felt sure their value would increase as soon as a healthier tone pervaded the Stock Markets. He moved the adoption of the report.

MR. F. W. CHANTER seconded, and the motion was carried *nem. con.*

MR. E. GARCKE proposed the re-election of Sir Chas. Ollivant and Sir Walter Hughes as directors. This was seconded, and carried unanimously.

Globe Telegraph and Trust Co., Ltd.

THE annual meeting took place on Tuesday last week at the offices, Electra House, E.C., under the presidency of Sir J. Wolfe Barry, K.C.B. (chairman).

The CHAIRMAN said that there had been some change since their last meeting, but that must be expected in a trust company such as that, as they were dependent practically upon the income from the various concerns in which their capital was invested. Taking the net result, they had not had an unsatisfactory year; while there had been losses, there had been gains as well. The net receipts, after deducting working expenses, amounted to £209,828, which was a slight decrease over the preceding year, but with the balance of £27,997 brought forward as shown by the balance-sheet there remained a total of £237,825. They had paid their usual quarterly dividends, which absorbed a sum of £131,085. The directors now recommended the payment of a dividend of 3s. per share, less income-tax, on the preference shares, making with previous distributions a total dividend for the year on those shares of 6 per cent. per annum, and 6s. per share net on the ordinary shares, making, with previous distributions, a total dividend on those shares of 6 per cent. net. Those dividends would absorb the sum of £79,922, leaving a balance of £26,817 to be carried forward to the next account. Their list of investments they would find had been altered somewhat. First, £4,500 of the Anglo-American Telegraph Co.'s preferred stock had been sold and 15 of the certificates of the Submarine Cable Trust had been drawn for payment at £120 per certificate, and the money had been re-invested. There had been a slight reduction from the Anglo-American Co.'s stock which was caused by a dividend of 6 per cent. being guaranteed by the Western Union Co. which took them over. There had been also a decrease in the yield of the United States Direct Telegraph Co., which was caused through a slight decrease in their dividend occasioned by an extra expenditure on cables. They had, however, sold some of the shares and re-invested the money at a higher rate of interest, which would also account for the difference in the returns. They had also had gains, one being an increased dividend from the Great Northern Telegraph Co.'s stock, and another from the Mackay Co.'s. The Telegraph Construction and Maintenance Co. had also declared a larger dividend, which meant an additional £1,000 to them; 150 extra shares had been bought in that company, which brought in an extra £300. He had pleasure in reporting a slight decrease in their working expenses this year, and their investments showed a present market value of something like £200,000 over cost price.

SIR JAMES PENDER seconded the adoption of the report, and Sir John Wolfe Barry was re-elected chairman.

Chilian Electric Tramway and Light Co., Ltd.

THE fifteenth ordinary general meeting of this company was held on Thursday last week at the offices, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer in the chair.

The CHAIRMAN, in proposing the adoption of the report, said that the credit balance of the year—£163,542—again compared most favourably with that of the previous year, which amounted to £135,978. In consequence, they were able to place £60,000 to the renewals reserve account and £7,000 to insurance suspense account, and sufficient funds were left to declare a dividend of 6 per cent. for the year 1912 on the preference shares, amounting to £39,000, and, further, to pay the full arrears of dividend of 6 per cent. for the year 1901, and 5 per cent. for the year 1902, amounting together to £60,500. After making those provisions they carried forward a balance of £8,381. The outstanding balance of cumulative dividends still in arrear on the preference shares had now been reduced to £202,500, and he looked forward to seeing that sum finally wiped out at an early date. Again, for the year they had the pleasure of submitting record figures for both tramway traffic and light and power receipts. In the year under review 102,677,482 passengers were carried, which was an increase of 10 millions over the previous year, which in itself was a record; while the receipts showed an advance of 1 million pesos. Owing however, to the increased expenditure in higher wages and the very low tariff which they were bound to maintain by the terms of their concession, the profit on the tramway undertaking was, in the opinion of the directors, hardly an adequate return on the very large capital invested. The question of the tariff was receiving the very earnest

attention of the board, and no opportunity would be neglected of endeavouring to get a modification of the concession from the municipality. The receipts from the lighting and power department amounted to 6½ million pesos, against 5½ millions in 1911, which gave satisfactory evidence of the great development of that branch of the business. The increase in the consumption, both of light and power, by the inhabitants of Santiago was a very gratifying feature of their industry, and he looked with confidence to still further expansion, and to that end they were making important additions and alterations to their existing installations.

Mr. V. Ribton Turner seconded the motion, and the report was adopted.

STOCKS AND SHARES.

Tuesday Evening.

The turn of the half-year has brought a slight amount of relief to the Stock Exchange so far as the monetary stringency is concerned, and the crisis of the past few weeks, financial and political, was regarded as happily over. Then the quarrels between Bulgaria, Servia and the rest, came to upset prices again. Members have got so used to the idea of these Balkan States being at one another's throats, that they are content, however, to pay less heed to what developments there may be, and prices are much better in the markets now than was the case a fortnight ago.

One striking example of the change which has come over things, is to be seen in the way in which purely investment stocks and shares have responded to the altered conditions. Hundreds of securities were marked *ex* dividend in the Stock Exchange last Friday and to-day (Tuesday), and in a great number of cases the deductions have been partially recovered. This may be seen in some of the quotations given in our own lists. Stock Exchange dealers report that there is a demand for stocks and shares, where a little while ago only sellers obtained. It is worth noticing that the electric light share market shows a number of rises of about ⅛ in extent, a clear indication of the way in which the investor is on the look-out for cheap stock.

Most of these improvements are due to the market realising that there were very few cheap shares about, and that for these there is noticeable inquiry. In consequence, jobbers have put up the prices, and it is doubtful whether buyers of substantial amounts would be able to fill their orders even at the present quotations. Rises of ⅛ have occurred in Metropolitan Preference, Westminster Ordinary and Preference, London Preference, and County Ordinary. City "Lights" regained last week's loss of 10s. St. James advanced 5s., and so did Charing Cross shares. The market is distinctly a good one.

A feature of the past few days has been a fresh rise in the price of Marconi shares. This was started by the bears covering, upon the announcement that the company had concluded an important contract for the Norwegian Government, which contract, by the way, has this week been ratified in the Norwegian Parliament. In addition to this, however, expectations are current that the company will be able to cancel its present contract with the British Government, and to substitute a fresh one, which shall be—according to rumour—on terms more advantageous to the company than the present one. A third bullish factor is the hope of a good dividend, as to which doubts should be set at rest before these notes appear. The estimates, as we stated before, range from anything up to 20 per cent. With the price of the parent shares, there has improved the Preference quotation as well. Americans are *ex* the dividend, equal to about 4¾d. per share, and the price is steady at about 16s. 3d. Canadians have scarcely moved from their previous level of 10s. 3d. The market is once more active, and, at the time of writing, fairly buoyant, though how long this is going to remain so only a tipster would care to prophesy.

Another stock around which there has been increased speculation is National Telephone Deferred, the price jumping up to 25¼ a day or two ago. Something ought to be known this week as to the amount which holders of the Deferred residue are likely to get in virtue of the Government purchase price. Reuters remain dull, a fall of 5s. carrying back the price to 9¾ middle. Reuter's Bank, Ltd., was registered last week with an authorised capital of a million pounds in shares of £10 each.

The Telegraph market is steady, with improvements in Anglo-American Preferred and Direct United States Cable shares. West India and Panama first Preference fell back to 9¾, so that both classes of Preference shares are standing at the same level. Dividend deductions from the Debenture stocks in this department were partially recovered in various cases. The Telegraph manufacturing shares are very steady.

The feature in the Latin-Canadian group is a substantial recovery in British Columbia Electric Railway stocks. Released from the pressure to sell which depressed prices badly last week, the Deferred stock has rebounded 5 points, and the Preferred 2, while the 5 per cent. Preference rose 1½. In the cases of the first two, the gains have not wiped out the entire loss of the previous week, although they have gone some way towards it. The company's 4½ per cent. Debenture stock rose 1½.

Mexican securities are still somewhat out of favour. The Tramway shares are down 3, though the company's 5 per cent. first mortgage bonds are 1 up. Rio Tramway Bonds are harder. Brazilian Tractions, moving pretty actively, have been down to 87½ and up to 90½, closing this evening at 87½, with a fall of 2½ on the week. The Anglo-Argentine descriptions are mostly *ex* dividend, with the deductions partially recovered. Victoria Falls Preference shares have given way in connection with further weakness in the Kaffir market, induced by the extension of a strike on the Rand. The price is now *ex* the dividend of 1s. 2⅝d.

In the Manufacturing group, the quotation *ex* dividend of Brush Second Debentures serves to direct attention to the remarkably high yield which the stock pays at its present price, a return which, of course, is in itself in the nature of a cautionary signal. The Prior Lien Debenture is also *ex* dividend, and the yield works out to 6⅛ per cent. on the money at the present price. Cromptons are now quoted 0-¼, some of the shareholders not liking the idea of reorganisation, but the Debenture stock retains its rise of last week. Babcocks & Willcox at 3 have recovered their slight loss. The Rubber market showed pronounced strength upon the scrambling in of the bear brigade after the Stock Exchange settlement had served to reveal the extent of the "short" account. Most of the rise has been held. This week's auctions were noticeable for the comparatively small amount put up for sale, this being due to the fact that a large quantity did not arrive in time for it to be listed in the present catalogue.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£23 10	..
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£8 10	£2 inc.
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8⅝d.	½d. inc.
c „ Tube (brazed)	„	9⅛d.	⅛d. dec.
c „ „ (solid drawn)	„	8⅜d.	⅛d. dec.
c „ Wire, basis	„	8⅛d.	⅜d. dec.
c Copper Tubes (brazed)	„	11½d.	⅛d. dec.
c „ „ (solid drawn)	„	10⅝d.	⅛d. dec.
g „ Bars (best selected)	per ton	£80	£2 dec.
g „ Sheet	„	£80	£2 dec.
g „ Rod	„	£80	£2 dec.
d „ (Electrolytic) Bars	„	£69	£1 dec.
d „ „ Sheets	„	£86	£1 dec.
d „ „ Rods	„	£74 15	10/- dec.
d „ „ H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	3/10	1d. inc.
i Iron Pig (Cleveland warrants)	per ton	56/3	11d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£19 15	£1 5s dec
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	9d. to 10½d.	dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£195 to £196	£13 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25	£2 5 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	5	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅞	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅛ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96 xd	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4¼ — 4¾	+ ¼	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	+ ¼	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	+ ⅛	5 12 6
Do. Do. 4 % Deb. ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5½	..	4 15 8
Do. 4½ % Deb.	Stock	4½	4½	94 — 97 xd	..	4 12 9
City of London, Ord.	10	8	9	15 — 16½	+ ½	5 9 1
Do. 6 % Cum. Pref.	10	6	6	12 — 12	+ ½	4 12 4
Do. 5 % Deb.	Stock	5	5	113½ — 117½ xd	..	4 5 1
Do. 4½ % Second Deb. ..	100	4½	4½	98 — 100 xd	..	4 10 0
County of London, Ord.	10	6	6	10½ — 11	+ ⅛	5 9 1
Do. 6 % Pref.	10	5	5	11¼ — 11¾	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 — 104 xd	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£8	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4½	..	3 6 8
Do. 6% Non-Cum. Pref. ..	5	..	..	1¼ — 2⅜	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7¾	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	8	2½	2½	1½ — 1¾	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	+ ⅛	5 13 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8½ — 8¾	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝ xd	+ ⅛	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99 xd	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	78½ — 81½ xd	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	5	9½ — 10½ xd	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	+ ½	5 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	+ ⅛	4 14 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½ xd	..	4 1 10
South London, Ord.	4	5	6	2⅞ — 3¼	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅞ — 1⅞	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£8	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	7⅞ — 8⅛	+ ⅛	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛ xd	+ ⅛	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	8½	6⅞ — 7⅜	..	5 15 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93 xd	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	108 — 112 xd	+ 3½	6 5 0
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	5/8 — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 5 % Bonds	100	6	5	90 — 92 xd	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	— ½	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	7/16 — 1/2	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 — 101 xd	+1	4 19 0
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105 xd	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	76½ — 79½ xd	..	6 5 9
Mexican Lt. & Power, Common	$100	4	4†	67 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	96 — 100	..	7 0 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	78 — 81	..	6 3 5
Montreal, Lt., H. and Power ..	$100	8	9†	210 — 220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 — 107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½ xd	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	126 — 130	..	4 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ — 106½ xd	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 100	..	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½ — 92½ xd	..	5 8 1
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅜d.	1/16 — 1/8 xd	— 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	5	106 — 108	..	5 11

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½ xd	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 — 132 xd	..	6 1 3
Do. Collat. Trust	$1000	4	4	89 — 91 xd	..	4 8 0
Anglo-American Telegraph ..	Stock	8	8	61 — 64	..	4 13 9
Do. 6 % Pref.	Do.	6	6	108½ — 109½	..	5 9 10
Do. Def.	Do.	80/-	80/-	23¼ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 — 106	..	4 15 3
Chili Telephone	5	7	8	7 1/16 — 7 1/8	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83 — 85 xd	..	4 13 7
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	6 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8½ — 9¼	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	..	6 12 0
Direct United States Cable ..	10	5	4	6 — 6¼	..	6 3 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	123 — 131	..	5 6 10
Do. 8½ % Pref. Stock	Do.	8½	9⅛	74 — 76	..	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	90½ — 92½	..	4 8 5
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	91 — 93	—1	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ — 100⅓	..	3 11 7
Globe Telegraph and Trust ..	10	5	6†	10⅜ — 11½ xd	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅛ — 12⅜ xd	..	4 15 1
Great Northern Telegraph ..	10	18	20	30 — 32 xd	+ ¼	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3 1/16 — 3 1/8	+ 3/16	5 5 0
Do. 7 % Cum. Partic. Pref.	1	17	..	3 — 3¼	+ ⅛	5 4 7
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97 — 98	..	4 11 10
Oriental Telep. and Elec. ..	1	8	10	1 1/16 — 1 1/8	..	5 10 2
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89 xd	..	4 10 2
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97 xd	..	4 2 6
Reuter's	10	10	10	9½ — 10½	— ¼	9 15 2
Submarine Cables Trust ..	Cert.	6	8	124 — 127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94½ — 96½ xd	..	4 13 3
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅓ xd	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 1/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96 xd	—1	4 1 8
West India and Panama Teleg.	10	1½	1½	2¼ — 2⅜	..	4 10 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	— ⅛	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	99 — 101 xd	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12⅜ — 13½ xd	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	8½ — 8⅝ xd	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	9½ — 11½	..	..
Do. Do. Deferred	100	..	..	4½ — 6⅛ xd	— ½	..
Do. Do. 6 % Cum. Pr'f	100	6	6	79 — 82 xd	..	7 6 4
Do. 7 % Non-Cum. Pr'f.	100	..	3	39 — 42 xd	..	7 2 10
Do. 5 % Perp. Deb.	100	5	5	89 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	8	8	77 — 79	+2	‡5 1 8
Do. Pref.	100	4	4	80 — 82	..	‡4 17 7
Do. Def.	100	2	2	76 — 78	..	‡5 2 7
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1903	100	5	5	99 —102	+2	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7/32 — 9/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 8
Do. 4 % Deb.	100	4	4	73 — 78 xd	..	5 2 7
Lancashire United. 5 % Deb.	100	5	5	76 — 78 xd	..	6 8 2
London and Suburban, Ord.	1	..	..	9/32 — 13/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	3/32 — 5/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	75 — 78 xd	..	5 12 6
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93 xd	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64 xd	..	6 5 0
Metropolitan Railway Consol.	100	17/4	18/4	46¼ — 46¾	—1	3 9 6
Do. Surplus Lands	100	2⅞	2⅞	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 5
Metropolitan District Ord.	100	Nil	Nil	33/32 — 34/32	+1	Nil
Do. 6 % Deb.	100	6	6	136 —139 xd	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94 xd	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	85 — 89 xd	..	5 1 2
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	2/32 — 3/32	..	..
Do. 5 % Pref.	1	6	6	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68 xd	..	5 17 8
Underground Elec. Railways	10	..	..	8½ — 3¾	+ 3/8	Nil
Do. "A"	1/-	4½	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	108 —110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	96 — 98 xd	..	4 11 10
Do. 6 % Income	100	3	6 †	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	4½	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5		8†	8 5/16 — 8 13/32 xd	+ 3/8	3 18 8
Do. 4½ % Deb.	100		4½	80 — 84 xd	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅜ — 5 xd	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 7/16 — 4 11/16 xd	..	5 17 4
Do. 4 % Deb.	100	4	4	90¼ — 92½ xd	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Do. 5 % Deb.	100	5	5	95½ — 97½	..	5 2 6
Auckland Trams, 5 % Deb.	100	5	5	99 —101 xd	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	5	5	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	86½—88½	—2½	6 15 7
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	120 —125	+5	6 8 0
Do. Pref. Ord.	100	6	6	106 —111	+2	5 8 1
Do. 5 % Pref.	100	5	5	100½ —103½	+1½	4 16 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	94½ — 96½	+1½	4 8 1
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16 xd	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½ xd	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 3/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97 xd	+1	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	
Do. Pref.	1	6	..	25/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 11/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1¼ xd	..	4 16 0
Do. 5 % Deb.	100	5	5	89½ — 91½ xd	+1/32	5 5 10
Madras Elec. Tr. (1904), Deb.	100	5	5	101 —103 xd	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com.	$100	7	7†	94 — 97	—3	7 4 5
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 92	+1	5 8 8
Do. 6 % Bonds	100	6	6	92 — 95 xd	..	6 6 4
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅝ — 7⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ —105½ xd	..	4 14 9
Rangoon El. Tr. & Sup., Pref.	5	6	6	5¼ — 5 3/32 xd	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97 xd	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99 —101	+ ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	91 — 93	+1	5 7 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	96½ — 98½ xd	..	5 1 6
Singapore Trams, 5 % Deb.	100	5	5	88½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4 7/8 xd	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛ xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	+ ½	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	5	..	5/8 — 7/8	..	6 17 2
Do. 6 % Pref.	1	6	6	2/2 — 3/2	..	6 17 2
Babcock & Wilcox	1	28	16	2 15/16 — 8 1/16	+ 1/16	5 4 5
Do. Pref.	1	6	8	1½ — 1⅝	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	¾ — ⅞	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 8
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	99 —102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb.	100	4	4	65 — 69 xd	..	5 16 0
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½ xd	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	28 — 27 xd	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11½	..	6 10 5
Do. Pref.	5	5	5	4⅞ — 5⅛ xd	+ 1/8	4 17 7
Do. Deb.	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	38/8 — 38/4	..	5 6 8
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	8	Nil	..	0 — ½	..	Nil
Do. Deb.	100	5	5	57 — 62	..	8 1 4
Dick, Kerr	1	5	Nil	5/16 — 9/16	..	..
Do. Pref.	1	6	6	32/32 — 38/32	..	7 18 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1¼	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62 xd	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	2½	3¾	1⅛ — 1 5/16	..	5 14 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9¾ — 10½ xd	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12 xd	..	6 5 0
Do. Pref.	10	5	5	9 — 10 xd	..	5 0 0
Telegraph Construction	12	17½	20	85 — 87	..	6 9 10
Do. Deb.	100	4	4	95 — 97 xd	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1913.

THE returns of electrical exports and imports during May show an increase and decrease respectively in value, as compared with the April figures. The exports for the month amounted to £638,271, as compared with £592,621 in the previous month. The total, however, includes £218,809 worth of telegraphic material (a figure which includes a very large submarine telegraphic export to the Dutch Indies), and the balance of general business valued at £417,462, was considerably less than in April.

The imports for the month were valued at £224,681, which compares with the April total of £263,268, while the re-exports reached £34,569, or over £11,000 more than in the previous month.

Looking through the various items of the exports, the machinery, battery and telephonic sections compare badly with the previous month, while some improvement is shown in the cable, fittings and lamp sections.

The imports, however, show a considerable falling off in value, except as regards telegraphic and telephonic material and carbons, the values of which were slightly in excess of the April ones.

Argentina, India, Canada and Brazil were good customers during the month, although, of course, the exceptional telegraphic export to the Dutch Indies, dwarfs all the other entries in the export table.

As regards the importers into this country, Germany retained the controlling interest, with the U.S.A. far ahead of the remaining countries.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	735	1,535	77	20	1,574	127	18,547	482	609	98	604	1,046	25,454
Germany	2,844	521	...	914	...	...	3,351	27	48	450	43	479	8,677
Netherlands, Java and Dutch Indies ...	533	2,161	168	10	25	212	1,542	29	2	20	91	136,280	141,073
Belgium	403	249	108	48	261	31	1,398	442	...	106	855	463	4,364
France	497	...	3,657	...	14	65	4,390	322	...	...	139	334	9,418
Portugal	381	13	94	22	591	7	136	...	30	13	428	310	2,025
Spain, Canary Isles and Spanish N. Africa...	1,372	656	553	10	435	703	3,934	103	8	25	791	311	8,901
Switzerland, Italy and Austria-Hungary ...	2,187	320	1,023	31	119	...	4,886	198	50	593	...	957	10,364
Greece, Bulgaria, Roumania and Turkey ...	65	116	32	10	...	...	647	...	58	...	...	41	969
Channel Isles, Gibraltar, Malta and Cyprus...	102	84	7	82	...	181	155	...	12	...	20	316	959
U.S.A. and Cuba	342	105	107	41	...	30	1,090	...	...	10	...	1,276	3,001
Canada and Newfoundland	412	9,978	361	531	...	3,090	20,403	2,186	836	12	1,515	12,518	51,842
British West Indies and British Guiana ...	140	29	417	80	41	...	260	...	2	14	77	89	1,149
Mexico and Central America	98	714	47	40	...	...	566	...	22	57	304	1,466	3,314
Peru, Paraguay and Uruguay	302	749	337	79	...	15	417	241	146	...	31	962	3,279
Chile	740	160	458	563	17	92	6,641	634	57	...	116	959	10,437
Brazil	2,334	559	1,843	315	209	954	6,495	1,297	143	17	1,051	30,374	45,591
Argentina	3,350	12,953	1,104	2,380	443	1,006	15,687	4,315	388	63	9,338	5,410	56,437
Colombia, Venezuela, Ecuador and Bolivia...	118	199	...	...	...	13	...	...	305	...	143	1,417	2,195
Egypt, Persia and Morocco	458	1,368	756	24	...	4	1,405	39	8	...	27	344	4,433
British West Africa and St. Helena ...	100	71	46	192	...	186	261	...	235	...	128	11	1,230
Rhodesia, O.R.C. and Transvaal	1,981	7,161	514	907	...	172	3,945	...	208	...	71	1,223	16,182
Cape of Good Hope	1,530	3,202	341	880	42	668	3,514	429	1,325	...	2,593	1,597	16,121
Natal	1,087	6,630	485	255	193	220	2,570	44	1,504	133	201	246	13,568
Zanzibar, Brit. E. Africa, Mauritius & Aden	345	38	...	168	...	21	1,072	...	77	14	25	751	2,511
Azores, Madeira and Portuguese Africa ...	371	907	62	128	...	66	3,727	6	47	...	34	1,153	6,501
China and Siam	1,385	3,815	867	1,132	...	444	2,642	99	31	30	350	...	10,795
Japan and Korea	815	130	95	211	...	1,550	11,289	2,216	31	...	59	...	16,396
India	6,735	10,333	4,707	2,366	681	817	15,647	4,420	3,893	245	495	2,834	53,173
Ceylon	549	589	68	64	...	30	1,013	33	142	...	...	531	3,019
Straits Settlements, Fed. Malay States, Brit. N. Borneo and Sarawak	1,152	716	794	230	...	...	1,214	1,416	78	6	2,872	3,459	11,937
Hong Kong	323	212	82	133	...	387	597	...	...	...	38	37	1,809
West Australia	502	677	9	507	...	459	1,056	...	60	...	166	44	3,480
South Australia	504	275	466	74	90	533	521	3,586	2	...	154	5,361	11,566
Victoria	3,086	6,879	459	654	25	370	4,229	299	638	16	1,317	833	18,805
New South Wales	2,409	4,843	677	1,098	...	596	3,816	725	337	3	15,359	4,075	33,938
Queensland	178	1,431	710	89	...	...	231	795	53	...	243	318	4,048
Tasmania	...	...	...	...	...	...	19	...	...	...	121	...	140
New Zealand and Fiji Islands	1,198	3,730	485	232	176	542	2,865	431	779	...	7,748	984	19,170
Total, £	41,663	84,108	22,016	14,520	4,936	13,591	152,178	24,814	12,164	1,925	47,547	218,809	638,271

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	81	...	14	4,488	80	629	...	9,624	14,916
Germany	3,087	23,375	1,887	10,899	5,753	3,016	59,545	215	1,843	8,106	7,174	124,900
Holland	...	33	...	546	699	...	80	120	...	...	...	1,478
Belgium	1,040	4,060	346	44	30	28	4,653	...	378	165	4,762	15,506
France	1,025	270	1,206	1,144	116	735	926	755	396	5,198	226	11,997
Switzerland	177	120	20	8	...	488	1,839	...	...	181	22	2,855
Italy	20	4,987	...	...	...	...	166	...	...	96	60	5,329
Austria-Hungary	39	284	...	388	56	...	...	...	5	387	...	1,159
United States	4,478	105	2,022	18	115	...	7,593	22,238	299	29	2,239	39,136
Total, £	9,866	33,234	5,481	13,128	6,769	4,281	79,290	23,408	3,550	14,162	24,107	217,276

Additional imports: Spain, carbons, £211; Canada, fittings, £44, telegraph material, £7,150.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

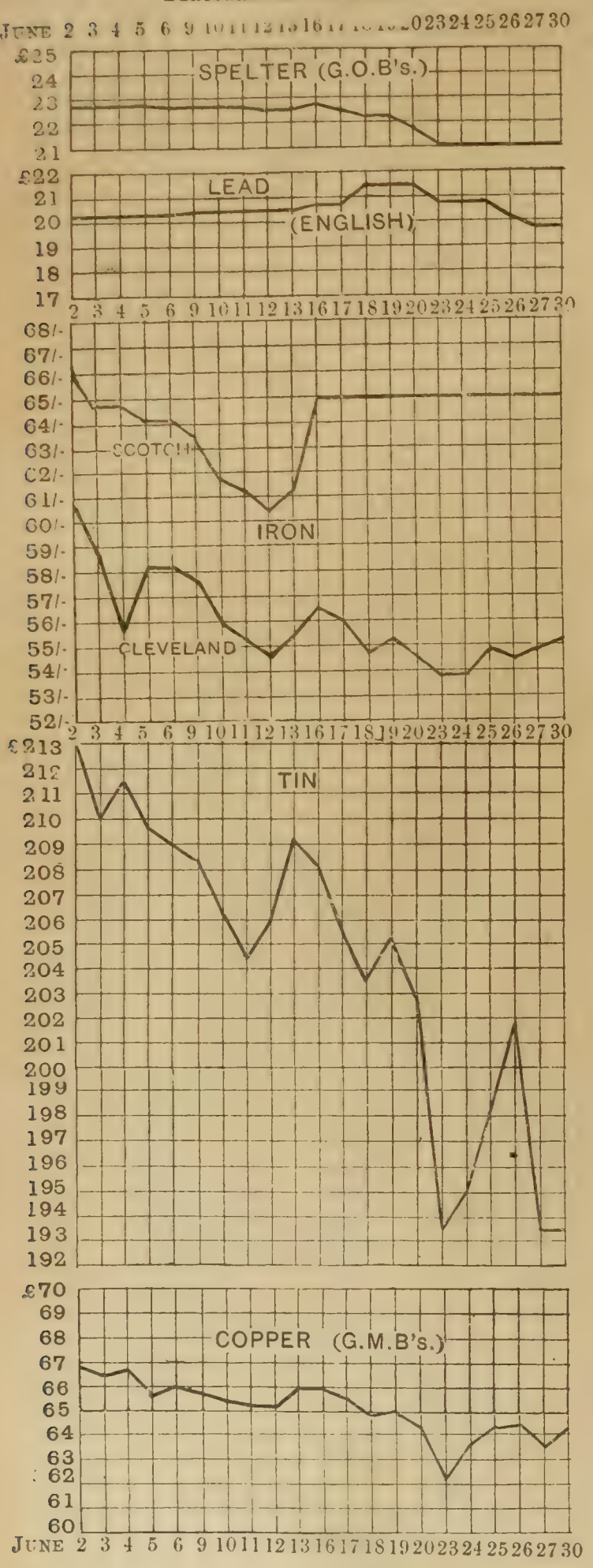
Various countries, mainly as above ...	18,661	1,642	...	1,955	775	...	10,605	...	308	420	203	34,569

TOTAL EXPORTS: £638,271. TOTAL RE-EXPORTS: £34,569. TOTAL IMPORTS: £224,681.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

METAL MARKET.

Fluctuations in June.



THE BEDFORD L.G.B. INQUIRY.

Some time ago the Bedford Corporation applied to the Local Government Board for permission to borrow the sum of £11,590 for new generating plant for the electricity undertaking. Inquiries were held by the L.G.B. in connection with this application on March 25th and April 10th last, but in consequence of a reference made during the proceedings it was decided to hold a further meeting, and Mr. T. C. Ekin, M.Inst.C.E., attended at the Town Hall, Bedford, for that purpose on the 18th ult.

Mr. Stimson, the town clerk, represented the Corporation, and Mr. E. Pollock, K.C., and Mr. Mears appeared for Messrs. W. H. Allen, Son and Co., Ltd., the British Westinghouse Co., Messrs. Willans and Robinson, Ltd., and Messrs. Mirrlees, Bickerton & Day, Ltd. Several representatives of each of these firms were also present. The inquiry was held for the purpose of investigating certain statements made in reference to Messrs. Allen's tender for a Diesel engine set, and the evidence given was taken on oath.

It appeared that in August last Messrs. Allen tendered for the required generating plant at £7,950, whereas, when in November they were asked to revise their figures, their offer was £8,980, an increase of £1,030.

Mr. Richard Allen was first called. He stated that he dealt with the technical side of the tender, his brother, Mr. Harold Allen, being responsible for the commercial side. Between August and November there was a considerable rise in the cost of materials, and it was also necessary to reconsider the sum allowed for contingencies. The revised tender was sent in on Saturday, November 9th. He discussed the matter with his brother on Monday, November 4th, and the following day they fixed the new contract price of £8,980. The amount allowed for increase in cost of materials was 12 per cent., representing about £800 of the extra £1,030. Tenders were being invited from five selected firms, but they did not know who they were. They, however, anticipated that Messrs. Mirrlees, Bickerton & Day, Ltd., would be amongst them, and on November 4th they wrote to them pointing out their desire to secure this order, and suggesting a discussion of the subject the following day. They also approached during the week Messrs. Willans & Robinson and the British Westinghouse Co. As a final result of the negotiations between the three firms, Willans and Robinson agreed to accept £100 towards the expenses of tendering, the British Westinghouse Co. £200, and Mirrlees, Bickerton and Day the sum of £250, the last-named firm declining to quote. Mr. R. Allen pointed out that their tendered price was settled on Tuesday, the 5th inst., before any of these arrangements were made, and that, therefore, the Corporation were unaffected by them. His firm had not built any Diesel engines, but were very anxious to do so, and for this reason they desired to get this order, as they could watch its performance and gain experience of its working. They had built the whole of the engines in use in the generating station, and naturally did not want any other maker to come in.

Questioned by the Inspector, Mr. R. Allen admitted that they paid this total sum of £550 in order to get the other contractors to raise their prices to protect the offer made by his firm. When they approached them they did not know that there would be anything to pay.

The Inspector said that the serious part of the matter was that the arrangement between four of the five firms who were asked to tender prevented the competition which was so necessary to protect the Bedford Corporation.

Mr. Pollock said that there was no necessity for the Corporation to select the lowest tender, and the sum of £8,980 was a fair price for the work to be done.

Mr. Harold Allen explained the difference in the August and November tenders. £800 out of the £1,030 was due to rise in cost of materials, and of the remaining £230, two-thirds was absorbed by alterations caused by the alternator. Mr. H. Allen stated that this was the first transaction of the kind they had entered into, and repeated that the price of £8,980 was in no way affected by the promise of payments to possible competitors.

Mr. W. M. Mordey, M.I.E.E., stated that, in his opinion, the tendered price of £8,980 was a reasonable one.

Mr. F. R. Davenport, of Messrs. Willans & Robinson, said that he thought the plan followed was a reasonable one. The fact that the parties were members of the British Electrical and Allied Manufacturers' Association had no connection with these transactions.

Mr. H. S. Russell, sales manager for Messrs. Mirrlees, Bickerton and Day, confirmed Mr. Allen's account of the negotiations, and stated that he considered he was entitled to be reimbursed for the expenses his firm had been put to in this matter. If they had tendered for the work in November their August price of £7,208 would have needed increasing by at least £1,000. He did not know of any previous case when exactly this arrangement had been made, but he had known manufacturers to put their heads together in connection with contracts, and make a pooling arrangement, by which the successful competitor paid the expenses of the rest.

Mr. Baldwin, of the British Westinghouse Co., in his evidence said that, assuming that their engine would not require alterations to the buildings, their figure in November would have been £9,157, as against Messrs. Allen's £8,980.

Mr. Pollock then reviewed the case, pointing out that by their action Messrs. Allen, Son & Co. did not eliminate competition, and that the tendered price was fixed before the arrangements were made.

The town clerk said it would give great satisfaction to the Corporation to know that no part of the sum they were asked to find for the tender had reference to any money to be paid to the other competitors. He thought, however, that the Corporation had a grievance, in that some of the other competitors might have been willing to forgo some of the extra cost of materials in order to get the contract. They knew that Messrs. Allen, Son & Co. had not built an engine of this type, but they had asked them to quote, and they regretted that these negotiations had taken place.

The inquiry then closed.

Patent Applications. — Application for restoration of patent No. 14,345, of 1908 ("Improved grate arrangement for refuse-consuming furnaces") has been made by Aloys Fried and Maschinenbau-Anstalt Humboldt Akt.-Ges.

Orders have been made restoring the following patents:—

No. 8,328, of 1907, "Improvements in and relating to conveyors"; E. M. Bassler.

No. 2,292, of 1909, "Improvements relating to the liquefaction of illuminating gas by pressure"; Hermann Blau.

OUTSIDE SHOP LIGHTING ON THE HIRE SYSTEM.

By "INTERESTED."

We all know that outside shop lighting is no longer a monopoly controlled by gas companies, and electricity has obtained a sure footing. Will she keep that advantage? Success is assured if customers are satisfied, and it is up to the electricity works people to retain their customers by "making good," or making certain they are satisfied. Satisfaction was, and is now, one of the strong points with our rivals. No end of trouble is taken to attend to the wants of their customers. The result is they are satisfied, and are not left grumbling, or in a state of discontent, ready to grasp at any new form of illuminant brought to their notice. And it must not be forgotten that outside shop lighting, whether it be done by electricity or gas, is an advertisement for whichever illuminant is used.

Electricity works have lately followed the example of others in the way of hire-maintenance agreements, and it is in this particular direction that the works staff have a certain amount of direct control, *i.e.*, where a hire-maintenance agreement is in force. The work of trimming, cleaning, or repairing may be carried out by contractors' men or the works staff. In either case nothing is lost and much may be gained by ensuring the satisfaction of consumers by careful attention to lamps, lanterns, &c., and a ready explanation for any apparent discrepancy in the accounts.

I have an instance in mind where men called weekly at a certain shop to attend to some lanterns. The consumer himself seldom saw the actual work done, for the simple reason that he was usually out at the time of the workmen's visit. One week of very bad weather with business slack in consequence; one of his lamps broken; the lanterns semi-obscured with mud and rain—he commenced blessing electricity in no small degree. A chance visit by a "high-pressure" man, and behold a change-over from electricity to high-pressure gas under a three years' agreement. This serves to illustrate the importance of keeping consumers satisfied, more especially those with whom business is transacted on hire or hire-purchase.

A rather good idea for keeping in touch with consumers such as these has been brought to my notice, and I give below copies of the cards in use. The printed matter thereon explains their purpose.

The great point is that upon every occasion when lamps or lanterns are attended to or cleaned by the electricity works men, the attention of the consumer is directed thereto by

ELECTRICITY DEPARTMENT.

HIRED FITTINGS MAINTENANCE.

Consumer .....

Address .....

.....

Workmen to obtain consumer's signature on completion of work.

Date.	Time finished.	Consumer's signature.

Fig. 1.

the fact of his signing the card after the work is done. Also, in the event of his shop being closed when the lamp attendant has finished cleaning, or trimming, as the case may be, a card (fig. 2) is dropped in the letter box, which reminds the consumer that his lamps or lanterns have again received attention. Of course, should the lighting be anything but satisfactory, the periodical visits of the attendants asking for signatures remind him to take the question up with the responsible officials forthwith. This signing a card each time the lamps are attended to is a small matter in itself, but it is certainly a good way of keeping in touch with consumers and is of assistance in retaining satisfied consumers. When a client feels that value is being obtained for money paid he is satisfied, and that forms a very strong weapon to be turned at the proper moment upon a rival.

Now that hire or hire-purchase is on the increase with regard to electricity, no time should be lost in securing to every customer satisfaction with his goods. Municipalities

ELECTRICITY DEPARTMENT.

HIRED FITTINGS MAINTENANCE.

Date.....

Dear Sir,

Please note that your outside fittings were cleaned, and left in working order at.....to-day, but as the premises were closed your signature on maintenance card could not be obtained. All complaints should be addressed at once to the Engineer.

To .....

.....

Fig. 2.

are by far the chief offenders in this respect, for they look aghast at the expenditure of a few pounds for show purposes, or for a convincing trial on behalf of a disappointed client. They do not seem capable of looking far ahead in order to see what may be lost or gained without or with the show or trial.

Oh! for a business Council!

NOTES FOR INSTALLATION INSPECTORS.

By "ELEMENT."

The duties of an inspector of installations for a supply authority cannot by any means be considered as purely of a routine nature. Every month we hear of improvements in the design and construction of wiring accessories, and as the new fittings find their way, through the wiring contractor, to the electricity consumer's premises, the inspector must keep himself in touch with all the latest installation devices with a view to finding whether or not they conform to the rules and regulations under which the supply is given. The man entrusted with this important work should, therefore, possess an unbiased judgment and an up-to-date knowledge of electric installation practice. He should also have a strong individuality, and be capable of carrying in his memory the substance of every clause in the supply authority's regulations.

In many towns the number of new consumers being added to the supply does not warrant the appointment of a special inspector of wiring, and the duty of testing installations is allotted to the meter inspector, who, probably, has never had any previous experience of wiring work beyond a superficial knowledge, obtained from a text-book, of how good wiring *should* be executed. The inspection then becomes a mere measurement of insulation resistance to "earth," and a cursory glance round the premises in search of examples of bad workmanship or defective materials. Where this method of examination is in vogue, the "unscrupulous contractor," or his underpaid wireman, can easily cover up the defects of an installation, and have the satisfaction of informing his customer that the job has been passed as electrically and mechanically perfect. The consumer having full confidence in the contractor's work, and knowing that it is in the supply authority's interests also that the job should be satisfactory, accepts the inspector's report, and takes over the installation.

No trouble may be experienced during the first few months, but afterwards, when faults begin to develop, and fuses to melt frequently, the consumer becomes doubtful as to whether or not he has after all obtained full value for the money he has expended on the installation. The contractor, when called upon to make good the defects, can, of course, advance many contingencies which *might* have been responsible for the trouble, but in very few instances will he

allow it to be suggested that bad workmanship or material is at the root of the matter. Yet such is often the case. Inferior cable may have been used; joints may not have been properly made and efficiently insulated; and loops may have been carelessly bound in terminals at switches and ceiling roses.

A common trick of some wiring contractors is to run old cable, or smaller gauge cable, in portions of an installation where its detection will be almost an impossibility. Short pieces of good class heavy cable can be jointed to the old cable at each end, and so drawn into tubing, or laid in wood casing, that only the good quality cable can be examined without withdrawing the wire from its encasement. The writer remembers one lighting installation, which, having been fitted up with low-grade cable, was condemned, and tenders were asked for its removal and replacement by an entirely new installation. When the new work was completed by the successful contractor, it was discovered that almost all the old wiring had been utilised in places where it was considered least likely to be minutely inspected.

Another dodge of the reckless wireman is to place a piece of tubing at each end of a concealed "run," the intervening wires being loosely laid without mechanical protection of any kind. Shirking of this kind very often takes place where difficulty is met with in placing tubes in a wall behind the lath and plaster. If it is impossible to get a rigid steel tube into such a position, a piece of composition tubing should be insisted on. A great many faults are brought about by the abrasion of cables where these enter tubes, and too great attention cannot be paid to the bushing of all tube-ends, especially behind distribution fuseboards, branch switches, and wall sockets.

When an installation is ready for testing, the inspector, after receiving written notice from the contractor, should spend some considerable time on the consumer's premises examining the materials and accessories forming part of the installation, with the object of ascertaining whether they conform to the regulations or not. The "break" and capacity of fuses and switches, the method of grouping lamps, &c., in circuits, and the size and quality of conductors should be carefully noted. The lids of one or two inspection boxes, or a piece of wood cover, should be removed in various sections of the installation, and the earth wire on a tubing job should be traced from the conduit to the water pipe.

A strict earthing regulation is a sore point with the jerry contractor, and many are the artifices adopted to cheat the wiring inspector. Cases have been known in which the earth wire was shown connected to the tubing and to the water pipe, but investigation led to the discovery that the earth wire was not continuous, the ends terminating at points between which the wire was supposed to be hidden from view.

In another instance, a small switch had been placed in an inconspicuous position and connected to the earth wire, so that when the earth test was taken, the switch was "off," but when the inspector connected his test lamp between the live supply terminal and the conduit system, the lamp indicated that the earth wire was continuous, the contractor's youngest apprentice, by this time, having slipped away unobserved and put on the earth-wire switch.

Each fuse in the distribution board should be looked to by the inspector. In some types of cut-outs, fuse wire can be inserted in the cut-out but not connected to the terminals, so that if an insulation test is being conducted from the main cables, the circuit which this fuse controls will not be included. A defective circuit may thus be overlooked at the test, and it is a simple matter for the wireman to make good the fuse connection before the installation is connected to the supply mains. It is recalled that in one job coming under the writer's notice, the fuse wires in a pair of cut-outs connected to a circuit of very low insulation resistance were cut through by a knife, and only a very cute inspector could have detected the break in the fuse wires. The intention of the contractor was to bring the broken wires together after the test, by removing and re-inserting the fuse bridge while the inspector's attention was attracted to another part of the installation.

In another lighting installation of about 60 lights an eight-way distribution fuseboard was fitted up to control the whole of the lights. To outward appearances the grouping of the various lamps from the boards seemed to have been systematically arranged and carried out. On further inspection being resorted to, by the temporary removal of the distribution box, the inspector was surprised to find that the whole installation was fed from three circuits only, and small pieces of cable had been clamped in the remaining five pairs of terminals to complete the deception.

The writer is of opinion that the test applied by the average installation inspector is not of very material value as an indication of the present condition of an installation. The insulation test certainly serves to show whether an "earth" exists on the premises, but it cannot reasonably be held as the basis for passing or condemning the installation. The only satisfactory examination of a job must be made by a competent inspector periodically, while the installation is being fitted up, and a reputable contractor would welcome, rather than discourage, an innovation such as this in towns where at present the inspection is left to a meter repairer.

Nowadays, ironmongers and gas fitters have inaugurated electric wiring branches, and the tendency has been to lower the general standard of wiring considerably, by the use of cheap cable and accessories, and by engaging improvers and apprentices to do the work. There are, however, many reliable contracting firms who will not condescend to employ anything but the best workmanship and materials. It is with a view to encouraging these firms that a qualified inspector, or inspectors, should be appointed by every supply undertaking in the country, as the mere issue of rules and regulations will never ensure a high standard of wiring work being maintained by electrical contractors and their workmen.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"R. D. G." writes:—"A power company proposes giving a low-tension supply from lines erected on steel poles, below the E.H.T. lines, a light guard wire construction protecting the L.T. lines. In the event of contact between the E.H.T. and the L.T. lines, and consequent damage to the consumer's apparatus, what would be the position of the consumer? Would he have a claim against the power company?"

*** There is little doubt, having regard to the case of Midwood *v.* Manchester Corporation (1905) 2 K.B., 597, that in the circumstances above described the undertakers would be liable as for nuisance and negligence. It may be remembered that liability for nuisance is reserved by Sec. 81 of Schedule to the Electric Lighting (Clauses) Act, 1899, and a similar clause is generally to be found in each Power Act.

"Thrust" writes:—"I should be much obliged if you would inform me as to whether an electrical department controlled by an Urban District Council can legally carry out the work of free wiring of private property, *i.e.*, houses, hotels, chapels, &c., the cost of such work to be defrayed from the revenue or net profits of the electrical undertaking?"

*** Without access to a copy of the provisional order under which the Urban District Council in question has power to supply electricity, it is difficult to provide an answer to this query. One thing is plain: that unless the Council has express power to expend the ratepayers' money on free wiring, it cannot indulge in this form of municipal trading. It is mentioned, however, in Mr. Shiress Will's book, entitled "The Law of Electric Lighting," 2nd edition, page 29, that "since 1899 free wiring (in which phrase are included arrangements for payment by way of rent, or by instalments spread over a number of years' purchase on the hire system, &c.), has become very common, and is to be met with where electric energy for lighting purposes is afforded by local authorities as well as by companies."

"Thrust" had better apply at the offices of the Urban District Council and obtain inspection of the provisional order.

Oulton Broad.—The Mutford and Lothingland R.D.C. on June 26th, received from the Oulton Broad Electricity Co. an intimation of its intention to apply for a prov. order for electric lighting at Oulton and Carlton Colville. The question of opposing the application has been referred to a committee.

RECENT DEVELOPMENTS AT STUART STREET STATION, MANCHESTER.

(*Concluded from Vol. 72, page 1073.*)

The general arrangement of the Kinetic air ejector is shown in the accompanying drawing. The air and water leave the condenser through a receiver from which the air is withdrawn by the steam jet and forced into the Kinetic ejector, and the water is withdrawn by a rotary pump and discharged into the Kinetic tank.

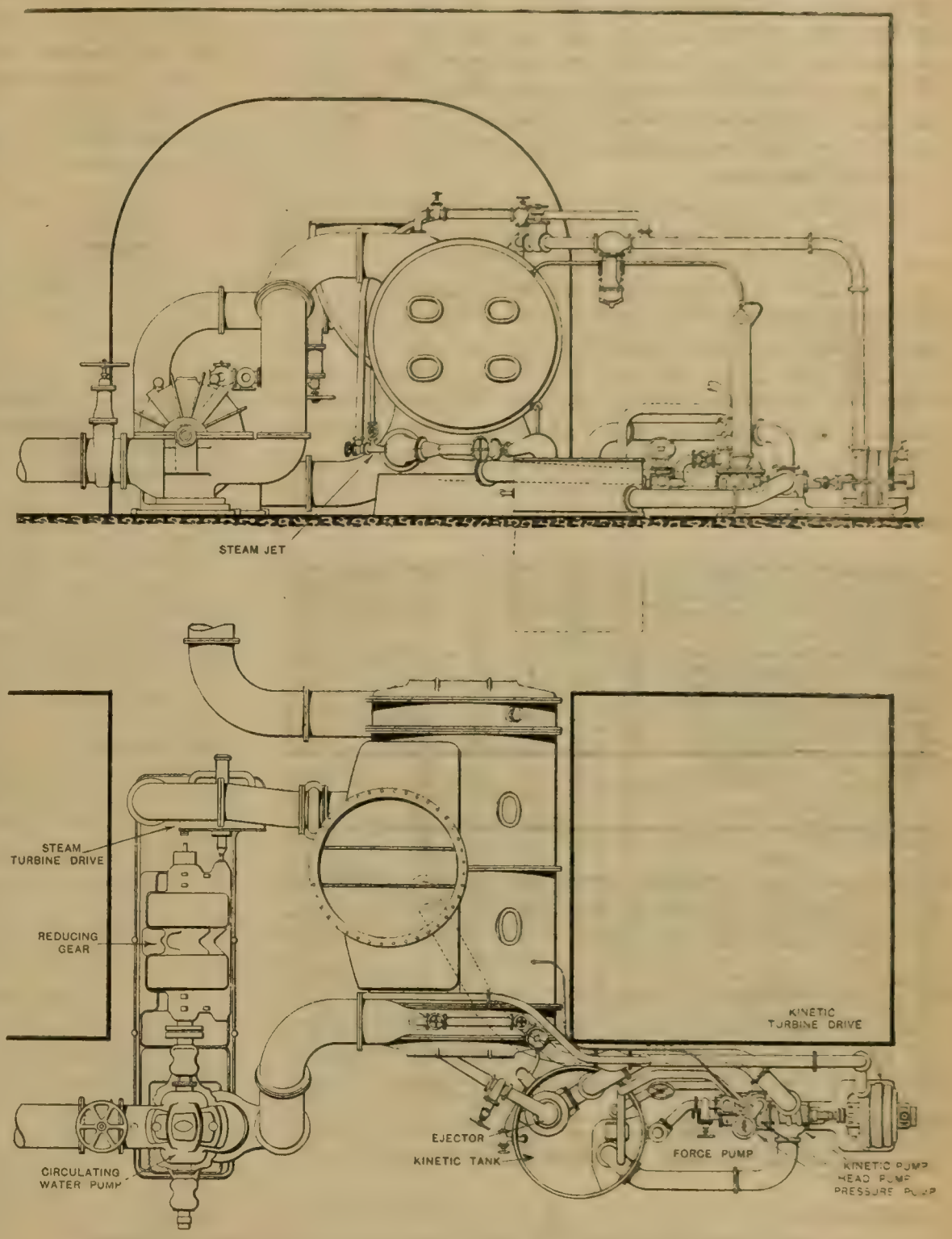
An ordinary centrifugal pump draws this water from the tank and delivers it under pressure to the water jets.

The condensate pump is of the two-stage type. The function of the first stage is to discharge into a receiver pipe in communication with the condenser. A suction head for the second stage pump is thereby established in the receiver pipe which admits of considerable variations without in any way affecting the suction head on the first stage pump, or, in other words, the system prevents the flooding of the condenser by giving greater stability to the pump that discharges the condensate to the feed tank.

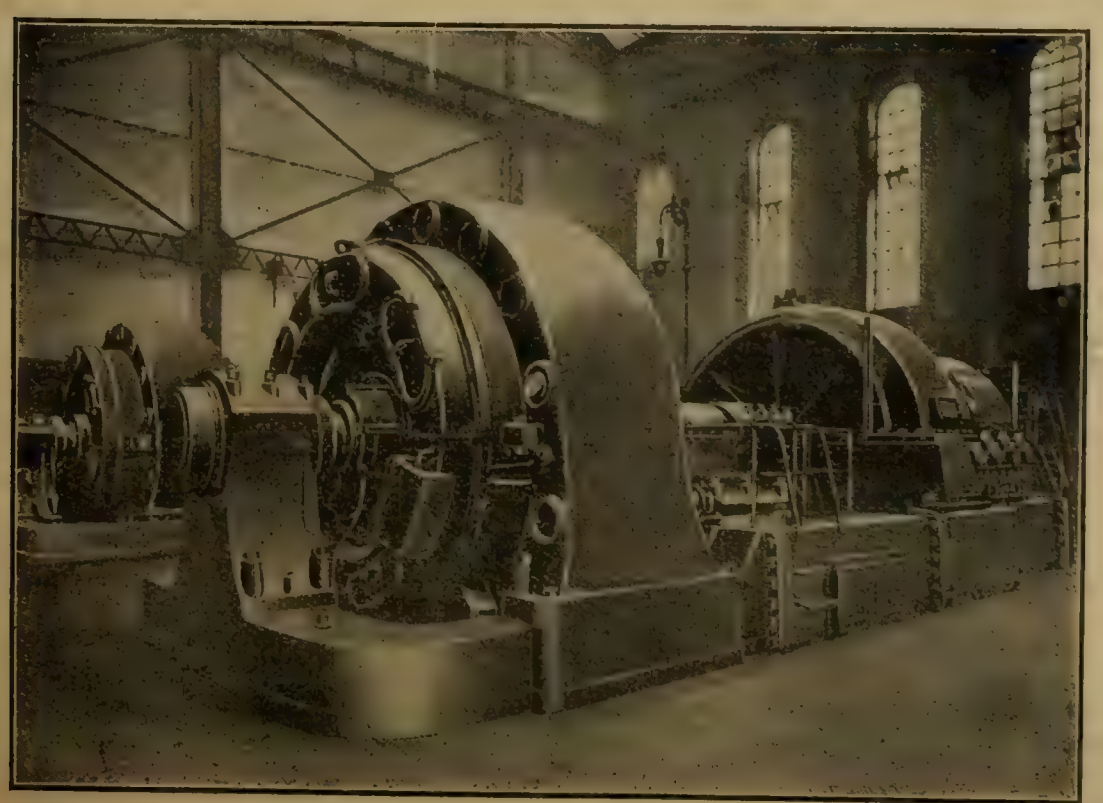
It is obviously advantageous to drive these pumps by a steam turbine, as is done at Stuart Street, and to use the exhaust in the steam jet. Of the total heat in the steam which enters the turbine, about 83 per cent. still remains in the exhaust, and if this exhaust steam is led to the jet, it not only withdraws the air from the condenser, but also gives up all its heat to the feed water, a combined effect which is unequalled in thermal efficiency by any other known apparatus.

This condensing plant was guaranteed to give a vacuum of 27 in. when supplied with circulating water at any temperature between 75° and 80° F., and dealing with 110,000 lb. of steam per hour. When recently tested, it was found to be capable of maintaining a vacuum of 27·5 in. when supplied with water, about 48 times the feed, at 80° F., and dealing with 117,000 lb. of steam per hour. The plant had such a large margin beyond the normal leakage that air could be admitted to the condenser through a hole ¼ in. in diameter on full load without affecting the vacuum in the least.

In place of the usual large valve provided to isolate the condenser from the turbine in emergencies, a less costly arrangement is adopted, a water connection being fitted by means of which the condenser can be flooded in about a minute, as compared with three or four minutes required to shut the ordinary type of valve.



Contraflo Kinetic Condensing Plant with Turbine-driven Pumps, Stuart Street Station, Manchester.



Howden-Siemens 8,000-kw. Turbo-Alternator, Stuart Street Station, Manchester.

The rotary air-pump is direct driven by a 72-H.P. Curtis turbine at a speed of 3,000 R.P.M., while the centrifugal circulating pump is driven from a 450-H.P. Laval turbine running at 7,500 R.P.M. through 10 to 1 reduction gearing. The latter pump delivers 750,000 gallons of circulating water per hour to the condenser.

The plant as a whole is an exceedingly interesing departure from the usual practice, the small size of the turbine-driven plant being in strong contrast to the adjoining electrically driven condensing plants with Edwards air-pumps.

The department has recently converted several of its natural draught cooling towers to forced draught, in order to get rid of the nuisance created locally by the discharged vapour under certain atmospheric conditions.

The *modus operandi* has been to fit

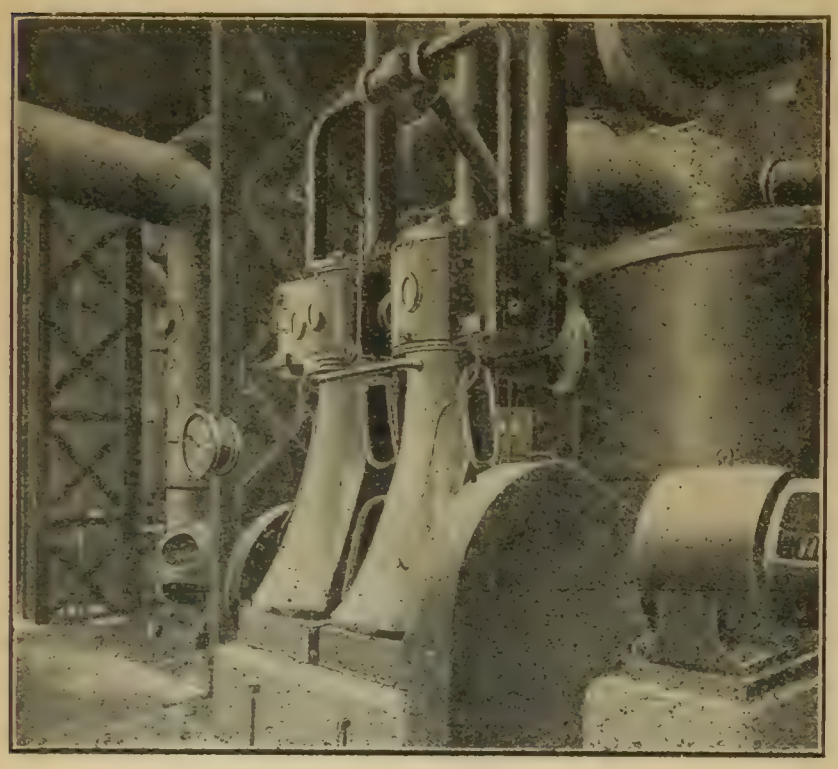
chain-driven fans to each tower, one motor being installed midway between each two fans.

Hydraulic tipping plant has also been installed to facilitate coaling operations, and two motor-driven turbine boiler feed pumps are being added to the existing plant.

In connection with the 15,000-KW. turbine unit on order, two additional marine type Babcock boilers, each of 40,000 lb. evaporative capacity, and two land type boilers by the same makers, each of 25,000 lb. evaporative capacity, are to be installed, bringing the total of boilers installed up to 46, or only two less than the ultimate capacity of the existing buildings—from which it may be gathered that the existing buildings at Stuart Street will in the near future be practically fully occupied, some 57,000 KW. of H.T. plant being installed and on order.

The above plant supplies the whole of the Manchester H.T. network through 22 Corporation sub-stations, two of which are installed in Stuart Street and Dickinson Street generating stations, there are also 59 consumers' sub-stations, the minimum capacity installed in the latter case being 100 KW. Some of the principal consumers' sub-stations have been described by us from time to time, but as this system of supply has greatly extended, it may be of interest to mention some of the recent developments in this direction.

The largest sub-station of this type is installed at London Road railway terminus, and contains two 800-KW. rotaries, together with two 900-K.V.A. three-phase transformers; this



Electrically Driven Dry-Air Pumps for Barometric Condensing Plant, Manchester.

plant operates the hydraulic cranes, capstans, &c., and the electric signalling installation, and an additional 125-KW. transformer is provided for the lighting service. Messrs. Armstrong, Whitworth & Co.'s works have two sub-stations, the first containing a 750-KW. and three 400-KW. motor converters and the second two 250-KW. motor converters, while a 500-KW. machine of the same type is being added. For the first sub-station there is an additional 1,500 KW. of converting plant on order.

In addition, Messrs. Armstrong, Whitworth have recently put down a 1,200-H.P. rolling-mill plant, which is also run off the Corporation's H.T. mains.

At Messrs. McConnell's mill, which is electrically driven, the various motors are supplied through five 500-KW. three-phase transformers (one spare); this mill is a branch of the Fine Cotton Spinners' Association and the Bengal Mill, another branch establishment, electrically driven from the Corporation supply, has three 500-KW. transformers installed in its own sub-station. Amongst others of the same class may be mentioned:—

Calico Printers' Association Works, Levenshulme.—Two 300-KW. rotaries and 350-K.V.A. transformers.

Mather & Platt, engineers.—Have added two 600-KW. motor-converters, also have two 200-KW. motor-converters.

Ashbury Railway Carriage Co.—One 700-KW. rotary and 800-K.V.A. transformer.

Great Central Railway, Gorton Works.—Three 300-KW. rotaries and 350-K.V.A. transformers.

Elm Street Corporation Cold Stores.—Changed from steam to electric drive; 250-KW. and 25-KW. transformers for power and lighting respectively.

Manchester Ice Co.—Changed from steam to electric drive; one 250-KW. transformer.

Marsland & Co.'s Cotton Mill.—One 500-KW. transformer for power and two 35-KW. lighting transformers.

Bazley Bros.' Cotton Mill.—Two 500-K.V.A. transformers (one spare).

Chas. McIntosh & Co., india-rubber manufacturers.—Recently introduced electric drive and installed one 500-KW. transformer.

These include a few of the more recent and larger power consumers; as there are 53 consumers with sub-stations, the list could obviously be much extended.

In conclusion, we are indebted to Mr. S. L. Pearce, chief engineer and manager to the Electricity Department, for the facilities he kindly placed at our disposal for the preparation of this article.

THE I.M.E.A. CONVENTION, 1913.

(*Continued from Vol. 72, page 1089.*)

Electric Automobiles.

By W. H. L. Watson and R. J. Mitchell.

The paper presented by these authors contains rather over 100 pages of reading matter, illustrations, &c., and as lack of space does not allow of extensive reprinting, we propose to give a brief outline of the contents.

The paper states the case of the electric automobile at the present time, and necessarily contains a good deal of information which has already been published in our own columns and those of our American and English contemporaries.

The American industry in the building of electrics has already attained great importance, some 40 companies being engaged in the actual manufacture of complete cars. Of these seven make both industrial and pleasure vehicles, while about a dozen plants confine their energies exclusively to the commercial type. Some £12,000,000 worth of vehicles are in use, representing 20,000 cars, and the authors estimate a yearly demand of 65 million KW.-hours for these cars.

A striking feature of the American industry in commercial electrics is that 70 per cent. of the sales of vehicles during the past two years were repeat orders from firms who, having started experimentally, had gained enough confidence to change over completely to electrics for their city transport. Reference is made to the energetic campaigns of the various branches of the Electric Vehicle Association of America, and to the favourable conditions in this country as compared with America.

There appear to be over 130 separate models of electric vehicles on the American markets, about half being pleasure vehicles.

Industrial cars range from a 500-lb. parcel van to a 10,000-lb. coal truck.

Table I, at top of p. 37, gives the average figures relating to the principal features of about 60 models of American electrics.

Very lengthy statistics relating to the principal features of American car practice are given; it is pointed out that cheap ton mileage depends on employing fairly heavy trucks— a 10,000-pounder weighing four times as much as a 300-pounder truck, but carrying 33 times the load. Experience shows that it is most economical to make the commercial electric vehicle of moderate speed, able to maintain a uniform speed over distances of from 35 to 75 miles on a single charge. This leads to saving in wear and tear. There are even now well-authenticated cases of electrics having been in active commission for 12 years, and still going well for all their service. Although it is usual to assess the life of these machines at 10 years for depreciation purposes, there is little doubt but that their life will be much longer.

The authors have made many tests of the hill-climbing abilities of a ½-ton van of Anderson manufacture—including the carrying of a load of 1½ tons weight from London to Portsmouth, and much heavy work around Hampstead. Similar tests were made in the Newcastle district with complete success—many of the hills there have tested petrol-engined vans to their uttermost. The electric scores as a sure hill climber largely because of the valuable property of the series motor in that armature torque increases almost proportionately to the fall in speed, thus giving the necessary "draw-bar pull" when it is most wanted. As a pure speed machine the electric is admittedly quite unlikely to compete successfully with present-day petrol automobiles. It is, however, interesting to note that a specially-designed "Baker" electric has achieved the distance of 1 mile in a second less than a minute, its equipment including a 12-cell battery weighing 300 lb. and a motor scaling only a 100 lb.

The electric can accelerate more quickly than the majority of road vehicles. On a test made quite recently in the London streets, a 6-ton battery 'bus showed an acceleration of 4·5 ft. per second per second on the level—a figure 40 per cent. in excess of the average value of this factor applying to London omnibuses. Speed is of importance only to the extent of its effect in reducing total cost per ton-mile. The electric has shown itself to be the cheapest lands goods carrier extant, an indirect indication that moderate speed is most economical in the end.

The authors naturally devote considerable space to the question of accumulators, and describe in some detail the Edison cell, giving tabular data and curves showing the characteristics of the latter.

The Edison battery has been fully described in our pages on several occasions.

TABLE I.—AVERAGE CHARACTERISTICS OF AMERICAN COMMERCIAL ELECTRICS IN 1913.

Loading capacity in lb.	300	500	750	1,000	1,500	2,000	3,000	4,000	7,000	10,000
Vehicle weight in lb.	2,200	2,650	3,000	3,450	3,500	4,300	4,700	6,000	8,500	10,850
Battery capacity in A.H.	150	150	150	150	150	225	225	300	375	450
Battery weight (lead) in lb.	1,260	1,260	1,260	1,260	1,260	1,800	1,800	2,500	3,150	3,800
Battery weight (Edison) in lb....	840	840	840	840	840	1,260	1,260	1,800	2,250	2,700
Average miles per charge	70—80	75	65	55	50	50	45	40	35	35
Maximum speeds on hard level asphalt in M.P.H.	20	17·5	16	15	14	11	10·5	10	8	6·5
Speeds recommended by Electric Vehicle Assoc. in M.P.H. ...	20	20	16	13	11	10	9	8	7	6

NOTE.—Battery equipments are quoted *pro rata* of their average weight and capacity.

Controller systems and transmissions are described and illustrated in detail; the effect of different tires on the power taken, and the essential features of vehicle motors are discussed at some length. The authors state that there is not much to be said in favour of extra-high-speed motors, nor for motors running at very low speeds—for the motor weight saved by high speed entails more weight in transmission gear and two reductions therein—whilst the very slow speed motor costs more initially and weighs too much. On an average the best practice inclines to motor speeds of 800 to 1,000 R.P.M. or thereabouts. The usual construction of these machines favours a carcase of cast steel, generally of the four-pole type. Considering the extra cost of making the field carcase from laminations would be hardly more than 15 per cent., and that a reduction in weight of 25 per cent. is claimed for this method of construction, there appears to be an opening for improvement in such a direction. Whilst the weight question takes a relatively minor place in the design of heavy machines, it is by no means to be ignored. For pleasure cars and all higher speed work it is manifestly necessary to cut weight down as much as is consistent with reasonable overload capacity and mechanical stability. American vehicle motors appear to weigh from 80 to 180 per B.H.P.—the overload capacity being usually very high. Table II shows the normal output and weight of a series of American vehicle motors.

TABLE II.—IMPORTANT CHARACTERISTICS OF ELECTRIC VEHICLE MOTORS.

Speed. R.P.M.	Volts.	Amps.	B.H.P at 80 % effective.	Weight per B.H.P.
1,700	20	27	0·57	156
2,250	28	33	0·93	98
740	40	28	1·20	171
1,600	40	28	1·20	129
1,000	36	35	1·34	116
740	80	16	1·36	140
1,600	80	16	1·36	118
1,500	60	23	1·47	105
950	60	30	1·92	130
800	110	16·5	1·94	80
1,200	60	31	1·98	136
1,200	85	22	2·00	125
900	80	24	2·03	115
1,200	80	25	2·13	117
1,800	72	28	2·15	92
850	80	27	2·31	110
900	80	28	2·38	113
1,400	60	40	2·56	105
850	80	31	2·64	106
700	56	45	2·69	193
1,100	60	45	2·88	121
900	60	85	5·44	101

The authors describe in detail the Crompton (C.M.B.) and Thomas transmission systems, both of which have been very fully dealt with in our pages; particulars are also given of the F.R.A.M. front driven electric tractor, in which the driving mechanism is mounted on a front truck, which is pivoted vertically, and steering is effected electrically, viz., by accelerating one motor above the speed of the other, each of the front wheels being geared to a motor. A 40-cell accumulator, weighing 18 cwt., and giving 240 A.H. output, is usually fitted; the important feature of the arrangement appears to lie in its convertability, as the front truck can be readily attached to any type of vehicle, so that it may operate in turn, say, a dust cart, water cart, road sweeper, or ordinary wagon. On a later page we note that arrangements have been made for the manufacture of 1,200 pleasure cars, all fitted with the Edison battery by the Arrol Johnson Co., at Paisley.

Turning to running costs, the authors give the following table, taken from American sources:—

Load rating,	Delivery service.	Miles per day.			Comp. expenses per del. as compared with horse.		
		El.	Petrol.	Horse.*	El.	Petrol.	Horse.
Lb.					%	%	%
1,000	Suburban parcel	37	39	29	79	88	100
1,000	City delivery ...	33	34	24	93	111	100
4,000	Furniture ...	32	33	25	89	108	100
7,000	Beer	31	33	22	80	95	100
10,000	Coal	28	32	19	76	86	100

*To cover these distances by horse wagon extra horses are required.

A further table shows the cost of operating 30 electric trucks over a period of three years, the figures being those of the owners, *i.e.*, the Commonwealth Edison Co., of Chicago.

The machines vary in size, from 700 to 3,000 lb. capacity, and 19 are fitted with Edison batteries, the remainder having lead batteries.

The average cost per car-mile (about 330,000 miles being run) was 6·8 cents, made up of (*a*) oil, &c., ·7 cent; (*b*) energy, at 4 cents per KW.-hour, 2 cents; (*c*) general repairs, 1·7 cent; (*d*) tires, 1·1 cent; (*e*) batteries, 1·3 cent. The average days in service per month of each wagon were 22·6, and the average miles per day per wagon in service 30·5.

The total operating charges, including depreciation and garage charges, averaged 25·2 cents per mile.

In conclusion, we reproduce a table showing the authors' estimate of operating cost for an Edison 10,000-lb. truck in London for a year.

	Per year. £	*Per day.* d.	*Per mile.* d.
Fixed Charges.			
Depreciation at 10 per cent. ...	107·0	85·4	3·57
Interest at 3 per cent.	32·1	25·7	1·07
*Fire insurance at 1 per cent. ...	10·7	8·54	0·36
*Third party risk	20·0	16·00	0·66
Total	169·8	135·64	5·66
Renewal Charges.			
Battery (Edison 60-cell A 12) ...	12·0	9·59	0·40
Tires	51·5	41·20	1·72
*Chains	11·6	9·28	0·39
*Gears and sprockets	15·8	12·62	0·53
*Bearings	8·6	6·87	0·29
*All other parts	10·0	8·00	0·33
	109·5	87·56	3·66
Garage Charges.			
Electric power at 0·5d. KW.-hour	25·0	20·00	0·83
Rent, &c.	16·4	13·16	0·55
Garage labour	18·6	14·88	0·62
	60·0	48·44	2·00
Driver	75·0	60·00	2·50
Grand total ...	414·3	331·24	13·82

NOTE.—Items marked * are taken on the same basis as in America. This is not strictly just, as replacement cost is greater in the States. The mileage per day—24—is lower than need be the case, as a truck of this size can be run easily 45 miles per day in heavy work, thus reducing the depreciation account, &c.

MR. A. H. SEABROOK (Marylebone), who opened the discussion referred to the value of the electric vehicle load to central station engineers. Regarding batteries for electric vehicles, it seemed to be a question as between the lead and iron battery, of small price and big maintenance, and large price and small maintenance. There was no doubt of our being ahead in the matter of electric heating and cooking, but for some reason we lagged behind all others in the use of electric vehicles. Possibly this was due to the indifference of English battery makers, and he congratulated the authors' firm on their progressive methods. At Brighton he believed they were proposing to do away with horse traction in the municipal service on hygienic grounds. In Marylebone they had had a trial of a F.R.A.M. vehicle for street sweeping and dust collection over a period of days, and the energy used was under 1 unit per mile run. The efficiency of the battery and gear was about 65 per cent. As this was new business, it was not necessary to offer very low competitive rates for charging, and he suggested that at least 1d. per unit could be obtained for ordinary charging, while large garages would require a reduction on that. He reminded them that the lighting business still wanted watching; he reckoned that the introduction of the 16-C.P. metal-filament lamp had cost his undertaking £7,000 in 12 months in reduced revenue.

MR. W. W. LACKIE (Glasgow) said they had been testing an electric van in the municipal service for some months past. It cost £620, weighed 33 cwt. empty, and carried 1 ton; it had run from 550 to 600 miles, and the cost of energy at 1d. per unit averaged ·6d. per car-mile, which compared with 1·2d. per car-mile for fuel for a similar petrol-driven vehicle. A horse van could be hired for similar work at £14 per month, but two of them would be required to do the work of the electric van, which cost £19 per month, including 20 per cent. depreciation charge. For a year the cost of charging current at 1d. per unit would be £26, and, therefore, it was a class of business well worth encouraging; the charge of 1d. per unit was quite satisfactory for the purpose.

MR. JOHN CHRISTIE (Brighton) said the Brighton municipal

authorities were considering how they could convert 16 or 18 battery omnibuses, which had recently been taken over by the tramways, for municipal use, incidentally displacing horse-drawn carts. The 'buses provided a good charging load at 1d. per unit, and he had had no complaint as to cost in comparison with petrol vehicles. In Paris he understood the T.C. has placed orders for several hundred electrical scavenging vehicles, although the price of charging current was high there.

Bailie Smith (Glasgow) urged that battery vehicles should be introduced for all municipal services as a means of encouraging their general adoption.

Mr. Frank Ayton (Ipswich) thought it was necessary to come to some decision as to charging rates, and that some uniformity would be needed if cars travelled from town to town. Municipal engineers were directly concerned in the success of the electric vehicle, and he urged the M.E.A. to give a strong lead in the matter. A special committee could be formed to standardise matters with the manufacturers, and to discuss uniformity of charging arrangements. This might help the smaller municipalities to make up their minds. He gathered that in his district garage charging was likely to be a difficulty with local firms, and it might be that station engineers would have to provide facilities to commence with. The question was, how were they to start? He greatly favoured the worm as against the chain drive for the electric vehicle, and suggested that motors should be standardised.

Mr. J. W. Beauchamp (West Ham) said they had had numerous inquiries as to electric trucks in his area, and should certainly push the heavy van. The Corporations could easily give this business a start, if they would, in their own departments. It appeared that a revenue of, say, £23 a year could be obtained from each vehicle, charging ¾d. per unit.

Mr. R. A. Chattock (Birmingham) thought there was a big business in prospect in connection with the battery charging, and that 1d. per unit could be charged for this work over the whole day, but another ½d. per unit would have to be added if garage facilities were included. If it were necessary to offer a rate of under 1d. per unit, then charging hours would be restricted, and they could well afford a lower rate in such a case. He did not favour the idea of Corporations running garages, and in Birmingham the local garage people were quite prepared to provide facilities.

Mr. J. Sykes discussed the question of charging rates, pointing out that charging would be mainly carried on at night when a cheap restricted-hour rate should be avilable.

Mr. Hogarth (Morecambe), referring to the petrol-driven tramway cars in use at this seaside resort, said he favoured the adoption of battery-driven cars, which could be charged during off-peak hours.

Mr. F. W. Crawter (Chloride E.S. Co.) said he had driven an electric vehicle 25 years ago, and was much interested in them between 1885-9. He denied that the battery maker was to blame for our backward position, and thought the conditions in Englaud were very different from those in America. Unless the electric car could make lengthy week-end runs as well as be suitable for town use, it would not supersede the petrol car for pleasure purposes; but for business purposes, and moving heavy loads, there was a great field open to the electric truck.

Mr. F. S. Grogan urged that in the matter of charging a distinction should be made between rates charged for pleasure and business cars, as the latter could be charged at pre-arranged times. He raised the question of providing battery loaning and charging stations on a co-operative basis, to provide ready charged batteries in exchange for those run down.

Mr. J. E. Edgcome (President, Kingston-on-Thames), following the last speaker's suggestion, said it would be necessary to standardise batteries and keep some in stock ready charged, and a clearing-house system would be necessary to apportion the charges to the vehicle owners who exchanged batteries. A representative Committee, say, of the M.E.A., would be required to do the preliminary spade work. He remembered some years ago considering the provision of a charging station on the Thames for river launches. He had then found out that a small competitor was charging 2s. 6d. per unit for this work, although he did not restrict himself to this rate as, on one occasion, his charge had worked out (unknown to the launch owner, of course) at a guinea for 3 units. It was not surprising that this firm had gone out of business.

Mr. Wm. Watson, in a brief reply, urged that a low price should be conceded to garages undertaking battery charging. The suggested conference would do a great deal of good, as the assistance of the station engineer was necessary to obtain success. His company would always give any information or assistance in connection with the electric vehicle.

The Meeting of the "Point Five" Association (June 17th, 1913).

The Chairman (Mr. A. S. Blackman, Sunderland), in opening the proceedings, said, as many of those present are aware, the "Point Five" Association has sprung from the suggestion, thrown out by Mr. Seabrook at Harrogate last year, to form a ½d. per unit Dining Club among the managing engineers of undertakings supplying electricity for cooking and heating at the rate indicated.

Several meetings have been held at which the dining feature has been a diminishing quantity and the technical discussions have absorbed an increasing proportion of the time; in fact, the subjects demanding urgent attention have been so many, that the last meeting was devoted entirely to the consideration of tariffs and apparatus.

The meetings of the Association have already been productive of valuable papers by the engineers responsible for the initiation of the '5 Tariff in Poplar, Southampton, Luton and Bradford, and we have avoided the trouble so many older institutions and associations experience, in obtaining papers, by changing our chairman at every ordinary meeting.

The chairman is responsible for an address, which is supposed to occupy five minutes—actually takes about 10, and frequently gives rise to a discussion lasting two or three hours.

In addition to tariffs and apparatus, selling and publicity methods, and, in short, everything pertaining to the advancement of electricity supply for domestic purposes comes within the purview of the Association.

The Tariff.—So far as private houses are concerned, electricity supply has, until recently and with few exceptions, been used for lighting purposes only, but there should be no two opinions among electrical men, that the time is now ripe for a general forward movement in the direction of making the electricity supply entirely supplant the gas service. This can, of course, only be done by the adoption of electricity for such purposes as cooking and heating, and many other domestic uses, and as the result of experience the members of the "Point Five" Association are convinced that no serious progess can under ordinary circumstances, be expected, unless electricity is sold for purposes other than lighting at not more than ½d. per unit. Where this has been done, and the sale of heating and cooking and other consuming devices energetically pushed, the load and diversity factors obtained from private houses has improved in a surprising manner.

Put shortly, the load factor obtainable from private houses is largely what the tariff makes it, provided always that the supply is pushed by an energetic sales department; and this proviso is necessary, because the applications of electricity to various household uses are continually increasing, to the benefit alike, of the load factor, the diversity factor, and the unit consumption, and heating and cooking by no means exhaust the multifarious uses which are developing, as vacuum cleaners, small motors, and other accessories account for quite a large number of units, without making their presence felt from a plant and mains capacity point of view; but in order to reap the benefit from these developments, an adequately equipped sales department is absolutely essential.

With regard to the unit charge, we, in Sunderland, tried ¾d., and as the result of a good deal of activity, a number of consuming devices were sold and put into use; the consumers were pleased with the comfort and convenience, but the cost of using was so great, that we were faced with the alternative of either letting the apparatus fall into disuse and of abandoning our cooking and heating development for the time being, or of materially reducing the unit price, which was accordingly reduced to one halfpenny.

With few exceptions, the electricity supply undertakings throughout the country are in a position to supply electricity for heating, cooking and miscellaneous domestic uses, at this price.

As evidence of the financial soundness of supply at this figure, the tariff has been for some time in extensive and growing use in places of such divergent characteristics as Poplar, Southampton, Bradford, Marylebone, Luton, Barnes, Reading and Sunderland, and, as the result of experience with the tariff, the responsible managers of these undertakings are energetically extending the use of it, and a more varied list of towns it would probably be difficult to find, so that what is proving uniformly successful in this varied group, may be said to be capable of very wide application.

An objection sometimes urged against the development of a general domestic load, under the '5 tariff, is the fear that consumers, having discovered a good thing, would come on at such a speed, that generating plant would prove insufficient, mains and services be found inadequate, and other troubles of a similar nature materialise.

It is probable that these fears largely arise from lack of experience, and it is questionable what proportion of those suffering from them, appreciate that the diversity of a heating, cooking and miscellaneous domestic load, is in the order of 20 to 1.

As regards work coming on too fast, it may be positively asserted that nothing of the kind will happen with electricity at ½d. per unit; if the rate was reduced to ¼d. per unit, or less, there would still be no fear of consumers coming on faster than the supply authority wanted them, and since a sales department was organised in Sunderland some three years ago, nothing in connection with it has impressed me more than the control a selling department gives over the development of the load.

A well organised sales department can develop, or if need be, check the load in any desired direction; and everyone with experience of the working of the '5 tariff will agree that anything in the nature of the load running away with one need not be feared for a moment. Whatever the rate may be reduced to in the future, we shall always have to go out and sell our wares.

The greatest stumbling-block to the development of electrical heating and cooking in towns which have adopted the '5 tariff, is the cost of the apparatus, and it is to be hoped that electricity supply undertakers will appreciate that the lack of a low-priced tariff throughout the country is largely responsible for the prevailing high prices.

I am only repeating a truism in reminding you that manufacturing costs are largely dependent upon quantity, and as manufacturers have at present to look for their principal market to a comparatively small number of towns, it follows that when the number of these is greatly increased, as it assuredly will be in the near future, the market for heating and cooking and other similar apparatus will correspondingly expand, and prices drop, to the advantage of all concerned.

The Mechanism.—And now just a few words with regard to apparatus. While the "Point Five" Association is doing all it can to standardise domestic tariffs, I would ask manufacturers of consuming devices and accessories, whether they cannot assist

the object we have in view, and incidentally themselves by standardising in some respects.

There are upwards of ten different spacings and diameters of 10-ampere plug pins in use, and the chaos is so great that plugs rated at the same amperage in the same house, are often not interchangeable ; and matters tend to get worse, rather than better.

We talk of the convenience attendant upon electrical methods, and year after year ignore such an obvious necessity as this ; and it is surely a pity that the inherent advantages of many portable domestic consuming devices should be discounted in consequence of a lack of concerted action.

Another point upon which standardisation might well be considered, is with regard to hot plates. Overall diameters, and the position, sizes, and conformation of the terminals and fixing arrangements, could surely be uniform ; and the design of the hot plate the same whether for use in the top plate of a cooker, as a heating element of an oven, or as an independent piece of apparatus.

In mentioning standardisation to manufacturers, one is apt to be met with the reply that the manufacturer in question has been fully into the pros and cons of design, and that the expenditure of a considerable amount of time and money has satisfied him that his particular designs are preferable to all others, and that he would not regard it as an advantage to turn out cookers to which other makers' hot plates could be fitted.

But I ask manufacturers to consider the matter from the electricity supply manager's view point.

The position is that electricity supply undertakings will, from now onwards expend considerable and increasing sums of money upon heating, cooking and other domestic consuming devices, and accessories for hire purposes ; and the quantity of apparatus that can be so placed, will very largely depend upon the rates at which it can be hired.

In arriving at these rates, considerable regard will have to be paid to the risk of obsolescence, because notwithstanding the state of reliability to which the articles in question have now attained, it will not be disputed that the near future is likely to witness further improvements, and the consequent depreciation to existing stock could undoubtedly be greatly minimised by such a measure of standardisation as would ensure interchangeability of parts.

I have been requested to say that the Association will welcome expressions of opinion, as to whether radiant or convected heat is preferable for ovens.

The question is one upon which considerable difference of opinion prevails, some people being of opinion that radiant heat is best for meat, and convected for bread, while others suggest that convected heat is better for all classes of oven work ; and it would be of great assistance if settled ideas regarding the comparative value of the two heats prevailed. In connection with this point, it must be borne in mind, that an oven which may be an outstanding success in the South of England, where people, for the most part, do not bake their own bread, may be a failure in the North, where speaking generally, they do.

Following the chairman's address came an animated discussion, the first speaker being Dr. Ferranti, who dwelt strongly on the question of price, reminding those present of his efforts in the past, through the I.E.E., to induce all supply authorities to give a tariff of under 1d. per unit for all purposes other than lighting. Although he did not succeed in his endeavour, he felt that it would have been of the greatest benefit to all concerned. He congratulated the Association on its policy of offering cheap electricity for domestic purposes. It was most important to extend the scope of the Association, as a few people offering a low tariff for electrical cooking would not result in the full benefit being obtained. A general low tariff would extend the market for apparatus, and induce manufacturers to supply apparatus at low rates. What was wanted was a 24-hour load ; this was a big question, and it was worth while to devise apparatus to utilise current all day and night for heat storage purposes.

Mr. Horace Bowden (Poplar) felt that serious attention must be given to the question of running and standing charges, also that a standard system of charging was wanted. The usual assessment charge was really settled by another Corporation department, but the assessment should depend on the cost to supply, and an ideal system would fix this for each individual.

Mr. A. F. Berry raised the question of tariff. He thought that probably more cookers were used on the 1d. rate than on the various so-called ½d. rates, which often worked out nearer ¾d. per unit. He favoured a "straight" rate, having found that to pay 1d. per unit, and know what you were paying, was better than to pay ½d. per unit and not know what you were paying. Consumers objected to having to work something out, and they must be taken into account. The question of hire rate was even more important than unit rate. English engineers produced electricity more cheaply, and yet were not doing so much as the Colonies in taking up electric cooking. The different rates for supply in various parts of London were against the interests of electric cooking, and he supported Mr. Bowden's contention, even if a flat rate were adopted. Among the 35 different authorities using his cooker, he believed there were 10 different rates of charging for supply. He concluded by urging the necessity of systematic publicity now, before it was too late.

Mr. Holmes (Marylebone) said few people realised the relation between unit charge and hire charge for apparatus. He had found that a complete electrical cooking equipment was in some cases less costly than a complete gas cooking outfit. Hire rates had been a difficulty in the past, and their experience was that maintenance could not be settled until 200 cookers were in use, after which the cost of hire and maintenance went up *pro rata*. People who bought cookers were entitled to the lowest rate, and this was an argument against decreasing the cost of hire at the expense of cost of energy. Of the electric apparatus sent out on approval in Marylebone, less than 8 per cent. was returned. A lady demonstrator was essential, especially in a good class district, to instruct in the use of the apparatus. In one house, six cooks were engaged in succession in a very short time, and each of them received instruction. Four of them in their new employment insisted on having electric cookers. In Marylebone they did not know what it was to have complaints as to cost of using electrical apparatus, and he was certain that gas and coal cooking had been put up with in the past because there was not a good substitute. It was important in heating to install large enough heaters ; quite satisfactory results could be obtained, and he instanced the Delico Restaurant (in which the meeting was held), where the cost during the winter was under 10s. per week.

Mr. Thos. Roles (Bradford) referred to the success of the domestic assessment tariff in his area during the past three years ; consumers and contractors both preferred it to a "straight" ½d. rate, and he could not see any complication in it. In Bradford during the year ending 1911, 106,376 units were sold on this tariff, the average price being 1·88d. per unit ; in 1912, 338,590 units were sold at an average rate of 1·69d. ; and in 1913, 464,767 units were sold at the same average rate. Out of 1,000 lighting consumers, 545 were on the domestic tariff, although many had no cooking or heating apparatus ; they had not started hiring cookers, and the business was done in radiators and heaters. Cooking apparatus would bear improvement, and he could not conscientiously ask his consumers to hire such apparatus. Trouble with heating arose from the use of small radiators, which had been put in in the past when current was more costly than now. In Bradford they hoped to give the ½d. rate to all business premises in the near future.

Mr. Belling agreed that both radiant and convected heat were required in cooking ; radiant heat was required at the start and finish for cooking either meat or bread ; it did the browning while the convection heat did the general baking.

Mr. Hughman urged engineers who were afraid of being swamped by cheap units to draw out a scheme to achieve this end. He didn't think it could be done, and if there were any danger the sales department could adjust matters. He also urged the necessity of more energetic publicity.

Mr. Haydn Harrison disagreed with standardisation of apparatus at the present time, although many details could be dealt with ; Mr. Schofield (Ferranti, Ltd.) also considered that standardisation of shape, size and arrangement of apparatus could not be carried out yet. He considered that tenants preferred to hire apparatus rather than to buy it, and that cost of hire might be included in the price of energy.

Mr. F. S. Grogan (British Electrical Transformer Co.) favoured a reduction of hire charges, which could be counterbalanced by an increased energy charge, as a low charge for energy was of little use, unless the consumer could obtain the cooking apparatus. Experience proved that this was the case, and that a low hiring rate, plus 1d. per unit, was quite satisfactory. He, too, disagreed with the suggested standardisation scheme.

Mr. Napier Prentice (Felixstowe) urged that both radiant and convected heat were necessary for cooking. It was not necessary to offer such a low rate as ½d. per unit, and even hiring charges might easily be reduced too low, as he thought some of the gas companies had discovered.

A number of other speakers also took part in the discussion, to which Mr. Blackman replied at a late hour.

(To be concluded.)

The Cooling of Rolling-Mill Motors.—The Allgemeine Electricitäts Gesellschaft are now building single motors for driving reversing rolling mills, with outputs corresponding to 15,500 H.P. One of the difficulties that had to be met was that, owing to the necessity of keeping the diameter of the armature as small as possible, on account of the output required for accelerating the masses as well as keeping them in motion when used to drive rolling mills in which reversal takes place frequently and very rapidly, unsatisfactory cooling conditions were set up. After many experiments, the A.E.G. have now definitely adopted the plan of cooling such motors by means of compressed air drawn from the outside. The stator of the motor is covered in on the opposite side to the commutator, except for a few small openings, the rotor being closed on the commutator side. The cooling air, which is led to the motor through filters by means of special fans, enters through an aperture in the neighbourhood of the shaft, whence it follows a predetermined course. Part of the air is forced through the core slots, part through the openings in the rotor covering, to cool the commutator, while the remainder is driven through the stator coils or through the air gap between the rotor and stator. The use of filters in connection with the arrangement has been found particularly advantageous for rolling mill service where the conditions are usually of a very unfavourable nature, as the danger of dirt entering the machine is greatly reduced, its life is lengthened, and the attendance is simplified.

Greenwich Generating Plant.—The Highways Committee of the L.C.C. reports, after considering the tenders received for the purchase and removal of certain plant at the Greenwich generating station which will not be required when the new turbines are installed, that none of these tenders be accepted. Tender forms are to be reissued in a slightly different form.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

13,884. "Thermo-electric generators." P. FERRA. June 16th.

13,844. "Electrical instruments." W. PHILLIPS and L. W. SMITH. June 16th.

13,901. "Electrolytic production of hydrosulphates." AKT.-GES. FUR ANILIN-FABRIKATION. (Convention date, July 6th, 1912, Germany.) June 16th. (Complete.)

13,903. "Methods of exciting Röntgen-ray tubes." SIEMENS & HALSKE AKT.-GES., K. BANGERT and E. UTECHT. (Addition to 9,499, 1912.) June 16th. (Complete.)

13,911. "Electromagnetic weight-lifting apparatus." MAGNET-WERK G.M.B.H., EISENACH. (Convention date, July 16th, 1912, Germany.) June 16th. Complete.)

13,918. "Electric discharge apparatus." R. MORETTI. (Divided application on 16,164, 1912, July 10th.) June 16th. (Complete.)

13,919. "Submarine electric leakage telegraphy." SIGNAL G.M.B.H. (Convention date, June 27th, 1912, Germany.) June 16th. (Complete.)

13,943. "Electrical conductors." F. EASTWOOD. June 16th.

13,945. "Rythmatic control, synchronous, differentiated or synthonic by Hertzian waves from a distance, and without relays of teledynamic machines and receivers." M. DE LEZINIER. June 16th.

13,955. "Electric browning device and heat economiser." C. W. CROSBIE, June 17th.

13,976. "Electric signalling systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and H. H. HARRISON. (Partly communicated by Automatic Electric Co., United States.) June 17th. (Complete.)

13,980. "Engine-starting and lighting equipment for motor-vehicles and like purposes." H. LUCAS and W. C. TUCKER. June 17th.

13,983. "Electromagnetic sparking plug." A. SCHUBERT. June 17th.

13,985. "Ignition device." C. R. OLIVER and AUTO LIGHTER, LTD. June 17th.

13,988. "Electrical elements for cooking." R. F. VENNER. June 17th.

13,989. "Construction of electrical elements for cooking purposes." R. F. VENNER. June 17th.

13,990. "Electric apparatus for heating air." R. F. VENNER. June 17th.

13,991. "Regulator switches for resistances." B. C. BRAZIER, G. H. GOSLING and F. J. GRAY. June 17th.

14,027. "Electric striking and damping mechanism for bells, bars, tubes and plates." T. L. SOUTHGATE. June 17th.

14,034. "Apparatus for closing and interrupting electric currents." V. POULSEN. June 17th. (Complete.)

14,035. "Supplying radio-telegraphic antennæ." E. GIRARDEAU. (Convention date, June 17th, 1912, France.) June 17th. (Complete.)

14,043. "Electric controllers." SANDYCROFT, LTD., and T. M. DUTTON. June 17th. (Complete.)

14,048. "Electric incandescent lamps." ALLGEMEINE ELEKTRICITATS GES. (Convention date, September 18th, 1912, Germany.) June 17th. (Complete.)

14,049. "Electrical driving of reciprocating machinery." BRITISH THOMSON-HOUSTON CO., LTD., and G. M. BROWN. June 17th. (Complete.)

14,071. "Electric arc lamps." A. H. RAILING and A. E. ANGOLD. June 18th.

14,072. "Electro-magnetic variable-speed mechanism." R. EDWARDS. June 18th.

14,079. "Tilting arrangement for attachment to electric light shades and the like." W. SCHOLES. June 18th.

14,083. "Magnetic compasses and like instruments." E. W. BARKER. June 18th.

14,091. "Casing for pocket accumulators or dry batteries." C. R. ZUMPE. June 18th. (Complete.)

14,106. "Tools for use in applying or repairing filaments of metallic-filament lamps." C. A. HARRISON. June 18th.

14,112. "Electric switches." P. S. TURNER. June 18th.

14,115. "Electric shot-signalling device for shooting galleries, rifle ranges, and the like." FR. BURKI-BRUGGER and FR. BURKI. June 18th. (Complete.)

14,122. "Arrangements for converting continuous currents of electricity into isochronous undulatory currents." SOC. DES TELEGRAPHES MULTIPLEX. (Système E. Mercadier-H. Magunna.) (Convention date, June 21st, 1912, France.) June 18th. (Complete.)

14,140. "Apparatus for emitting heat waves." W. P. THOMPSON. (Compagnie Universelle de Telegraphie et de Telephonie sans Fil, France.) June 18th. (Complete.)

14,149. "Cut-outs for electrical instruments, glow-lamps and the like." A. J. DOWNES. June 18th.

14,167. "Machines for covering wire and other cores with yarn and the like." N. STOTT. June 19th.

14,170. "Electric light fittings of the indirect kind." O. D. LUCAS and VERITYS, LTD. June 19th.

14,188. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG and G. PEGG. June 19th.

14,203. "Sparking-plugs." H. H. PATRICK. June 19th.

14,210. "Manufacture of earthenware ducts for electric cables." C. SHARP. June 19th.

14,214. "Automatic short-circuiting device for lightning arresters." SIEMENS & HALSKE AKT-GES. (Convention date, September 9th, 1912, Germany.) June 19th. (Complete.)

14,218. "Transmitters for submarine sound signals." SIGNAL G.m.b.H. (Convention date, June 24th, 1912, Germany.) June 19th. (Complete.)

14,229. "Telephone exchange systems." TELEPHON APPARAT FABRIK E. ZWIETUSCH & Co., G.m.b.H. (Convention date, July 5th, 1912, Germany.) June 19th. (Complete.)

14,243. "Mounting motors on electric tramcars or other rail carriages to prevent side swing." I. BULFIN. June 19th.

14,259. "Automatic speed-regulating device for the direct electrical drive of presses, shearing machines, punching machines or the like." F. R. VON. MERKL. (Addition to 14,109 of 1910. Convention date, October 8th, 1912, Austria.) June 19th.

14,285. "Ships' telegraphic or signalling and like apparatus." W. CHADBURN. June 20th.

14,293. "Mariners' compasses." KELVIN & J. WHITE, LTD., and M. B. FIELD. June 20th.

14,294. "Wire-drawing machinery." N. K. TURNBULL and H. SAVILLE. June 20th.

14,306. "Switching apparatus for the inside lamps of motor vehicles." E. FREITAG. June 20th.

14,310. "Electrolytic meters." W. A. CHILDS and REASON MANUFACTURING CO., LTD. June 20th. (Complete.)

14,313. "Electric condensers, resistances, coils and the like." H. S. HATFIELD. June 20th.

14,314. "Electromagnetic instruments." H. S. HATFIELD. June 20th.

14,317. "Means or appliances for mounting and securing half-tone, electro, stereo, and zinc plates." C. F. MOORE. June 20th.

14,321. "Telephone transmitting apparatus." W. KENNEDY-LAURIE DICKSON. June 20th.

14,330. "Combined switches and plug contacts." J. P. JACOBSEN and H. F. JENSEN. (Convention date, June 21st, 1912, Denmark.) June 20th. (Complete.)

14,333. "Illuminated signs and the like." G. A. PATTERSON. June 20th.

14,380. "Stranded electrical conductors." SIEMENS. BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 21st. (Complete.)

14,387. "Telephones phonographs, and such like apparatus." A. S. BOWLEY. June 21st.

14,390. "Dynamo-electric machines." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, June 22nd, 1912, Germany.) June 21st. (Complete.)

14,395. "Electric-fluid turbines." WARWICK MACHINERY (1908) CO., LTD. (General Electric Co., United States.) June 21st.

14,407. "Automatic telegraphic apparatus." J. GELL. June 21st. (Complete.)

14,423. "Electric lamps." G. F. HITZELBERGER and NEW BRITISH EVER-READY CO., LTD. June 21st.

14,426. "Magnetic separators." F. KRUPP AKT.-GES. GRUSONWERK. (Convention date, July 19th, 1912, Germany.) June 21st.

14,427. "Magnetic separators." F. KRUPP AKT.-GES. GRUSONWERK. (Convention date, July 15th, 1912, Germany.) June 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

ELECTRIC HEATING AND COOKING DEVICES. R. F. Venner. 12,569. May 28th.

ELECTRIC SEARCHLIGHTS. L. Pasqualini. 13,680. June 11th.

SIGNALLING APPARATUS. J. Moyes and C. A. Stevenson. 13,910. June 15th. (Addition to No. 5,615 of 1910.)

ELECTRICALLY-OPERATED ANNOUNCERS. A. J. W. Munden and J. M. Muir. 14,224. June 18th. (November 23rd, 1911.)

ELECTRICALLY-OPERATED ANNOUNCERS. A. J. W. Munden and J. M. Muir. 14,225. June 18th. (January 29th, 1912.)

SYNCHRONOUS PHONOGRAPHS AND KINETOGRAPHS. I. Kitsee. 14,880. June 26th.

AUTOMATIC ELECTRIC SUPPLY SYSTEM. H. Leitner. 16,174. July 10th.

ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 18,220. August 7th.

POLARISED TELEGRAPHIC RELAY. A. Colonna. 18,869. August 9th.

ELECTRIC FLEXIBLE CONDUCTING CORDS. M. S. Conner and J. Healey. 19,607. August 30th.

AERIALS FOR USE IN WIRELESS TELEGRAPHY. E. Girardeau. 24,345. October 24th. (October 25th, 1911.)

ELECTRIC ALARM CLOCKS. F. Goss. 26,502. November 18th.

FITTINGS FOR ELECTRIC INCANDESCENT LAMPS. T. B. Pickard. 29,736. December 24th.

PROJECTION APPARATUS. F. Dussaud. 5,424. March 4th. (March 11th, 1911.)

CONCRETE COLUMNS, AND PARTICULARLY CONCRETE COLUMNS OF TOWERS FOR WIRELESS TELEGRAPHY. J. A. Malcolm. 10,542. May 3rd.

MANUFACTURE OF INSULATED ELECTRIC WIRE COILS. L. Frenkel. 12,580. May 28th. (August 13th, 1912.)

ELECTRIC CONVEYORS OR TRANSPORTING DEVICES. Elektromoteren-Werke Hermann Gradenwitz. 12,833. May 31st. (May 31st, 1911.)

AUTOMATIC SWITCHING SYSTEM FOR TELEGRAPHY AND THE LIKE, AND APPARATUS FOR THE SAME. J. Gell. 12,847. May 31st.

TELEPHONE EXCHANGE SYSTEMS. W. Aitken. 12,973. June 3rd.

TELEPHONE SWITCHING SYSTEMS. W. Aitken. 12,974. June 3rd.

BRANCH TELEPHONE EXCHANGE SWITCHBOARDS. W. Aitken. 12,975. June 3rd.

ELECTRIC TELEGRAPHY. E. S. Heurtley. 13,155. June 4th.

ELECTRIC SIGNALLING APPARATUS. H. F. Chapman. (Chapman.) 13,208. June 5th.

ELECTRICAL MEASURING INSTRUMENTS. British Thomson-Houston Co., Ltd., and A. P. Young. 14,378. June 19th.

MEANS FOR ENSURING ELECTRIC CONTINUITY IN METALLIC CONDUITS. E. A. Edwards. 16,318. July 12th.

CONSTRUCTION OF FIELD MAGNET FOR DYNAMO-ELECTRIC MACHINES. M. A. McLean. 17,391. July 26th.

COOLING OF DYNAMO-ELECTRIC MACHINERY AND MEANS THEREFOR. Siemens Bros. Dynamo Works, Ltd., and J. W. Howard. 18,087. August 6th.

CIRCUIT-BREAKERS FOR ELECTRIC WELDING MACHINES. E. C. R. Marks. (Clinton Wire Cloth Co.) 18,109. August 6th.

ELECTRIC CRANES. British Thomson-Houston Co. (General Electric Co.) 18,746. August 15th.

CABLE CONNECTORS TO ELECTRICALLY HEATED LAUNDRY AND SIMILAR IRONS G. H. Collins and H. F. Collins. 20,776. September 12th.

HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. M. J. Hoppock, jun., and A. Stout. 22,231. September 30th.

MEANS FOR DISPLAYING CHANGEABLE ADVERTISEMENTS ON VEHICLES. A. Beger 23,824. October 18th.

MARINERS' COMPASS. W. D. Whyte. 25,028. November 1st.

SHORT-CIRCUITING DEVICE FOR THE IGNITION MECHANISM OF INTERNAL-COMBUSTION ENGINES. Firm of R. Bosch. 27,403. November 28th. (January 13th, 1912).

ELECTRIC ARC LAMPS. F. R. Boardman, R. V. Boardman and F. Boardman. 29,160. December 18th.

ELECTRIC HEATERS. L. H. Mayer. 29,569. December 23rd.

1913.

ELECTRIC ARC LAMPS. Crompton & Co., Ltd., and C. Crompton. 237. January 3rd.

RECEIVER FOR SUBMARINE SIGNALLING. Signal Ges. 1,995. January 24th. (June 1st, 1912.)

APPARATUS FOR THE PRODUCTION OF ALKALI METALS FROM THEIR FUSED HALOGEN COMPOUNDS. Elektrizitatswerk Lonza Akt.-Ges. 3,575. February 11th. (February 15th, 1912.)

ELECTRIC SAFETY-FUSE PLUG. O. Weiss. 3,732. February 13th.

MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES USED ON MOTOR-VEHICLES. T. W. Tattersall. 1,206. January 15th.

ARRANGEMENT FOR STARTING GROUPS OF ELECTRICAL MACHINES, CONSISTING OF A SYNCHRONOUS AND AN ASYNCHRONOUS MACHINE CONNECTED IN CASCADE WITH IT. W. P. Thompson. (Ateliers de Constructions Electriques de Charleroi.) 5,481. March 5th. (Addition to 7,135, 1912).

THE

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(J. A. Berly's).

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"OUR" TELEPHONE SERVICE.

THE British public, having now possessed its very own telephone service for some 18 months, is awakening. It has dawned upon the intelligence of John Bull that perhaps, after all, national ownership is "not all that it's cracked up to be," and that expert management in the hands of a highly developed commercial and technical staff is not so detrimental to the public welfare as he has been told. Indeed, we fancy he would gladly find himself once more within the greedy clutches of the devouring telephone trust, which he has just recently succeeded in parting from its ill-gotten gains under conditions which, if suffered by himself, he would have characterised as extremely unfair.

Last week the growing popular irritation was voiced by the London Chamber of Commerce, which sent a deputation to interview the Postmaster-General on the subject of the injustice of the contracts with subscribers and the inefficiency of the service. Mr. Samuel admitted that the service was not all that could be desired—an admirably diplomatic way of putting the best face on the matter. He also detailed the sums of money that he was spending and would spend on the system, and expressed most praiseworthy views regarding the importance of efficiency rather than cheapness; but kind words butter no parsnips, and, much as we respect and admire Mr. Samuel, who has done his best and deserved well of the country, we cannot accept his soft answers as compensation for the deficiencies of the telephone service.

In London alone, he said, there were one million calls a day—and this he gave with charming inconsequence as a reason why subscribers should accept without question the Post Office record of the number of their calls! He proceeded to say that the number of calls that were ineffective, owing to the lack of sufficient junction lines, was extremely small—less than $\frac{1}{2}$ per cent. But $\frac{1}{2}$ per cent. on a million is no less than 5,000 calls a day wasted through this cause alone, to say nothing of the others—is not this a serious matter?

The *Times* devoted a leading article to the subject on Saturday last, and emphasised the fact that this country lags behind the world in the development of the telephone service. We cannot altogether agree with our contemporary in its references to the cost of the service in London; it is useless to attempt comparisons between the enormous metropolitan area and Continental towns where the telephonic conditions are totally different, and it is unreasonable to demand more than a moderate reduction in the charges, if, indeed, any reduction at all can be effected. It is true that there is no royalty to pay, that the Government can raise capital on better terms than a company, and that there is no restriction to the life of the concern, but the royalty will be more than swallowed up by the inevitable reduction in commercial efficiency which is certain to accompany State control, and it is not correct to say that there is no dividend to pay—the Treasury will not forgo its pound of flesh, and the Postmaster-General, as he indicated in his reply to the deputation from the Chamber of Commerce, will be obliged to provide "a small margin of profit to the Exchequer in consideration of the large amount of public capital involved" (if he can). But as regards the inefficiencies of the service, of which a long list is given, we are at one with the *Times*.

In this connection the attitude of the Telephone Department towards the immense problem with which it is confronted is put in a remarkable light by the statements of one of the secretaries of that department who visited Nottingham last week, to hear the complaints of the Corporation and the local Chamber of Commerce. These statements were published in the *Evening Standard* of June 30th, in which we read that the secretary admitted that complaints were being made on all hands by subscribers. "The service is not what we would like," he confessed; "the telephone system is a worrying business." Oh, for peace and a quiet life! "There are places in London where we do not want any more subscribers, for it would be impossible to give them a good service. . . . People in the West End are continually writing to the Postmaster-General asking for lines, but they are told that they cannot get them, and this is just what they cannot understand." The naïveté of these remarks is delicious. "There are places"—is there any place in London where the existing subscribers get a good service? According to a further statement of this candid secretary, until the end of the year the Post Office can take no more subscribers at Victoria. It may be inferred that the Post Office is not in the telephone business with a view to developing it, but merely to keep things going—to maintain the *status quo*, that fetish of politicians which is born of ignorance and timidity: ignorance regarding the business in hand, and fear of the consequences of a bold forward step. Why will not those West End people be quiet and cease from troubling? Ears have they, says the Post Office, and they do not understand—that they cannot have telephones too. Dolts!

Proceeding, the secretary, with a nerve which commands admiration, if not respect, says that the lack of sufficient provision for future business "was the fault of the National Co." "When the Post Office took up the telephones in 1902, we did not provide for service for the whole of London, expecting that the National Co. would have made ample provision by the time the transfer came into force."

We are at a loss to comment on this remark. As the bargee said in a similar strait, "There ain't no words for it." It appears from further remarks that the Post Office offered to do it and lend the new plant to the company, but the latter most naturally declined, pointing out the obvious fact that if this were done, the Post Office would refuse to buy the company's old plant when the transfer came. "Ultimately we built an Avenue Exchange, and for some time the result of transferring was a ghastly business. For a few weeks there was a very bad time for the Avenue subscribers." Yes; but why say "for a few weeks"? "We have increased the staff of operators . . . . for the moment this seems to be no advantage." The Post Office appears surprised to find that under State management a larger staff is required to do the same work. Every one else knew that years ago, and said it.

"The truth" (there is quite a lot of truth in *this* secretary's statements) "is that at present we are not anxious to advertise the telephones." No need—the subscribers are doing that efficiently.

"We hope that in five years' time we shall have as good a system as that in New York, and we believe that *already we have as good a system as that in Paris.*"

This is a fitting climax to this astounding series of disclosures. It is notorious in telephone circles that the State service in Paris is the last word in inefficiency and mismanagement; the subscribers had to form an association to fight the Government and compel reform.

What do we learn from the foregoing extracts? Is it not that the Post Office entered upon this gigantic undertaking without appreciating the necessities of the case? without due preparation, without co-operation with the company on a reasonable basis, without an adequate staff, without the necessary funds? The department has shown a deplorable lack of foresight and incapacity for handling the tremendous problem which it so light-heartedly took up.

We do not for a moment blame the engineering staff of the Post Office, for the members of which we have sincere respect and cordial sympathy. The fundamental canker is the lack of co-ordination of the administrative and technical staffs, to which we drew attention some years ago, and which results in constant friction and waste of effort. Under the National Telephone Co. the management of the system was in the hands of a machine organised upon a sound commercial basis, by which the highest technical skill and the best business ability were combined and utilised with the utmost efficiency and perfect harmony. The Post Office in taking over the undertaking rejected the best men. Cannot our bureaucrats realise that the best is the cheapest in the end? That a good man is worth a high salary, and can command his own price?

But it is useless to protest; the defects of State control are inherent to the system, and the teachings of history are lost upon the politician, who, of all men, ought to make them his special study. As in England, so it is in France and in Germany; the City Council of Dresden, for example, last month discussed a statement that the Postal authorities threatened to close the telephone exchange for 12 months, to put a stop to the continuous complaints from all parts of the community. The service was described as insupportable, scandalous, and detrimental to the commercial life of Dresden—but the charges had to be paid all the same, in advance. The Council resolved to demand redress from the Postal authorities.

On the other hand, a postal official stated that the alleged threat had not been made—but probably, as in London, the different departments of the German Post Office act in ignorance of each other's movements. To sum up the whole: State management is mismanagement now, as it always has been, and, after all, the people who brought it about have only themselves to blame. We warned them.

Protection for Engineers.

The proposal to form a society for the mutual protection of staff engineers and draughtsmen is one of those subjects which, like the wages of shift engineers, periodically invades our "Correspondence" columns, and invariably evokes an animated discussion. But hitherto, with equal regularity, the attempt to form an association has failed, the numerous difficulties met with by the promoters having proved too great to be overcome with the means at their command. The singular aversion to anything in the nature of a trade union which is always displayed by employés whose vocation lies outside the limits of manual labour may have a good deal to do with it; we are not sure that the feeling is well founded—there is nothing objectionable about a trade union, so long as it adheres to its legitimate objects, and is conducted by honourable men. Moreover, the fundamental principles of trade unionism are to be found in every society formed for mutual assistance and support, whether the members be employés or employers, and there need be no loss of dignity in belonging to such a body. However, the feeling undoubtedly exists, and its intensity is perhaps most marked in the case of men whose work differs only in kind from that of the skilled handicraftsman, and often is actually worth less in point of remuneration.

Other obstacles are to be found in the fear of unwelcome consequences to those who ally themselves with such a society while it is still a weakling, and the difficulty of reaching the eyes and ears of the class of men concerned, many of whom cannot afford to subscribe to a weekly journal, or are too indifferent to their future to concern themselves with the technical Press.

The efforts of existing Societies to take advantage of the agitation on such occasions and to capture the movement with a view to the extension of their own membership, are usually viewed with undisguised suspicion by the coy subjects of their blandishments, who desire to be loved for themselves alone, and not for the sake of their subscriptions. A letter elsewhere in this issue, however, from Mr. W. A. Tookey, draws attention to the advantages of membership of the Junior Institution of Engineers (of which he is vice-chairman), and, we think, deserves the serious consideration of all who are interested in the question.

Mr. Tookey's letter fully explains the policy and organisation of the Institution, upon which, therefore, we need not dwell; but having been intimately acquainted with the

Juniors for many years, we are in a position to confirm all that he says regarding its claims, as one of the most "live" and energetic societies of its kind, to meet the case of the men who are in search of mutual aid. We have examined the Memorandum of Association of the Institution, and find that its scope is extremely wide, explicitly embracing every branch of the profession of engineering and contemplating the promotion of improvements in the law, the advancement of knowledge of persons engaged in the engineering or allied professions, "or in any employment, manual or otherwise, in connection therewith," the encouragement of invention, the establishment of a benevolent fund, and doing "all such lawful things as are incidental or conducive to the attainment of the above objects"—provided that it shall not make itself a trade union. The subscription is one guinea per annum (provincial members, 16s.). The membership is about 2,000.

We believe that the Junior Institution is, in fact, exactly what our correspondents have been looking for, and we strongly recommend them to inquire closely into its merits, lest they go farther and fare worse.

The Prevention of Fire in Central Stations.

Nowadays when the capacity of central electric lighting stations is becoming greater and greater, and where the same plant produces the power required for a steadily-increasing number of different industries, any total or even partial interference with the supply of electrical energy may have results so disastrous that it behoves those responsible for the management of such plants to take every possible care, so that no interruptions may arise. Amongst the causes of accidental interruption in the supply of current, perhaps the one to be the most feared and guarded against is fire at the generating station.

In this connection, we would draw attention to the *résumé* on another page of an interesting article entitled: "The Causes of Fires at Central Stations, and their Remedy," recently contributed to our French contemporary, *La Lumière Electrique*, by M. André Gerard, the engineer of the Société de l'Electricité du Pays de Liége, and a son of the well-known Prof. Gerard.

Among the precautions to be taken in the laying-out of new generating stations, the author mentions the advantage that is to be secured by entirely separating the switchgear from the engine room, and establishing it in a special and independent building. No doubt such a plan would be excellent, if there were not other conditions to be taken into account, which do not permit the switchgear to be entirely separated from the generating plant. We believe that the arrangement adopted at the St. Ouen and Issy generating stations of the Compagnie Parisienne de Distribution de l'Electricité, which, by the way, were described in our issue of the 16th ult., while not being so radical a change, offers all the necessary guarantees against risk of fire. In each of these stations the high-tension switches are installed in a multiple-storey building contiguous to, and communicating with, the power house, a balcony projecting into the latter forming a central controlling point, from whence all the distribution apparatus can be operated, the alternator and feeder panels being arranged in arcs of circles. These stations are almost entirely constructed of reinforced cement, the use of wood not being permitted. In this issue also we print that portion of Mr. G. Scott Ram's interesting report, in which he describes the three important fires in electricity works for which the past year was unhappily noteworthy. In each case the fire originated amongst the cables and quickly involved the switchgear, indicating clearly that this is the weak spot in our present designs. Mr. Ram recognises the great difficulty in dealing with the problem, and suggests that the cables be enclosed in separate channels to prevent the spread of fire; this is good so far as it goes, but does not wholly meet the case. The iron covers which encase the power cables on the London underground railways suggest a practicable method of confining damage to cables in existing stations within the narrowest limits, without waste of valuable space, and the use of ironclad switchgear where possible would obviously reduce the risk of fire.

Lead.

With slightly more plentiful arrivals of lead during the last week or two, the situation has eased to a certain degree, but a considerable proportion of the metal coming in has had to be shipped abroad against old contracts entered into. These supplies had to be drawn from new arrivals, for the simple reason that stocks can hardly be said to exist either in Europe or America. Fresh export inquiries have fallen off during the last week or two to a small extent, but there are important engagements to be filled this month, and about half the quantities arriving early this week will not be available for the English trade. It is quite possible that there may be a renewal of the stringency experienced for near delivery metal, in view of the restricted quantities coming along, though there is no likelihood of anything approaching actual famine conditions being set up. The hopes of consumers continue to be concentrated upon the situation in Mexico, where conditions appear to be settling down, though the process is a slow one. Undoubtedly, had there not been any disturbance in that country, the highest points attained for lead would not have been seen, and the resumption of normal conditions is awaited with impatience. The fact that some lead has come to London from New York has no special significance, and the only complaint of the shippers is that they were not able to get more of it.

Half Watt per Candle Lamps.

The latest development in connection with a low watt consumption per candle-power is reported from Germany, where the A.E.G. intends to place on the market in the autumn a new lamp which is claimed to consume only one-half of a watt per candle, as compared with ·8 watt to 1 watt per candle of the existing wire lamps. It is announced that the Incandescent Gas Light (Auer) Co., which manufactures Osram lamps, will also introduce a lamp having a similarly low watt consumption. The figures, of course, refer to the Hefner candle, which has a value about 10 per cent. less than the English candle.

Are Hertzian Waves Injurious?

Radio-telegraphists, says the *Elektrotechnische Zeitschrift*, are subject to anæmia—a deficiency in red blood corpuscles and their hæmoglobin contents. This malady is traceable to various causes, notably to the faulty location of, and unhealthy conditions in, some operating rooms—particularly on ships. It is not unlikely that the ozonisation of the air round about the high-frequency current apparatus has an injurious effect—this suspicion being confirmed by the headaches, anæmia and bad appetite and digestion of employés in the Niagara and other high-tension stations. It remains to be established whether Hertzian waves themselves have any physiological or pathological action. Dr. Thompson has observed the production of subjective light glimmerings when the head is approached to a powerful electromagnet, and Danilewski has observed muscular contraction in a frog placed near a powerful dynamo; the latter investigator has also noticed that, if the muscles of a frog contract under the influence of electric oscillations to which an insulated man serves as conductor, they cease when the experimenter earths his body. Collins claims that a sleeping cat can be awakened by the influence of Hertzian waves, and that the powerful radiations now employed by many wireless stations have an appreciably injurious effect on operators.

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BRITISH TRADE WITH CANADA.

As our readers are aware, for a long time we have made a special feature of the importance of Canadian trade to British manufacturers, and have done our best to arouse interest in the subject and to promote the cultivation of this very promising field. That its possibilities are gradually obtaining recognition is evidenced not only by the rapidly-increasing value of our exports to the Dominion, but also by numerous facts which have come to our knowledge, proving that our manufacturers are devoting more attention to the matter, and that determined and successful efforts are being made to introduce British products to the Canadian market, and we are glad to be able to say that some of the obstacles to our trade in this direction are likely to be removed in the near future.

Some of the difficulties were pointed out in the valuable report of Mr. Hamilton Wickes to the Board of Trade, which we published in our issue of January 3rd, 1913; others were mentioned in our article of May 3rd, 1912, in which we welcomed the advent of the Canadian-British Engineering Co. as affording a good prospect of development. The orginator of the scheme, Mr. Leonard Andrews, had then already spent two years in investigating the conditions, and in formulating plans for the establishment of a satisfactory medium through which British manufactures could be delivered to Canadian purchasers under conditions which would immensely facilitate the speedy execution of orders and ensure satisfaction to the purchaser. With these objects in view, the organisation of his company was so devised as to make it, in a sense, two-headed. An explanation of the telegraph given to an interesting recital of his experiences, the gist of which is given below.

By an extraordinary stroke of good fortune, the directors were brought into touch with a going concern of good standing with a widely extended connection in the engineering world, which was about to come into the market for reasons quite foreign to the business, and were enabled to purchase it *en bloc*, at a price below the market value of the stock alone. Their first care was to reorganise the concern and to rehabilitate its reputation in commercial circles; the business is now in full swing, on the same lines as before, and by itself alone would afford ample occupation for the staff and for the energies of the directors. But naturally, the business done at present is mainly in goods of American origin, whereas the C.-B. E. Co.'s directors are anxious to develop the trade in British manufactures; Mr. Andrews has therefore returned in order to proceed with that undertaking, and Mr. Porter is just leaving for Canada to continue the campaign on that side for a few months.

The commercial methods adopted in the New World differ very markedly from those to which we are accustomed. It is quite useless merely to appoint agents in Canada and to provide them with goods, in the face of the American system. According to the latter, the manufacturer does not confine his activities to supplying his agent with goods; he undertakes the whole of the advertising of his wares and creating a demand for them, leaving the agent to carry a stock, distribute the goods to his (the agent's) *clientèle*, and be responsible to the manufacturer for payment for the goods. The manufacturer also provides expert salesmen to co-operate with the agent's salesmen, the former being capable of discussing points of technical detail with prospective customers—a condition absolutely essential to success. It will



General Office and Shipping Department of the Canadian-British Engineering Co., Ltd., in Winnipeg. External View Inset.

Eastern chief in the old days by one of our pioneers, was that it was like a dog with its head in London and its tail in Afghanistan: "When you tread on its tail in Kabul it barks in London." In a similar way, if a purchaser from the C.-B. E. Co., in Canada, had a grievance which he communicated to the Canadian staff, the London end would take up the matter with the British manufacturer; or if the potential customer explained his individual and peculiar requirements to the staff in Canada, the London office would see to it that his wants were filled to the letter. Thus the Canadian-British Engineering Co. was formed to promote the supply of British goods to Canadian purchasers, by actually impersonating the manufacturer in Canada and the purchaser in London.

The co-operation of a number of important British firms was secured, and the company was duly brought into existence last year. Thereafter Mr. Andrews for the third time proceeded to the Dominion, to complete the overseas organisation of the business, and in the meantime Mr. R. Porter, the company's London manager, has been keeping manufacturers on this side posted with information received from Canada respecting the requirements of that market. Mr. Andrews recently returned after a sojourn of nine months, mainly in Winnipeg, and favoured us with a most be seen that the difference in method is fundamental and of the greatest importance. The Canadian purchaser, though he has a strong predilection in favour of British goods, is not going to buy them simply and solely because they are British; he must be offered satisfactory inducements to purchase—he must be satisfied that the price and quality are right, and convinced as to the merit of the design in comparison with rival offers—and this can only be done by a man who is fully acquainted with both classes of goods and capable of discussing their points.

Again, the British makers must be prepared to meet their competitors on equal terms. Take, for instance, the case of electric cooking and heating apparatus. Many British manufacturers are ready to guarantee their products for a period of, say, two years; the American in some cases guarantees his goods *indefinitely*. For one thing, they are of good quality; they are made by firms which specialise in these lines, in enormous quantities, so that the cost of manufacture is kept down; and if a utensil lasts, say, two years, the user will consider that it has had a fair life, and will not generally dream of asking for the fulfilment of the guarantee. Thus prestige is secured at a nominal cost. Electric irons and kettles, and cooking ranges, are popular in Winnipeg; they are usually better finished than the British article, with nickel

and polish, and their superior appearance gives them a great advantage, while costing very little.

The company finds that there will be no difficulty in introducing British apparatus and material ; as a matter of fact, its travellers are keen to take them up, for they find that "British-made" is a good "talking-point," which arouses the interest of their clients and facilitates business. Moreover, municipal inspectors of electrical apparatus are, in many cases, quite willing to approve of British material and accessories, even without the imprimatur of the Chicago Board of Underwriters, provided that the goods bear the brand of a manufacturer or distributor of repute. Again, if the selling price of an article in London is the same as, say, in Boston, from which centre many electrical appliances are imported into Canada, it can compete with the United States product in the Prairie Provinces on equal terms, as the combined freight charges and preferential tariff on British-made goods are approximately the same as the lower freight charges and higher tariff on U.S.A. goods. Energy is extraordinarily cheap in Winnipeg—$3\frac{1}{3}$ cents per unit, flat rate, for lighting, and 1 cent for heating—so that there is an excellent field for the sale of consuming appliances, provided that they comply with standard requirements ; for instance, lamps, &c., must be fitted with the Edison cap, as the bayonet cap is practically unknown in Canada.

The company has already a large business in Winnipeg, provided with the necessary office staff and travellers, and branches in other centres. It is in a position to deal with British goods right away. But it is of no use, as we have shown above, to supply the goods alone ; the aid of experts is essential, to explain the good points of the stuff to the purchaser. The company, therefore, invites manufacturers to co-operate with it on the following basis :—The company will provide the necessary office accommodation at its own cost—no small item in Winnipeg—and will place at the disposal of the manufacturer its existing organisation and distributing network, while the manufacturer is asked to appoint and pay the salaries of experts who can talk about the goods with technical knowledge and cope with the eloquence of the rival "spell-binders." A similar system is already in operation and has afforded good results in India, and in view of the extraordinarily rapid development which is taking place in Winnipeg and the adjoining areas, in which the company is already favourably known, there is every reason to anticipate still better results from the co-operation of manufacturers with each other and with the Canadian-British Engineering Co. The company already have over 500 customers on their books in the Prairie Provinces alone, many of these customers being very large buyers of engineering plant.

The directors of the company have set themselves the task of developing the system on the lines above described, and they have our best wishes for their success in a venture which promises well, not only for those associated with them but also for British engineering trade in general.

DISTRIBUTION SYSTEM IN HAMILTON, CANADA.

By W. A. COATES.

As reported in the Electrical Review last autumn, the City Council of Hamilton, Ontario, has decided to lay underground all wires at present carried overhead within the main business area of the city. This area is considerably less than 1 sq. mile, but the cost of the change is estimated to be about £50,000.

The authorities chiefly concerned are the City Hydro-Electric Power Department, the Dominion Power and Light Co., the Bell Telephone Co., the Western Union Telegraph Co., and the City Fire and Police Departments.

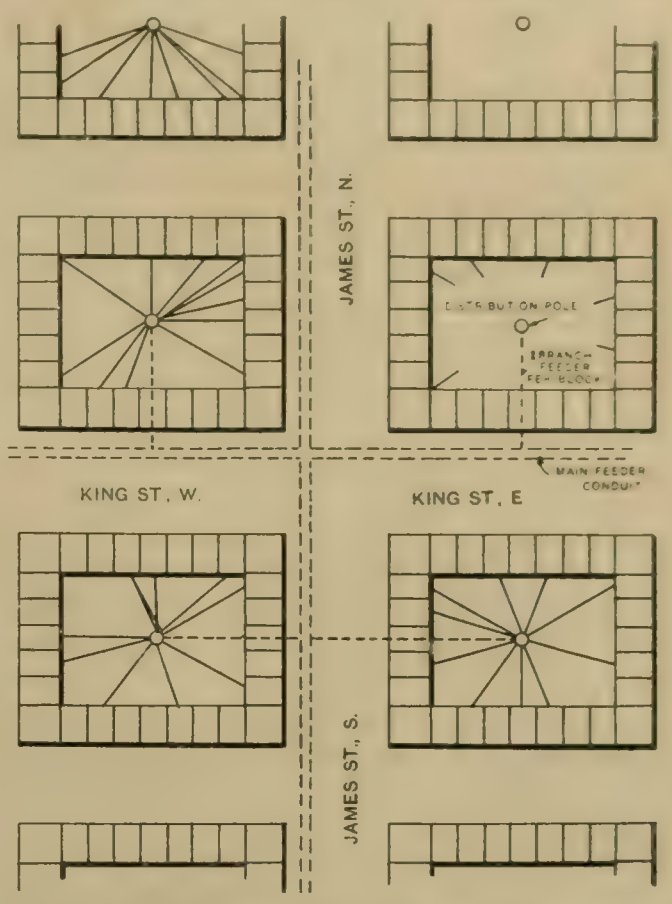
The proposal is for the Bell Co. to install their own conduit system, while the city authorities will undertake the laying of conduits for all other parties concerned, charging each with their proportionate cost.

The system of distribution to be adopted is not a fully underground one, but will be as shown in the sketch plan.

The conduits will be laid along the main streets, only one branch being taken to each block of buildings. In the centre of each block, and consequently out of sight from the street, a distribution pole will be erected, from which aerial feeders will run to the individual consumers. This scheme will avoid tearing up the footpaths to any great extent, and, more important, will obviate the necessity for changing the wiring of buildings. These are all arranged with the incoming feeder at the top of the building, and not in the basement, as is customary with fully underground systems.

This method of distribution is one deserving of careful consideration in many of the smaller English towns. It is more economical than a fully underground system, and yet retains the advantage of good appearance from the road.

Mr. Gaby, the chief engineer of the Hydro-Electric Power Commission, of Ontario, has recently made an extended European tour, and on his return is reported to have said



that he was most impressed by the neat appearance of the towns, due to the absence of overhead wires. He expressed the opinion that a like state of affairs must eventually exist in Canada. So far as we are aware, Montreal and Hamilton are the first cities to make any definite move in this direction. In both places the work of changing over is to be tackled this year.

FURTHER PROGRESS IN THE DEVELOPMENT OF THE ELECTRIC VEHICLE BUSINESS IN AMERICA.

By DOUGLAS SUTHERLAND MARTIN.

When he reads in the English papers of the wonderful faith which has inspired the banding together of the "Point-Fives," of the heroic efforts in the production and marketing of excellent off-peak apparatus, such as flat-irons and cooking ranges, and the degree of expansion which has actually been secured as the result of these efforts, the American reader is filled with wonder at the apparent disinclination of the new-business agents of the central stations in England to tackle seriously the electric vehicle business, and at least to find out by actual practice whether there is, or is not, a wealth of off-peak revenue to be obtained from it. Because in America by now the thin edge of the wedge has been surely driven in, and every succeeding year will see big increases in the sales of electrics, with a corresponding revenue to the central stations and an improvement in the load factor.

The writer had occasion to look closely into this matter for the first time two years ago, and some of the results of his study of the American situation were given in an article which appeared in the London Electrical Review in November, 1911. Since then he has followed with increasing interest the doings of the men who are behind the electric vehicle business in America, and, even in the comparatively short time which has elapsed since the publication of that article, has been able to witness, in common with any other observer of the commercial situation here, a really

wonderful progress in the driving home of the wedge. To those who are interested in the matter the writer would like to suggest that a study of these rough notes on recent progress in the development of the electric vehicle business in America could be made more profitable by a glance at the data and opinions given in his earlier article.

The reason for the apparent inaction in English supply circles might previously have seemed to be due to some doubt as to the possibility of the electric vehicle; and, in the then unsatisfactory state of the home market, to a justifiable desire to stand off from a speculation in these possibilities until, at least, some data and proof were forthcoming which would show that, with the right kind of campaign, the game was really worth the candle. Any such doubts have been long since dispelled. The American interests have furnished the proofs, and are now proceeding month by month to pile up fresh evidence of their wisdom and foresight; their courage and enterprise were never in question. Now that such splendid work is being accomplished in England in popularising electricity for domestic uses other than mere lighting, is it too much to hope that central station managers will soon begin to boost for the electric vehicle? Do they realise that the load factor of the average commercial electric is at least 30 per cent., against, say, 10 per cent. for the average industrial motor? Do they appreciate that a single 2-ton electric truck, in regular operation through the year, represents an income to the station equal to that from 86 flat irons, while representing a connected load, and therefore plant equipment, of only one-eighth that of the 86 irons? A paper which was recently presented before the Electric Vehicle Association of America, by Mr. H. W. Hillman, contained some very interesting information along this line. By means of a census of 30 central stations situated in cities ranging in population from 1,000,000 down to 25,000 inhabitants, the author of the paper compiled a table showing the relative annual income per kilowatt of the necessary plant equipment for a wide variety of loads. In his list were included large and small residences, small retail stores, churches, drug stores, industrial power installations of one, two, three, eight and twenty motors, saloons, and a 2-ton electric truck. It should be carefully noted that the revenue from the 2-ton truck was found to be second only to the saloon and the drug store. This table, and the conclusions based upon it, attracted considerable attention, and certainly furnished a striking indication of the wisdom of those supply companies who have taken at least some measures to cultivate the truck business, while, of course, not neglecting the other items enumerated in the classification. They had known of this relation before—had known that it was economically unsound to spend all their time and advertising appropriation in the cultivation of loads in which the overhead charges were always, and inevitably, high, and which could not always be regarded as profitable.

It would be idle to imagine that there is anything like a gold mine in this vehicle business, or that it can be acquired without a lot of hard work; and the English concerns which are thinking of entering the field actively will do well to learn all they can from American experience, and thereby profit from the troubles of the pioneers, even if they can take none of the glory for frontier enterprise.

The difficulties to be encountered are such that great faith in the possibilities of the vehicle load is needed before any good is likely to come—the kind of faith which is willing to devote a considerable percentage of a year's earnings to a publicity campaign, the results of which may not be apparent for three or four years. Even in Boston, the city which, of all others, has done the most meritorious work in popularising the electric vehicle, there were, at the end of 1912, only about 300 commercial vehicles in service; although, when noting that figure, the reader should bear in mind that it has grown from 120 in 1910, and from 10 in 1905. The English new-business expert can figure what this would mean in his own city, in an English city of a size comparable to that of Boston—say, Greater Birmingham. If we assume that five years' steady work in Birmingham would result in placing 100 electric trucks in service, and that the charging of these vehicles would provide an average annual load of 6,000 KW.-hours for each truck, we see that this would result in an income of £5,000 a year, taking a rate of 2d. per KW.-hour. From that point on, the revenue should increase easily at a rate of anything between 50 and 100 per cent. per year. At least 90 per cent. of the charging takes place at off-peak hours. Are this revenue and this load worth having?

Mr. Arthur Williams, the President of the Electric Vehicle Association of America, reports that in New York the number of electrics grew by 45 per cent. between the summers of 1910 and 1912, and that in the last two years electric trucking in Chicago has increased by no less than 400 per cent. In this country there are now 30,000 electric vehicles in service, 10,000 having been built in 1912—6,000 pleasure cars, and 4,000 commercial wagons. An output of 15,000 is predicted for 1913. By the end of 1915 there will very likely be 100,000 electrics in service on the streets and roads of America, giving an aggregate charging load of something like half a billion kilowatt-hours a year. There is no question as to the commercial value of such a load to the whole of the electrical industry; and, whatever progress may have been made in other directions, it certainly is difficult to sympathise with any policy of inaction in this particular field, which holds out such bright promise of an accretion of hard cash. Instead of having to commence an active campaign in 1913, the American electrical men have now their plans in nice working order, with sufficient practical experience gained in the last few years to enable them to tackle the remaining opposition intelligently, with a maximum of efficiency and a minimum of wasted effort. Apparatus is now available which, on a fair showing, runs no risk of stultifying the rosy claims which are made for it; gasolene is steadily rising in price, and horses are becoming more costly as the demand for them diminishes; rates for electrical service—especially for the off-peak demand—are dropping year by year. Ten years ago the owner of an electric had to pay anything over 20 cents per kilowatt-hour for charging his batteries. To-day he can, in most localities, obtain his supply at 3·5 and 4 cents, and in but rare instances does he have to pay as much as 5 cents. After much hard work and an unremitting energy in making representations, the Electric Vehicle Association of America, has succeeded in convincing the underwriters of the reduced fire risk associated with the electric vehicle, as well as its general safer operation and control; with the result that the insurance companies are beginning to revise their schedule of rates, and in some instances are quoting figures for the electric which will bring the annual percentage for insurance some 20 per cent. below the figures for gasolene cars and wagons. There is no lack of talking points for the electrical man. He now has everything in his favour; and, if he has troubled to equip himself with all the arguments which now stand to the credit of his apparatus, he need be afraid of no opposition.

Boosting the popularity and application of the electric vehicle presents one of the most conspicuous instances of the advantages of—or even the necessity for—the active co-operation of the various interests who stand to gain from such boosting—the central stations, the garage proprietors, the vehicle makers, and the manufacturers of the electrical equipment. Such co-operation is the first essential, and without it the rate of progress is bound to be slow, and may dwindle to a value closely approximating zero. If it is realised, the rate of progress, as we have seen, may be expressed in percentages of several hundred. There is no space here to deal with all the difficulties which are to be encountered in building up an electric vehicle industry, and how they may be overcome by the assistance of full and intelligent co-operation; nor to show in how many different directions the Associations making for such co-operation in this country—such as the Electric Motor Car Club of Boston, locally, and the Electric Vehicle Association of America, nationally—have been able to secure results. The figures are sufficient proof of the success of their efforts, and some of the things which they have been able to achieve have already been briefly touched on. Two further instances may be cited in this article, since they relate to the solution of the two most persistent problems which the pioneers in this country have been called upon to handle—the collection of concrete comparative data regarding the performance of electrics, gasolene vehicles and horse wagons; and the establishment of adequate garage and charging facilities for the users of the electric car or truck.

It is no uncommon thing for the manufacturer of electrical and other merchandise to support costly laboratories, and to stock them with a well-trained staff of scientists and engineers who pursue various lines of research connected with the materials which the manufacturer handles. It sometimes costs a lot of money, but it gives the manufacturer a standing, and generally means money in his pocket in the long run. The work of the laboratory resembles the work of a university very closely, and it is usually difficult to detect any trace of the commercial atmosphere about it. It is a more uncommon thing to find the university actively engaged in research along a line which is with difficulty separated from frankly commercial matters. Often the research faculty in the university is maintained not so much with an idea of discovering anything new, or of providing data which are going to be of any direct economic benefit, as to teach the student *how* to investigate ; and in many schools the same old l nes of work are followed year after year by succeeding groups of aspiring young engineers, who thereby learn how to research, but do not succeed in increasing the sum of knowledge at the disposal of mankind. In other, though infrequent, instances, they prosecute a line of study, the results of which are directly to be applied to the solution of a problem which is baffling someone in the commercial field, who may not possess the necessary funds and facilities himself for finding a solution.

Such study seems worth while ; and no more striking instance of its commercial value can be furnished than is given us by the contemplation of the work of a group of men at the Massachusetts Institute of Technology, Boston, working hand in glove with the local electric supply company—the Edison Illuminating Co., of Boston. One of the greatest handicaps which the sponsors of the electric vehicle have had to face has been the lack of performance data on the cost of trucking. Usually they have had to confine themselves to generalities ; and in any case their arguments have always been less convincing than they might have been had any authentic set of comparative figures been available. The Boston Edison Co., of course, were well aware of this ; and they have, therefore, been placing money at the disposal of the College Laboratory, in order that the latter may go ahead and actually find out to what degree the electric is superior to the gasolene and horse truck, and what kind of a dollar-and-cent talk can be handed out to the merchant in endeavouring to get his name to a contract. This work is still being carried on, and only recently has begun to yield results of value ; but already the expenditure has been amply justified, and the contributions which have emanated from the Boston Technical Institute, from Prof. Pender, Mr. Harry Thomson, and others have been amongst the most valuable which the electrical vehicle people have ever obtained. Reports have from time to time been given, and there will be many more such publications in the future—consisting for the most part of analyses of actual field costs taken from the records of local concerns in the territory between Boston and St. Louis. Over 100,000 observations have been made upon the speed-time performance of road transportation equipment ; and it is believed that within a few months the Massachusetts Institute will have analysed enough operating data from actual street service to furnish a basis for the predetermination of costs with fair accuracy. All this is work of the greatest commercial importance. Before the sales of electrics can amount to anything really worth while, it is essential that the vehicle men shall have the data ready to show to the merchants, and present the data to them in the only language in which merchants care to discuss the matter—the language of the dollar. We are now on the way towards such a condition ; and we may find here a very eloquent symbol of the value of co-operation.

(*To be concluded.*)

New Cable Factory.—A new factory for the manufacture of electric cables and insulated wire was registered at Helsingfors, Finland, on December 5th, 1912. Hitherto all such articles have been imported.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Mutual Protection of Engineers.

I have noticed for several weeks past in your columns letters from a number of your readers who are particularly interested in all that pertains to the advancement of those who desire and deserve suitable employment at an adequate rate of remuneration, and who are also keen to take advantage of combined action such as an institution or society would offer to its members in this respect, as well as in the equally important matters of technical improvement and social intercourse.

In none of the letters from your correspondents do I find any reference to the good work that the Junior Institution of Engineers is doing in this connection, and it has occurred to me that the present is a suitable opportunity of stating briefly the aims and objects of this flourishing body, and of mentioning the unremitting efforts of its Council in doing all that is possible for the welfare of its members.

Being established by the young men of the engineering profession for their own benefit, it has ever been essentially an institution for "juniors." Its members are recruited from all branches of engineering—civil, mechanical, electrical, mining, shipbuilding, surveying, heating, illuminating, and so on. Many members of the Senior Institutions are proud to retain their interest in the "Juniors," and a tribute to its position in the engineering world is to be found in the fact that many of the most eminent engineers and scientists have esteemed it a great honour to have been elected as its president.

The Junior Institution is governed by a Council elected by members. There is no "official list." There are no freeholds on the governing body. Every councillor serves but for a period of three years, and two years must then elapse before a past councillor can again become eligible for re-election. I mention this as, in the opinion of many "Juniors," the rule explains why the Institution is ever growing and never stagnant.

The thirtieth anniversary of its foundation was celebrated on June 30th last. The Junior Institution of Engineers can, therefore, claim to be thoroughly well established. Its membership is steadily rising to the completion of its second thousand, and it is represented throughout the United Kingdom and the British Dominions, and, indeed, throughout the civilised world. The "atmosphere" of the Junior Institution is unlike that of any similar body. Its camaraderie is a by-word, and all its many activities are thoroughly successful because of the "verve" of its governing body and the whole-hearted support of members generally.

Very few are to be found who relinquish their privileges as members once they have joined its ranks and have participated in its meetings, visits, discussions, and other technical and social events.

Any member in need of technical assistance has only to write to the secretary, who promptly puts him into touch with a fellow member whose knowledge is at the disposal of his colleague for the benefit of the Institution. Discussion evenings are held at the offices throughout the winter session —October to May—every Friday evening, when members associate without formality and seek and impart information upon various subjects of topical and professional interest, specially chosen with a view to assisting those who desire to add to their technical abilities.

In connection with the Junior Institution, an "Engineers' Register" has been inaugurated with the object of securing suitable appointments for those of its members who may be out of employment, and of obtaining posts for those who, being in employment, yet desire a change for the better. All such services are provided free of expense to members. Since the inauguration of the scheme, the Institution has been able to secure posts for all who have applied for appointments, and, as a matter of fact, more applications have been received from employers for men to fill vacancies than the secretary has received applications from employés.

In order that these few facts should be fully realised and appreciated by your correspondents, I hope that you, Sir, will be willing to find room in your columns for this letter.

W. A. Tookey.

London, E.C., *July 4th*, 1913.

[We refer to this matter in our leading columns to-day. —EDS. E.R.]

Feeder Resistances.

For the coming winter I shall require resistances for feeders for use during the winter peaks, to carry from 50 to 200 amperes, with voltage drop of about 40 volts, which should be obtainable at any of the above currents. The drop of voltage should be easily regulated within reasonable steps, so that the resistance may enable the correct pressure to be kept at the feeder end.

No doubt the problem has been faced by many stations, and I shall be very glad to have details of successful solutions to the problem. It would be quite easy to fit up elaborate resistance frames with regulating switches, but as the resistances will only be needed for a few hours in the year during the heavy peak loads, it is desirable that the apparatus should be as cheap as possible.

Feeder.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

FOR some time past the question of adopting tubes as a solution of the traffic problem in Toronto has been debated, and now a consulting engineer in Montreal has forwarded a report to the Board of Control of that city, recommending a similar solution for the traffic difficulties there. He believes that by expending some $20,000,000, a gross revenue of $3,000,000, and a net one of half that amount, could be obtained in the first year. The expenditure would cover the cost of an underground tube system having 12½ miles of double track.

The Dominion Government has arranged to construct a new Welland Canal, on which $50,000,000 will be spent during the next five years. Though not directly of interest to electrical men, it is one of the big engineering undertakings of the country, and is an indication of the growing importance of this great land. The present Welland Canal, joining Lake Erie with Lake Ontario in a course approximately parallel to that of the Niagara River, is too small, hence the need for a new one. This will have only seven locks, instead of the 27 at present in existence, and the locks are to be 800 ft. long × 80 ft. wide, and to have a 30-ft. draft capacity. The existing canal route will be followed for a portion of the distance.

The Dominion Power and Transmission Co., of Hamilton, Ontario, are going to spend $1,000,000 on an auxiliary steam plant.

As a result, no doubt, of the investigation made recently by the Dominion Government (already mentioned in these notes) as to the feasibility of utilising the great lignite beds of Saskatchewan for power purposes, one of the owners of extensive lignite deposits in the southern portion of that Province is reported to be forming a company with $1,000,000 capital, to generate power from the lignite.

The great dam being constructed by the British Columbia Electric Railway Co. on the Jordan river, to which also reference has already been made, will be finished next month. It is expected that 14,000 more horse-power will be available owing to this dam, which is 800 ft. long, and which has a maximum height of 135 ft.

At Kamloops, British Columbia, the ratepayers have decided to spend $260,000 in erecting a hydro-electric power plant on the Barriere River, about 40 miles away. An extension of the electric lighting system at a cost of $120,000 has also been decided on.

Medicine Hat, in Alberta, is to have an automatic telephone exchange for 10,000 subscribers; this will be built by the Provincial Government. Port Coquitlam, B.C., is also considering the question of having a similar system.

A steam-driven generating station, equipped with water-tube boilers of 5,000 H.P. capacity and turbo-alternators, is proposed for Prince Albert, Saskatchewan.

An additional oil engine and generator, estimated to cost about $50,000, will probably be purchased by the City of Vernon, B.C., this year.

INTERNATIONAL ELECTRICAL CONGRESS, SAN FRANCISCO, 1915.

PRELIMINARY plans for this Congress, which is to be held during the week beginning September 13th, 1915, in conjunction with the Panama-Pacific International Exposition, and under the auspices of the American Institute of Electrical Engineers, are being prepared by the Committee on Organisation. In the week preceding the Congress there will be a meeting of the International Electrotechnical Commission. The Congress is being divided into 12 sections as follows: —

1. *Generation, Transmission and Distribution.*—Central station and sub-station design, control and operation. Long-distance transmission of electric power.
2. *Apparatus Design.*—Generators, motors and transformers. Prime-movers and their relations. The rating of machinery.
3. *Electric Traction and Transportation.*—City, surface and rapid transit railways; inter-urban and trunk lines; electric vehicles, ship propulsion, mining railways, elevators and hoists.
4. *Electric Power for Industrial and Domestic Use.*—Factories, mills, refrigeration, heating devices, &c.
5. *Lighting and Illumination.*—Arc and incandescent lighting; the science and art of illumination.
6. *Protective Devices; Transients.*—Switches, circuit-breakers; condensers; electrostatics; disruptive phenomena; high frequency phenomena.
7. *Electrochemistry and Electrometallurgy.*—Electrolytic and metallurgical apparatus and processes.
8. *Telegraphy and Telephony.*—(*a*) All communication of intelligence by the use of wires. (*b*) Electromagnetic waves and radio-telegraphy and telephony.
9. *Electrical Instruments and Electrical Measurements.*—Switchboard, portable, standard and absolute instruments. Testing and standardisation methods; absolute measurements.
10. *Economics of Central Stations and Systems.*—Load factors, power factors and all problems affecting the economy of central stations; also rates and regulation by public service commissions.
11. *Electro-Physics.*—Radio-activity; Röntgen rays; gas and vapour conduction; electron theory; constitution of matter.
12. *Miscellaneous.*—Such as History of literature of electrical engineering; symbols and nomenclature; engineering education and ethics.

In each section it is desired to include as many as practicable notable papers dealing with the status or the progress of the art. Offers of papers and suggestions in this connection should be directed to the Secretary of the Committee on Organisation, Dr. E. B. Rosa, Bureau of Standards, Washington, D.C.

Lead.—MESSRS. JAMES FORSTER & Co., in their lead report for July 5th, say: "The effect of the 'bear' raids of last week on this market is gradually wearing off, and values have appreciated this week about 15s. per ton, up to £20 having been paid for July delivery and £19 17s. 6d. July shipment, and for August £19 5s., the closing prices last night being a little easier at £19 15s. July, with sellers for June shipment at £20. Arrivals here for June are just about 7,000 tons, against an average of about 10,000 tons, and even so a large proportion of the arrivals have been shipped abroad. About 2,000 tons are due to arrive early next week, and we estimate that of this about 1,000 tons will be re-shipped. There is no evidence of any existing stocks at any of the providing centres, and to supply June contracts 400 tons of lead is arriving from America, shippers admitting that they would have liked more of it. There has been a good demand from consumers, and a considerable quantity has been booked for the Continent. After next week's arrivals we anticipate a renewed pressure for early lead."

Argentina.—The report of the Société de l'Electricite de Rosario for last year states that the old generating station has been relied upon to maintain the service, but that, although run at high pressure, it was unable to meet the whole of the demand. Two drawbacks were experienced during the year—the high cost of coal owing to the strike in England and—an unusual cause—an invasion of light-attracted insects during the summer months, which forced inhabitants to make as little use as possible of artificial lighting. The new Sorrento station of the company in Rosario, which will eventually have a capacity of 40,000 KW., was put in operation at the commencement of 1913, to the extent of 18,000 KW. The current generated is three-phase (6,000 to 6,600 volts), this being transformed in four sub-stations to continuous current for the running of the tramways and for lighting in the districts formerly served by the old station. In the new districts to be supplied, the mains will be directly fed with alternating current.

LEGAL.

THE BRITISH VACUUM CLEANER CO. *v.* THE DAISY VACUUM CLEANER CO.

BEFORE Mr. Justice Neville on Friday, July 4th, MR. T. TERRELL, K.C., mentioned this patent action. He had, he said, a motion for an interlocutory injunction, but he had seen Mr. Walter, K.C., who appeared for the defendants, and had read the evidence filed on their behalf. They were agreed that it was not a case that could be decided on interlocutory proceedings, and it had been arranged, therefore, that the defendants should keep an account, and there should be no order except that the costs of the motion should be reserved.

His LORDSHIP assented.

GLYN *v.* HOLOPHANE, LTD.

(*Concluded from page* 11.)

PROF. CHAS. V. BOYS, F.R.S., further examined for the defence by MR. SHEARMAN: Does the Holophane system demand that the prisms should be a certain distance from the light, and must the light be placed a certain distance from the shade?—Yes and no, so to speak. It depends on the size of the light. If you use a small light it does not matter, but in the case of a strong light a certain distance should be maintained between the two. A small hemisphere would not be suitable for a large light.

MR. VALENTINE M. MCKINNIE, in the employ of the defendant company, explained that when the Dilux ware was purchased from the German company, in accordance with the agreement he was asked to make tests of the relative value of the Dilux and Holophane shades. He made a report to Major Glyn, pointing out the difference.

MR. SHEARMAN: Is the object of the Holophane system to throw as much light down as possible?—Yes.

And the tops and bottoms of the spheres are different?—Yes.

MR. SHEARMAN (to his Lordship) said his case was that the shades which were sold by Major Glyn at that time were inferior to Holophane, and he wanted to make it clear that Major Glyn knew that.

MR. MCKINNIE said no suggestion was made to him about grinding off the word Dilux from the shades of that name.

MR. MYGATT, in the witness-box, said his interest in the Holophane system had extended over many years, and it was not true that he had made large sums of money out of the promotion of companies in connection with the patent.

COUNSEL said there was a suggestion that the witness had bought up the assets of the company for £1,000, and Witness said the first company was started with a capital of £10,000. At the end of six years that was used up. It was proposed to get a little more capital by issuing shares, and witness took half the debentures. When the company came to an end he paid off the other debenture-holders and became liable for the debts of the company. For some time the Holophane shade was manufactured in America, and three years ago he met Major Glyn and they started the defendant company in England. Major Glyn put in £250, and witness had about £40,000 invested in the American business, which he handed over to the English company.

MR. SHEARMAN said it had been suggested that witness had neglected the interests of the defendant company, and this Mr. Mygatt emphatically denied. He said he had been ill for some time, and was not able to answer letters until September, 1911. Then he heard of the General Electric contract (by which the stock of Dilux in the hands of the G.E.C. were purchased), which had been negotiated by Major Glyn.

It has been suggested that you owe the company money, and will not pay it?—Witness replied by referring to various contracts entered into, in which assignments were made to the English company, and said he had taken the opinion of a well-known King's Counsel (now a Judge) as to his rights, and he had been advised that the company owed him nothing and he owed the company nothing. The matter had been referred to arbitration. Witness added that he heard of the Dilux contract in the summer of 1912.

Was it ever said in your presence that it was proposed to sell the stock of Dilux taken over as Holophane ware?—No.

What was your knowledge as to how Dilux compared with Holophane?—It was very inferior in every way. When he heard that Dilux was sold as Holophane he could not believe it, as he thought it impossible. He asked his informant to order a couple of the hemispheres in the ordinary course of trade to see whether it was correct that the Dilux were being sold as Holophane, and he then found that his information was correct.

Two shades were purchased, and both were found to be Dilux?—Yes.

Were they invoiced as Holophane?—Yes. Witness added that he did not hear the plaintiff say at any meeting that he had been selling Dilux as Holophane, and had been grinding off the word Dilux. The board, he said, expressed great disapproval of the plaintiff's conduct, and deprived him of his powers as managing director.

In cross-examination, Witness said that under the plaintiff's management the sales had increased, but the profits had declined of late. When the company was started he got 50,000 shares, and was also to get £25,000 in cash. He had received practically nothing of the cash.

Did you promise plaintiff, asked MR. CAMPBELL, that if he made the company a success, he would get 10 per cent. of anything that you might get out of it?—I told him that if he raised the amount of money he promised to raise and made a success of the company, I would do that which you have mentioned.

Did you charge it as fraud that Dilux ware, supplied under the agreements, was sold as Holophane?—Yes.

But that was suggested when the agreement was contemplated?—Oh, no; it was, I believe, contemplated that the stock should be broken up.

Did not the agreements contemplate that for four years Dilux ware to the value of £2,000 should be supplied, and that was to be sold as Holophane?—Witness did not agree with that interpretation of the agreement, and characterised counsel's suggestion as ridiculous.

Do you wish the jury to understand that you are charging Major Glyn with having wilfully lied to the board on December 11th?—Major Glyn stated several things to the board that were misunderstood by everybody. Major Glyn stated things to the board with the definite idea of misleading them. Witness agreed that Major Glyn was very angry when the charges were made.

LORD ERNEST HAMILTON, a director of the defendant company, also gave evidence. He said he voted for the resolution recording a lack of confidence in the plaintiff, and in doing that he decided that he was acting in the best interests of the company.

Other evidence was called to prove the sale of Dilux as Holophane, and the complaints received by the defendant company from firms in the trade.

On Tuesday, July 1st, MR. MYGATT was recalled, and asked whether he was aware of the value of the stock of Dilux at the end of 1912. He said he believed it was put down as £2,000, but he also thought the whole of the stock of Dilux was put in with Holophane stock. He strongly objected to that.

MR. SHEARMAN: There was no separate value placed on the Dilux stock?—No.

MR. E. P. BARFIELD, one of the managers of Siemens Bros. Dynamo Works, Ltd., was next called.

Have your firm, asked MR. SHEARMAN, made large purchases of Holophane shades?—Very large.

Were the spheres supplied you by Holophane of good quality in especially white glass?—Yes.

Was a conference called by the defendant company among the leading wholesale houses with regard to the sale of Holophane?—Yes. The conference dealt with the genuine Holophane material, and members of the conference were asked not to supply any cheap imitation article.

There were frequent discussions as to cheap imitations being put on the market?—Yes.

Did you know that the Dilux stock had been bought up by the Holophane Co.?—Yes.

In November of last year it came to the knowledge of the firm that there was a difference in the quality of the Holophane shades?—Yes, the spheres were very unsatisfactory and inferior.

Did complaints reach you?—Yes.

What was done with the defective spheres?—I think the majority were returned to the defendants.

Of course, the sale of inferior ware would be very prejudicial?—Oh, yes; very disastrous.

MR. CAMPBELL (cross-examining): You urged on Major Glyn the necessity of coming to some terms with the General Electric Co. regarding the sale by them of the competing Dilux shade?—Yes, and with regard to maintenance of prices.

Because you found that the General Electric Co. were competing with the Dilux ware?—Certainly.

MR. E. C. LAWTON, also an employé of Siemens Bros., Ltd., denied that he received any information to the effect that the Dilux shades were to be sold as Holophane.

MR. GEORGE LANE, A.M.I.C.E., manager of the Aylesbury Gas Co., said he was shown a sample of the Holophane shade, and was so impressed with it that he induced the managers of the Aylesbury Grammar School to purchase two 16-in. hemispheres. They were ordered from Best & Lloyd, of Birmingham, but when they came to hand, he was surprised at the difference between them and those he had seen previously. He made a complaint, and the two hemispheres were sent back. He afterwards viewed the defendant company's stock, and was handed two excellent shades in the place of the inferior ones.

That was the defendants' case, and MR. SHEARMAN said the question for the jury was whether the plaintiff had been guilty of such misconduct as would justify the defendants in dismissing him. He would argue a legal point on the articles of association of the company after the jury had given their verdict. Addressing the jury, Mr. Shearman suggested that what Major Glyn had done was done by him without the cognisance of his co-directors, and against the advice of members of the staff. He had sold inferior stuff for the real thing, thus perpetrating a fraud on the public, and that was misconduct which at once justified the defendant company in revoking his agreement, seeing that what he did was calculated to disparage the future of the company.

After MR. CAMPBELL had pointed out that Major Glyn at no time gained any pecuniary advantage from the alleged "fraud on the trade."

His LORDSHIP said Major Glyn was just as much interested in the future of the company as was Mr. Mygatt, and was, therefore not likely, *a priori*, with a set purpose, to do anything which would tend to injure the company. Major Glyn did not, it was admitted, possess technical knowledge, and in all probability he therefore *bonâ fide* believed that the Dilux and Holophane shades were to all intents and purposes similar. Was it reasonable to think that the directors, who had purchased the stock of Dilux at 50 per cent. more than its invoiced price, would throw it on the

scrap-heap without passing a resolution to that effect, and if Mr. Mygatt was not in accordance with the sale of the Dilux as Holophane, would he not have warned his co-directors of the fact that, although they paid a high price for the ware, it must be broken up so that the quality of the Holophane stock should not be depreciated? The question they had to consider was whether it was a fraud on the trade to mix up the Dilux stock with the Holophane stock and sell it—not intending to continue to do so when the Dilux had been disposed of—in the belief that one shade was as good as the other.

Without leaving the box the jury found for the plaintiff, awarding him £400 damages. His Lordship decided in the plaintiff's favour on the law, and entered judgment in accordance with the jury's findings, with costs.

Charing Cross, West End and City Electric Supply Co., Ltd., v. The London Hydraulic Power Co.

Mr. Justice Scrutton, in the King's Bench, on Saturday, July 5th, gave judgment in this case, the hearing of which was reported in our last issue.

His Lordship first dealt with the facts in regard to each burst of the defendants' water mains, and said he found that the bursts were due to subsidence of the soil above, caused by the vibration of the heavy traffic, and that the defendants' works had nothing to do with them. The pleadings alleged that the defendants' pipes were of insufficient strength, in that they were of cast-iron instead of steel, and that the joints were too rigid. He was satisfied that the cast-iron pipes and the joints were of sufficient quality, and were in accordance with first-class hydraulic engineering practice, and that while later experience might render it desirable to employ steel in some places in view of the heavier traffic now using the City, he was satisfied it was not negligent to use the pipes and joints now used. He thought the bursting of the pipes did throw on the defendants the burden of accounting for it, and that unexplained the bursts were evidence of negligence. The defendants satisfied him that the pipes which burst were sound pipes of sufficient strength, and that the bursting was due to subsidence of the soil which defendants did not cause, and which they could not by reasonable care detect. They kept watch on their pipes. They looked out for leakage, and watched the surface for subsidence. But they could not be continually pulling up the streets of the City of London to see that all was going on allright underneath. The remedy or precaution would be worse than the accidents which might happen. He, therefore, found that the defendants were not guilty of any negligence in the construction of their system, or in its working. On this finding defendants contended that they were under no liability, and that before plaintiffs could succeed they must establish negligence. All four works were executed in the statutory zone authorised by the Act of 1871, to which plaintiffs replied that while this was so, two of them were executed after the defendants' second Act of 1884 was obtained, and that though the first Act did not contain the usual section, "Nothing in this Act shall exempt the company from any indictment, suit, action or proceeding in respect of any nuisance caused by them," the Act of 1884 did contain the section. It also contained a section saying that the Act of 1871 was to be read together with that of 1884. Plaintiffs contended that the effect of these clauses was that Sec. 17 of the Act of 1884 applied to all works executed under the Act of 1871. He held that contention to be correct. The result was that the defendants had not an absolute statutory authority to lay their mains, but a power qualified by the provision that granting them the power was not to affect their legal liability and nuisance. Without the guidance of cases that had been cited, he must have given the matter more careful consideration, as it was not clear at first sight that the isolated damage not caused by defendants was a nuisance. The cases cited bound him to decide that the defendants had brought for their own profit a dangerous thing—water at a very high pressure—so that if it escaped, it did enormous damage. They were liable for escapes, even without their negligence, unless they could bring themselves within the one exception to the doctrine of absolute liability which they had not established. All the exceptions to the statutory authority which would be a defence were excluded under the terms of Sec. 17 of the Act of 1884. The gradual subsidence of the soil by wear and tear of traffic was not an act of God, which would be an exception. He had found that the subsidence did not result from the Act or default of the defendants, not did it result from the action of a third party which defendants were not under any duty to guard against, which would be a defence. But for Midwood's case (a case cited), he should have some doubt whether defendants were not affected as persons using the road in the ordinary way, and not liable for damage caused by the user unless negligence was proved. But he thought it was now an ordinary user of the road to carry mains of water, gas and electricity underneath it, and there was something to be said for the view that all these co-licensees take the road subject to the risk arising from the ordinary use of their co-users. In the result, he thought the defendants had brought a dangerous thing into the road, and the dangerous thing had escaped through the subsidence of the soil. That was just how the water escaped in Rylands and Fletcher (a cited case), where defendants were held liable. In his view, he was bound to hold the defendants in this case also liable. He, therefore, held that defendants were liable for the amount claimed, with costs. The same measure of justice would also apply to the plaintiffs as to their escapes and any damage caused.

Cork Tramway Claim.

At Cork City Quarter Sessions on June 30th, Hannah Carroll sued the Cork Electric Tramways and Lighting Co., Ltd., for £20, for loss and damage sustained through the negligence of the defendant company's servants in replacing flags on the footpath in Albert Street, Cork.

Plaintiff's case was that on April 22nd last, she was walking along the footway opposite the Cork, Blackrock and Passage Railway station, and owing to the negligent way in which the servants of the defendant company had relaid the flagging of the footpath there, she was suddenly tripped up and fell. As a result of that fall, she had been prematurely confined, and her child since birth had been suffering from injury to the spine, and was being treated for it. The defence was a denial of negligence. The flags in question had not been permanently replaced at the time, as it would have been bad workmanship to have them replaced before the ground had become consolidated. There was plenty of light at the place, and a watchman had been employed at the spot complained of by plaintiff.

The Recorder granted a decree for £6 against the company.

Infringement of Colliery Rules.

At Lanchester Police Court on the 3rd inst., Thomas Gardiner, a workman in charge of an electrical coal-cutting machine at Hamsterley colliery, near Ebchester, pleaded guilty to a charge of having infringed the special rules of the colliery. For the prosecution, it was stated that the accused had doubled the fuse in the machine. Accused was fined 20s. and costs.

H.M. Postmaster-General v. The Hendon Urban District Council.

In the Railway and Canal Commission Court, before Mr. Justice Bankes, the Hon. A. E. Gathorne Hardy and Sir James Woodhouse, on Monday, July 7th, this case was heard.

The Solicitor-General (Sir J. Simon) appeared for the Postmaster-General, and explained that the matter came before the Commissioners under the provisions of the Telegraph Acts. The Acts provided that "any body or persons within the meaning of the 1863 Act, having power to give or withdraw their consent to the Postmaster-General to place telegraph poles in or along a street or public road, and failing to do so within 21 days after request has been made by the Postmaster-General, a difference shall be deemed to have arisen between the Postmaster-General and such body or persons, and that difference shall be decided by a stipendiary magistrate, or, failing such magistrate, by a County Court Judge." It was further provided that should the parties be dissatisfied with the award, the matter might be brought before the Railway and Canal Commission Court. Such a position had arisen between the Postmaster-General and the Hendon authority in respect of the telegraph poles within the Council's area. The Postmaster-General contended that the Hendon U.D.C. was a body within the Acts which had power to give or withhold its consent, and the other side submitted that owing to the facts and circumstances about the particular roads in question, the Hendon U.D.C. had nothing to do with the matter. There was another point, as to whether the three roads affected were streets or public roads within the meaning of the statute.

Mr. Foote, K.C., for the urban authority, said he did not propose to contest that point. The only point was whether the Hendon authority was a body entitled to give or withdraw its consent.

Sir J. Simon submitted in the course of his arguments that the decision of the County Court Judge, to the effect that the Hendon Council was not a "body" within the meaning of the statute, was wrong. What happened, as had happened in this case, was that in outlying but developing districts, houses were built, large houses, and the telephone system naturally extended its feelers into such districts. A man would build his house and want the telephone. It then remained for the Postmaster-General to bring the wire to his house. The way to do that was to ask the proper authority or person for leave to go down that road. It was purely a question in this case whether the Postmaster-General had asked the right authority, but the seriousness of the matter was that if he had not there was no one else to go to as a person or body who, within the meaning of the Act, had control over the roads in question. It was argued for the Hendon Council that that authority was not responsible for the repairs of the roads in question, but that, Sir John argued, did not prove that that body was not the controlling authority.

Mr. Foote, K.C., for the urban authority, contended that his clients had not control over the roads in question such as would bring them within the provisions of the Telegraph Acts. It was quite true if the owners of a road failed to make it up to the satisfaction of the Urban Authority, the Council might call upon such owners to repair to its satisfaction, but he submitted that that did not give the Council such a control over the road as would empower it to grant to or withhold permission from the Postmaster-General to erect a telephone system down that road.

The Commissioners intimated that they would consider their judgment, and deliver it at a later date.

National Telephone Co.—Distribution of Assets.

In the Chancery Division on Tuesday, Mr. Justice Neville heard an application in the above matter.

Counsel said there was a summons in the list by the liquidator as to the distribution of the assets. The summons was partly heard by Mr. Justice Swinfen Eady, and it was important that the matter should be disposed of before the long vacation. Mr. Justice Astbury (the other company judge) had advised on the matter when practising at the bar, but the state of Mr. Justice Sargant's list was such that he thought that judge would be able to take it.

His Lordship: How long will the case last?

Counsel said he thought about a day.

His Lordship said he would consult Mr. Justice Sargant about the matter.

Johnson-Billington Electricity Meters, Ltd.

In the Company's Court on Tuesday, Mr. Justice Neville had before him the petition of W. H. Johnson for the compulsory winding-up of the above company. Counsel, who appeared in support of the petition, asked that it should be dismissed without costs. The petitioner was the only creditor of the company. His Lordship dismissed the petition without costs.

Litholite, Ltd. *v.* Travis and Insulators, Ltd.

In the Chancery Division, on 4th inst., Mr. Justice Joyce heard this action for an injunction restraining the first defendant from disclosing particulars of the plaintiffs' secret process for making litholite and restraining Insulators, Ltd., from employing Travis in breach of the terms of an agreement entered into by the latter with Litholite, Ltd.

Evidence having been called, his Lordship (according to the *Financial Times*) granted an injunction against both defendants.

British Insulated & Helsby Cables, Ltd., *v.* The London Electric Wire Co. and Smith's, Ltd.

At the Chancery Court of Lancashire, held at Liverpool on Monday, Vice-Chancellor Stewart Smith, K.C., delivered judgment in this action, which was reported last week. He gave judgment for the defendants, with costs. We shall probably quote from the judgment in our next issue.

The Poulsen Telegraphone Patent.

In the Chancery Division on July 3rd, Mr. Colefax, K.C., on behalf of the petitioner, Valdemar Poulsen, applied to Mr. Justice Warrington to allow the evidence of M. Poulsen and another witness from Denmark to be given in support of the petition to extend the time for the patent No. 8,961 of 1899, granted to M. Poulsen, to be taken before a special examiner. Counsel said these witnesses, who were in this country to give their evidence in the petition put down for hearing that day by his Lordship, had to return to Denmark before the petition could be heard.

The Solicitor-General, K.C., said he appeared for the Crown, and did not oppose the application, but the Crown must not be held to blame if all the evidence his Lordship desired was not brought out before the Examiner.

His Lordship: You can recall them.

His Lordship granted the application, and on a further application by counsel, appointed Tuesday last for the hearing of the petition.

On that day Mr. Colefax, in opening for the petitioning company (the Telegraphone Corporation of Columbia, U.S.A.), explained that the patent was for an apparatus for storing up speech or signals by magnetically influencing magnetisable bodies or wires. It was an invention of striking novelty and note, and he would call expert evidence to say that until the apparatus was seen working it was not thought possible that the terms of the specification could be carried out. The invention was based on the fact that when a body made of a magnetisable material was touched at different points and at different times by an electromagnet included in a telephonic or telegraphic circuit, its parts became subject to such varied magnetic influences that conversely by the action of the magnetisable body upon the electromagnet, the same sounds and signs were subsequently given out in the telephone or recording instrument as those which previously caused the magnetic action on the magnetisable body. Pulling it simply by means of a wire or band of metal becoming magnetised by means of a current set up when an ordinary telephone was spoken into, it was possible to faithfully reproduce inflexions of the human voice upon the steel band or wire with extraordinary clearness. The invention was of the greatest importance to the telephonic transmission of speech, because by the device used in conjunction with a telephone, it was possible to take communications transmitted in the absence of the subscriber for whom they were intended, to be given out again in faithful reproduction wherever required. Briefly put, it was a method of receiving, storing and reproducing messages, signals, or the like, by subjecting a magnetisable body, such as a steel wire or strip, to the action of an electromagnet which moved along it, or along which it was moved, the coil of the magnet being first in connection with the transmitter, so that the wire or strip was influenced in a manner corresponding to the signal transmitted, the coil being then in connection with the telephone receiver, by which the signals which influenced the wire or strip were reproduced. From a commercial standpoint, continued counsel, the greatest future of the machine was as a dictating machine, and it had been perfected by the long labours of Danish and American companies. The machine, as originally constructed, was composed chiefly of a horizontal cylinder or band which reproduced, with extraordinary clearness, the human voice, but it had one or two serious drawbacks, one was that the electromagnet travelled over it in about half a minute, which, of course, rendered the apparatus useless as a dictating machine. Then there was an improved pattern brought out in which the cylinder was superseded by a piano wire coiled round drums. The wire travelled from one drum to another, and was of considerable length, and would run for some 30 minutes. When the record of the conversation and dictation was taken, the drums or spools of wire could readily be tranferred to another machine, and the conversation or whatever it might be clearly reproduced. There were other improvements, and the result of it all was that the human voice was reproduced without that nasal twang and distortion which was the difficulty with the ordinary gramophone and disk machines.

Mr. Justice Warrington said the British patent had already expired; he did not know whether any difficulty arose with regard to that.

The Solicitor-General said he did not intend to raise any ground of objection with regard to that.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Disc" Moving-Coil Instruments.

The accompanying illustration shows a moving-coil instrument of the long-scale type, suitable for use on a D.C. switchboard, which Messrs. Everett, Edgcumbe & Co., Ltd., of 117, Victoria Street, S.W., have recently introduced. These instruments are similar in appearance to the same firm's long-scale instruments for A.C. circuits, in which the scale occupies practically the whole of the circumference. The scale is exceptionally long considering the size of the instrument, and is extremely easy to read even from a considerable distance. The "Disc" type moving-coil ammeters and voltmeters have evenly divided scales and are magnetically shielded; temperature errors are quite negligible. They are also extremely dead-beat in action. A full scale deflection is obtained with 0·075 volt across the shunt terminals up to and including 3,000 amperes. Above this current the volt drop is special. The voltmeters are directly connected, in general through an external resistance box, up to 800 volts.

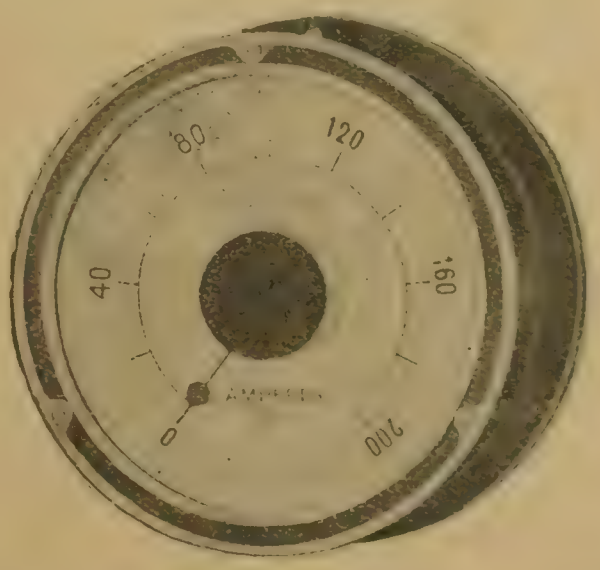


Fig. 1.—"Disc" Type D.C. Moving-Coil Ammeter.

The standard finish is a bright black stove enamelled cast-iron case with the facings in relief of polished nickel or copper. They can be supplied of the projecting pattern for mounting direct on the board, and of the flush pattern to be let into the board. They can also be supplied of the controller pattern with a flanged base for use with ironclad gear. The overall diameter of the projecting pattern is 9⅛ in.

Mirrlees Condensing Plant for the Glasgow Tramways.

In connection with the 5,000-kw. turbo-alternator which has recently been installed by the Glasgow tramways department, the condensing equipment, as in the case of the previous seven sets, was supplied by the Mirrlees Watson Co., of Scotland Street, Glasgow.

The condensing plant is of the surface type, with a single turbine-driven pump set for air and water extraction, and circulating purposes, and is designed to deal with 72,000 lb. of steam per hour, giving a 28-in. vacuum with cooling water at 70° F. The condenser

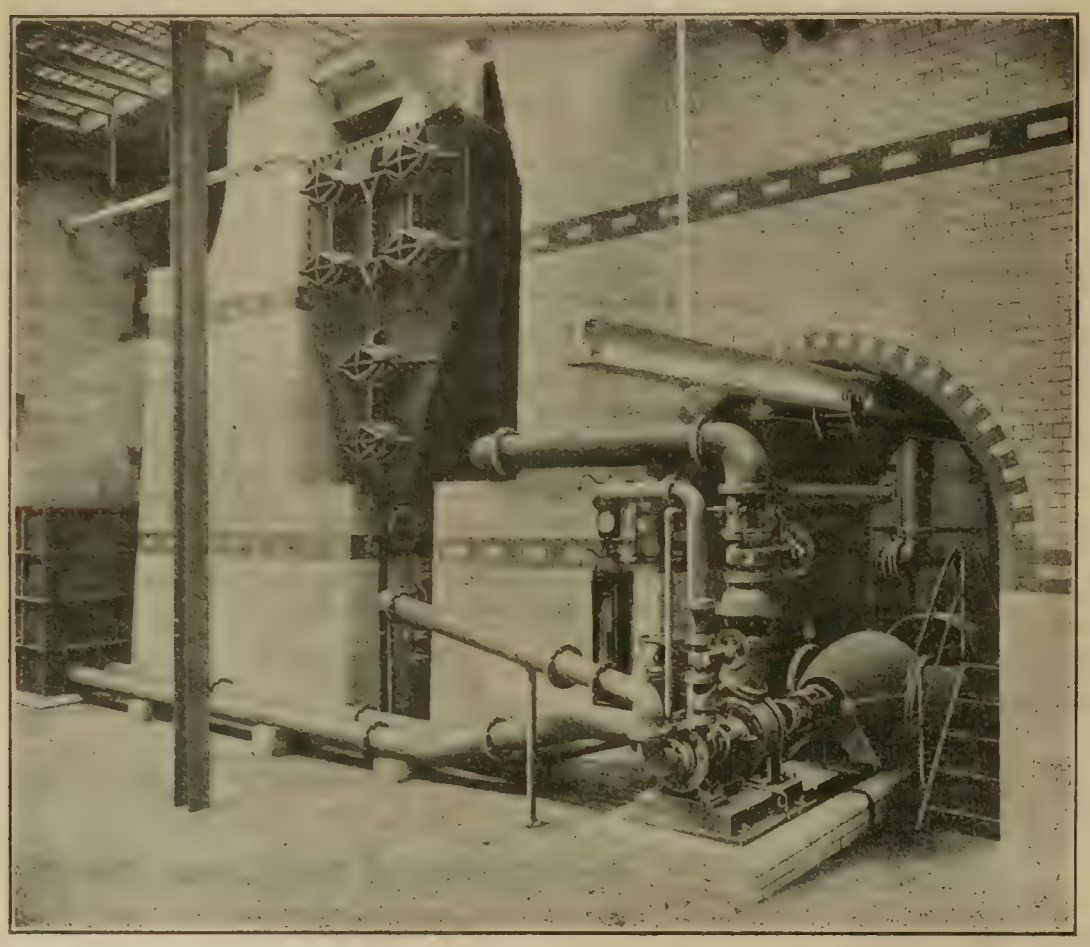


Fig. 2.—Condenser with Turbine-Driven Mirrlees-Leblanc Rotary Air Pump and Centrifugal Circulating Pump for 5,000-kw. Turbine.

is wedge shaped, with 10,200 sq. ft. of cooling surface, and the internal tubing is arranged so that the circulating water passes from end to end three times before being discharged.

The air and water extraction pumps are of the Mirrlees-Leblanc rotary pattern, mounted on the same spindle as the centrifugal circulating pump, and direct driven at 2,000 r.p.m. by a 120-B.H.P. Curtis steam turbine. The water extraction pump delivers to a Lea Recorder placed 20 ft. above the floor. The circulating pump delivers 6,000 gallons per minute against a total head of 20 ft.; it is fitted with six small diameter impellers working in parallel and

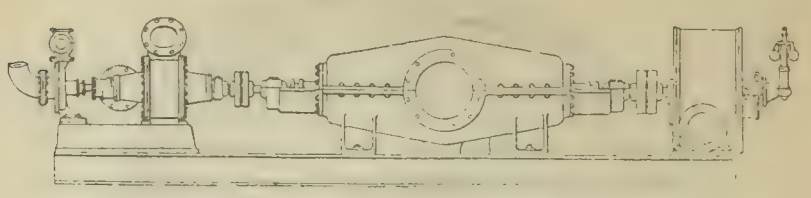


Fig. 3.—Diagram Showing Mirrlees Turbine-Driven Pump Set, Consisting of (left to right) Condensate, Air and Circulating Pumps and Turbine.

has an efficiency of 62 per cent. Our illustrations, figs. 2 and 3, show the extremely compact design of the pumping set, which, we understand, is practically noiseless in working.

From readings taken under usual working conditions, when the steam per hour dealt with increased gradually from 64,000 lb. to 90,000 lb., the vacuum in the turbine exhaust chamber dropped gradually from 28·6 in. to 28 in., the circulating water inlet and outlet temperatures being 54° F. and 80° F. for the lower duty, and 63° F. and 89° F. for the higher duty, and the temperature difference between inlet steam and circulating water outlet being 4° F. at approximately the rated duty of the condenser.

St. Germans.—Workhouse Lighting.—The B. of G. has appointed a Committee to consider a more modern method of lighting the workhouse premises, oil being the present illuminant, together with the advisability of installing a telephone system. Some three years ago the board decided in favour of the electric light, but the proposal was never carried out. There is now a prospect of electricity being introduced into Torpoint, in which event the supply will be available for the workhouse.

BUSINESS NOTES.

Book Notices.—We have received from Messrs. Creed, Bille & Co., Ltd., of Telegraph Works, Selsdon Road, Croydon, a handsome brochure describing the Creed system of high-speed automatic printing telegraphy, which is in use in the offices of six British and foreign Governments and four leading submarine telegraph companies. In this system the keyboard is an essential component; the keyboard perforator works at 60 words per minute; the receiving perforator can reproduce Wheatstone perforated slip at 200 words per minute, and the printer, controlled by the perforated tape, turns out the message in large capitals at a speed of 775 letters, or 155 words, per minute. The system can be readily adapted to work in conjunction with existing systems without a specially trained staff, and greatly increases the capacity of the lines, besides saving all manual retransmission and copying. The British Post Office employs it at several of its chief offices, and it is working on a number of submarine cables up to 500 miles in length, as well as on landlines 2,000 and 3,000 miles long; excellent reports from the users are reproduced, one in particular from Lord Northcliffe referring in almost enthusiastic terms to the efficiency with which the Creed machines transmit the entire contents of the *Daily Mail* to Manchester, saving time and labour and preventing errors. Descriptions of the apparatus are given, largely reprinted from our pages, and an account of the *Daily Mail* installation is included. The style of the brochure deserves special mention, the paper, printing and illustrations being of the highest order.

"Science Abstracts." Vol. XVI, Part 6. June 30th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Experimental Wireless Stations." By Philip E. Edelman. Minneapolis: The Author. Price $2.

"Graphs in a Cable-Ship Drum-Room. Notes for Junior Assistants." By E. Raymond-Barker. London: H. Alabaster, Gatehouse & Co. Price 2s. 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 5, May, 1913. Chicago: The Society. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 7, July, 1913. New York: The Institute. Price $1.00.

"*Bulletin* Mensuel of the Société Belge d'Electriciens, Vol. XXX, May, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, May, 1913. Liége: The Association. Price 13 fr. 50 c.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 25, May, 1913. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"Annales des Postes, Télégraphes et Téléphones." June, 1913. Paris: A. Dumas. Price 6 fr.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 12, June, 1913. Milan: Stucchi, Ceretti & Co. Price L 1.50.

Mr. Ferdinando Geronimi, of Piazza Venezia 2, Milan, informs us that arrangements have been made with the Committee of the Congress which enable him to offer his "Chronique Illustrée du Concours International de Télégraphie Pratique" at the low price of 10 francs, post free.

Patent Applications.—Application has been made by Edward Temple for restoration of Patent No. 25,736, of 1908, for "Improvements in and relating to washing or purifying apparatus for use in gas generating plants."

Mr. Justice Warrington, in the Chancery Division, will, on October 27th, hear the petition of the National Telewriter Co., Ltd., for an extension of the term of patent No. 24,048 of 1899 (granted to Foster Ritchie), for "Improvements in telautograph apparatus."

Catalogues and Lists.—Messrs. Siemens Bros. and Co., Ltd, Woolwich, Kent.—Illustrated leaflet (No. 534 I) describing the Siemens watertight loud-speaking marine type telephones.

Messrs. Everett, Edgcumbe & Co., Ltd., 117, Victoria Street, Westminster, S.W.—Catalogue sheet (10A) describing a new type of moving coil long-scale instruments suitable for use on continuous-current switchboards.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—Two new circulars, "H" and S35. The former which is a second and enlarged edition of 16 pages, relates to tumbler switches for the control of heating and cooking appliances, a large number of controls being shown. The latter is a four-page list of the "Imp" single and two-way switches.

The Sanitas Electrical Co., Ltd., 61, New Cavendish Street, London, W.—A batch of fully-illustrated lists giving brief particulars and prices of their electric vibrators and hot and cold air apparatus, also a large sheet of illustrations of the numerous electro-medical instruments and outfits supplied by the firm.

Messrs. Werths & Co., 41, Aldersgate Street, London, E.C.—Lists relating to and giving prices of their non-rubber compound for insulating and filling in cable ends, sleeves, &c. ; also "Elektra-band" insulating tape, both of which they are introducing. Certificates of tests of the compound, made at the Physical-Technical Imperial Institute at Charlottenburg, accompany the lists.

Messrs. Erith's Engineering Co., Ltd., 70, Gracechurch Street, London, E.C.—No 213 catalogue (second edition) of 20 pages fully describes and illustrates with both half-tone and sectional views, their patent recording heater, purifier and filter.

The Westinghouse Cooper-Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—List No. 24 contains illustrated descriptive matter relating to Cooper-Hewitt mercury vapour converters for projection arcs, with notes on their advantages, installation, bulb replacement, and tabulated prices, on single and three-phase supplies, 40-60 periods. These converters have been largely adopted for use in cinematograph theatres on A.C. supply, providing the advantage of low-voltage D.C. for the arc with the economy of regulation possible with A.C.

The Edison and Swan United Electric Light Co., Ltd., Ponder's End, Middlesex.—Specimens have been received of electric fan postcards that are being issued to the trade. The supply is limited, but we understand that the company will send a number to any of their fan customers who have not already received same.

Messrs. Veritys, Ltd., 28, King Street, Covent Garden, London, W.C.—24-page export list (No. 724) of Aston tropical fans—desk, ceiling, railway carriage, saloon, ships' cabin, portable, electrolier and other types, also the "Aston-Sirocco" D.C. pressure blowers. Fan speed regulators are also shown and priced.

Messrs. Siemens Bros. Dynamo Works Ltd., Tyssen Street, Dalston, London, N.E.—Price list D10 (20 pages) contains full particulars, illustrations, and prices of weatherproof lanterns, (including new designs of internal fittings, with white enamelled zinc reflectors, for gas lantern conversion) and street lighting fittings (brackets, lamp-posts, &c.) for "Wotan" and tantalum lamps. Among the devices illustrated is the new Goliath Edison screw-holder for use in connection with high C.P. lamps burning in series. This is fitted with a special shunting device which immediately completes the circuit in case of a lamp failure and also when the lamp is withdrawn from the holder. Copies of the list will be sent to illuminating and other engineers interested in street lighting schemes.

Dissolutions and Liquidations.—G. C. Milnes, Voss & Co., Ltd.—This company is winding up voluntarily with Mr. H. R. Graves, 51, North John Street, Liverpool, as liquidator. A meeting of creditors is called for July 18th.

Anglo-Norwegian Aluminium Co., Ltd.—This company is winding up voluntarily with Mr. F. C. Potter, 28, Victoria Street, S.W., as liquidator. A meeting of creditors is called for July 18th.

International "Z" Lamp Association, Ltd.—A meeting will be held on August 11th, at 22-28, Broad Street Avenue, E.C., to hear an account of the winding up from the liquidator, Mr. C. Field.

H. F. Angus & Co., manufacturers of and dealers in scientific instruments, 83, Wigmore Street, Cavendish Square, London.—Messrs. M. J. Swift & H. F. Angus have dissolved partnership. Debts will be attended to by Mr. Angus who will continue the business under the same style.

Liverpool Fittings Co., electrical fittings and accessories dealers, 55, Renshaw Street, Liverpool.—Messrs. E. J. Arnold and I. E. Poyser have dissolved partnership. Mr. Poyser attends to debts, &c., and will continue the business under the same style.

Doncaster Electrical Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. A. E. Stringer, Manor Row Chambers, Bradford, one of the liquidators, by July 21st.

The Electrical and Incandescent Stores, Manchester Chambers, Parliament Street, Nottingham.—Messrs. G. Moore and J. T. Kemp have dissolved partnership. Mr. Kemp will attend to debts and continue the business under the old style.

Bankruptcy Proceedings.—Frank Hucks, electrical engineer, 2, Adelaide Road, Hampstead.—The public examination was held on June 3rd, at the London Bankruptcy Court, before Mr. Registrar Hood. The receiving order was made on June 4th last, on the application of the debtor, who returns unsecured liabilities £777, and assets, good book debts, £111, and a bad debt of £90. Replying to Mr. W. P. Bowyer, Official Receiver, the debtor stated that, having previously been employed in the trade, he, in October, 1908, commenced business as an electrical engineer and contractor at his father's office in James Street, Camden Town, removing in May, 1910, to 18, Charing Cross Road, W.C. From February, 1911, till last February he carried on the business from Adelaide Road. In May he formed a company to conduct aerial flights, and had since been employed by the company. Witness attributed his insolvency to loss on contracts owing to their having been underestimated, and to ill-health. The examination was concluded.

Trade Announcements.—Messrs. Wm. White & Co., of 25, Budge Row, E.C., announce a change in their telephone numbers to :—City 689 (three lines).

Messrs. Scholey & Co., Ltd., announce that their telephone number has been altered to "City 5863" (two lines).

Messrs. Scarr, dealers in electric light fittings, have opened new premises at New York Street and Kirkgate, Leeds.

The "Baldur" Engineering and Supply Co., Ltd., 39, Victoria Street, S.W., have been appointed sole agents for London by the Stella Conduit Co., of Bilston. They have taken additional stores for the purpose of carrying a complete stock of conduits and conduit fittings for immediate delivery. They will forward lists of cables and electrical accessories on application.

Messrs. Morris & Lister (London), Ltd., 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W. (directors, Mr. D. K. Morris, Ph.D., M.I.E.E., Mr. F. J. Bakewell, A.M.I.M.E. ; manager, Mr. Philipp Laubach, A.M.I.E.E.), have now taken over the whole selling organisation of Messrs. Morris & Lister, Ltd., Coventry, and are developing further agencies for the sale of electrical apparatus of all descriptions. All inquiries, &c., should be addressed to Messrs. Morris & Lister (London), Ltd., instead of to Messrs. Frampton & Paine, as formerly.

Mr. Lester B. Betts, who has for some years been associated with the electrical export trade, has started business as a manufacturers agent and general wholesale and export supplier, at 9, London Street, E.C., under the style of Lester B. Betts & Co., Ltd., and has the agencies for several important English and Continental manufacturers.

LIGHTING and POWER NOTES.

Accrington.—The borough electrical engineer has reported that the sulphate of ammonia plant in connection with the gas engines at the electricity works is now in working order again, and that the sulphate on analysis is quite satisfactory. He has also reported that the Accrington Brick and Tile Co. has put to work a 220-H.P. motor, the largest individual motor on the plant.

Barrow.—According to a report by the borough treasurer, the gross profit on the electricity department for the past year was £8,274, and the net profit £702.

The Council has decided against reconsidering the lighting of the main streets of the borough, although a claim was made for high pressure incandescent gas lights rather than the present electric lights.

Belfast.—New Loan.—The T.C. has decided to apply for sanction to a loan of £35,000 for mains, services and meters, in connection with the electricity undertaking.

Blackburn.—The abstract of accounts for the year ended March 25th last shows that the income of the electricity undertaking was £42,460, and the expenditure £36,916, leaving a profit for the year of £5,544. In the provision for the redemption of debt there is set aside £11,161.

Bootle.—Annual Report.—Mr. T. D. Clothier, the borough electrical engineer, in his report, states that the trading of the undertaking has resulted in a surplus revenue which has been sufficient to pay interest on the capital employed, the sum required to repay the capital within 25 years, £200 into the machinery insurance account, £1,500 as a contribution in aid of the general district rate, and £860 as a contribution to the contingency fund. The surplus shows an increase over that realised last year, and exceeds the amount which was estimated by £439. The undertaking is now in a position to supply large consumers, and to give a bulk supply wherever this is required. The new generating station is nearing completion, and will be used in conjunction with the Pine Grove Station during the latter part of the ensuing year. The need for laying a second H.T. feeder, and providing a sub-station, has necessitated the immediate provision of this plant. The Committee has not seen its way to revise the rates of charging until after beneficial use of the new works has been obtained, more especially in view of the heavy increase in the price of coal.

Bournemouth.—Public Lighting.—The T.C. has decided to apply to the L.G.B. for a loan to carry out schemes of electric lighting at the Undercliff Drive and the West Undercliff Promenade. Arc lamps of 2,000 C.P. each are to be utilised ; current will be supplied by the Bournemouth and Poole Electricity Supply Co., Ltd.

Bradford.—The system of supply in the Leeds Road district east of Lapage Street is to be changed from direct to alternating current. The cost of providing new cables and relaying cables is put at £1,500.

Burnley.—Annual Report.—The report of Mr. J. E. Starkie for the year ended March 31st last, shows that the total capital expenditure was £132,961, against £126,895 the previous year. The total net income from all sources amounted to £29,751, against £26,940 for the previous year, an increase of £2,810. The increased income of £2,810, after deducting £848 increased costs, represents £1,962 more profit on revenue account than in the previous year, the gross profit this year being £15,998, against £14,036. The net profit is £7,926, against £6,781 in the previous year. The balance of reserve and depreciation fund now stands at £23,038, which represents 17·3 per cent. on the total capital expenditure, or 28·8 per cent. of the amount still owing on mortgage loans. The capacity of the plant now stands at 3,890 KW. The amount contributed towards the relief of the rates is £4,500. The total units sold were over 4½ millions, an increase of 535,000 on the previous year. Mr. Starkie recommends that a new booster and automatic regulator be obtained to deal with peak loads on traction, and thus obviate the necessity of running small sets for short periods. The cost of the above plant is estimated at £550, but the engineer states that there is no doubt as to its being a very remunerative investment.

Cardiff.—Proposed Loan.—It is stated that the Corporation has been asked to raise a loan of £30,000 for the provision of new plant at the power station.

Carlisle.—There was a gross profit of £8,736, and a net profit of £1,509 on the working of the electricity undertaking during the past year. The net profit for the previous year was £3,340.

Continental Notes.—Austria.—The Erste Brunner Maschinenfabrik Gesellschaft, of Brunn, reports an increasing demand for steam turbines. Last year such plant to the extent of 71,000 H.P. was turned out, while among the orders at present in hand are five with a capacity of over 40,000 H.P. for the new central electric lighting stations of the Vienna municipality. The company has also lately taken up the construction of Diesel engines.

Italy.—A company has lately been formed at Bivongi with the title La Societa Idro Elettrica L'Avvenuire to establish a plant to utilise certain available water power near that town in the generation of electrical energy for lighting and power purposes.

France.—A new departure in electric lighting schemes is being made in the Marne department of France, where the authorities of no less than 52 communes have formed an Inter-Communal Commission with the view of drawing up a scheme to establish a central generating station for the supply of electrical energy for lighting and power purposes throughout the district.

Croydon.—The Guardians have adjourned the consideration of the question of wiring the Crosslands and Linden Homes, in order to enable the clerk to submit a return of gas, &c., used at these homes during the past year and the cost of electric lighting, &c., at the Pawson's Road Homes.

Darwen.—Loan Sanction.—Sanction for the borrowing of £3,572 for mains, £1,050 for extension to boiler house, and £1,778 for new boiler, &c., and transformers, has now been received from the L.G.B.

Durham.—Colliery Electrification.—The Londonderry Collieries, Ltd., has decided on an extensive scheme of electrification at its Seaham and Silksworth Collieries, under the direction, and to the specification of Mr. W. C. Mountain, of Newcastle-on-Tyne, the consulting engineer to the company. At the Seaham Colliery a 750-KW. mixed-pressure turbo-generator is being installed, as also a 160-H.P. electrically-driven three-throw pump for main shaft pumping purposes. Two new haulage gears with motors of 500 H.P. are also being put down to replace the old steam-operated gear, the boilers in connection with which underground are being removed. At the Silksworth Colliery two 750-KW. turbo-generators, arranged to be operated by the exhaust steam from the winding engine plant, are being laid down, together with three electrically-operated haulage gears.

Ebbw Vale.—A serious explosion occurred on Wednesday, last week, at the Ebbw Vale blast furnaces, which is reported to have completely wrecked the boiler house and "electric lighting" house.

Egglescliffe.—The P.C. is considering with the Preston P.C. an offer by the Cleveland and South Durham Power Co. to introduce the electric light into the parish. Providing there is a sufficient demand, the company will supply current at 4½d. per unit.

Elland (Yorks.).—A Sub-Committee of the Street Lighting Committee of the District Council has recommended that all the arc lamps be converted into high C.P. street lighting lanterns. The recommendation has been adopted, and tenders are to be invited for the supply of lanterns.

Farnworth.—The Electricity Committee has amended the lighting charges as follows:—That power consumers of 2,000 units and over per quarter be allowed 10 per cent. of the annual consumption for lighting and other purposes; current for lighting in excess of this quantity to be charged at lighting rates.

Foleshill.—The D.C. has received intimation of the intention of the Midland Electric Light and Supply Co. to apply to the B. of T. for a prov. order to give a supply to various portions of Warwickshire, including Bedworth, Binley, Walsgrave, and Willenhall.

Glasgow.—Although it will be some time yet before the annual report of the T.C.'s electricity department is issued, the Glasgow correspondent of the Review learns on good authority that something in the nature of a record has been accomplished in the 12 months ending May 31st. It is stated that the output works out at about 50 per cent. above that for 1911-12. This is attributed in great measure to the many power consumers now supplied from the Corporation mains, quite a number of steam plants in large works having been displaced by electrical installations recently. A no inconsiderable fillip has also been given by the growing popularity of electricity for heating, cooking and other domestic purposes, apart from lighting. In this respect, however, the electricity department labours at a disadvantage compared with the gas undertaking, under whose auspices cookers are given out free, while gas fires are supplied on the hire-purchase system. The electricity department has not even a showroom and cannot, or has not the T.C. sanction to supply appliances direct to the consumer. It is understood too—the high prevalent prices of coal notwithstanding—that the balance-sheet is a most satisfactory one. Definite figures are not yet available.

Grasmere.—A postcard canvass is being made by the Windermere and District Electric Lighting Co., in order to ascertain whether it will be worth while to extend the cables to the parish.

Hamilton.—Plant Extensions.—Plans passed the Dean of Guild Court last week, for an extension costing between £9,000 and £10,000 at the electricity works of Messrs. Edmundson's Corporation, Ltd. A new high-speed engine and dynamo of 400 KW. capacity and new condensing plant for 1,000 KW., together with Babcock boilers, will be added.

Hastings.—At Friday's meeting of the T.C., the chairman of the Electricity Committee, in reply to questions, said the present charge of 6½d. per unit to private consumers came into force on July 1st, 1909; since that date the prices for current for heating and power had been reduced from 3d. to 1½d. per unit, and the cost per unit calculated upon current sold was '98 of a penny. A proposal of the Electrical Committee to reduce the price of current for heating and power to 1d. per unit and reduce the rental of meters was rejected, and the Committee was directed to consider the advisability of reducing the cost to private consumers.

King's Lynn.—Annual Accounts.—The annual statement of accounts shows a profit of £876 on the past year's working of the electricity department, as compared with £503 in the previous year, despite the fact that the rise in the price of coal had caused increased expenditure and the rates were £94 more. From the year's profit the Committee decided to pay off the past year's capital expenditure on mains, meters, &c., amounting to £246. This would leave £629, which would bring up the balance in the reserve fund to £2,140, which will be used for the extensions of plant and buildings recently decided on.

Leeds.—The City Council has adopted the recommendation of the Electricity Committee for supplying electricity to Bramley, and has authorised the construction of two transformer chambers at Bramley, the engineer (Mr. C. N. Hefford) to lay mains at a total estimated cost of £10,200. The British Westinghouse Co. has been instructed to supply five 325-KW. 50-period rotary converters for Bramley and Kirkstall stations at total cost of £3,885. A spare main from Copley Hill to Bramley is to be placed at the service of the department.

London.—Hackney.—In consequence of the rise in prices, and the ultimate selection of the sub-station sites, the Electricity Committee of the B.C. recommends the adoption of a supplemental estimate of £3,250, which represents the extra cost of the conduits and mains work required to be done in connection with the scheme for extending the transmission and feeding systems.

Hammersmith.—*Proposed Hydraulic Coal Storage and Conveying Plant.*—The E L. Committee is recommending to the Council, in principle, a novel scheme for coal storage and conveying in connection with the electricity works, which has been outlined by Mr. Bell, the borough electrical engineer. The cost of delivering coal over the Corporation wharf to the electricity works, at present works out at 5·85d. per ton, but as additional coal is handled over a private wharf, the cost actually averages 7 02d. per ton. In order to safeguard the fuel supply at the station and prevent deterioration, Mr. Bell proposes to store the coal there under water in tanks, five of which are suggested. His complete scheme appears to be to lift the coal from the barge by a Priestman Grab, dropping it into an automatic weigher, from which it would pass into a hopper, and from the latter be automatically fed into a suction tank by a centrifugal suction dredger pump; the tank would also be fed with water from the station circulating mains or from the return pipe from the coaling tanks. The dredger pump would deliver a mixture of coal and water to a pipe line (15 per cent. of the volume being coal), the velocity in the pipe being 7 ft. per second. The pipe would deliver to an auxiliary coaling tank, which it is suggested shall hold a barge load of coal, near the station, and if it were decided to transfer the coal to a main storage tank, another pump and pipe line would be installed for this purpose. Return pipes and pumps for returning the water to the wharf would be installed, and a mechanical conveying plant for lifting the stored coal to the bunkers. The estimated cost is put at £10,000, exclusive of the mechanical conveyor, and it is proposed to submit detailed costs, if the Council approves of the scheme.

Poplar.—The Electricity Committee reported at the last meeting of the Council that, having regard to the fact that the showroom in East India Dock Road had proved self-supporting and had been of considerable benefit to the undertaking in the rapid extension of business, it had under consideration the question of providing similar accommodation at Bow.

Woolwich.—The L.C.C. has sanctioned the borrowing of the following sums for electricity purposes:—£1,500 for mains, repayable in 25 years; £1,100 for house services, repayable in 12 years; £630 for meters, repayable in 10 years; and £1,000 for electrical apparatus for hire-purchase, repayable in 10 years.

Dock Crane Equipment.—The Port of London Authority has recently reviewed the question of crane equipment at the Albert Dock, and it is proposed to replace 31 hydraulic cranes at present in use by 43 new electric cranes for lifting normally 30 cwt. loads and at reduced speed up to 3-ton loads. According to the *Shipping World*, one fact which has influenced the Authority, is that the working of electric cranes is less costly than that of hydraulic cranes. The displaced cranes are, however, to be utilised in the upper docks.

Loughborough.—Plant Extensions.—The T.C. on Monday decided to apply to the L G.B. for loans of £14,000 for electricity purposes. Of this £11,000 is for a 1,000-KW. generating set for the supply of alternating current, and £3,000 for cables, meters, &c.

Manchester.—Loan Sanction.—The Corporation has received sanction from the L.G.B. for the borrowing of £45,000 (repayable within 24 years), and £30,000 (repayable within 15 years) for electricity purposes.

Melbourne (Derbyshire).—Street Lighting.—The P.C., on the recommendation of the Lighting Committee, has approved of a scheme submitted by the Melbourne Electric Light and Power Co., for lighting the major portion of the town by electricity.

Middleton.—At a meeting of the T.C., on July 2nd, when the question of the lighting of the centre of the town was discussed, certain members urged that gas as an illuminant should be considered along with electricity. Councillor Wood, however, pointed out that the Council must recognise that, as the centre of the town had always been lighted by electricity, they would have to continue that method, or else pay a considerable sum to the Electricity Committee. They would like to have the centre of the town uniform, and they would certainly go into the question of gas with regard to the other parts of the town, in order to see if it could be done at the same cost.

Newport (Mon.).—The repairs in connection with the recent fire at the Corporation power station will cost about £1,000; a tender of the G.E. Co. to carry out repairs to plant has been accepted.

Oulton Broad.—Public Lighting.—The U.D.C. has requested the Oulton Broad Electricity Co. to submit a tender for public lighting.

Paisley.—The electric light installation at the Hawkhead Asylum, which has cost approximately £3,000, was formally inaugurated on June 26th.

Ripon.—The T.C. has received notice from a firm of its intention to apply for a prov. order for electric lighting in the city.

Rochester.—Street Lighting.—In connection with his scheme for the electric lighting of the High Street, Mr. Harvey, engineer of the Kent Electric Power Co., has asked the Council's permission to put up an experimental installation which would, he states, enable the Committee to form an opinion as to the efficiency of the system, and would form the basis of an estimate for the cost of the whole system. Subject to the Corporation not being in any way committed to the adoption of the scheme, the necessary permission is to be given. The borough librarian, in his yearly report, complains of the need of some improvements in the lighting arrangements of the library, as, owing to the large number of gas burners necessary for efficient lighting, the library, he states, gets into a very close and unhealthy condition during the evenings.

Rochdale.—Loan Sanction.—The L.G.B. sanction has been received to the application for permission to borrow £30,000 for extensions to the electricity works.

The Electricity Committee has intimated to the Heywood Corporation that, owing to the applications it is now receiving for large supplies of electricity for power purposes, it does not feel warranted in undertaking to supply electricity in bulk to the Corporation.

Royton (near Oldham).—The U.D.C. has had under consideration the question of the supply of electricity by the Oldham Corporation to the Industry Mill, Royton, and has resolved that the Corporation be asked to canvass the district with a view to ascertaining the probable demand for electricity in Royton. The Council will then decide whether to apply for a special lighting order.

Sheffield.—Annual Report.—The general manager (Mr. S. E. Fedden) reports that the total income of the electricity supply department from all sources during the year ended March 25th last, amounts to £116,210, as against an expenditure of £41,663, leaving a gross profit of £74,546. From this sum has to be deducted £24,078 for interest on productive capital, and £29,137 the annual instalment to be set aside out of revenue for the extinction of indebtedness, which leaves £21,330 as the net profit on productive capital. Allowing off this sum £5,701 in respect of interest on unproductive capital, and £4,114 in respect of the sinking fund on unproductive capital, and adding the surplus brought forward at the end of last year (£6,974), there remains (after deducting £10,000, the amount to be transferred to the renewals fund this year, £1,878 for special law charges, and £300 the amount to be set aside for the purchase of motors for hire) a net surplus of £6,312. The number of units sold during the 12 months under review, amounted to 21,671,978, while the cost per unit sold amounted to ·46d. The total working expenses amounted to £41,664, and the capital expenditure to March 25th last is put at £1,130,656. Mains are to be extended in various parts of the area at a cost of about £1,214.

A L.G.B. inquiry was held on July 3rd into the application of the T.C. to borrow £130,860 for the extension of the electricity undertaking. It was agreed to ask sanction for £83,200, the amount of tenders accepted, sanction to the remainder being deferred until an amended estimate of the other tenders was supplied.

South Africa.—The electric lighting supply to the Mowbray district, Cape Town suburbs, has been changed over from direct-current to alternating two-phase, 220 volts between outers and neutral. The supply to the Green and Sea Point district has also been changed over from 110 volts to 220 volts alternating.

South Shields.—Plant Extensions, &c.—At a meeting of the T.C. on the 2nd inst., the Electrical Committee in its report recommended that the profit on the year, £3,156, be placed to the credit of the reserve fund. It also recommended the Council to apply to the L.G.B. for sanction to borrow £30,000 for the extension of the plant at the electricity works, including a new turbo-generator set, with condensing plant, air filter, rotary converters, &c., two water-tube boilers, with economisers, coal bunkers, conveyors, &c. Alderman Rennoldson, in moving the adoption of the report, said the profit last year was a record one. The Committee was of the opinion that the whole of the surplus should be carried to the reserve fund, which would then be £12,841. The capital of the undertaking was now verging on £200,000, and the reserve fund to be at all adequate should be £20,000. There would be a reduction in the fund in a year or two, when the new plant was installed, to the extent of something approaching £2,000. Referring to the proposed extension scheme, he said there was an absolute and urgent need for it. The new turbine set had been carrying almost the entire load ever since it had been installed; the plant was sufficiently loaded at the present time, and it would be risky to go further without an increase of plant, particularly when they remembered that the bulk of the local factories, dockyards and dry-docks, &c., were now entirely dependent upon the town's station for their power supply. Alderman Gibbon asked if the proposed outlay would have an earning capacity over and above the earning power of the present capital of the undertaking? Alderman Rennoldson said that it would, because they would be able greatly to economise with the new plant. They anticipated a big reduction in the cost for fuel; in fact, the engineer went so far as to say to the Committee that he saw his way quite clearly to make a saving which in amount would pay the interest and redemption on the new capital, and judging from what he had seen and the report, he (the speaker) believed it quite possible. They expected to get 17 years to repay the load. Alderman Bowman: That is about £2,000 a year in capital and interest. Do you mean to say you are going to save that on the new plant? Alderman Grant said their coal bill was something like £6,000 a year, and it was quite within the range of possibility to save £2,000. After further discussion the report was adopted.

The department has recently opened new offices, with a ground floor showroom and window display, surmounted by a Venner sign 60 ft. long. We understand from Mr. Ellis that this new departure is much appreciated locally.

Southend-on-Sea.—The T.C. has applied to the B. of T. for consent to the use of overhead transmission from Thorpe Bay Gardens to the borough boundary for the supply of current.

Staines.—It was intimated at the last meeting of the R.D.C. that the promoters of the Feltham and District Electric Lighting Order proposed making another application for a prov. order for electric lighting in the district.

Stoke-on-Trent.—The T.C. has decided to obtain a supply of electric cookers for hiring-out purposes. As the mains are not to be extended to Trent Vale, the Corporation Sewage Committee has decided to obtain a supply of current from the Tramway Co. for power purposes.

Stalybridge.—Annual Accounts.—The electricity department shows an expenditure on capital account since the commencement of £266,229; loan debt, £206,983; and loans redeemed, £49,749. The income for the year amounted to £45,579, against an expenditure of £28,960, the gross profits amounting to £16,618. Interest on loans, &c., absorbed £8,274, and the amount transferred to sinking fund was £7,432, the net surplus amounting to £911.

Stowmarket.—Workhouse Lighting.—The B. of G. has appointed a Committee to consider the lighting of the workhouse and the installation of telephones. At the meeting of the Board on July 3rd, the chairman (Mr. G. J. Gostling) suggested that it would be better to have the electric light installed. At present oil lamps are in use.

Sunderland.—A new turbo-generator, installed by the A.E.G. Electrical Co., was started on the 3rd inst. The new generator is of 5,000 KW. normal rating, but capable of carrying a load of 7,500 KW. for prolonged periods. Ald. Bruce, chairman of the Committee, said the total cost of the new plant, with all accessories, had been £22,000. The capital expended on the undertaking up to the end of March last was £453,927, and of that sum they had paid or reserved in the sinking fund £150,727. The profit last year amounted to £7,099 compared with £5,958 in the previous year, and the output was 13½ million units against 12 million units in the preceding year. He complimented Mr. Blackman, the borough electrical engineer, and said that gentleman had reduced the consumption of coal from 8½ lb. per unit sold in 1907 to 3½ lb. per unit sold last year.

Swansea.—Loan Inquiry.—A L.G.B. inquiry was held on Tuesday into the application of the T.C. to borrow £40,000 for electrical extensions.

Quite recently a brief strike took place at the Corporation Electricity Works, about 40 members of the Dockers' Union having left work after giving 24 hours' notice. The cause of the trouble was the dismissal of a man for lack of work; the Union claimed that he should be reinstated, and the latest addition discharged in his place. Ultimately the Council decided to recognise the principle of seniority urged by the Union, other things being equal, the men having returned to work.

Swinton.—The Salford Tramways Committee has agreed to allow the Council to fix 12 experimental fittings of the Barrow system of public lighting to tramway standards in Manchester Road, Swinton.

Tunbridge Wells.—The Electricity Committee has adopted the advice of the borough electrical engineer (Mr. R. N. Torpy) and reduced the price of energy for heating, cooking and power to 1d. per unit; this is a step in the right direction, and should be the means of bringing about a large increase of new business.

Wakefield.—The Electricity Committee has appointed a deputation to visit Huddersfield, Leeds, Coventry, Hertford and Barnes, to inspect the types of destructors used in those towns. It was reported at the last meeting of the Committee that the sanction of the L.G.B. to borrow a further £235 for electrical plant had been received; that electricity was to be supplied to Chevet Hall and Kettlethorpe Hall, and that the tender of the Victoria Coal Co. for the supply of 1,000 tons of unscreened slack for the electrical department had been accepted.

Walmer.—Messrs. Foote & Milne have informed the U.D.C. that they intend applying to the B. of T. for a prov. order for electric supply.

West Hartlepool.—L.G.B. INQUIRY.—Mr. H. R. Hooper, of the L.G.B., held an inquiry on the 1st inst., into the application by the Corporacion for sanction to borrow £4,330 for the purposes of the electricity undertaking. The town clerk explained that plant was required for the supply of current to the tramways which had been taken over by the municipality. The plant at the present generating station was now, he said, fairly well used up, but would probably last until the new station was in operation. The proposed change would also help the electricity undertaking by giving it an additional load in the day time. The space that would be available at the old generating station would be utilised to increase the shed accommodation for the cars. The Inspector asked if the plant they had purchased at the tramway generating station would be "scrapped," and the town clerk said it would be; they had to buy it when they purchased the tramways. The Inspector said he took it that the plant that had to be taken out to make room for the plant that was now being purchased had practically come to the end of its useful commercial life. That being so, the outstanding debt on that plant would have to be met by money other than loan—the amount would have to be deducted from that loan. Mr. Lambert (the borough accountant) said they had a reserve fund of about £5,000. There was no opposition, and the inquiry closed.

Alderman Mafarlane, chairman of the Electricity Committee, speaking at the subsequent meeting of the T.C., said the tender which they proposed to accept was lower than had been anticipated, and enabled them to reduce the amount they would require on loan from £4,330 to £3,900.

Wimbledon.—Electrical energy is to be supplied to the garage proposed to be erected by the London General Omnibus Co., in Merton High Street, at 1½d. per unit for all current consumed, subject to (1) a guaranteed minimum consumption of 20,000 units per annum; (2) the maximum demand not exceeding 30 KW.; and (3) the supply being taken for a period of not less than three years.

York.—SUPPLY TO ADJOINING DISTRICTS.—The Electricity Committee has recommended the City Council to apply to the B. of T. for permission to extend the area of supply to include Great Ouseburn, Bishopthorpe, Escrick, Tadcaster, Flaxton and Easingwold.

TRAMWAY and RAILWAY NOTES.

Australia.—The purchase of the Perth, W.A., tramway system by the Government was completed on June 30th, and the lines were taken over on that date.

Birkenhead.—At a recent T.C. meeting, Mr. H. B. Webb brought forward a motion that the Wallasey Corporation should be approached with a view to establishing a better means of communication between the two boroughs by running railless electric cars or motor-cars over the most suitable route between both towns. The distance to be covered between Cleveland Street and Wheatland Lane, Seacombe, across the Duke Street bridge, was 1,840 yards, and the total cost of erecting overhead wires would approximately be £1,200. For the service they would probably require four cars, each of which would cost £750. Mr. H. Halsall, chairman of the Tramways Committee, suggested that the resolution should be withdrawn for the time being, as the Committee would shortly have before it a big scheme for the development of the tramway service. In the circumstances, the motion would only hamper the Committee. Mr. Webb agreed to withdraw the motion.

Birmingham.—The City Council has had under consideration the scheme for the linking up of the tramways. The proposal to connect Navigation Street with Corporation Street, *viâ* Stephenson Street, was rejected, and the suggestion as to the linking up of Broad Street with Colmore Row, *viâ* Victoria Square, was referred back to the Tramways Committee. All the other proposals, including that for a double line of tramways along *d* Street, were agreed to.

Blackburn.—The income from the tramways undertaking of the Corporation for the year ended March 25th last was £66,793, and the expenditure £62,923, leaving a profit of £3,870, of which £2,000 has been allocated towards the relief of the rates. The provision for the redemption of debt was £14,909.

Bradford.—ANNUAL REPORT.—The working of the Corporation tramways department last year showed a net profit of £41,921, as compared with £52,783 in the previous year, a decrease of £10,662. The traffic income was £279,523, an increase of £6,014, but owing to an increase in mileage of 271,000, the income per car-mile was only 11·3d., as compared with 11·6d. Of an increase in drivers' and conductors' wages of £4,458, £2,000 was in respect of advances, and £2,500 in respect of increased staff. The Committee's contributions under the National Insurance Act were £530. The income on the railless trolley section was £1,233, or 7d. per car-mile, whilst the expenditure in this section had been 9d. per car-mile, resulting in a deficit in the section of £380. It is pointed out, however, that the railless section is a valuable feeder to the tramways. The decrease in profits is accounted for partly by the adoption of ½d. fares on cars before nine o'clock in the morning, and partly by the bad weather of last summer, which resulted in small patronage of the cars on the holiday routes.

The city engineer has received instructions to proceed with the construction of the tramway across Cottingley Bridge. The Council is urging local Members of Parliament to vote for the deletion of the clause inserted in the L.C.C. (Tramways and Improvements) Bill giving the L.U.T. Co. compulsory running powers over tramways now being acquired by the Council from the company.

The Corporation tramway men have demanded a general increase of wages, and have intimated that this demand is not intended to take the place of the general revision which is due to take place next February.

Brazil.—The Electric Tramways of Ribeirao Preto, Ltd., an English company, with a capital of £210,000, has secured the necessary Government authorisation to construct and work a system of electric tramways at Ribeirao Preto, in the State of Sao Paulo.

Continental Notes.—HOLLAND.—According to some figures recently issued by the Dutch Institution of Engineers, there are now eight electric tramways, four light electric railways, and one ordinary electric railway in Holland. The total length of the same being about 370 miles.

GERMANY.—According to the official returns lately issued, out of 550 light railways in Germany at the end of 1211, 210 were electrically operated, while of the 246 tramway undertakings in the country 84·2 per cent. were equipped for electric traction.

Dewsbury.—In connection with the suggested construction of tramways to Dewsbury Moor there appears to be a rather more optimistic feeling prevalent than for some time past. This is in consequence of an inspection of the district by the National Electric Construction Co. as a result of which it has expressed itself as being more favourably impressed with the possibilities of the Dewsbury Moor line, than it was when it last visited the district.

The Corporation has decided to apply to the B. of T. for the prolongation for a further period of two years of the Dewsbury Corporation Tramways Orders, 1911 and 1912, which imposed an obligation to commence the proposed tramway services to Dewsbury Moor and Shaw Cross by the end of the present month.

Glasgow.—TURBO-ELECTRIC LOCOMOTIVE TRIALS.—During the last two or three years trials have been carried out on the railways in the vicinity of Glasgow, with a steam turbo-electric locomotive constructed by the North British Locomotive Co. This machine which is now undergoing further tests, is described by the *Railway News* as follows:—Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, and the coal and water supplies are carried in the side bunkers and in the side water tanks at both sides of the boiler. The steam from the boiler is led to a turbine of the impulse type running at a speed of 3,000 R.P.M., to which is directly coupled a continuous-current variable voltage dynamo. The dynamo supplies current at pressures varying from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser, and is, together with the circulating condensing water, delivered eventually to the hotwell.

The condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast which induces the draught through the firebox and boiler tubes. In the experimental locomotive the induced draught is replaced by forced draught provided by means of a small turbine-driven fan. The fan is placed within the cooler, so that it will deliver hot air to the boiler fire, and at the same time assist the current of air through the cooler. The small switchboard and the instruments required, the controller for grouping the four motors in series—series-parallel and parallel, according to the draw-bar pull to be exerted—and the regulator for controlling the voltage in the electrical circuit, and consequently the speed of the train, are all placed on the driver's platform within easy reach.

Hove.—With reference to the two resolutions recently passed by the T.C. in regard to the proposed trolley 'bus scheme (see our issue of June 13th under this head), the town clerk of Brighton has written to the General Purposes Committee informing it of the decision of his Council to adopt the "under-running"

type of overhead equipment for Brighton, including the "through routes." "With regard to the first of the resolutions passed" (the letter continues), "the double-deck trolley 'bus has been officially submitted to the Board of Trade for approval, and the reply of the Board may be looked for in the course of two or three weeks. With regard to the second of the resolutions my Council are of opinion that the construction of an experimental route is unnecessary, as railless traction systems on the 'under-running' system are working in this country, from an inspection of which all necessary information may be obtained." The clerk enclosed a description of the system of equipment and apparatus proposed to be adopted, and asked the Hove Corporation to agree to the same system for the purposes of the "through routes." The General Purposes Committee has referred the letter to the Traction Committee with instructions to consider the system of overhead equipment submitted (particularly as to whether such system is that most adapted for use in Hove, and with double-decked cars), with power to take expert advice thereon, and, if necessary, view any systems at work.

Edinburgh.—After discussing the Colinton tramway extension proposals, the T.C. has declined the offer of the Colinton Tramway Co. to sell its undertaking. The convener of the Tramway Committee said the Corporation should supply electric light from its power station for the lighting of the Redford Barracks, and the War Office should be asked to make its own arrangements for a connection between the Barracks and Slatefold, the Corporation giving running power over its tramway. The Committee was unanimous with regard to the passenger communication to the Barracks, that the natural and proper line to be extended was the Gilmore Place line. Several notices of motion were given at the last week's meeting of the Council proposing tramway extension to Corstorphine, Redford and Dreghorn districts.

Folkestone.—At the last meeting of the T.C., the Town Clerk reported that the Folkestone, Sandgate and Hythe Railless Traction Bill had been withdrawn by the promoters.

Glasgow.—Everything points to Parliamentary powers being sought by the T.C. for another tramway extension not included in the list provisionally adopted in the spring of the present year. The latter, it may be recalled, contained many important augmentations, among them being the lengthening of the lines from Cathcart to Clarkston, from Burnside to Cathkin braes, and from Baillieston to Coatbridge. So far as these are concerned, negotiations are proceeding between the T.C.'s Tramways Committtee and the various local authorities and others interested in order to avoid, if possible, costly and protracted litigation. The latest scheme affects the centre of the city purely, and is designed so as to relieve the congestion at Jamaica Bridge, the main cross-river viaduct over which no fewer than five different route cars cross, to say nothing of a particularly heavy general vehicular traffic. The projected line will start at Cowcaddens, where it taps the red line to Maryhill and the blue line to Lambhill and Keppochhill Road—and proceed directly north along Hope Street, cutting across Argyle Street and down Oswald Street. There the difficulty of crossing the Clyde is encountered before it can be continued to Commerce Street and linked up with the main line in Nelson Street, and both the Tramways and the Statute Labour Committees have been considering the difficulty. It was distinctly stated some months ago by the convener of the Tramways Committee that if a relieving bridge was constructed, his Committee would make a substantial contribution. Now it appears that this promise has been somewhat gone back upon, and the proposal of the Statute Labour Committee is rather open—that the proposed bridge be constructed either at the foot of Oswald Street or Robertson Street, which is further west. The general opinion seems to be that the Oswald Street proposal will be favoured.

In committee a proposal by Mr. Izett to inquire into the feasibility of instituting a season ticket system for the Corporation Tramways was negatived by 21 votes 2.

At the same meeting, and by a majority, it was agreed to recommend the T.C. that the general manager (Mr. Dalrymple) be authorised to visit American cities, with a view to acquainting himself with the most modern and up-to-date methods of tramway traction.

Halesowen.—The U.D.C. has been informed by Messrs. Balfour, Beatty & Co. that they have decided to abandon the construction of the proposed electric tramways in the Halesowen area. This decision, it is understood, is in consequence of obstacles placed in the way by the Birmingham T.C. The order was granted in 1900 to the U.D.C., and was disposed of to the Empire Lighting Co., whose powers were subsequently acquired by Balfour, Beatty and Co.

Japan.—Charters to two new light electric railways have just been granted by the Japanese Government—one to the Owari Electric Railway Co., for a projected line 21½ miles long, and one to the Mariko Electric Railway Co., for a line 5 miles in length.

London.—L.C.C.—The General Purposes Committee recommends the Council to become a member of the International Tramways Congress, 1914, also that the chairman and the vice-chairman represent the Council thereat.

The Tramways Committee has had under consideration the question of the tramway renewals and reserve funds, the former of which was to be reconsidered at the expiration of five years from June, 1908. Based on an annual mileage of 56,000,000 car-miles, it estimates that the required amount to be placed to renewals is ·635d. per car-mile, as against ·66d. originally estimated. The total expenditure on renewals for the next five years is estimated to be £695,000. The renewals fund at March 31st last amounted to £633,010, while in addition the general reserve fund amounted to £273,786. The Committee finally recommends that for two years any surplus on the tramway working shall be paid into the renewals fund, and that the matter shall be reconsidered at the end of that period

Longbenton.—The U.D.C., at its meeting on Friday last, decided to invite the Newcastle-on-Tyne Corporation to extend its tramway system into, or through, the Council's area.

Newcastle-on-Tyne.—B. of T. Accident Inquiry.—Col. von Donop held an inquiry on the 2nd inst. into an accident which occurred on Westgate Hill on June 21st, when a car that had been reported for defective brakes, and was being removed to the sheds, ran away and collided with another car, whereby several persons were injured.

Motorman Joseph Nugent said when he went on duty he took over the charge of the car on the Elswick Road—Chillingham Road route—and made two complete circular trips, and was satisfied with his brakes. On the third trip the conductor drew his attention to the fact that his brake at the rear end of the car was wrong, the chain shaking. He informed time-keeper Fairless of the fact. Witness suggested that as it was a circular route, and as he was at the good end, he should go round the route and change cars at Elswick terminus. The time-keepeer agreed to him completing his trip.

Col. von Donop: I think the time-keeper took a certain amount of responsibility off your hands in agreeing, but I am not sure that you were right in continuing in face of your rules.

Witness said he completed the trip, and at Elswick terminus he handed the car over to timekeeper Fairless and fitter Irwin, and took over another car.

Timekeeper Fairless, examined by Col. Von Donop, said he knew all the rules and considered that as it was a circular route, and Nugent had said he could manage, there would be no harm in letting the car make another round of the circular route, despite the rule against allowing such a car to run. Witness said the route was safely completed, and Irwin and he took over the car at the terminus, Irwin driving and witness being on the rear platform. The end of the car then in front was the one at which the hand-brake was defective. They proceeded to take the car to the Wingrove sheds, and the car was brought to a stop by means of the magnetic brake. After the car stopped he applied the hand-brake and shifted the trolley. While he was doing this the car began to move forward, and he shouted to the motorman, but got no reply. Witness tried to get the trolley on, thinking that the magnetic brake would pull up the car again; he tried to jump on the car with the trolley rope in his hand, but could not do so owing to the weight of the trolley; the rope seemed to have got about his legs, because he was flung to the side of the street. After the collision he examined the hand brake at the end of the car, and found it still hard on, and the "dog" was still in.

Benjamin Irwin, the fitter who took charge of the damaged car, said he brought the car up short of the points leading to Westgate Hill, and intended to shift the points with the point bar. He turned round to get the bar, and was reaching over the front of the car to do so, when he found the car gliding away. He had stopped the car with the magnetic brake, and, as far as he knew, Fairless had not applied the hand brake. He fully expected that the hand brake would have been applied at the back to keep it standing. He felt sure at the time the car moved that the magnetic brake would bring it up, and he did nothing until he got on to the top of the hill, when he knew that there was something seriously the matter. At the top of the hill the speed of the car would be 8 to 10 miles an hour. He saw a car in front of him, and whistled to the conductor of it to give him warning. As soon as he saw the man clear off his platform witness went to the back of his car and applied the hand brake, which had not been applied at all; it seemed to be having the effect of lessening the speed, but they were then into the other car.

Mr. Ernest Hatton, general manager, said he gave instructions to have the damaged cars removed to the Byker sheds and locked up until a proper inspection could take place. On Monday morning he had the controller at the damaged end of the car taken out of the car into which it had been placed after the collision. Beyond the controller inside being covered with fresh dust due to the force of the collision, it was in perfect order. Both motors were also in perfect working order. The car was badly damaged, and the magnetic brake was all twisted. Without doing anything to it at all, he had the car taken into the yard, and they tested its electrical equipment as it stood, with the remaining controller, and it worked perfectly on every notch. The hand brake also was tried, and it still was well able to control the car.

This concluded the evidence, and the inquiry terminated.

Salford.—The Corporation has approved of an agreement with the Prestwich U.D.C. with reference to the widening of a portion of Bury Old Road, and the construction of a double line of tramways along that road.

Stalybridge.—Annual Accounts.—The abstract of accounts of the Tramways and Electricity Board shows expenditure on capital account in the tramways department since the start in 1904 to March 31st last amounting to £279,778; the loan debt amounted to £224,700, and the loans redeemed to £56,289. The revenue account for last year shows income amounting to £35,637, and expenditure totalling £28,884, the gross profits for the past year being £6,753. Interest on loans, &c., absorbed £8,570, and the amount transferred to sinking fund was £7,307, leaving a

deficit on the year's working of £9,124. The passengers carried numbered 8,896,836, as compared with 10,256,918 in the previous year.

Warrington.—The new motor-'bus service proposed by the Electricity and Tramways Committee of the Corporation was inaugurated last week.

TELEGRAPH and TELEPHONE NOTES.

Austria.—According to *Der Elektrotechniker*, the Austrian telephone credits for the current year remaining for expenditure amount to 12,000,000 kronen, which, with the 7,000,000 kronen unspent last year, makes a total of 19,000,000 kronen. The new programme is to be fixed for several years in advance, and if the procedure of the last programme be followed, will mean the outlay, over and above the regular yearly credit, of a special credit of some 20,000,000 kronen. The new programme contemplates the erection of exchanges, the creation of new interurban lines, and the enlargement and reconstruction of networks.

Boy Scouts and Wireless Telegraphy.—The 1st Dorchester Boy Scouts attached to Mr. A. V. Dodderidge's Commercial School have now a wireless telegraph station. It has a receiving radius of between 500 and 600 miles, and communications have been taken from Cleethorpes, Eiffel Tower (Paris), and Norddeich. The transmitting set is not yet installed; the whole of the apparatus is being fitted, and instruction is to be given to the boys, by Mr. Hopkins, assistant scoutmaster, who is a certificated wireless telegraph operator. Special advantages will shortly be offered by the Marconi Co. to boys who have been trained in wireless telegraphy, and first and second-class certificates of proficiency will be given, also valuable prizes, such as complete sets of Marconi field telegraph apparatus.

The Goldschmidt System.—The Anglo-French Wireless Co. state that trans-Atlantic wireless communication has been established by means of the Goldschmidt system between Hanover, in Germany, and Tuckerton, near Atlantic City, U.S.A., a distance of 3,600 geographical miles. This was done in the daytime with an entirely new type of receiving apparatus, the sending power being 150 KW.

Imperial Wireless System.—On Friday last in the House of Commons, Mr. Samuel explained the policy of the Government with regard to the erection of the stations for the Imperial wireless system. A new contract had been made with the Marconi Co. for the erection of the stations, which, as before, would become the absolute property of the Government, and would be worked by the Government staff; owing to the rise in price of materials, the cost of each station would be increased by about £6,500. Interest would be paid at the rate of 2 per cent. on 30 per cent. of the purchase price from the date of signing the contract, on 30 per cent. for a period of nine months thereafter, and on 30 per cent. from the completion of the stations until the final settlement. The company absolutely declined to accept the contract unless the 10 per cent. royalty on the gross receipts was retained in the agreement. The sites for the six stations had been secured. No other firm could be relied upon to erect stations of a satisfactory character; the Post Office could not do it, and the Admiralty staff was fully employed on Naval business, from which it could not be diverted with serious detriment to Naval interests. There was no engineer in the country outside the Admiralty and the Marconi Co. who had actual experience with long-range stations and could take charge of the work. It was not the fact that the Government could use the patents of the Marconi Co. without the payment of royalties. Moreover, delay was inevitable unless the work was given to the Marconi Co., which had the designs and staff ready for an immediate start.

The contract was not to be binding on the company unless ratified before August 31st this year. A provision accidentally omitted from the former contract had been inserted, under which the company, while guaranteeing to work under all conditions at 20 words a minute, was not required to guarantee automatic working at that speed under all circumstances.

In a supplementary statement, Mr. Samuel showed that the royalty would be paid on each station separately, and only on stations in which Marconi patents were employed. The Government could call upon the company at any time to cease work upon the South African, Indian or Malay stations if it desired to install other apparatus, subject to payment for the work done, and to an opportunity being given to the company to show that it could provide apparatus of equal economy and efficiency. The stations would at all times be available for Government experimental work. The company was now able to raise the guarantee for automatic working from 50 to 75 words a minute, except during strong electrical disturbances of the atmosphere. The provision that the Government should seek the advice of the company when contemplating the installation of another type of apparatus was to be dropped, and the company's right of inspection of apparatus alleged to infringe its patents had been modified, in that an independent engineer of high standing was to make such inspection. The contract will be submitted to Parliament for discussion before it can become binding.

In reply to a question as to the reopening of negotiations with the Marconi Co. for the supply of Imperial wireless stations, while Ministers held shares in the American Marconi Co., the Prime Minister stated that the Ministers had taken steps to divest themselves of any interest in the shares of the American company.

The Telephone Service.—In reply to a deputation from the London Chamber of Commerce with regard to defects in the telephone service, the Postmaster-General on Friday last admitted that the service had not yet reached the standard of efficiency that was desirable; regarding the complaints of overcharges, he said there were one million calls a day in London, and it would be impossible to conduct the service if the Post Office record were not accepted as conclusive. The Post Office engineers were trying to devise a meter which would solve the difficulty. The number of ineffective calls due to the inadequacy of the junction lines last year was less than ½ per cent. During the present financial year about £3,000,000 was being spent on new construction and development, and he was going to ask for the sanction of Parliament to borrow £10,000,000 for the development of the telephone system during the next few years; this money would be provided out of the funds in the hands of the National Debt Commissioners. Nearly half the trunk calls were between 10 and 12 noon, and it was, therefore, advisable to avoid those hours if possible. The Post Office was spending £300,000 on a new underground cable from London to Birmingham, which would provide three times the present number of wires, and would help the service to the north and west of England. £1,800,000 was now being spent on the development of the trunk service.

The number of women operators in London had been increased by 1,335, and of male night operators by 201. The average speed of answering calls was five seconds. His policy was to effect no change in the existing system of rates until the whole question had been investigated. In seventeen large towns advisory committees had been set up to confer with the Post Office on telephone matters, and 12 more were in course of formation.

The Telephone Transfer.—In reply to a question in the House of Commons, the Postmaster-General stated that the award of the Railway and Canal Commission assessed the value of the National Telephone Co.'s plant, property and assets purchased by the Post Office at £12,515,264. The company were also allowed their costs in the valuation proceedings. An appeal against two items of the valuation was lodged by the Post Office, and a cross-appeal against the award generally by the company. Under an arrangement made between counsel, subject to Treasury approval, the appeal and cross-appeal were withdrawn, on condition that the purchase price of the plant and other property should be reduced by £45,000, and the company should waive the payment of their costs, for which a claim of £122,000 had been made. The total sum payable to the company was, therefore, reduced to £12,470,264, which compared with the original claim of the company of £20,924,700 for plant, &c., and £122,000 for costs.

CONTRACTS OPEN and CLOSED.

OPEN.

Abergele (North Wales).—July 12th. One 9—11-KW. steam dynamo, erected complete at the Sanatorium, Plas Uchaf, for the South Manchester B. of G. Specifications from Mr. F. W. Page, consulting engineer, 14, St. Ann's Square, Manchester. Deposit £2 2s.

Australia.—VICTORIA.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

August 19th. 105 miles paper-insulated, lead-covered cable. See "Official Notices" to-day.

September 9th.—Common-battery multiple switchboard. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 19th. Switchgear and accessories for an electric power station at Perth. See "Official Notices," June 27th.

SOUTH AUSTRALIA.—August 13th.—Common-battery switchboards and telephone parts for Adelaide. See "Official Notices," July 4th.

NEW SOUTH WALES.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s. each) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

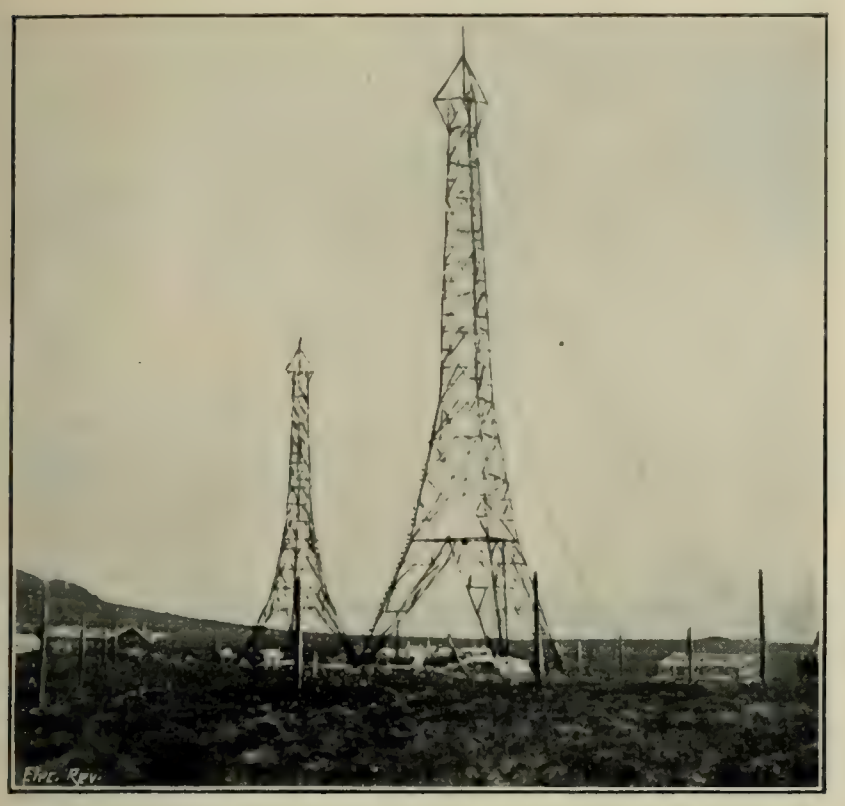
August 27th. Telephones, switchboards and incandescent lamps, for the P.M.G. See "Official Notices" to-day.

(*Continued on page* 64.)

A SIBERIAN WIRELESS STATION.

[BY OUR BERLIN CORRESPONDENT.]

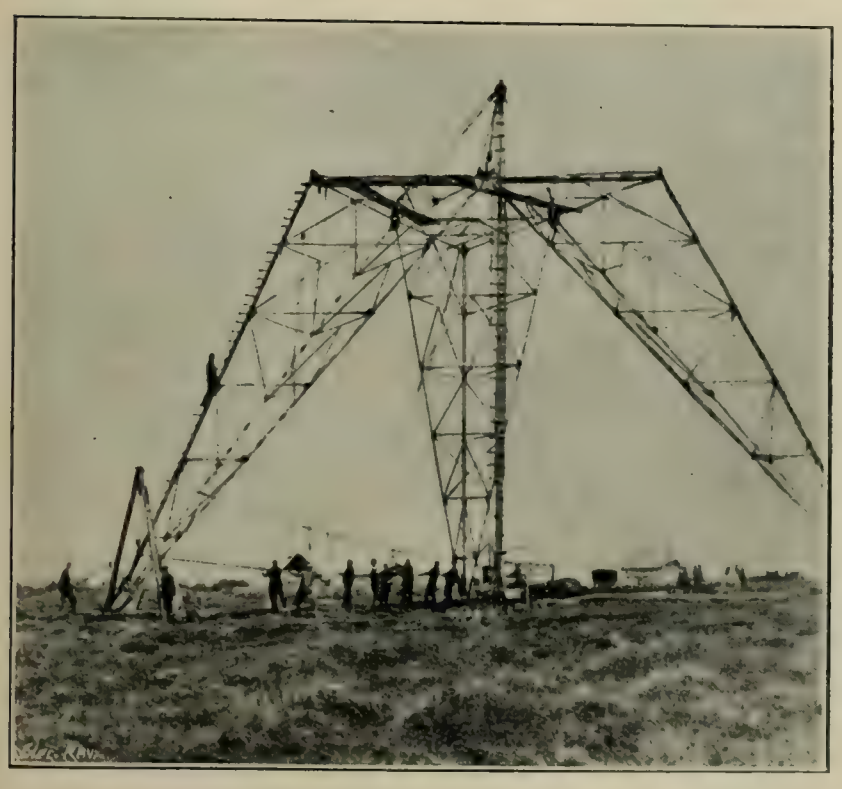
The equipment of the Telefunken station at Nayachan, Siberia, which was carried out by the Russian Siemens and Halske Works to the order of the Russian Postal Department, is a remarkable feat of engineering skill.



The Nyachan Wireless Telegraph Station.

The staff at the disposal of the Russian firm comprised an engineer, two fitters for radio-telegraphic apparatus, one mechanic, one fitter for erecting the tower, and 39 auxiliary hands engaged at Vladivostock. The expedition was also accompanied by a physician.

The entire staff, with the whole of the apparatus and materials, sailed from Vladivostock on June 19th, 1912, on the ss. *Sichan*, which was specially chartered for the purpose.



Wireless Tower During Erection.

The steamer arrived at Nayachan on June 26th, but, on account of the unfavourable weather and tide, the materials could not be unloaded before July 4th. The unloading was rendered more difficult by the fact that the steamer had to come to anchor about two miles from the shore, small boats with a carrying capacity of 8 tons being used to transfer the materials to the land.

Nayachan is a small village of about 30 inhabitants at the mouth of the river of the same name, on the Sea of Ochotsk, situated in 60° 30 northern latitude. Its climate is cold, the mean summer temperature being + 8° C., and the mean winter temperature — 30° C. Summer begins in the first half of June, and lasts until the first half of September.

On July 11th, when the whole of the materials had been landed and the tents put up, the installation of the two iron towers, 75 m. high, was commenced. On September 1st, that is after 51 days, both towers were completed, and four days afterwards the antenna and counterweight had been stretched out and the first provisional receiving tests were performed.

Since the ground, even in summer, only thaws to a depth of about 30 or 40 cm., the laying of the tower foundations involved much difficulty. The pits dug out kept filling with water from the thawing ice, which had to be removed continuously, while the pits would increase considerably in size, as the walls were thawing and falling down. No concrete foundations were used; the feet of the towers were anchored on substantial wooden planks covering the





Upper View Showing Telegraphic Material Being Landed; Lower View, of Erector's Tent.

bottom of the foundation pit in the frozen ground, being embedded in a concrete layer about 70 cm. in thickness which was covered by a peat layer about 1½ metres thick, so as to protect the ground round the tower base against any risk of thawing in summer.

On September 23rd the station building was sufficiently advanced for the installation of the machinery and electrical apparatus to be commenced. On October 13th, that is, in the extremely short time of 20 days, the two machines—viz, one radio-telegraphic sender of about 28 H.P. primary energy (7·5 KW. in the antenna) and an additional sender of about 3·5 KW. primary energy (1·5 KW. antenna energy) for communication with ships, the receiving apparatus and the electrical tuning had been completed. After three days' tests by the Official Committee the station was taken over, and the official inauguration took place on October 25th.

The wireless station of Nayachan communicates with the following stations:—Novo-Mariinsk, 990 km.; Ochotsk, 910 km.; Petropavlovsk, 985 km.; and Nicolayevsk, 1,460 km.

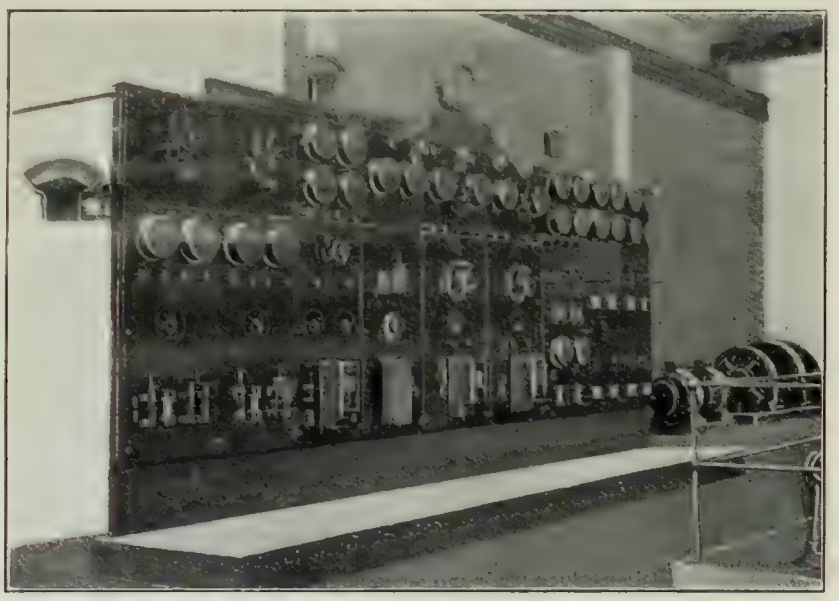
According to contract, communication had to kept up daily during eight hours with Novo-Mariinsk and Ochotsk,

whereas a wireless service with Petropavlovsk and Nicolayevsk had to be ensured by night during eight hours. The acoustic intensity—with a tuning accuracy of 5 per cent.—had to be 200 units as a minimum.

As a matter of fact, these guarantees were far exceeded, the following data being obtained on the delivery of the station : —

Corresponding station.	Distance.	On land.	On water.	Acoustic intensity.
Novo-Mariinsk	... 990	Only land		0·5 units
Okhotsk ...	... 910	,,	,,	0·5 ,,
Petropavlovsk	... 985	300 km.	685 km.	3·0 ,,
Nicolayevsk	... 1,460	60 km.	1,400 m.	3·0 ,,

At the same time wireless communication to 1,000 km. distance was effected between the station and the ss. *Sichan*,



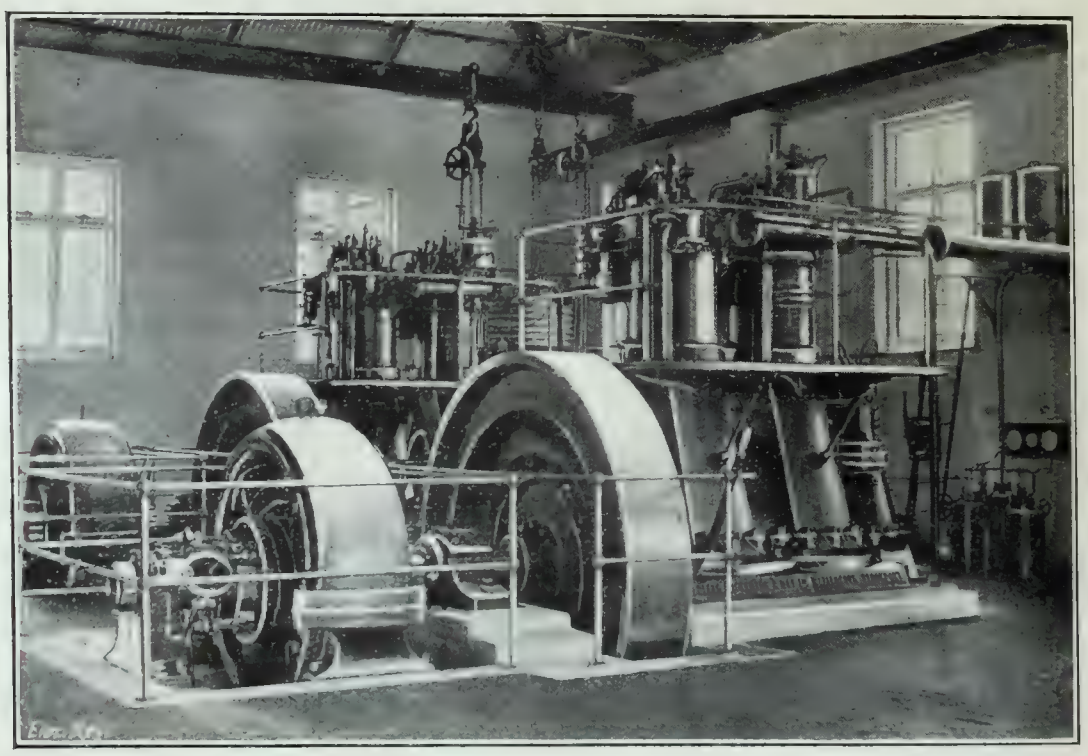
Main Switchboard, Queenstown Electricity Works.

which during the erection was equipped with a ship station of 3 kw. primary energy and an antenna mast 20 m. in height, the acoustic intensity being 50 units.

QUEENSTOWN (CAPE COLONY) ELECTRIC LIGHTING.

[from our South African correspondent.]

One of the most recent South African towns to inaugurate an electricity undertaking is the Municipality of



Diesel Engine Sets at Queenstown, Cape Colony.

Queenstown, which has a population of 3,775 white and 5,000 coloured people. Though a small installation, it is nevertheless interesting, being a departure from the usual practice as Diesel oil engines have been installed. The plant was started up on November 9th last year, and bids fair to have a very successful career ; Mr. W. Bellad-Ellis is the municipal electrical engineer, to whom we are



The Generating Station, Queenstown, Cape Colony.

indebted for the particulars here given. The whole scheme was designed and laid down by Mr. Bellad-Ellis, whose estimate for the work was £12,800, while the actual sum



Battery Room, Queenstown Electricity Works

expended, exclusive of house services and meters, was £12,300.

The generating plant consists of two 100-h.p. Diesel engines manufactured by Messrs. Mirrless, Bickerton & Day, which consume crude oil costing 9d. per gallon ; the engines run at a speed of 250 r.p.m., and it is interesting to note that the running costs are consideraly lower than for suction gas.

The engines are coupled direct to G.E.C. direct-current generators of 70 kw. each, at 460 volts. A balancer is also installed capable of dealing with 35 amperes out-of-balance current without assistance from the battery ; also a booster capable of maintaining a 72-ampere charging rate to the battery, both these machines being supplied by the G.E. Co.

The battery consists of 258 Tudor cells of 190 ampere-hours capacity, and it carries the light load as well as assisting during the peak load.

The plant is housed in a brick building, 60 ft. long × 50 ft. wide, which again is a departure from the usual wood and iron building and steel stack.

The switchboard was supplied by the G.E. Co., and consists of two generator and nine circuit panels, also booster, battery and balancer panels, and is fitted with the usual recording instruments, &c.

The distribution is on the three-wire system (220-440

volts D.C.), being partly overhead and partly underground; the underground cables were supplied by Messrs. Henley, and consist of two, three and four-core cables of from ·15 sq. in. to ·0125 sq. in. section, all armoured and paper-insulated, there being a total length of 6½ miles. The overhead routes have a total length of 16 miles, and consist chiefly of No. 00 bare copper wire, carried on 25 to 35 ft. Mannesman steel poles, numbering about 550.

During the few months of running, 328 consumers have been connected for lighting, as well as a few small power consumers, all connections being made overhead through pole fuses. Ferranti meters are used, and the price of current is 1s. per unit for lighting, and 6d. per unit for power. The street lighting is by means of Osram lamps, and consists of 56 100-C.P. and 180 50-C.P. lamps, spaced about 100 yd. apart, the mileage of streets lighted being 13 miles. The lamps are extinguished at 11.30 p.m.

The contractors for the installation were Messrs. Bellad-Ellis & Co., of Port Elizabeth.

SUBMARINE POWER TRANSMISSION IN THE BALTIC.

The electrical and daily Press a short time ago announced that a large Swedish electricity company had concluded a contract with the largest Danish electricity and tramway company, according to which the Swedish company was to lay a high-tension cable from its inland power station to a place on the coast north of Helsingborg, whence a submarine cable was to be taken across the sea to Helsingör. This extremely interesting scheme of power transmission by high-tension submarine cables has, however, three predecessors of recent date, the Isle of Rügen and the Peninsula of Wittow having for some months been supplied from the Stralsund power transmission station, and the Isle of Fehmarn from the Lübeck power house.

In order to supply the Isle of Rügen with electricity, Messrs. Siemens-Schuckertwerke, in the summer of 1912, laid two high-tension cables, from the Stralsund power transmission station through the Stralsund Bay as far as Rügen, the way across the small island of Dänholm being chosen in order, if desired, to supply current there also.

The particulars of the cable are as follows:—Working voltage, 15,000; copper cross section, 3 × 35 sq. mm.; number of cores, three; insulation, impregnated paper; protection, lead sheathing and armour of round iron wires.

The submarine cable connecting Stralsund with Dänholm is 335 m., and that between Dänholm and Rügen 1,350 m. long. In the latter section a coupling sleeve had to be inserted in each cable, as a single cable length of 1,350 m. would have entailed a considerable increase in the cost of manufacture and transport. The two cables connected by the sleeve were 750 m. and 600 m. long respectively, the weight of a cable drum, inclusive of 750 m. of cable, being about 19,000 kg. This is the first instance of high-tension coupling sleeves being fitted at sea.

From the bus-bars in the power transmission station the two cables were first taken to a small intermediary station on the Island of Dänholm, before terminating at the large sub-station on Rügen, the starting point of the overhead conductor system covering this island.

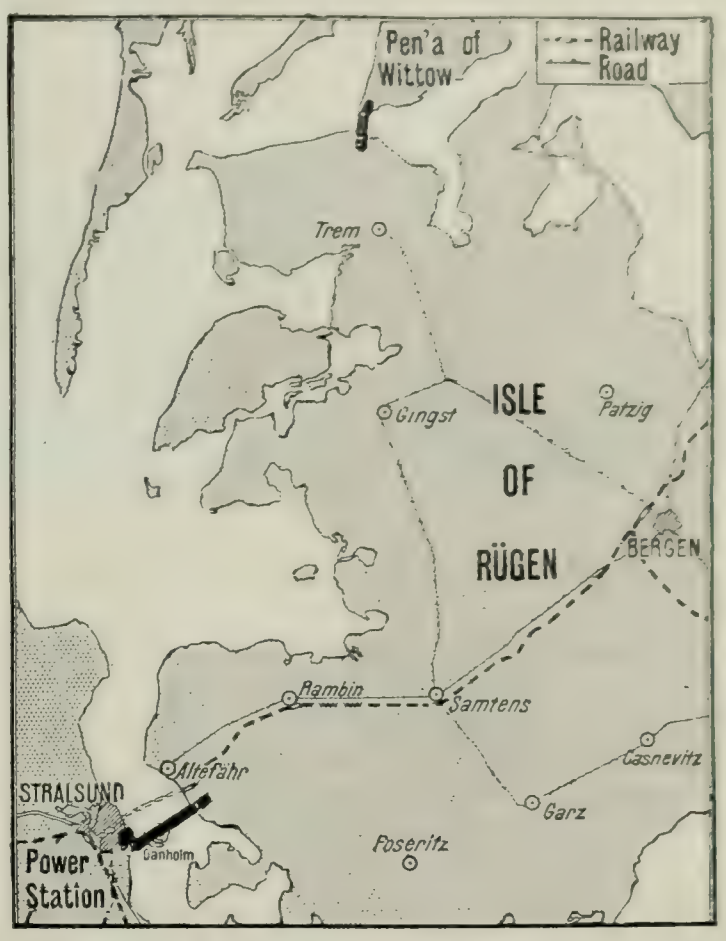


Fig. 1.—Map of Submarine Power Cables.

The submarine cables designed for this installation were supplied on six cable drums, the two largest of which were each 3 m. in diameter and 1·8 m. in width (fig. 2). These cable drums were transported by rail as far as Stralsund, and there taken on the Royal railway department's ferry-boat to the crane of the Royal shipyards.

Two barges coupled close together sideways by iron girders were used in laying the cables. These barges carried the wooden trestles into the bearings of which the cable drums were fitted. They were so arranged that first the two drums comprising 750 m., and subsequently those comprising 600 m. of cable, could be fitted into the two trestles and paid out. After laying the four cables, their ends were attached to a third barge moored in the water, on board of which the connection sleeves were eventually inserted.

Operations were commenced on the coast of Rügen and ended at Dänholm, trenches 6 m. wide and 1 m. deep being, at the Rügen and Dänholm ends, dredged into the sea to

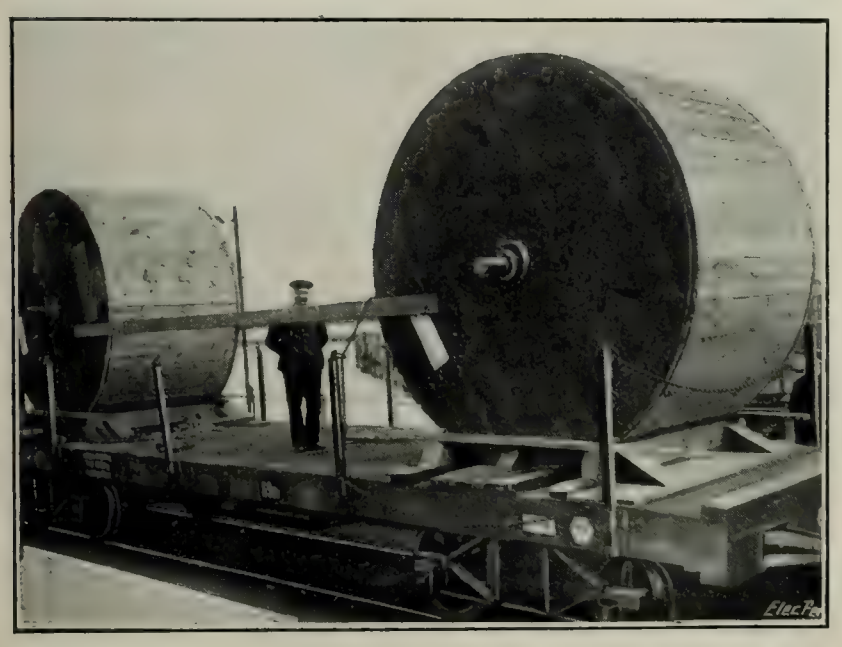


Fig. 2.—Large Cable Drums.



Fig. 3.—Hauling the Cable End up the Shore of the Isle of Rugen.

200 m. distance from the coast, on account of the shallowness of the water.

On June 20th, 1912, at 6 a.m., a steamer took the two



Fig. 4.—Fitting the Coupling Sleeves.

cable barges to the Rügen coast, the sea being quiet and the weather favourable for the cable laying. On reaching Rügen, the barges could not be brought nearer than 150 m. from the shore, the water being only 2 m. in depth. This 150 m. of cable, as well as another length of 40 m. for installation on land, thus had first to be hauled up the steep bank



Fig. 5.—Lowering the Joint into the Sea.

about 20 m. high (fig. 3). For this purpose the steamer was moored with her bow behind the two barges. By means of the steam capstan on board the steamer and a steel hawser about 20 mm. in diameter carried over a pulley on shore, the submarine cables were hauled up the bank, this operation being completed towards noon. On account of a heavy gale blowing in the afternoon, the continuation of cable laying had to be postponed until the following day. The cable barges were moored, and the trestles were secured against the storm by struts installed between the drum disks and by lashing the drums to the barges by means of hawsers. In spite of the enormous top loads, there was no risk of the barges tipping sideways, the girders ensuring a substantial connection. Chains had, moreover, during the preliminary work, been arranged crosswise fore and aft below the barges and fastened to the bollards on deck.

Further preparations for the cable laying were made, in spite of the heavy sea, by laying out anchors. The anchor towards Dänholm was intended eventually to allow the steamer and barges to be hauled forward by means of a steam capstan, thus paying out the cables from the drums. On account of the slow and uniform motion required in cable laying, it was not generally advisable to propel the steamer and barges by the ship's engine.

Anchors were also laid out on either side to prevent the barges from driving to leeward. On each shore were installed two beacons about 4 metres in height, destined to mark the direction of travelling, which could be controlled by hauling in or slacking out the hawsers moored sideways.

Cable laying was resumed on the following day at 6 a.m., the weather having again cleared up. As, however, the water had become so shallow that the barges touched the ground, and could only after three hours' work be got off by the steamer, the laying of the two cables 750 m. in length was not completed before three o'clock, when the two cable ends were fixed by stoppers on the third barge above referred to, which had come to anchor at 700 m. from the Rügen shore. A watertight storm-proof tent for work on the two cable sleeves was put up on this barge (fig. 4), while the empty cable drums were, towards five o'clock, taken to the shipyards. At eight o'clock in the evening, the two drums, each containing 600 m. of cable, were installed on the barges, and in half-an-hour were towed to the place where the anchored barge was waiting. After taking the ends of these two cables under the tent and fixing them there, the fitting of the sleeves could be commenced, two lanterns, each containing three 25-c.p. incandescent lamps, being installed in the tent.

On the following evening, towards nine o'clock, the cable connections were soldered and covered with insulating material. While this was allowed to cool, operations were interrupted for some hours, to be resumed on the following morning, when the iron sleeves were closed and likewise filled with the insulating compound. At two o'clock in the afternoon, the coupling sleeves were consecutively lowered



Fig. 6.—Flaking the Cable.

into the water (fig. 5). This was done by slipping ropes round the sleeve and the cable and fixing one end of each rope on board while the free end was slowly released until



Fig. 7.—Laying the Wittow Cable.

the sleeve touched the ground at about 8 to 10 m. depth. The steamer then hauled the two barges slowly to the Dänholm shore, where it anchored at about six

o'clock, while further cable lengths were paid out and dropped into the water. The cable barges were now about 200 metres distant from the shore, the shallow water preventing any further approach.

In order to take the 300 metres of cable left on each cable-drum to the shore, the two lengths of cable had to be unwound consecutively, and arranged in 8-shaped loops on deck, thus disengaging the cable ends (fig. 6). The end of each cable thus arranged was then hauled up to the shore by means of steel hawsers and a pulley and steel capstan. Two railway rails, 10 m. long, had been buried in the ground behind a hill transversely to the direction of travelling for mooring the pulley on land. A number of rowing boats had to be slipped below the cables to reduce the friction in the muddy soil.

The laying of these cables took about six days, and insulation measurements made immediately after completing the work gave very satisfactory results.

For the purpose of laying the two short cables, each of 335 metres, between the Stralsund shore and the Isle of Dänholm, the drums were placed behind one another on a barge on separate trestles set at an angle. A winch connected with a rope made fast on the other shore was installed in the fore part of the barge, and served to haul it across. The trench dredged for the cables was about 1 metre in depth.

After laying the Stralsund-Rügen cable, two cables, each 430 m. in length, of the same design, were in November, 1912, installed from the Wittow Ferry to the Peninsula of Wittow (on the Isle of Rügen). The two cables were supplied on wooden drums, each about 2·8 metres in diameter and 1·5 m. in width, and were installed on the Rügen shore on trestles. A Stralsund steamer took up its position on the opposite shore (Wittow Peninsula) with the stern turned towards the land. From the steam capstan of this steamer a steel hawser was led across the pulley moored on the Wittow shore, and thence back through the whole width of the water, to the cable drum. The hawser was fixed to both cables so that these, during the working of the capstan, were simultaneously hauled across through the water to Wittow. Short trenches had been dredged below water from both shores to receive the cable.

On account of the considerable weight of the two cables (more than 10 tons each), and the rather muddy ground, the cables were carried on fishing boats. These were spaced about 25 m. apart, and passed, one after the other, immediately in front of the cable drums, over the cables sliding from the shore into the water. To each longitudinal side of the boat one of the cables was fixed by means of a rope; the steam capstan hauled the boat on another 25 m., to make room for the next boat, and so on.

The traffic was interrupted on the day the cables were laid (fig. 7). The cable track and the boats were lighted by night by searchlights from the steamer, thus causing any passing vessels to stop. When the work was resumed on the following morning, about 200 m. of cable was left on the drum. Considerable difficulty was experienced during the further part of the work, some of the ropes having got loose and covered up with shifting sand. When the two cable ends had at last been taken across sufficiently near to the shore, they were moored there and the ropes used to attach them to the boats were cut.

A third instance of submarine power transmission is the laying of submarine cables through the Straits of Fehmarn.

Messrs. Siemens' electricity works supply from the Lubeck power transmission station a considerable part of Holstein with electric power and light. In order to connect the Isle of Fehmarn up to this power transmission system, two 3 × 25 sq. mm. high-tension cables, designed for a working pressure of 11,000 volts, had to be laid across the straits, the two shores being about 1 km. apart. The cables were insulated with paper and lead-sheathed with armour of Z-shaped iron wire.

The two cables were, as in the case of the Stralsund installation, each supplied in two sections, the two large drums being each 3 m. in diameter, 1·80 m. in width, and, inclusive of the cable, about 20 tons in weight. The cables were taken by rail from Messrs. Siemens-Schuckert's Cable Factory at Berlin, to Kiel, in order there to be loaded on the cable boats by the crane of the *Germania* shipyards and to be shipped to Fehmarn. Two beacons having been erected on the shore of the island, a wire rope was led across the Straits and moored on the continent. This wire rope indicated the track of the cable, and was to be used for carrying the cable barges along in laying the cables.

Operations were commenced at the Fehmarn cable house, where the water was deep enough for the first barge with the two cables to approach the shore to within 20 m. distance. The cable ends were taken across the stern of the barge into the cable house. After fixing the two cable ends there, a bow anchor was lowered, and the boat moved on by heaving on the windlass, so that the cables ran out into the water. After thus paying out some hundred metres of cable, operations had to be temporarily discontinued on account of a storm coming up. The boats were anchored, and preparations were made for cutting the cables if necessary, thus allowing the boats to escape from the coast out into the sea. The cable ends would in this case have been fitted with water-tight seals and fixed to buoys in the water. Fortunately, however, the weather soon calmed down, so that the work could be resumed on the following day, when the steamer slowly towed the cable boats towards the land, the cables being paid out at the speed of 30-40 m. per minute. The two ends of the cables thus laid out were fixed by means of stoppers on the boat and got ready below a tent for connection with the two remaining cables. The boat was then firmly anchored and the second cable length from the other boat paid out in the same way as above described, after taking the cable end over to the anchored boat. Two days and two nights of almost uninterrupted work was required to complete the two connections.

In the meantime, the cables had been led into the sub-station on the mainland. The connecting sleeves were dropped to about 10 m. depth by the aid of the two boats and the mast winches which they carried.

Throughout the cable-laying operations the position of the cables was determined by means of a sextant and recorded on the chart.

British Inspection for the American Underwriters.—We are able to announce that Messrs. Heap & Digby, of 48, Westminster Palace Gardens, Victoria Street, S.W., have been appointed engineers in Great Britain to the Underwriters' Laboratories Inc., Chicago. Our readers are aware that the "National Electrical Code" of the rules and requirements of the National Board of Fire Underwriters, consisting of the British and American insurance companies, governs very closely the construction, component materials and design of all such articles as switches, fuses, rubber-covered wire, flexible cord, conduits, flexible tubing, circuit-breakers, lamp sockets, porcelain fittings, ceiling roses, motor starters, and so forth, to be used in positions where a fire hazard is involved. The "National Electrical Code" and the semi-annual "List of Electrical Fittings," issued by the Board of Fire Underwriters, in the one case prescribe the general requirements to be met, and, in the other case, give a schedule of the approved fittings. The function of the Underwriters' Laboratories is to see that these rules and requirements are carried out. For this purpose it is necessary to submit samples of the apparatus to them for approval, after which inspections are made at regular intervals to ensure that the quality of the commercial article is maintained, and in certain specified cases labels are supplied which may be attached to them as evidence to the purchasing public that such have received their approval.

Hitherto all British-made electrical fittings of the above type for use in Canada have had to be examined by the Underwriters' Laboratories' Inspectors after arrival. The arrangement which has now been made enables this to be done by Messrs. Heap and Digby before the goods leave the maker's factory, thereby giving to the British manufacturers the same facilities as those enjoyed by the American, and removing a difficulty to which His Majesty's Trade Commissioner in Canada has recently drawn attention.

Mr. Arthur C. Heap and Mr. W. Pollard Digby have each a very intimate knowledge of the British manufacturing conditions and British-made apparatus. In addition Mr. Heap has, during the last 12 months alone, paid three visits to Canada for the express purpose of studying Canadian conditions and requirements.

Messrs. Heap and Digby will be pleased to give manufacturers any information they require as to the regulations of the Board of Fire Underwriters, and supply them with copies of the National Electrical Code.

Educational Notes.—In the Faculty of Engineering at University College, the Entrance Scholarships awarded to Messrs. C. H. Avery and G. G. Dawson have been renewed for a further year, as has also the Goldsmid Scholarship that was awarded to Mr. P. L. Capper. The Archibald P. Head Medal and Prize goes to Mr. W. J. Duncan. Sixteen students have obtained Engineering Diplomas.

CONTRACTS OPEN.

(*Continued from page* 58.)

Batley.—July 15th. Steam coal (4,000 tons of pea nuts or beans) for the Corporation electricity works. Mr. S. Derwen Jones, engineer.

Belfast.—July 21st. One 3,500-ampere traction switchboard panel, for the Corporation. See "Official Notices" July 4th.

Belgium.—July 26th. The Belgian Telegraph authorities in Brussels (La Salle de la Madeleine) are inviting tenders for the following :—

Supply and laying of two cables to connect the telephone exchange in the Rue de la Paille, Brussels, with that in the Rue des Freres Cellistes, Antwerp.

Two cables to connect from Ans the existing telegraph and telephone lines between Liége-Guillemins and the telephone exchange in Verviers.

Birkenhead.—July 14th. Low-tension main cable, and india-rubber lead-covered and armoured service cable for the Corporation. See "Official Notices" June 27th.

Blackhill (Co. Durham).—July 19th. Electric light equipment, Richard Murray Hospital (dynamo, battery, switchboard, and about 200 lights) ; Mr. Ernest Caldwell, secretary of the hospital (returnable deposit of £1).

Chile.—September 13th. (1) An electric generating plant with distributing system ; (2) an electric lighting installation—both for the harbour of Valparaiso. Tenders to "Al. Sr. Secretario de la Comision, Comision de Puertos, Calle Santo Domingo No. 1,147," Santiago de Chile, where the specifications, &c., may be consulted.

Eccles.—July 21st. Mechanical stokers for four Lancashire boilers at the electricity works, Cawdor Street, Patricroft. Borough Electrical Engineer.

France.—July 30th. The French State Railway authorities (Bureaux du Service Electrique) in Paris (43, Rue de Rome) are inviting tenders for the establishment and equipment of a number of transformer stations at Rouen and Sotteville.

India.—An announcement appeared in our advertisement pages last week to the effect that the Government authorities are prepared to grant licences under the Indian Electricity Act for supply within the municipalities of Allahabad, Lucknow, and Bareilly.

London.—Hackney.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" June 20th.

H.M. Office of Works.—July 18th. Supply of electric cable and wire during one year from September 1st, 1913. See "Official Notices" July 4th.

L.C.C.—July 22nd. Switchgear for tramways sub-stations. See "Official Notices" to-day.

July 23rd. Electrical installation (235 points) at Tollit Street School, Mile End, E. See "Official Notices" to-day.

Newport (Mon.).—July 19th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" July 4th.

New Zealand.—September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of current from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Nuneaton.—July 15th One line booster for the Electricity Committee. See "Official Notices" July 4th.

Portsmouth.—July 16th. Coal (not Welsh) for the Corporation electricity works. Engineer and Manager, Gunwharf Road (returnable deposit of £2 2s.)

Roscrea.—July 11th. Roscrea Bacon Factory, Ltd., invite tenders for buildings, gas engine and suction plant, dynamos, battery, switchboard, overhead feeders, mains and street lamps, for the electric lighting of the town. See "Official Notices" June 27th.

Roumania.—The municipal authorities of Constantza have just invited tenders for the concession for the supply of electrical energy for lighting purposes and for the operation of the tramway in the town and district.

July 18th.—The municipal authorities of Togu-Ocna are inviting tenders for the establishment of a central electric lighting station in the town.

Scarborough.—July 12th. Electric light installation at the Workhouse and Infirmary, for the B.G. (about 360 lights). Messrs. Tennant & Barrs, consulting engineers, Cathedral Buildings, Dean Street, Newcastle-on-Tyne (returnable deposit of £5).

Shipley.—July 22nd. Two 1,000-KW. steam turbines, two 1,000-KW. alternators, two surface condensers, and one controlling switchboard, for the U.D.C. See "Official Notices" to-day.

South Africa.—Details of the electrical machinery requirements for which the Wellington Municipality, Cape Province, are inviting tenders, are now to hand, and comprise two suction gas engines and producers, or, alternatively, superheated steam engines ; two 48-KW. three-wire dynamos ; one 10-KW. motor balancer ; and one three-wire battery booster set ; also battery and distilling plant, switchboard, poles, insulators, feeder pillars, travelling crane, meters, instruments, overhead equipment, &c. Total cost, £10,000. Specifications may be obtained on deposit of certified cheque for £10 10s., payable to the order of the Town Clerk, Wellington, from Mr. Charles G. Trevett, 70, Fletcher's Chamber's, Cape Town.—*British and South African Export Gazette.*

September 10th.—Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Swindon.—July 26th. Steam coal for the electricity works of the Corporation. See "Official Notices" to-day.

Todmorden.—July 26th. 300-KW. converting plant, H.T. switchboard and cables, mechanical stokers and superheaters, for the B.C. See "Official Notices" to-day.

West Hartlepool.—July 8th. Single L.T. paper-lead cables, and pilot and telephone cables for the Tramways Department. See "Official Notices" to-day.

CLOSED.

Accrington.—The tender of Messrs. Simpson Bros., of Hapton, for a rearrangement of the electric lighting of the Market Hall, for £54, has been accepted by the Corporation.

Barrow.—The T.C. on Monday accepted the tender of Messrs. Balcke & Co., at £167, for a new interior to the No. 1 cooling tower ; the present one has been in use 13 years.

Belfast.—The Corporation has accepted the tender of the Sturtevant Engineering Co., Ltd., at £369, for supplying a wet-air filter for turbo-generators. For renewal and reconstruction of the permanent way and for permanent way depôt, the following were the tenders received :—

Permanent Way.

G. Percy Trentham, Ltd.		£6,575
Dick, Kerr & Co.	(accepted)	6,797
Grainger Bros.		6,804
Wm. Griffiths & Co.		7,190
Workman, Ltd.		7,520
J. & W. Stewart		8,856

Permanent Way Depôt.

Wm. Dowling	(accepted)	£2,066
J. & R. Thompson		2,073
Wm. Courtney		2,079
J. Hogg & Son		2,148
J. & W. Stewart		2,400

Belgium.—One Belgian and six German firms submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cable in the Antwerp district, the lowest offer being that (£5,433) of Messrs. Felten & Guilleaume, of Mulheim-am-Ruhr.

Bournemouth.—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for Sandberg steel tramway rails, at £5,535.

Bradford.—The Board of Guardians has accepted the tender of Mr. Charles Bell, Bradford, for the work in connection with the electric lighting in the altered male imbecile wards, £42 10s.

The City Council has accepted the tender of Messrs. Beecroft and Wightman, Ltd., at £972, for hardwood paving blocks for the tramways department.

Brighton.—The T.C. has accepted the tender of Messrs. W. Cory & Son for coal for the electricity works at Southwick—Muirfield washed nuts (from 10,000 to 12,000 tons, with option of from 20,000 to 22,000 tons), at 16s. 3d. per ton.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for 252 yd. of armoured electric cable.

Buxton.—Out of 23 quotations, the U.D.C. has accepted the tender of Messrs. Day & Ferguson for Pilsley hard slack, for the electricity works.

Canterbury.—The tender of Messrs. E. J. Philpot has been accepted for electrical illuminations at public buildings during Cricket Week, at £40.

Cape Town.—The tender of Messrs. Edward A. Shaw and Co. has been accepted for the electric lighting of the new Cathedral. The same firm have also in hand the wiring of the new Town Hall at Robertson, Cape Province.

Clacton-on-Sea.—The U.D.C., on July 2nd, accepted the tender of the Consolidated Diesel Engine Co., Ltd., for an engine, water cooler, switchboard and Crompton dynamo, at £5,438.

Colchester.—The Essex County Asylums Committee has accepted the tender of Messrs. J. & E. Hall, Ltd., of Dartford, for refrigerating plant, electric motor and insulation work at Colchester Asylum, at £349.

Doncaster.—The Electricity Committee of the T.C. has accepted the following tenders :—

Willans & Robinson, Ltd.—Turbine and condenser, £3,308.
British Westinghouse Co., Ltd.—One 850-kw. rotary converter, £1,071; and one 600-kw. rotary converter, £1,510.

Eccles.—The Electricity Committee recommends the acceptance of the following tenders for coal and coke for 12 months :—

Earl of Ellesmere.—Screened washed nuts, 14s. per ton.
Eccles Co-operative Society.—Best selected house coal, 16s. per ton.
T. Slack.—Screened ordinary quality house coal, 13s. 6d. per ton; and best gas coke, 14s. 2d. per ton.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for coal for the electricity works for a year—Hillhouse washed nuts at 19s. 1d. per ton, and Hillhouse washed peas at 17s. 10d.

Glasgow.—The Tramways Committee has recommended acceptance of the following tenders :—

Special trackwork.—Lorain Steel Co., and E. Allen & Co.
Ten-ton travelling crane for Whitevale sub-station.—Chambers, Scott & Co.
Teak planks.—J. Watt Torrance & Co., and Robinson Dunn & Co.
Mica.—Micanite and Insulators Co., Ltd.

The Works and Stores Sub-committee has considered offers which had been received for a condenser for the new turbine to be erected at Pinkston station for No. 4 engine there, and agreed to recommend acceptance of the offer of Messrs. Willans & Robinson for the condenser, and Messrs. John Jackson & Co. for the engine.

Hereford.—The T.C. has accepted the tender of Messrs. Walker & Co. for installing the electric light at the municipal slaughterhouse, at £24.

Heston and Isleworth.—The following tenders have been accepted by the U.D.C. for supplies of coal and coke to the electricity department :—

W. Cory & Son, Ltd.—Coleorton hard steam coal, 15s. 11d. and 16s. 11d. per ton.
Phillips & Co., Ltd.—Mapperley or Riddings bituminous nutty slack coal, 16s. 8d. per ton.
Bradbury, Son & Co., Ltd.—Gwaen-cae-Gurwen anthracite coal, 19s. 8d. per ton.
Spenser, Whatley, Ltd.—Best Derby brights house coal, 18s. 5d. per ton.
Charrington, Sells, Dale & Co.—Coke, 20s. 4d. per ton.

Lamp Contracts.—The Brimsdown Lamp Works, Ltd., have received the annual contracts for the Great Northern Railway and the Bedford Corporation; also two large orders from the Buenos Ayres and Pacific Railway.

Leeds.—The Tramways and Electricity (Works) Sub-committee has recommended the acceptance of the tender of the J. G. Brill Co. for 20 to 40 trucks for new cars, at £42 12s. 6d. each; and that of Dick, Kerr & Co., Ltd., for 20 electrical equipments, with option to take a further 20, at £234 10s. each.

The tender of Messrs. Wm. Airey & Son, for the erection of a new depôt in Sovereign Street, at £23,199, is recommended for acceptance.

London.—L.C.C.—The Council has approved of a contract with Messrs. Venner's Signs, Ltd., to supply and fix the advertisement of the Home and Colonial Stores on 1,675 of the Council's cars for 12s. 3d. a car (one end only).

The contract for machinery oil for Greenwich generating station, placed with Messrs. C. Price & Co., Ltd., is at £11 10s. per ton. The Stern Sonneborn Oil Co. will supply cylinder oil up to May, 1914, at 1s. 5½d. per gallon.

Messrs. W. Cory & Son, Ltd., have received the contract for the removal of ashes from the station for one year, at 1s. 3d. per cb. yd. Messrs. W. T. Henley's Telegraph Works Co. will supply 880 yd. of L T. vulcanised bitumen-insulated cable for £213, and the B.I. and Helsby Cables, Ltd., 50 cwt. of D.C.C., H.C.C. wire for £222.

The following were the tenders received for the electric lighting at Elthorne Road School, Islington :—

H. J. Cash & Co., Ltd.	(accepted)	£108
A. Hawkins & Sons		115
W. C. Tackley & Co., Ltd.		122
Cunningham, Ltd.		124
C. H. Cathcart & Co.		139
F. Reade & Co.		150
G. Weston & Sons, Ltd.		168

Hammersmith.—The B.C. Electricity Committee has accepted the tender of the British Electric Transformer Co., Ltd., for ten 100-kw. transformers and five 50-kw. ditto. The tenders received for each transformer were as follows :—

	100-kw.	50-kw.
	£ s.	£ s.
Johnson & Phillips, Ltd.	79 0	46 17
British Electric Transformer Co., Ltd.	85 0	50 5
W. E. Burnand & Co.	87 10	54 0
Brush Electrical Engineering Co.	93 10	56 12
Foster Engineering Co., Ltd.	94 0	47 10
Ferranti, Ltd.	94 0	60 0
Electrical Engineering and Equipment Co., Ltd.	105 10	59 0
British Westinghouse Co.	141 0	83 10

Woolwich.—The B.C. has accepted the following tenders :—

W. T. Henley's Telegraph Works Co., Ltd.—Cable, £2,881.
Drew-Bear, Perks & Co., Ltd., Battersea.—Steelwork for boiler house, £3,931.
Mechan & Sons, Ltd.—Circulating water piping, £116.

Southwark.—The B.C. has accepted the tender of the Strand Building Co., at £1,715, for carrying out the works required in connection with the extension of the electric light station in Penrose Street.

Stepney.—The following tenders have been received by the B.C. for various supplies to the Electricity Department :—

40 Street Disconnecting Boxes.

	Drawing No. 2,410. 25	Drawing No. 2,428. 24
Universal Electrical Manufacturing Co. (accepted each)	£1 6 6	£0 15 9
B. I. and Helsby Cables, Ltd.	1 14 6	1 0 6
Reason Manufacturing Co., Ltd.	2 18 6	1 19 6

less 2½ per cent.

Motor-Driven Boosters.

Siemens Bros. Dynamo Works, Ltd. (accepted)	£1,073
Bruce Peebles & Co., Ltd.	1,095
Crompton & Co., Ltd.	1,150
British Westinghouse Co., Ltd.	1,151

Storage Battery.

D.P. Battery Co., Ltd. (accepted)	£1,934
Chloride Electrical Storage Co., Ltd.	1,[illegible]
Electrical Power Storage Co., Ltd.	2,060
Do. Do. (alternative)	2,407
Hart Accumulator Co., Ltd.	2,122
Tudor Accumulator Co., Ltd.	2,214

Annual Supply of Carbons.

Sloan Electrical Co., Ltd. (accepted)	£1,043
Electrical Co., Ltd.	1,0[illegible]
W. Geipel & Co.	1,101
Ditto, alternative (lower grade carbon)	988
G. Braulik	1,[illegible]
Crompton & Co., Ltd.	1,191
Siemens Bros. Dynamo Works, Ltd.	1,774
Electrical Engineering and Equipment Co., Ltd.	1,453
Ship Carbons, Ltd. (part only)	423
Union Electric Co., Ltd. (part only)	519

The following tenders have been accepted for annual supplies of coal to the Electricity Department :—

Smokeless Welsh and Bituminous Steam Coals.

Bradbury, Son & Co., Ltd.—250 tons London made small Dowlais, 15s. 9d. per ton.
C. Franklin—100 tons Bwllfa, 24s. 1d. per ton; 250 tons Welsh Colliery Smalls Gored Merthyr, 18s. 6d. per ton; 600 tons Griff 2 yd. Hard large, 21s. 10d. per ton; 700 chaldrons broken coke, 12s. 11d per chaldron; 150 chaldrons unbroken coke, 11s. 11d. per chaldron; 200 tons Charlsden Wallsend in 1-cwt. sacks, 25s. 8d. per ton; in 2-cwt. sacks, 24s 8d. per ton; Newland Wallsend, in 1-cwt. sacks, 25s. 8d. per ton; in 2-cwt. sacks, 24s. 8d. per ton; Featherstone, in 1-cwt. sacks, 25s. 8d. per ton; and 2-cwt. sacks 24s. 8d. per ton; 25 tons Tanfield (Smith's), 24s. 2d. per ton.
Rickett, Cockerell & Co., Ltd.—200 tons London made small coal, 14s. 6d. per ton.

Bituminous and other Small Coals.

A. Blackmore & Co.—5,000 tons Wemyss washed peas, 14s. 8d. per ton.
Cleeves & Co.—3,000 tons Cowdenbeath peas, 15s. 3d. per ton
Dinham, Fawcus & Co., Ltd.—5,000 tons Mansfield D/S nuts, 15s. 6d. per ton.
E. Foster & Co.—4,000 tons Ibstock D/S nuts, 11s 11d. per ton; 2,000 tons Ibstock peas, 15s. 6d. per ton.
Harris, Hardman & Co., Ltd.—3,000 tons Hillhouse peas, 15s. 3d. per ton.
J. Hudson & Co., Ltd.—5,000 tons Wemyss washed peas, 14s. 8d. per ton.

Manchester.—The Tramways Committee has accepted the tender of Messrs. Simons-Carves, Ltd., for the supply of pitch.

The Education Committee has accepted the tender of Messrs. W. P. Theerman & Co., Ltd., for an electric lighting installation at the Municipal Trades School.

The following tenders have been accepted by the Electricity Committee :—

William Gornall.—For the whole foundations and floor extensions at engine house, &c., for 15,000-kw. turbo-generator.
W. T. Henley's Telegraph Works Co., Ltd., B.I. and Helsby Cables, Ltd., C. Macintosh & Co., Ltd., and the Electrical Engineering and Equipment Co., Ltd.—For cable.

Reigate.—The T.C. has accepted the tender of Messrs. Wilson, Carter & Pearson, Ltd., for Nixey navigation coal for the electricity works, at £1 5s. 3d. per ton.

Rotherham.—The tender of the Daimler Co., Ltd., has been accepted by the Tramways Committee, at £432, for the supply of spares and other accessories required for three motor-buses.

St. Helens.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for a rotary converter.

Sheffield.—The following tenders have been accepted by the City Council :—

British Westinghouse Co., Ltd.—One motor-driven surface condensing plant, capable of dealing with 75,000 lb. of exhaust steam per hour, £2,647, and 10 per cent. allowance for contingencies, and with a further allowance of £100 for the old condenser.
Chatteris Engineering Works Co.—Hand travelling crane of 15 tons capacity for Kelham Island power station, £375.
J. P. Hall & Son, Ltd.—One direct-acting boiler feed pump for Kelham Island power station, £190.

Southampton.—The B. of G. has accepted the tender of Messrs. H. C. Taplin & Sons for the installation of the electric light at Shirley Warren Infirmary, at £867.

South Shields.—The Corporation has placed a contract for Wotan lamps for car-shed and office lighting, &c., and tantalum traction lamps for use on cars for 12 months, with Messrs. Siemens Bros. Dynamo Works, Ltd.

Stockport.—The Corporation has accepted the following :—

16,000 yards of 3-in. self-centring conduit, with "Stamford" joints: Doulton and Co., Ltd.
Field magnet: Lancashire Dynamo and Motor Co., Ltd.
W. T. Glover & Co., Ltd.—Twelve months' contract for cables.

Sunderland.—The T.C. on Wednesday accepted the following tenders :—

Ferranti, Ltd.—Oil switches and meters.
B.I. and Helsby Cables, Ltd.—440 yd. L.T. cable.
Phœnix Dynamo Co.—Winding motor generator.

Wakefield.—The Electricity Committee has accepted the tender of the Victoria Coal and Coke Co. for 1,000 tons of unscreened slack.

NOTES.

The £250 is still Required.—July 16th is the closing date under the terms of Mr. Byng's offer. Unless that gentleman sees his way to extend the period, the matter will, we suppose, have to close before our next issue appears. We greatly hope that the desired result will yet be secured. Will all of our readers personally consider their own position in relation to the Electrical Trades Benevolent Institution, and immediately, or between now and Wednesday next, either bring their influence to bear upon their well-to-do friends, or themselves send, the further £250 required to make up this additional £1,000 which the Fund must have, if it is to meet the increasing demands that are made upon it?

Croydon Tramway Sports.—In our last issue we referred very briefly to the sports of the Croydon Corporation Tramways Athletic Club, which took place on Wednesday, the 2nd inst., on the Brighton Railway Co.'s Athletic Club's ground, Mitcham Road. Prior to the sports, we, with several members of the technical Press, were invited to meet the Metropolitan Tramways managers and others interested in the industry over a most enjoyable and well served cold collation at Dennett's Restaurant in George Street, with that most genial of hosts and most popular of managers, Mr. T. B. Goodyer, in the chair. Those of us who lunched (!) at the Norbreck Hydro during the Blackpool Conference doubtless made mental comparisons between the fare there provided and that placed before us at Dennett's!

The Mayor of Croydon, Councillor S. Rogers, and Mr. H. E. Blain, late of West Ham, spoke in the highest terms of Mr. Goodyer's all-round excellence in everything he undertook, and we, who know him, can bear out all that was said in his praise. What we specially like about Mr. Goodyer is the keen personal interest he displays in all matters conducive to the welfare of his employés, for such friendly feeling between manager and men must result in more amicable relations between them. The capital Tramways Military Prize Band, in which he takes a special pride, is a most excellent organisation and reflects much credit upon the training of the bandmaster, Mr. W. Ellis. Only the other day, the Bishop of Southwell expressed the hope that another Carnegie would come forward and subscribe not organs, but bands, so that they could brighten life and drive out insobriety and gambling. Mr. Goodyer understands the value of a good musical combination amongst his men.

After the sports, which, towards the end of the afternoon, were somewhat marred by rain, a couple of hours were spent in the Croydon "Empire," by the kind permission of the manager and under our host's guidance. In one of the comical "turns," a "vacuum cleaner," represented it was said by a firm in Queen Victoria Street, showed up to great advantage in clearing the stage of cats, articles of ladies' attire, &c. Then the train, and home, after a most pleasurable day enjoyed alike by competitors, guests, and onlookers generally.

Production Managers' Association.—The July dinner will be held at the Holborn Restaurant to-morrow (Saturday), July 12th, at 6.45 for 7 p.m., the subject for discussion being "Scientific Management." Mr. Frank B. Gilbreth, of New York, will be the guest of the evening. The dinner will be open to anyone who is interested in production problems. Tickets, price 5s. each, can be obtained from the hon. secretary, Mr. J. W. Stannard, Queen Anne's Chambers, Westminster, S.W., or at the doors if previous notice of attendance is given.

Sheffield Electrical Workers' Wages.—According to a Sheffield newspaper, the Sheffield and district branch of the Electrical Trades Union is organising its area with a view to securing a rise of wages for electrical workers. The question was fully discussed at a meeting of the branch held in the Foresters' Hall, Sheffield, last week. Mr. T. Stewart (one of the organisers of the Union) presided, and stated that the electrical workers in Sheffield had not received an advance in wages for 13 years. At present they were paid 8½d. per hour, compared with 9d. per hour in such cities as Manchester, Liverpool and Glasgow. He urged them so to strengthen their membership that they would be in a position to approach the employers, and bring their rate of pay into line with that obtaining in the cities he had named. The speaker's remarks were endorsed by Messrs. A. Rigley (district organiser of the Painters' Society), and H. Stone (secretary of the Bricklayers' Society).

Storage Battery Litigation in the United States.—The action brought by the Electric Storage Battery Co., of New York, against the Gould Storage Battery Co., for alleged infringement of the Madden patent, a machine for making grids for secondary batteries, has just been decided in favour of the defendants by the U.S. Circuit Court of Appeals.

Scottish Electrical Contractors' Association.—The first annual general meeting of the Electrical Contractors' Association of Scotland was held at Glasgow. Mr. W. M'Whirter, president, occupied the chair. The following officials were elected for the forthcoming year:—President, Mr. Alexander Pratt, Edinburgh; vice-president, Mr. E. J. B. Lowdon, Dundee; secretary, Mr. James M. Davies, jun., chartered accountant, Glasgow; solicitor, Mr. Walter Finlay, W.S., Edinburgh.

British Trade with China.—Prof. C. A. M. Smith, of Hong-Kong University, writes as follows from St. Ermin's Hotel, Westminster, S.W., under date July 8th:—

"During the past week, one of the leading newspapers in London published an editorial note, in which was expressed great surprise at an official statement that the German trade in one of the Provinces of China had passed in value that done by the English. Such statements, however, do not cause surprise out on the Chinese coast, and I would again venture to call the attention of British manufacturers to the fact that every effort should be made by the Britishers at home to prevent these continual rumours and statements concerning the advance of our trade rivals in the Far East.

"One of the most encouraging signs of the enterprise of the British manufacturer in the Chinese market is the remarkable response which has been made to the appeal for equipment of the University of Hong-Kong, which you have generously sponsored in the columns of your journal.

"During the last few weeks, since my return to the old country, I have found among the many manufacturers to whom I have been introduced, a definite determination to do something, not only in their own trade interests, but because of the Imperial prestige.

"In the last few days, Messrs. Ferranti, Ltd, have presented a 12-panel power station switchboard complete; Messrs. Buckton, of Leeds, a 30-ton tensile testing machine; Messrs. Mather & Platt, various electrical motors, dynamos, &c., and Messrs. W. F. Stanley a large number of most valuable surveying instruments.

"I am also pleased to be able to add that I have received an intimation from the Colonial Office, that Mr. Secretary Harcourt has approved of the request from the Governor of the Colony of Hong-Kong that the Colony should make an additional contribution to the funds of the University, which is specifically allocated to pay for the salaries of two new lecturers in engineering. Thus British engineering firms will see that the Government will help them in this work if they will show themselves to be in earnest.

"There is still need for further equipment, but I feel quite confident that in a few weeks we shall be able to send the message out to the Britishers in the Far East that the whole of our engineering equipment has been presented by firms at home, and that, in addition, we have received valuable contributions for our running expenses.

"This success has been only possible because of the far-sighted policy of your Journal, and those others who have so splendidly helped in the past, and who will, we are confident, reap the reward of the work now being done. We certainly must beat our trade rivals in China.

"Yours faithfully,

"C. A. M. Smith,

"*The Dean of the Faculty of Engineering,*
"*Hong-Kong University.*"

Electricity Supply Rifle League.—The following matches were decided during June:—

St. James's (Hocking, 94), 544; Central (Gaze, 98), 568. Ilford (Wilde L. Tufnell, 96), 564; Westminster (Horley, 98), 573. Shoreditch (Weekes, 98), 548; Brompton (Mugford, 96), 554. Shoreditch (Herbert, Ebner, 98), 578; Poplar (Robert, 92), 504. Brompton (Mugford, Beale, 98), 574; St. James's (Strange, 95), 546. Hackney (Self, Smith, 96), 556; Stepney (Mansell, Graves, Barber, 93), 531. Hackney (Smith, 96), 547; Ilford (R. Tufnell, 97), 566; Stepney (Barber, 94), 540; Central (Wells, Gaze, 96), 565. Poplar (Randall, 95), 509; Westminster (H. A. Pearman, 98), 575. Poplar (Randall, 91), 484; Brompton (Willis, Furneaux, 96), 559. The following are the positions to date:—

	Shot.	*Won.*	*Lost.*	*Points.*	*For.*	*Against.*
Shoreditch ...	8	7	1	14	4,567	4,336
Westminster ...	8	7	1	14	4,562	4,375
Ilford	8	6	2	12	4,513	4,330
Central	8	5	3	10	4,502	4,368
Brompton ...	8	5	3	10	4,465	4,345
St. James's ...	8	3	5	6	4,286	4,407
Hackney ...	8	2	6	4	4,324	4,356
Stepney	8	1	7	2	4,327	4,311
Poplar	8	0	8	0	3,761	4,479

Parliamentary.—Brighton Corporation Bill.—The Committee on Unopposed Bills reports having passed the preamble of the Brighton Corporation Bill, and fixed the following periods of time for the repayment of loans authorised under the Bill: lands, sheds and buildings, underground cableways and cables (£9,000) 40 years; overhead line equipment, shelters, and miscellaneous equipment (£5,300) 20 years; trolley vehicles (£4,900) 10 years. The amount payable under the Rottingdean agreement for the acquisition of the Brighton and Hove Co.'s powers to construct a system of trolley vehicles from Brighton to Rottingdean is fixed to be paid 15 years from the date of the original loan.

Royal Assent.—The Royal assent has been given to the following Acts:—Crowborough District Gas and Electricity Act; Northern Counties Electricity Supply Co., Ltd., Act; Herne Bay Gas and Electricity Act; Dundee Corporation (Improvements and Tramways) Act; S. Staffs. Mond Gas (Power and Heating) Co.'s Act; Cleveland and Durham County Electric Power Act.

Various Bills.—In the House of Lords on July 3rd the Mexborough and Swinton Tramways (Railless Traction) Bill was read a second time.

The Kelvin Memorial at Westminster Abbey.—On Tuesday next, 15th inst., at 3 p.m., the dedication will take place in Westminster Abbey of a window in memory of Lord Kelvin. The window, which is the result of action taken by engineers in the British Dominions and the United States, has been placed in the North Aisle of the Nave, in close proximity to the one erected in 1909 by civil engineers to the memory of Sir Benjamin Baker, and has been designed and made by the same artist, Mr. J. N. Comper. The chief features of the design are :—At the head of the window is a cinquefoil containing the arms of Henry V, and his badges of the Swan and Antelope, as represented on his Chantry in the Abbey. The lights contain two large figures under canopies, both lights being framed with borders, having niches holding 16 statuettes and 13 shields relating to them. In the left-hand light is the figure of King Henry V in armour (d. 1422); in the right-hand light is that of Abbot William Colchester vested as in the effigy on his tomb in the Abbey (d. 1421). Within the canopy above the King is a picture of his Coronation. The design also includes a number of other heraldic devices relating to the connection of Henry V with the Abbey. In front of the pedestals of the two large figures are tablets held by angels, containing the words :—

1. In Memory of Baron Kelvin of Largs.
2. Engineer, Natural Philosopher, B. 1824, D. 1907.

And beneath these again are the arms of Lord Kelvin and of Glasgow University. A special service, with music, is being arranged by the Abbey authorities, and Mr. R. Elliott-Cooper, President of the Institution of Civil Engineers, will make the formal presentation of the window on behalf of the donors.

Members of the American Engineering Societies and of the Canadian Society of Civil Engineers who may be in London at the time are invited to attend the dedication ceremony, whether they subscribed to the cost of the window or not, and they may obtain cards of admission by writing before Monday, July 14th, to the Secretary of the Institution of Civil Engineers, 12, Dartmouth Street, Westminster, S.W.

Foreign Trade in June.—During the month of June this year imports advanced in value by 15·1 per cent, exports by 22·4 per cent., and re-exports by 48·8 per cent. In the corresponding period of 1912, it must be borne in mind, the London Transport Strike was seriously affecting shipping on the Thames. From the published statistics we gather the following relating to the electrical and machinery trade :—

Imports.	*Month of June.* £	*Inc. or dec.* £	*Six months, 1913.* £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and insulated wire	121,261	+ 30,399	764,129	+ 24,308
Machinery	595,245	+ 51,393	3,757,738	+ 330,363
Exports.				
Electrical goods and apparatus, excluding machinery and insulated wire	301,454	− 20,125	2,682,811	+ 616,478
Machinery	3,233,910	+674,386	18,424,543	+2,735,357

Fatalities.—At Redruth (Cornwall) an inquest was held relative to the death of Frederick Thomas Crowe, 40 years of age, the Cornwall Electric Power Co.'s assistant manager, who died from injuries received by being thrown from a motor-cycle at East Hill, Tucking Mill. Verdict "Accidental Death."

Charles Westbury Wakelin (27), of Hulme, electrical engineer, was killed on Tuesday last week at the Partington Iron and Steel Works, Irlam. The deceased, who was employed by Messrs. Simon-Carves, Ltd., engineers, Manchester, who are erecting coke ovens at the works, was engaged on a scaffold in the ammonia house when, from some unexplained cause, he fell and alighted on the floor, 27 ft. below. In his descent his head struck an iron girder, and his skull was fractured. Verdict "Accidental Death."

An inquest was held at Weston-super-Mare regarding the death of Reginald J. Clark, an employé of the Weston Electric Lighting Co. The evidence showed that Clark, with other employés, had been engaged in removing a cable, which supplied power from the company's works to the Milton drainage scheme, from the uprights. While he was on the top rung of a ladder placed against one of the posts, the copper wire attaching the cable to the insulator broke, and the post, relieved of the strain, flew back into position, throwing deceased down. The deceased received a compound fracture of the thigh-bone, which was splintered. At the hospital the bone was wired, but septic poisoning setting in, the limb had to be amputated, deceased expiring as soon as this operation had been completed. The jury returned a verdict of "Accidental Death," and suggested that in future the tower wagon should be used for such work as deceased was employed in, and, failing this, the employé should be fastened to the post by a strap.

Edna Electric Lamp Dispute.—In the City of London Court on Tuesday, before Judge Rentoul, K.C., a claim was made by Messrs. Louis Schloss & Co., metallic-filament lamp manufacturers, 110, Cannon Street, E.C., against Mr. L. S. Anderson, electrical engineer, 15, Howden Place, Leeds, formerly of 54, Shoreham Street, Sheffield, to recover £12 4s. 6d. for Osram lamps supplied. Mr. Morley appeared for the plaintiffs. The Judge said the defendant had written to say that the plaintiffs' claim was in respect of Edna electric lamps, the bulk of which were received on February 10th from abroad. At the time when the lamps were supplied by the plaintiffs they (plaintiffs) were being prosecuted by the Osram Lamp Works, Ltd., defendant added, for infringement of patents in the manufacture and sale of the Edna lamps. On February 7th Mr. Justice Swinfen Eady, in the Chancery Division, had before him a motion to restrain the plaintiffs from infringing the patents. On March 7th the Judge granted an interim injunction of restraint in the manufacture and sale of the lamps. The injunction was ultimately granted, and an order made for the delivery up of the infringing articles. He submitted, therefore, that the lamps now sued for could not be sold by the plaintiffs, and that the plaintiffs were not entitled to payment. Further, the lamps were very defective in character, as although stated to burn an average of 1,500 hours, their average life was less than 50 burning hours. He had to replace most of those lamps with another make, at his own expense. In fact, the Edna lamps injured his lamp trade in Sheffield so badly, that he had in consequence to give up business there. Mr. Morley said that the lamps were sold long before the proceedings referred to by the defendant. Judge Rentoul said that of course what the defendant said was rubbish, and had nothing to do with the matter. Mr. Morley said that at most defendant could have raised a counterclaim, but that he had not done. Judge Rentoul said that the defendant had asked for an adjournment. If he were a solvent man he would grant it. Mr. Morley added that his clients had grave doubts as to whether they would recover. Mr. Schloss having proved his case, judgment was given for the plaintiffs for the amount claimed, with costs.

Copper.—Visible supplies at the end of June, though not decreasing so rapidly as in the early part of the year, are by no means high. Messrs. H. R. Merton's statistical circular shows stocks in England and France and afloat thereto from Chile and Australia, 28,142 tons ; European stocks 39,460 tons. The decrease in English stocks during the month has been 1,291 tons. European arrivals from America have been low, and the quantity received by England and France from Spain and Portugal is exceptionally small. Chile shipments are below the average, and Australian the same. Total deliveries at 35,896 tons are the lowest since last September, but the heavy figure of the preceding month pointed to a decrease in this. At the end of May American stocks stood at 30,122 tons, a decrease of 3,606 tons on the preceding month. The world's visible supplies were 70,309 tons, showing a loss of 7,247 tons on the figure for the end of April.

Appointments Vacant.—Assistant master in the Electrical Engineering Department of the Polytechnic, Regent Street, W. (£150) ; instrument maker and electrician for Hong-Kong University (£200 + £100 house allowance). See our advertisement pages to-day.

Annual Outings.—The Linolite Co. had their annual outing on Saturday last, the office and works staffs leaving Victoria Station at 6.45 a.m. for Herne Bay. The weather was favourable, and the party, after indulging in boating and swimming, lunched at Messrs. Borst's picturesque tea gardens on the Lees. In the afternoon the interesting ruins of Reculver Towers, which date back to the Roman period, were explored. Tea was served in the summer houses on the lawn of the above gardens, the party returning to London by the 8.40 p.m. train, after a most enjoyable day. Mr. R. L. Matthews, the assistant manager, was present, but, to the regret of all, Mr. A. S. E. Ackermann, the engineer to the company, was unavoidably absent, he having left a few days previously for Egypt, as already announced in our columns.

The Tunbridge Wells Corporation electricity works staff and employés, accompanied by the local wiring contractors—always a happy feature of the Tunbridge Wells festivities—went for their annual outing. Margate was visited, and the party was met there by the chief electrical engineer, Mr. R. N. Torpy, who was just returning from a visit to Ghent Exhibition. Luncheon at the Popular Restaurant was followed by some of the party with a sail in the *Moss Rose*, after which tea, the joy-wheel, and songs and speeches in the saloon on the return journey, were all parts of the programme. Mr. Torpy said how glad he was to see the contractors at their tenth outing. Other speakers were Mr. J. Bemrose, Mr. J. B. Strange and Mr. H. A. Stonham (for the contractors). Thanks were accorded to Mr. Hayden for arranging the programme.

The employés of Messrs. Page & Miles, Ltd., of Brighton and Worthing, accompanied by the chairman, Councillor J. W. Penfold ; managing directors, Messrs. E. J. Page and H. J. Miles ; secretary, Mr. A. C. Ganson ; and works manager, Mr. J. T. Baker, held their annual outing on Saturday last. Starting from 60, Western Road, at 7 o'clock in motor coaches provided by the Brighton, Hove and Preston Omnibus Co., they proceeded to Washington, having breakfast at the Burrell Arms, after which they journeyed to the Swan Hotel, at Fittleworth, the headquarters for the day. Sports were indulged in, the prizes having been given by the directors and friends. At the dinner which followed, the toast of "The Firm" was proposed by Mr. F. Patching, and responded to by the chairman, who mentioned that a new branch of the firm was about to be started in Eastbourne. The visitors were toasted on the proposition of Mr. H. J. Miles, who mentioned that on this the twenty-third outing they numbered nearly 80. At the first outing they ever had there were 16, and out of that 16, eight were present on this occasion. This was responded to by Mr. Wilson in a very humorous speech, and the health of Mr. J. T. Baker was proposed by Mr. Lowe. After the prizes had been presented, the party returned home. The arrangements for the day were made by the works manager, Mr. J. T. Baker.

The Merthyr Electric Traction and Lighting Co. had a very successful annual outing to Parkmill, Gower, recently. They were conveyed from Merthyr to Gower in motor char-à-bancs and cars. Mr. G. J. Summerville, chairman of the company, and Mr. S. J. Clements, the secretary, were present. Mr. H. King, late traffic superintendent of the company, was presented with a testimonial by the company's employés and staff, upon his leaving Merthyr to take up his duties as traffic manager on the Aberdare new tramways.

The G.E.C. Head Office Fire Brigade held their first annual outing on July 5th, when the members, under the command of their captain, Mr. W. H. Snowden, and accompanied by their instructor, Mr. Riley (late of the Metropolitan Fire Brigade), visited Windsor. The weather was not exactly on its best behaviour, but having been trained to brave the dangers of fire, the brigade was not to be daunted by the steady downpour of water. On arrival at Windsor, a brake was chartered and visits were paid to some of the most interesting spots in Windsor Great Park and Windsor Forest. On returning to the hotel, full justice was done to an excellent repast, which was followed by an impromptu concert. After an hour or so on the river in the evening, the party wended their way homewards, having had, in spite of the rain, a very enjoyable time.

The employés of the Western Electric Co., Ltd., had their annual outing to Herne Bay on Saturday, June 28th. About 950 went to Herne Bay by the *Yarmouth Belle*, while hundreds more went by train. A sports meeting was held in the Recreation Ground, High Street, during the afternoon. Selections were played by the Western Electric Brass Band, under the direction of Mr. T. Pender. The prizes were presented by Mr. C. L. Rice.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Bolton Electricity Committee on Monday appointed MR. W. J. WOOD borough electrical engineer, in the place of Mr. A. A. Day, who has resigned through ill-health. Mr. Wood has been in the service of the Corporation since 1901, and has latterly performed Mr. Day's duties. His salary commences at £400, rising to £600 per annum.

MR. S. FORBES BOYD, of Didsbury, has been appointed assistant superintendent of the wiring and fittings department of the Sheffield municipal electricity undertaking (owing to the resignation of Mr. H. G. Bennett) at £150 per annum, rising by biennial increments of £10 to £180 per annum.

MR. F. E. SPENCER, at present station superintendent, has been appointed chief assistant electrical engineer to the Birkenhead undertaking.

The St. Helens Electricity Committee has appointed MR. W. A. JOYNSON, of St. Helens, as mechanical engineer at the electricity works.

MR. A. G. CROSS, of the Newcastle-on-Tyne Electric Supply Co., Ltd., has been appointed shift engineer at the Avonmouth substation of the Bristol Corporation electricity department, which vacancy was recently advertised.

MR. J. P. MEIKLEJOHN, who has been chief assistant engineer to the Penarth Electric Lighting Co., has been appointed managing engineer in place of Mr. H. Cameron, who has resigned on account of ill-health.

The Gillingham (Kent) Town Council has appointed MR. D. W. RITSON, recenty charge engineer at Ebbw Vale, as assistant electrical engineer.

The Morley T.C. has appointed MR. P. B. WRIGHT as engineer-in-charge at the Electricity Works.

The Crewe T.C. on July 2nd adopted the recommendation of the General Purposes Committee to increase the salary of MR. H. H. DENTON, chief electrical engineer, from £300 to £350 per annum, and that of the assistant electrical engineer, Mr. J. J. HOOLEY, from £150 to £175.

Tramway Officials.—Last Friday evening the members of the Metropolitan Association of Electric Tramways Managers entertained MR H. E. BLAIN, their late chairman, to dinner at the Municipal and County Club, Whitehall Court, S W., when there were present Messrs. Ullmann (East Ham), vice-chairman; Fell and Bruce (L.C.C.); Schofield (Leyton); Harvey (Ilford); Coveney (Erith); Stokes (Bexley); Murray (Walthamstow); Hammond (M.E.T.); Mason (South Met.); and Goodyer (Croydon), hon. secretary. Mr. H. England (Wakefield) was also present. Mr. Ullmann, in proposing the toast of the evening, and expressing the general regret of all present at the circumstances which had brought about Mr. Blain's severance from Metropolitan Municipal Tramways operation, and more particularly his connection with their Association, of which he was the chairman and prime founder, spoke feelingly of the many excellent qualities possessed by their guest. He stated that no tramways manager in the metropolitan area had done more to support the usefulness of the Association and the most cordial relationship of its members, than had Mr. Blain. Mr. Goodyer, in supporting the views expressed by Mr. Ullmann stated that, as hon. secretary of the Association for several years past, and also in connection with many other matters, he had been in very close touch with Mr. Blain, and would look upon that gentleman's departure as a personal loss. While congratulating him upon the excellent appointment he had secured, he stated that his new employers would find that they had gained a "real live man." Mr. Fell, Mr. Bruce, Mr. England, and others, also bore testimony to Mr. Blain's excellent abilities. Mr. Blain, in response, referred to the good work which had been accomplished from time to time by the Association, and expressed his keen appreciation of the very kindly feeling which had prompted the holding of that function, and which, he affirmed, had characterised the whole of their mutual relationship during the 10 years he had been amongst them in the area. He expressed his genuine pleasure at the good fellowship and warmth of personal friendship extended to him, and stated that he would be very sorry if any change he had made implied the breaking-away from such genial ties.

The Bolton Tramways Committee has appointed MR. J. BARNARD, who has been acting as traffic superintendent, to the post of tramways general manager, at a salary of £400, rising to £600. He has been in the employ of the Corporation 13 years.

The electricity and tramways staff at Doncaster have presented a marble clock and pair of bronzes to MR. R. COOK, of the tramway staff, on his resignation.

General.—MR. GEO. SCHULTZ, engineer and manager of the Notting Hill Electric Lighting Co., Ltd., having retired after 23 years' service, has been presented by the directors and staff with a silver salver suitably inscribed. The presentation was made by Sir William Crookes, O.M., F.R.S., the chairman of the company. MR. R. G. RAWKINS (secretary for the past 20 years) has been appointed manager and secretary, and MR. A. P. MCDOUALL (assistant to Mr. Schultz for 16 years) has been appointed chief engineer.

MR. W. LUNN, A.M.I.E.E., has resigned his position after seven years as supervising engineer for outside contracts for Messrs. Siemens Bros. & Co., Ltd., Woolwich, and sailed on July 9th to settle in San Francisco.

On Monday PROF. E. RUTHERFORD was elected a member of the Royal Institution.

On the occasion of his marriage to Miss E. M. Brookhouse, MR. HAROLD LUCKIN has been presented by the staff of Messrs. Crompton & Co., Ltd., of Chelmsford, with a canteen of cutlery.

MR. PHILIPP LAUBACH, late manager switchgear department, Electrical Engineering and Equipment Co., has now taken up the position of manager to Messrs. Morris & Lister (London), Ltd., 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W.

MR. H. J. BUTTERFIELD, assistant engineer to the Oxford E.L. Co., Ltd., has resigned after 15 years' service, to join the firm of Hill, Upton & Co., electrical engineers, of George Street, Oxford. The directors and staff of the company have presented Mr. Butterfield with an inscribed gold watch, which was handed to him by Sir Henry Mance, chairman of the company, who wished the recipient every success in his new business of electrical contractor.

Obituary.—The death is announced from Heidenheim, Wurtemburg, of DR. FRIEDRICH VON VOITH, head of the firm that makes the well-known Voith turbine.

Will.—The late MR. JOHN SAXBY (Saxby & Farmer), of railway signalling fame, left £55,583.

NEW COMPANIES REGISTERED.

Delabole Electric Lighting and Supply Co., Ltd. (129,917).—This company was registered on July 3rd, with a capital of £1,500 in 5s. shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—H. Spragg, High Street, Delabole, quarryman; J. D. Stacey, Pengelly, Delabole, vanman; R. Pearce, School House, Delabole, schoolmaster; S. Radcliffe, Rockhead, Delabole, baker; J. Haley, Medrose, Delabole, ex-police constable; J. Stephens, Delabole, butcher; M. J. Wells, 3, Tamar Terrace, Launceston, managing director of Old Delabole Slate Co., Ltd. Minimum cash subscription, £200. The number of directors is not to be less than three or more than seven; the first are M. J. Wells, F. L. Houghton, W. H. Hawke, Rev. K. Pollock, R. Pearce, S. Radcliffe and J. Stephens. Registered by A. J. Vere-Bass, 30, Budge Row, E.C.

Eclipse Electric Sign Co., Ltd. (129,866).—This company was registered on July 1st, with a capital of £15,000 in £1 shares, to carry on the business of manufacturers of, agents for and dealers in electrical machinery of all kinds, and to adopt an agreement with Victor Von Vangel. The subscribers (with one share each) are: C. Black, Aston Grays, Pinner, secretary; R. L. Urquhart, Tavistock Hotel, W.C., gentleman. Private company. The number of directors is not to be less than two or more than five: the subscribers are to appoint the first; qualification £100; remuneration, £100 each per annum (chairman £150). Registered office, Empire House, Piccadilly, W.

Lester B. Betts & Co., Ltd. (129,952).—This company was registered on July 4th, with a capital of £1,500 in £1 shares, to carry on the business of electrical, mechanical, constructional and consulting engineers, founders, japanners, electroplaters, contractors, iron and steel merchants, cycle dealers, &c., and to adopt an agreement with Lester B. Betts. The subscribers (with one share each) are; A. E. Robinson, 30, Whitefriars Crescent, Westcliff-on-Sea, engineer; Lester B. Betts, 92, Eccles Road, Lavender Hill, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Robinson and Lester B. Betts; qualification of first directors, 50 ordinary shares; of others, 100 shares. Registered by Richmond, Gilbert & Pratt, 18, Walbrook, E.C.

Jackson Electric Stove Co., Ltd. (129,825).—This company was registered on June 28th, with a capital of £10,000 in £1 shares (8,000 preference), to carry on the business of manufacturers of electrical, heating and cooking apparatus, general electrical engineers, &c., and to adopt an agreement with E. W. Brighten. The subscribers (with one share each) are:—E. W. Brighten, 4, Mitre Court, Temple, E.C., solicitor; F. H. Williams, 87, Northbrook Road, Ilford, electrical engineer. Private company. The number of directors is not to be less than three or more than five: the first are E. W. Brighten (permanent chairman) and F. H. Williams. So long as T. and J. Jackson, Ltd., hold not less than 2 000 shares they may appoint a director; qualification, £50; remuneration of chairman, £25; of other directors, £5 each per annum. Registered office, 38, Blandford Street, Baker Street, W.

Scottish Midlands Electricity Supply, Ltd. (8,716).—This company was registered in Edinburgh on June 24th, with a capital of £20,000 in £1 shares, to carry on the business of an electric light, heat and power supply company. The subscribers are:—A. H. Beatty, 66, Queen Street, E.C., contractor, 200 shares; W. S. Swinton, King's Avenue, Bromley, Kent, company secretary, 200 shares; H. L. Williams, Copthorne, Worcester Park, engineer, 200 shares; C. Don, 63, Castle Street, Edinburgh, engineer, 300 shares; T. Tauser, 3, Upper Gilmore Place, Edinburgh, clerk, 100 shares; R. F. Shepherd, 16, Charlotte Square, Edinburgh, W.S., 300 shares; I. C. A. Murray, 63, Castle Street, Edinburgh, secretary of public company, 100 shares; J. R. Little, 18, Charlotte Square, Edinburgh, secretary of public company, 300 shares. The number of directors is not to be less than two or more than four, the first are J. R. Little, C. Don and R. F. Shepherd; qualification, 100 shares. Registered office, 63, Castle Street, Edinburgh.

Galashiels and District Electric Supply Co., Ltd. 8,717).—This company was registered in Edinburgh on June 24th, with a capital of £30,000 in £1 shares, to carry on the business of an electric light, heat and power supply company. The subscribers are:—A. J. Sanderson, Knowepark, Galashiels, manufacturer, 250 shares; A. Fairgrieve, Maplehurst, Galashiels, manufacturer, 250 shares; H. Sanderson, Rylands, Galashiels, manufacturer, 250 shares: A. Brown, Maryfield, Galashiels, manufacturer, 250 shares; J. Wishart, 23, Rutland Street, Edinburgh, solicitor. 1 share; I. C. A. Murray, 63, Castle Street, Edinburgh, secretary, 1 share; T. Tauser, 63, Castle Street, Edinburgh, clerk, 1 share. The number of directors is not to be less than two or more than five; the first are G. Balfour, A. Fairgrieve, and H. Sanderson; qualification, 100 shares. Registered office, 23, Rutland Street, Edinburgh.

Autokal Syndicate, Ltd. (129,688).—Registered June 21st, by Faithfull & Owen, 58, Lombard Street, E.C. Capital, £50,000 in £1 shares (20,000 pref.). Objects: To carry on the business of engineers, manufacturers of appliances, &c., to acquire certain patents for inventions relating to calculating machines, and to adopt agreements (1) with E. R. Clark and E. R. Debenham, and (2) with the said E. R. Clarke. The signatories (with one share each) are:—W. H. Alexander, 91, Wimpole Street, W., secretary; F. Owen, 58, Lombard Street, E.C., solicitor. Private company. The first directors (to number not less than two or more than five) are E. R. Debenham and E. R. Clarke (both permanent, subject to holding 5,000 ordinary shares); remuneration as fixed by the company. Registered office, 152½, Blackfriars Road, Southwark, S.E.

S. Gillitt, Ltd. (129,743).—This company was registered on June 24th, with a capital of £10,000 in £1 shares, to take over the business carried on at Newcastle-on-Tyne, by S. Gillitt, and to carry on the business of electricians, engineers, manufacturers of, and dealers in, electrical appliances, novelties and specialities and mathematical and philosophical instruments, hardwaremen, &c. The subscribers (with one share each) are:—S. Gillitt, 1, Clifton Ville, South Gosforth, Northumberland, electrical engineer; W. H. D. Arthur, Oakland House, High West Jesmond, Newcastle-on-Tyne, gentleman. Private company. The directors are to number not less than two or more than five. S. Gillitt is one of the first: qualification, 100 shares; remuneration of first directors, £200 per annum. Solicitors, Maughan and Hall, Newcastle-on-Tyne. Registered office, 33, Great Market Street, Newcastle-on-Tyne.

CITY NOTES.

Electric Construction Co., Ltd.

The directors report that the net profit for the year ended May 31st, 1913 (after payment of £6,903 for debenture interest, and crediting £5,000 as formerly to depreciation account), is £27,501. Adding £5,694 brought forward, the amount available for distribution is £33,194, which is to be appropriated as follows: Dividend of 7 per cent. per annum on the preference shares (whereof a moiety was paid on January 31st), £4,395; dividend of 5 per cent, per annum on the ordinary shares, £11,210; transfer to general reserve fund (which will then amount to £46,000) £10,691; balance carried forward, £6,899. The company's works have been fully employed during the past financial year, and better prices having prevailed a further improvement in profits is shown in the accounts. The orders on hand are very satisfactory. During the year £12,700 (including the £7,700 referred to in last report) of the company's 4 per cent. debenture stock has been redeemed at a discount, which has been credited to general reserve fund. The total amount of the debenture issue is now £170,000. The directors report with regret the death of Sir Irving Courtenay, Kt., who had held a seat on the board since the incorporation of the company, and who had been appointed chairman only a few months before his death. Mr. Philip Edward Beachcroft has been appointed chairman, and Mr. William Bulloch, who has been manager of the company's works for eleven years, has been elected to fill the vacancy on the board. Mr. Bulloch retires at the general meeting, and offers himself for re-election. Sir James Pender, Bart., also retires and offers himself for re-election. Representations have been made to the board that the fully-paid preference and ordinary shares of £2 each of the company should be divided into two fully-paid shares of £1 each, and notice of an extraordinary meeting, to be held at the close of the general meeting, has been given, to consider and, if thought fit, to pass the necessary resolution. It has been decided to close the financial year on March 31st in future, and the next accounts will, therefore, embrace a period of ten months only.

The annual meeting is called for July 15th at Winchester House, E.C.

Telegraph Construction and Maintenance Co., Ltd.—An interim dividend of 5 per cent. is announced.

Chile Telephone Co., Ltd.

The report for the year ended March 31st, 1913, states that the aggregate number of subscribers at all centres at the end of the year was 12,651, as compared with 11,647 at the beginning or a gain of 1,004 for the year. The gross revenue in Chile from all sources was:—In 1912-13, $2,836,550, an increase of $526,732; the expenditure in Chile was, in 1912-13, $1,376,415, an increase of $239,445; the net income in Chile from all sources was:—In 1912-13, $1,460,134, an increase of $289,287. The average rate of exchange for the year was 10·13d., as compared with 10·49d. in the previous year, giving a decrease for the year of 0·36d. Converted into sterling at these rates, the figures given in the preceding paragraph are:—In 1912-13, £61,623, an increase of £10,413. The liquid assets and liabilities in Chile on March 31st, 1913, were valued at 10d., the current rate of exchange on that day, as compared with 10½d. at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £3,382 brought from the previous year, is £61,771, of which £17,565 has been expended in Chile in replacements, &c., of plant and £13,904 carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 15th last, and the directors now recommend a final dividend of 5s. per share, free of income-tax, leaving a balance of £3,901 to be carried forward.

Japanese Notes.—The Osaka Electric Light Co., of Osaka, reports a profit of £139,000 for the last financial half-year; it is expected that a dividend at the rate of 12 per cent. per annum will be declared. The Yokohama Electric Tramway Co. reports a profit of £40,045 for the past six months, and is declaring a dividend of 11 per cent. This company proposes to construct a light electric railway between Yokohama and Yokosuka. The Osaka Electric Lamp Co. is paying a dividend at the rate of 12 per cent. per annum for the last financial half-year.

Perth Electric Tramways, Ltd.—At an extraordinary general meeting held on 4th inst. at Oxford Court, Cannon Street, E.C., Mr. O. Wethered presiding, the shareholders passed a resolution winding up voluntarily, to enable the directors to carry out the sale of the property. The chairman congratulated the shareholders on the arrangements made. As soon as the resolution was confirmed, there would be no difficulty in at once making a distribution, probably £1 per share, the distribution of the balance of the assets following as soon as the necessary details of the liquidation are carried out. Mr. Stoneham, who seconded, said that the Government had made a good bargain, and as they had raised the money to pay for the undertaking at a little over 4 per cent., if they carried on the tramway as the company had carried it on, they would no doubt be receiving something like 10 per cent. upon their money.

Cape Town Consolidated Tramways and Land Co., Ltd.—The directors report that the profit and loss account for the year to December 31st, after charging London administration expenses, &c., shows a debit balance of £1,678, which makes the total to the debit of profit and loss account £6,306, to be carried forward. No dividend has been declared by the subsidiary companies during the past year. The Estate Co., the Cape Marine Suburbs, shows a small profit for the year of £457, and the Camps Bay Tramway Co. shows a profit of £2,973 for the same period.

Continental.—France.—A new company has just been formed at Nogent-le-Rotrou, with a capital of £10,000, and the title La Société Electrique de Nogent-le-Rotrou et Extensions, to establish a small central electric lighting station in the town.

Russia.—La Société Belgo-Russe de Chemins de Fer, Tramways, et Electricité, is the name of a new company, which has just been formed in Brussels with a capital of £10,000.

Germany.—Messrs. Brown, Boveri & Co., of Mannheim, are declaring a dividend of 8 per cent. for the last financial year, as compared with only 5 per cent. in the preceding 12 months. The capital of the company has lately been increased from £300,000 to £450,000.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax (at the rate of 4 per cent. per annum), for the quarter ending June 30th, 1913, payable July 31st.

Dublin United Tramways Co. (1896), Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum on the preference shares, and at the rate of 6 per cent. per annum, on the ordinary shares, both less income-tax, for the half-year to June 30th.

Cuban Telephone Co.—The directors have declared a dividend on the common stock of 1¼ per cent. for the quarter ending June 30th.

R. Waygood & Co., Ltd.—The directors have issued a circular to the shareholders offering them 15,000 6 per cent. preference and 15,000 ordinary shares of £1 each at par.

Anglo-American Telegraph Co., Ltd.—The board has declared an interim dividend for the quarter ended June 30th, 1913, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax.

Humphrey Pump Prospectus.—A financial daily is informed that the issue of shares by this company was considerably over-subscribed.

General Electric Co., Ltd.

The directors' report for the year ended March 31st, 1913, shows that the net trading profits and income from investments, &c., amounted to £145,261, plus £32,050 brought forward, making a total available profit of £177,311. Debenture interest and depreciation amount to £32,543; dividend on the preference shares at the rate of 6 per cent. for the year ended March 31st, 1913, has been paid, absorbing £19,878, leaving an available balance of £124,890, which the directors recommend should be appropriated as follows:—Provision for managing director's and employés' bonus, £9,284; provision for expenses of new issue of preference shares, £10,275; provision for dividend on ordinary shares at the rate of 10 per cent. for the year, £40,000; to reserve account, £30,000; to conditional appropriation to staff benevolence, £3,000; balance to be carried forward, £32,331. The reserve account balance at March 31st, 1912, was £140,000, and the proposed appropriation of profit for 1913 as above, £30,000, gives a total reserve account of £170,000.

The directors are pleased to record a further advance in the net result of the year's trading. The company's works have been fully employed throughout the year, and further extensions are contemplated. The increase in stock is due to the continued advance in the sales and orders on hand. The investment account shows a further increase on account of the development of the company's oversea undertakings. During the year an issue of £150,000 6 per cent. cumulative preference shares has been made, the expenses of which have been dealt with in the above accounts. Mr. Fred S. Sells, who was appointed director by resolution of the board dated November 5th, 1912, being eligible, offers himself for re-election. Mr. L. G. Byng retires, and offers himself for re-election as a director.

We give below the comparable figures from the reports for the three years ended March, 1911, 1912 and 1913:—

	1911.	1912.	1913.
Net trading profit and income from investments ...	£119,146	£133,564	**£145,261**
Depreciation and debenture interest	32,331	32,400	**32,543**
Balance	95,734	113,377	**144,768**
Pref. dividend	12,500 (5 %)	12,500 (5 %)	**19,878 (6 %)**
Available balance	83,233	100,877	**124,890**
Managing director's and employés' bonus	7,431	8,866	**9,284**
Expenses of new issue of pref. shares	—	—	**10,275**
Staff benevolence	—	—	**3,000**
Ordinary dividend	19,973 (5 %)	29,960 (7½ %)	**40,000 (10 %)**
To reserve account	43,615	30,000	**30,000**
Balance carried forward ...	12,214	32,050	**32,331**
Reserve fund total	202,104*	140,000	**170,000**

* As £92,104 of this was applied towards writing down goodwill and patents, the total reserve was £110,000.

The annual meeting was held yesterday.

STOCKS AND SHARES.

Tuesday Evening.

The settlement of the strike on the Rand provided markets with a stimulus to better prices, and, after the acute depression of the previous week, this factor was welcomed with chastened gratitude. Lively fears had been aroused that the threatened stoppage in the mines might exercise a serious effect upon the world's supply of gold, hence the Consol and other investment departments went back sharply. For the time being, the Balkans business became a back number, ignored until the settlement of the Transvaal strike sent the bears hunting for other game.

Victoria Falls Power Preference shares weakened, as shown in our previous report, and the fall nominally has not been regained, although the market is decidedly stronger than it was. The incident has shown in unmistakeable colours to what a large extent the gold mining industry of the Witwatersrandt is dependent upon electricity in its service, for what was dreaded above all else was the rioters wrecking one or more of the power stations of the Victoria Falls Co. The danger is over now, but one need not be short of Kaffir shares to recognise the danger of sporadic outbreaks before the strike affair can be considered altogether over.

Electric Supply shares remain a firm and a good market. The dozen advances secured in this department last week have been held. Westminster Ordinary and London Electric Preference have further gains of 2s. 6d. each to their credit. Bournemouth and Poole Ordinary rose to 10. The only decline in the list has taken Chelseas back to 4¾. Most of the few shares which come on offer are absorbed with ease, and the market is supported by inquiries for "cheap" shares by prospective buyers, "cheap" being held to mean bargain-counter prices, and these the holders are not accepting.

Electric Constructions remain at 23s. 9d., despite a report showing an increase of 1¼ per cent. in the dividend, raising it to 5 per cent., while the allocations are on a generous scale. The directors propose to split both Ordinary and Preference capital into shares of £1 each; at present the nominal value is £2, and no doubt the suggestion will meet with cordial support from proprietors.

Home Railway stocks are a dull and spiritless market. Owing to the new arrangement whereby the companies will not issue half-yearly reports nor hold half-yearly meetings, the attention usually directed to Home Rails at this season of the year is almost entirely lacking. Nobody takes any interest in the stocks; it is generally supposed that the interim dividends to be declared this month will be much about the same as those of a year ago. The old undergrounds are depressed, Districts being down ¾ and Metropolitans ½. Underground Electric Railways £10 shares are ⅛ lower; the 1s. shares keep about 9s. London and Suburban 4½ per cent. Debenture stock has slumped several points. London United Tramways 4 per cent. Debenture reacted to 61. British Electric Tractions are weak, the 6 per cent. Preferred shedding 30s. to 9, the Deferred dropping back to 4½.

The telegraph department is none too lively. A tip has been revived to buy West India and Panama Ordinary, but it had no effect upon the price of the shares, and with markets in cautious mood as a whole, there is not much inducement to touch speculative issues. Western Telegraphs are ⅛ lower, as are also Globe Ordinary, Chili Telephones and Eastern Extensions. Orientals went a little better, on the advance in the dividend. Rumours drift across from New York to the effect that the Telephone merger is to be attacked as a combination in restraint of trade, but they exercise more effect upon the railroad than upon any other market. National Telephone Deferred rose to 27, to react to 26¼. It is thought that the final adjustment of the award given last week will result in the proprietors receiving anything between 25 and 27 per cent. They have already been paid, of course, 75 per cent. Great has been the fall from the exuberant optimism of the prophecies current this time last year, when 180 was predicted to be the break-up value of the Company's stock.

Marconis have been clinging closely to the neighbourhood of 3¾. The Government acquiesence in the cancellation of the contract was read rather as a bull point. Hope looks for another contract to be entered into on terms more favourable to the company. The amazing political bitterness imported into the recent investigation is still sufficiently strong to render it tolerably certain that the terms of any fresh agreement will be keenly scrutinised—to put it mildly.

Affairs in Mexico are in a very unsettled condition; every mail and every returned traveller bring news the reverse of pleasant concerning the conditions now prevailing. Mexican Light and Power Common shares have fallen 2½, the Preference 3 points. Mexico Trams lost 4, and the 6 per cent. Bonds dropped 1. To deal with any degree of freedom in the Latin-Canadian securities becomes a matter of increasing difficulty. Rio Tramway Bonds are 3 lower, but Sao Paulo Bonds, at par, show a gain of 2½. British Columbia Electric Railway stocks are still on the mend, the Preferred Ordinary rising 3, and the Preference 2½. Brazilian Traction fell 1½ to 86, in sympathy with the depression which overshadows a number of Brazilian issues because of the long-continued fall in the price of rubber.

The rubber market's recent spurt of strength possessed no staying power, and prices have given way materially. Much disappointment has been caused by the dwindling of the price of the product, and by some of the latest dividend declarations. The public are doing little in the market, and the "bears"—of whom there are battalions—have matters all their own way at the present time.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	Receipts for the month. £*	No. of weeks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Bath	June 25	4,577	+ 831	26	22,172	+ 340	..	..
Blackpool-Fleetw'd	„ 28	8,192	+ 268	25	13,308	+ 893	8	..
Bristol	„ 27	33,545	+ 4,339	..	189,181	+ 19,712	30·5	..
‡Brit. Elec. Trac. Co.	„ 27	106,966	+ 9,267	26	618,666	+ 38,015	..	..
Chatham and Dist.	„ 26	8,906	+ 403	25	22,270	+ 941	14·98	..
Cork	„ 26	2,161	+ 32	25	11,986	— 197	3·89	..
Dublin	„ 27	26,353	+ 1,931	..	148,142	+ 2,074	54·25	..
Hastings	„ 26	4,037	+ 157	..	..	+ 1,150	19·3	..
Lancashire United	„ 25	6,282	+ 657	25	36,613	+ 3,614	39	..
Llandudno-Col. Bay	„ 27	1,401	+ 18	80	6,861	+ 726	6·5	..
London United ..	„ 27	28,265	+ 1,824	..	154,436	— 2,299	..	..
Tyneside	„ 25	3,329	+ 344	26	13,672	+ 760	11	..
Anglo-Argentine ..	July 1	220,409	+ 22,925	..	1,451,781	+ 120,639	..	..
Auckland	June 6	20,007	+ 1,828	48	240,980	+ 31,993	24·86	1·05
Bombay (B.E.T.) ..	May 30	12,827	+ 1,017	24	68,505	+ 2,765	..	..
Brisbane	May	26,560	+ 3,710	21	125,990	+ 39,906	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 30	15,573	+ 534	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	May	3,059	..	21	14,372	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
†Madras	June 30	2,804	+ 266	..	21,277	+ 1,668	15·25	1
Montevideo ..	June	28,820	+ 2,428	31	268,427	+ 20,005	..	..
Cen. London Rly.	June 28	19,005	+ 482	26	133,243	+ 12,431	6·78	·4
City & S. Lon. Rly.	„ 28	10,043	— 1,810	26	73,983	— 7,652	7·26	..
Dublin-Lucan Rly.	„ 27	832	+ 125	26	3,601	+ 67	7	..
G.N. and City Rly.	„ 28	5,335	— 869	26	37,363	— 5,125	8·5	..
L'pool Overh'd Rly.	„ 29	7,114	+ 695	26	42,736	+ 2,782	6·6	..
London Elec. Ry. Co.	„ 28	59,880	— 690	26	369,280	+ 8,295	21·25	..
Mersey Railway ..	„ 28	8,746	+ 444	26	58,169	+ 8,644	4·5	..
Metropolitan Rly.	„ 29	71,176	— 712	26	434,703	+ 3,085	25·75	..
Met. District Rly.	„ 28	53,059	+ 1,472	26	342,666	+ 13,581	25	..

* Compared with the corresponding period of 1912.

† Two weeks only.

‡ Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9½ — 10½	+ ½	5 14 3
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅝	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 10¾	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96 xd	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4¼ — 4¾	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
Do. Do. 4 % Deb. ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	— ½	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97 xd	..	4 12 9
City of London, Ord.	10	8	8	15 — 16½	..	5 9 1
Do. 6 % Cum. Pref.	10	6	6	12 — 12	..	4 12 4
Do. 5 % Deb.	Stock	5	5	118½ — 117½ xd	..	4 5 1
Do. 4½ % Second Deb. ..	100	4½	4½	98 — 100 xd	..	4 10 0
County of London, Ord. ..	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	11¼ — 11¾	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 — 104 xd	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4½	..	3 6 8
Do. 6% Non-Cum. Pref. ..	5	..	..	1¾ — 2⅜	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7¾	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7¾	..	5 14 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 9
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	8	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛	+ ⅛	5 14 4
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 7 9
Metropolitan	5	4	4†	3⅛ — 3⅜	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜ xd	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	90 — 91 xd	..	4 19 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	75½ — 81½ xd	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½ xd	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 3
Do. 3½ % Deb.	100	3½	3½	85½ — 85½ xd	..	4 1 10
South London, Ord.	4	5	6	2⅞ — 3¼	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅛ — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	86 — 90	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord, ...	5	10	10	8 — 8½	+ ⅛	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¾ — 5⅛ xd	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5¼	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7½	+ ⅛	5 13 4
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93 xd	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	108 — 112 xd	..	6 5 0
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	5/16 — 1 3/16	..	6 3 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92 xd	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 3/16	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 — 101 xd	..	4 19 0
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105 xd	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77 xd	—2½	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	64 — 67	—3	5 19 5
Do. 7 % Cum. Pref.	$100	7	7	96 — 100	..	7 0 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	78 — 81	..	6 3 5
Montreal, Lt., H. and Power ..	$100	8	9†	210 — 220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	5	5	102 — 107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½ xd	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	126 — 130	..	4 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ — 106½ xd	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 100	..	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½ xd	..	5 8 1
Victoria Falls Power, Pref. ..	1	11 7/8d.	17/8d.	1/16 — 1/8 xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 — 108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½ xd	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 — 132 xd	..	6 1 3
Do. Collat. Trust	$1000	4	4	89 — 91 xd	..	4 8 0
Anglo-American Telegraph ..	Stock	8	8	61 — 64	..	4 13 9
Do. 6 % Pref.	Do.	6	6	108¼ — 109¼	..	5 9 10
Do. Def.	Do.	30/-	30/-	28¼ — 28¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 — 106	..	4 15 3
Chili Telephone	5	7	8	7 9/16 — 7 13/16	— ⅛	5 2 5
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83 — 85 xd	..	4 13 7
Cuba Telegraph	10	6	6	8½ — 9⅛	..	6 6 4
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	6 — 6⅜	..	6 3 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 — 130	— 1	5 7 8
Do. 8½ % Pref. Stock	Do.	8½	8½	74 — 76	..	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	90½ — 92½	..	4 8 5
Eastern Extension	10	7	7	12⅝ — 12⅞	— ⅛	.
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ — 100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 10⅝	— ⅛	5 8 9
Do. 6 % Pref.	10	6	6	12⅛ — 12⅜ xd	..	4 15 1
Great Northern Telegraph ..	10	15	20	80 — 82 xd	..	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3¾	— 1/16	5 6 8
Do. 7% Cum. Partic. Pref.	1	17	..	8 — 8¼	..	5 4 7
Monte Video Telephone, Ord. ..	1	5	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97 — 98	..	4 11 10
Oriental Telep. and Elec. ..	1	8	10	1⅜ — 1⅝	+ 1/16	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89 xd	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97 xd	..	4 2 6
Reuter's	10	10	10	9 — 10	— ½	10 0 0
Submarine Cables Trust ..	Cert.	6	6	124 — 127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94½ — 96½ xd	..	4 13 8
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½ xd	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/8	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96 xd	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2¼ — 2⅜	..	4 10 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	99 — 101 xd	..	4 19 9
Western Telegraph, Ltd. ..	10	7	7†	12⅜ — 13⅛	— ⅛	5 6 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	5/16 — 7/16	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 1 3/32 xd	..	6 9 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	—1½	..
Do. Do. Deferred	100	..	..	3½ — 5½	—1	
Do. Do. 6 % Cum. Pr'f	100	6	6	73 — 81	—1	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	—1	7 6 4
Do. 5 % Perp. Deb.	100	5	5	89 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	8	8	77 — 79	..	†5 1 3
Do. Pref.	100	4	4	80 — 82	..	†4 17 7
Do. Def.	100	2	2	76 — 78	..	†5 2 7
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
City & S London, 5 % Pref., 1891	100	5	5	101 — 103	..	4 17 1
Do. Do. 1896	100	5	5	100 — 102	..	4 18 0
Do. Do. 1901	100	5	5	99 — 102	..	4 18 0
Do. Do. 1903	100	5	5	99 — 102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1 7/8 — 2 1/8	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1 7/32 — 1 9/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	69 — 73	..	6 3 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 1/8 — 2 3/8	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 77	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	3/32 — 1/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	3/32 — 2/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	70 — 75 xd	—4½	6 0 0
London Elec. Railw'ys, 4 % Deb.	100			91 — 93		4 6 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	—1	6 7 0
Metropolitan Railway Consol.	100	1 7/8	1 9/8	45 3/4 — 46 1/4	— ½	3 10 3
Do. Surplus Lands	100	2 1/8	2 3/8	61 — 63	..	4 7 4
Do 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 0
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	—1	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32½ — 33	—1½	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 13 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	—1	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 6 10
Potteries, Ord.	1	4½	..	2/32 — 1 3/32	..	..
Do. 5 % Pref.	1	6	5	5/8 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	5 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3 3/8 — 3 5/8	— 1/8	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	108 — 110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	96 — 98	..	4 11 10
Do. 6 % Income	100	[redacted]	6 †	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	..	..	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	..	3†	3 1/16 — 3 1/8	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 3/8 — 5 xd	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16 xd	— 1/8	6 0 7
Do. 4 % Deb.	100	4	4	90½ — 92½ xd	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Do. 5 % Deb.	100	5	5	95½ — 97½	..	5 2 6
Auckland Trams, 5 % Deb.	100	5	5	99 — 101 xd	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11 1/4	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd		4 13 9
Do. 5 % 2nd Deb.	100	5	5	95 — 97 xd	— 2	5 3 1
Brazilian Traction Light and Power	$100	..	6†	85 — 87	—1½	6 17 11
Brisbane Trams Invt., Ord.	5	8	8	6 7/8 — 7 3/8	..	5 8 6
Do. 5 % Pref.	5	5	5	4 3/8 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 — 100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	121 — 126	+1	6 7 0
Do. Pref. Ord.	100	6	6	109 — 114	+3	5 5 3
Do. 5 % Pref.	100	5	5	103 — 106	+2½	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 — 103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 — 102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	+ ½	4 7 8
Calcutta Trams, Ord.	5	7	5†	5 5/8 — 6 1/8	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16 xd	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½ xd	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5 1/4 — 5 3/8	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97 xd	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 — 101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	
Do. Pref.	1	6	..	29/32 — 1 1/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	5	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	5	1 — 1 1/4 xd	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96 xd	+1½	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	5	4 3/4 — 5 1/8	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 — 103 xd	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ — 100½	..	4 19 6
Mexico Trams Com.	$100	7	7†	9 — 93	—4	7 10 6
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 92	..	5 8 8
Do. 6 % Bonds	100	6	6	91 — 94	— 1	6 7 8
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 3/8 — 7 1/8	..	7 0 4
Do. 6 % Pref.	5	6	6	4 3/4 — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 — 100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1 1/8 — 1 3/8	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ — 105½ xd	..	4 14 9
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/4 — 5 3/4 xd	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97 xd	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	—3	5 2 0
Do. 5 % Mort. Bonds	100	5	5	91 — 93	..	5 7 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 101 xd	+2½	4 19 9
Singapore Trams, 5 % Deb.	100	5	5	83½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	7	4 3/8 — 4 7/8 xd	..	7 3 7
Do. 6 % Pref.	5	6	6	4 3/4 — 5 1/8 xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ — 100½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	5	..	5/8 — 7/8	..	6 17 2
Do. 6 % Pref.	1	6	6	5/8 — 7/8	..	6 17 2
Babcock & Wilcox	1	28	16	2 1/32 — 8 1/16	..	5 4 5
Do. Pref.	1	6	6	1½ — 1 3/8	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	— 2	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5 7/8 — 6 3/8	..	4 14 1
Do. Deb.	100	4½	4½	99 — 102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb.	100	4	4	65 — 69 xd	..	5 16 0
Do. 6 % Prior Lien	100	6	6	99 — 102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½ xd	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	5	15	15	10 3/8 — 11 1/8	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	— 1/8	4 18 9
Do. Deb.	100	4½	4½	97 — 100	—1	4 10 0
Castner-Kellner	1	20	20	3 3/8 — 3 3/4	..	5 6 8
Do. Deb.	100	4½	4½	103 — 106	..	4 4 11
Crompton & Co.	8	Nil	..	0 — 1/4	..	Nil
Do. Deb.	100	5	5	54½ — 59½	—2½	8 8 0
Dick, Kerr	1	5	Nil	5/16 — 9/16	..	..
Do. Pref.	1	6	6	21/32 — 25/32	..	7 18 10
Edison & Swan, A, £3 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil		1 1/4 — 1 3/4	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62 xd	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3 3/4	5	1 7/16 — 1 5/8	..	7 12 5
Do. Pref.	2	7	7	1 3/4 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	5	5	9 3/4 — 10½ xd	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12 — 12 3/4	..	5 17 8
Do. Pref.	5	4½	4½	4 3/4 — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12 xd	..	6 5 0
Do. Pref.	10	5	5	9 — 10 xd	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 9 10
Do. Deb.	100	4	4	95 — 97 xd	..	4 2 6
Willans & Robinson	1	Nil	..	1/8 — 3/8	..	Nil
Do. Pref.	5	Nil	..	1/2 — 5/8	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

THE I.M.E.A. CONVENTION, 1913.

(*Concluded from page 36.*)

THE annual general meeting of the Association was held on June 20th, when the business of electing a President and certain members of Council for the ensuing year was proceeded with. This resulted as follows :—

President.—*R. A. Chattock, Birmingham.
Senior vice-President.—*H. Richardson, Dundee.
Junior vice-President.—*Alex. Cramb, Croydon.
Council: Engineer Members.—*F. Ayton, Ipswich ; *S. E. Fedden, Sheffield ; C. Furness, Blackpool ; S. L. Pearce, Manchester ; *Thos. Roles, Bradford ; A. H. Seabrook, Marylebone ; S. J. Watson, Bury ; *Wm. Wyld, Hampstead.
Councillor Members.—Alderman Bruce, Sunderland ; Councillor Gibson, Wolverhampton ; *Alderman Sinclair, Swansea ; Alderman J. P. Smith, Barrow ; *Bailie Willock, Glasgow ; *Councillor Ellaway, Birmingham.
Hon. Solicitor.—*Alderman Pearson, Bristol.
Hon. Treasurer.—*J. E. Edgcome, Kingston-on-Thames.
Hon. Secretary.—*H. Faraday Proctor, Bristol.

*Elected or re-elected.

The report shows that the membership now stands at 386, an increase of six on the previous year's total. The Council have further considered the question of establishing a statistical bureau, but are of opinion that both in the matter of expense and prospective support, this would not be justified. They urged members to continue the present system of filing information with the secretary. The Editing Committee's report refers to the various papers received for the Convention, which included one on "Reliability of the Total Costs per Unit Sold," by Mr. A. M. Reid, chief accountant, Dundee Corporation, which will take the form of a contribution to the proceedings.

The Finance Committee's report shows that there was a slight falling off in the income from subscriptions due to fluctuations in the membership, but there was a very considerable increase in the income from "proceedings," and the Convention showed a profit. The liabilities decreased, and there was a total surplus of assets of £721. The outstanding subscriptions were only £25, part of which had since been received. The invested funds had been increased by £100, and now stood at £600 at cost, and there was a cash balance of £116.

The Council were approached by the Electric Supply Publicity Committee with a view to getting some of the larger municipalities to financially support a scheme for an extension of the Committee's proposals on a large scale. The report says the difficulty was, and is, that many local authorities are at present debarred from spending money on publicity and other similar objects, and until the I.M.E.A. Bill is passed, the electrical industry will continue to be hampered, and to be unable to compete with other industries in regard to developing its resources.

The Council have decided in favour of marking metal-filament lamps with their rated consumption in watts.

The Parliamentary Committee's report is a long one, and naturally refers in the first place to the Association's Electric Lighting Bill and the Sheffield Bill, both of which our readers have been fully informed on.

Negotiations are proceeding between the I.M.E.A. and B.E.A.M.A. with a view to standardising conditions of contract as between purchaser and contractor. So far no agreement had been reached. The Council apparently declined to ask the L.G.B. to extend the term of meter loans to 10 or 15 years. They succeeded generally in inducing members not to publish the prices of municipal tenders in the technical journals.

At the wish of the Institution of Electrical Engineers the feeling of the Council of the Association regarding closer relationship between the two bodies and the holding of annual joint conferences in place of the I.M.E.A. annual conventions was ascertained. The result of a communication to members of the Council was that the majority were averse to the proposal in principle though several saw no objection to an occasional joint conference. The opinion was expressed that the interests of the two bodies were entirely different and distinctly opposed in some instances. After due consideration it was agreed that while there was a general feeling in favour of co-operation under special circumstances, the Council did not consider it to be feasible to hold joint conventions.

As regards the constitution of the Council, the Council have given very careful consideration to the wishes of the members as expressed at the last annual general meeting, and the consensus of opinion was to the effect that some alteration of the constitution of the Council was advisable ; that the representation of the Association upon the Council should not be upon a proportionate basis ; that a change was desirable in the present method of election of the Council ; and that the Institution of Electrical Engineers' method of nomination and election should be adopted subject to certain modifications. They accordingly recommend that the number of ordinary members of the Council be increased from 14 to 15 by the addition of one engineer member, and that one-third of the ordinary members of the Council, that is, three engineer members and two municipal representatives, shall retire annually. They also recommend that the retiring past president shall not be eligible for re-elecction as an ordinary member of the Council until after the expiration of one year.

The Council consider that the method suggested of nomination and election will, with certain modifications, be suitable for adoption by the Association. They accordingly recommended that the method of election of the members of the Executive Council be revised in accordance with the foregoing suggestions.

A brief discussion took place on the report.

MR. BELL (Hull) urged that the Association should adopt means to save its members from the labour involved in answering numerous requests for information, and Mr. Faraday Proctor intimated that the expense stood in the way at any rate until the Bill was passed.

In response to a suggestion by MR. WATSON (Bury) it was unanimously agreed to elect Mr. C. E. C. Shawfield as an hon. member of the Association.

MR. W. C. P. TAPPER (Stepney) introduced the question of expenditure on publicity, advertising, &c., which he urged should be properly organised on recognised lines, as in the case of the gas undertakings.

MR. ALEX CRAMB (Croydon), a member of the Publicity Committee, said there was no way at present of meeting this expenditure. He understood that the Commercial Gas Association were trying to get the L.G.B. not to surcharge such expenditure in the case of municipal gas undertakings, and if they were successful, municipal electrical undertakings would be entitled to spend money similarly without hindrance.

ALD. PEARSON voiced the legal view, being of opinion that an authority whose accounts were audited could not make such expenditure without fear of surcharge, while Mr. Shaw (Ilford) said his authority was subject to audit, and the L.G.B. raised no objection to such expenditure by his department, providing something was shown for it. Mr. Shaw further asked that a short report of the proceedings of the National Association of L.G. Officers, to which the Association has appointed delegates, should be placed before members of the I.M.E.A.

MR. WILKINSON (Harrogate) said they were concerned in the question of superannuation, and when anything definite was done in the matter, the members would be informed.

This ended the discussion on the report and balance-sheet, which were then adopted.

MR. TURNBULL (Tynemouth) asked for another discussion *in camera* next year, on heating and cooking, also that the exhibition should be repeated, and this was supported by other members.

MR. R. A. CHATTOCK (Birmingham) intimated that the Council would consider the question.

MR. BURNETT (Barrow) urged the Council to take up the question of protecting its junior members in the matter of salary and conditions of service. MR. EDGCOME, the President, in replying, offered as an explanation for holding meetings, *in camera*, that it was really to avoid giving unnecessary offence to contractors and manufacturers. The term used was unfortunate, and had been misinterpreted by the Press.

MR. FRANK AYTON (Ipswich), referring to his previous suggestion for the formation of a committee on electric vehicles, submitted a resolution that a committee should be appointed by the Council to consider and adopt measures for extending the use of the battery vehicle, and that it should be empowered to co-opt engineering and manufacturing representatives and others to assist.

This was supported by Messrs. SEABROOK (Marylebone), VIGNOLES (Grimsby), and WILKINSON (Harrogate), and carried without dissent.

A private discussion then took place on the I.M.E.A. Bill.

Lead Poisoning.—In the report of the Medical Inspector of Factories for 1912, it is stated that in the manufacture of electric accumulators the creation of dust is inseparable from many of the operations, and it is evident that, with the increased number of persons employed, there is risk of one worker inhaling dust and fumes produced by another. Extension of the requirement of exhaust ventilation to such processes is being pressed for in the processes of lead burning, filing and finishing. In one factory visited by the Inspector 12 years ago, when some 20 persons were employed, there are now nearly 200. Examination of the health register gave the following results as regards the number of persons in the different processes showing signs of lead absorption :—

	Number examined.	Number marked showing lead absorption.	Per cent.
Casting	28	4	14
Pasting	27	6	22
Forming	16	5	31
Lead burning	19	7	37
Filing, finishing, cleaning ...	29	9	31
Packing...	16	3	19
Others	24	5	21
Total	159	39	24·5

Exhaust ventilation locally applied below the breathing level opposite each worker and as near as was practicable, without interference with the work, was required wherever filing or lead burning was done at fixed stations.

During the year 38 cases of lead poisoning were notified in connection with electric accumulator works, of which one was fatal. This is the largest number since 1901, and compares with 24 cases in 1911. Control of sources of dust is again pointed out as the most important factor in bringing about a reduction in the number of cases.

ELECTRICAL ACCIDENTS IN 1912.

(*Continued from page* 14.)

Of the accidents in the use of portable apparatus, 31, or half the total, were due to damaged flexible conductors, the wires short-circuiting and burning the men holding them. In one case the man, in order to have his hands free whilst working, had coiled the flexible wire round his neck. In the case of one accident, a portable lamp was being used in the pit of a motor garage, and the fusing of the wires ignited petrol vapour, severely burning two men. Most of these accidents would be prevented by systematic examination and proper maintenance of the wires, especially in places such as engineering shops and shipyards, where the wires are subjected to very rough usage, although often the protecting covering of the wires is of poor quality to start with. One accident was due to the non-earthing of the metallic armouring of the flexible conductors. Apart from the trouble in having to earth metallic armouring, this form of protection is often less satisfactory and durable than other non-metallic coverings. Nineteen accidents were due to the use of improperly constructed connectors, and would have been avoided by the use of connector plugs with hand shields, as described in my former reports. Some were due to the use of "adapters" for connecting to lampholders in the place of proper wall connectors. Two further accidents were caused by persons attempting to connect the wires of portable lamps to the circuit without any connector at all. Eight accidents were due to the use of improperly constructed hand lamps. Two were due to the absence of a proper cord grip in the handle. Two further fatalities occurred which are not included in the above tables, as the medical evidence was not sufficiently definite in regard to the cause of death. In one case the man, aged 42, who had been seen at work a few minutes before, was found lying on a wet floor with an improperly constructed and non-earthed hand lamp, connected to a 230-volt alternating-current supply, lying about 2 ft. away from him. The post-mortem examination showed that there was no indication whatever that he was liable to sudden death from natural causes. He was a robust man, muscular and well-nourished, and there was nothing to show the cause of death, the verdict at the inquest being "sudden death from some cause unknown." In the other case, two men were working on a wet iron floor, and were using as a hand lamp a lamp in an ordinary metal lampholder not earthed, attached by flexible wires to an adjacent electric light bracket. The man holding the lamp shouted and fell down, and the other man on attempting to lift him received a shock. The verdict at the inquest was "death from hæmorrhage on the brain." In this case the voltage of the lamp was only 50, and possibly this low figure had an influence on the finding of the Court. The 50-volt circuit was, however, taken from an auto-transformer on a 240-volt circuit, and the shock might have been from the full voltage, or at any rate from some pressure considerably more than 50 volts. Some time afterwards I found the pressure from one conductor to the earth plate on which the men were standing to have been 130 volts. A prosecution was subsequently undertaken for breach of the Regulations in respect of the use of the non-earthed portable apparatus, and the occupiers were find and £5 costs.

In the next class—accidents due to unprotected conductors—in 12 cases the chief injuries were shock, and in 15 burns. A fatal case occurred to a lad who touched the conductors (460 volts D.C.) of a motor controller, the cover of which had been removed.

Of the accidents to skilled persons, described as "electricians" or "wiremen," due to working on live conductors, 12 were due to short circuits by the use of metal tools (*e.g.*, spanners, pliers, screw-drivers); one was due to measuring across live terminals with a steel rule. Most of these accidents could undoubtedly have been avoided, as the work need not have been done whilst the conductors were live.

Of the similar accidents to unskilled persons (*e.g.*, fitters, labourers) no fewer than five were fatal. One of these occurred to a labourer in getting up to an overhead crane. He caught hold of the trolley wires and could not let go. The current was switched off and he then fell to the ground, fracturing his skull. The second fatality occurred to an electrician's assistant who commenced to carry out some work himself instead of waiting for the electrician. He had taken the leads out of a motor (400 volts, three-phase) and apparently turned on the switch whilst holding the end of the wire. The third fatality occurred to a labourer getting hold of the crane trolley wires (440 volts, three-phase). He appears to have had no duties to take him up to the crane, and his presence there was unexplained. The other two fatalities occurred to two men engaged in painting steel standards carrying overhead power wires (6,000 volts), one man going to the assistance of the other. Their instructions were that the work of painting the standards was to be done on Sundays when the wires would be dead, and they had been warned and threatened with instant dismissal if they went up the poles without having previously ascertained that the wires were dead. With regard to the other accidents under this heading, some were due to the men having been put to work under dangerous conditions without supervision, and others to the men undertaking the work on their own initiative. Several were due to work being carried out close to live trolley wires of cranes.

The accidents in testing departments of electrical manufacturing works were mostly short-circuits causing burns, but four were shock accidents in high-pressure testing. Considering the amount of work done in these testing departments, the number of accidents is not great. Much of the work is carried out by apprentices or pupils for reasons which I have explained in former reports, the average age of the whole of the 32 persons injured being only 23 years. Some of the accidents were due to carelessness on the part of the workers and others due to faulty apparatus and worn-out cables used in making the tests. Many test rooms are also too small for the work carried on. In some cases the works have been enlarged and the output enormously increased without any increase in the accommodation for the testing departments.

Under the heading "Miscellaneous" there are nine fatalities. The first was a very unusual type of accident, as the victim appears to have received a shock from foot to foot whilst walking over electrically-charged ground. An electric lamp standard, consisting of a 2-in. iron pipe about 12 ft. in length, was planted in the ground out of doors, and was provided at the top with a metal bracket for an electric lamp. The system was 440 volts, three-phase, the lighting being by two lamps in series across one phase. Owing to leakage in the lampholder, the whole standard became electrically charged. The current was conveyed to the standard by overhead wires. The standard was erected over the foundations of an old chimney which had been demolished. Twenty inches away there was a water main in the ground 8 in. below the surface, and about 5 ft. away was an iron plate (about 4 ft. × 2 ft.) about 4 in. under the surface. The accident was investigated by T. K. Evans, and the following particulars are taken from his report:—

The fact that there was a leakage to earth was detected on the previous evening by a workman, and all hands were warned to keep clear of it till it could be set right. The next morning a man was wheeling a wooden barrow, and another man, seeing that the direction in which he was going would be close to the standard, warned him to turn back. The first man, however, said that he would risk it, and stepping forward gave a cry and fell. His nearest foot had not been within 5 ft. of the standard. Artificial respiration was started at once and continued for three-quarters of an hour with medical aid, but without success. The surface of the earth was wet and muddy. The leakage was subsequently definitely traced to the lampholder. The standard thus electrically charged appears to have charged up a well-defined patch of surrounding surface earth, while adjacent to this was an equally well-defined surface at the usual earth potential (no doubt owing to the proximity of the water pipe), so that within a space of 2 ft. 6 in. it was possible to bridge practically the full potential. Under the Regulations this metal standard should have been efficiently earthed.

The second fatality occurred at a "goliath" crane at a steel works. The crane driver, who appears to have been a competent person, had gone along the cross platform to carry out some repairs, where he would necessarily have had to touch the trolley wires. He had forgotten to pull out the crane switch, which would have made the wires dead.

In the third fatality, a sub-station on the factory premises was supplied with three-phase current at 2,000 volts by overhead wires 26 ft. above the ground. A jib crane had been temporarily erected. One man, in pulling the steel rope of the crane, put it into contact with one of the overhead wires. A second man also received a shock, and a third man, in running to his assistance, took hold of the handle of the crane and received a shock, with fatal results. The overhead wires were not part of the factory equipment, but were mains or service lines belonging to the power company. The fourth fatality occurred in the yard of a motor-car works. This works, together with the adjoining premises, had previously been occupied by another tenant, and there had formerly been electric light in one of the outbuildings. The wiring had been in iron piping. When the present tenants came into occupation, the premises were split up, and also the electrical installation. The light in question was not used by the present tenants; in fact, the fitting had been removed from the end of the pipe, the ends of the wires being left bare and the pipe had fallen out of position. A man took hold of this pipe to move it out of the way and received a shock, the ground being wet, and he was unable to let go. Another man who was with him ran to the main switch and pulled it out, but on returning found the current was still on; he managed, however, to cut the wire with a hammer. It transpired that the switch controlling the circuit was on the next door premises, and that the circuit had not been disconnected at the time that the premises were divided up. The current was 200 volts alternating. In the case of the fifth fatality, no electricity was used on the premises, but overhead wires, 500 volts, three-phase, passed over the ground to a colliery. A derrick was being erected near the wires, and a wire guy rope which a man was holding was brought into contact. The occupiers of the factory were not responsible for the wires, and evidently did not realise the danger, as a man had had a shock in a similar way the previous week. Probably the fact that no serious consequences ensued on that occasion led them to the belief that there was no danger. In the case of the sixth fatality, a new building was being added to existing factory premises, and an electric lift was being put in. The controller house for the lift was at the top of the building, and a workman engaged in cementing the floor was found lying dead with his neck against the resistances of the controller. The pressure was 230 volts direct current. The man should, of course, not have been allowed to lay the floor whilst the current was on the lift. The seventh fatality was again due to the erection of a derrick close to overhead wires, in this case 440 volts, three-phase. A wire rope between the winch and the pulley on the derrick made contact with the wires, and a boy taking hold of the rope was killed. The eighth fatality occurred in connection with building operations in extending an iron works. A labourer climbing up a lattice girder came into contact with the crane trolley wires, 400 volts, three-phase. The ninth fatality occurred through the

breaking of an overhead wire (440 volts, three-phase) during a gale in the night. The foreman noticed the wire lying on the ground at 6.30 in the morning, but did not realise that it might be dangerous. About 8 a.m. a boy having to wheel a barrow past the spot picked up the end of the wire and was killed. The wires were protected by fuses and although there were signs of arcing to the ground, the fuses had not blown. Artificial respiration was tried for two hours without success.

Another fatality, not due to electric shock and not classed as an electricity accident, occurred in the purifier house at a gas works, in which there was an electrically-driven crane for lifting the lids of the purifier boxes. Although the motor and controller were specially constructed to be gas-tight, ordinary collectors with sliding contact on bare trolley wires were made use of. A lid of a purifier had just been lifted and was being traversed across the purifier house when the cloud of gas from the purifier was ignited. The crane driver in the cabin of the crane was killed by the burns he received from the ignited gas.

Amongst the non-fatal accidents under this heading, the following may be referred to. One was due to the non-earthing of the winch for raising and lowering an arc lamp, the winch handle becoming alive. In a shipyard a man received a shock from an electric winch which was not properly earthed. Several other accidents were also due to the non-earthing of electrically-driven machinery. Another man received a shock whilst fettling a casting, another part of which was being electrically welded. In another case the man received a severe shock, rendering him unconscious, through picking up a broken overhead wire, 440 volts, three-phase. In another case a boy of 16 received a severe shock from a lamp bracket which had become charged. He was rendered insensible, and was brought round by artificial respiration. Another shock accident was due to a man trimming an arc lamp (220 volts alternating), the lamp being "protected" by a single-pole switch only. An accident which can hardly be regarded as electrical occurred in a motor-car works, where petrol vapour was ignited by a man touching the sparking plug of a motor with a metal oil can. He was wearing a celluloid collar, which instantly ignited, and he was severely burned.

After an interval of several years, in which no serious fires have occurred in public supply generating stations, there are three recorded during the year under review. One occurred in a high-tension station where a new high-tension switchboard had just been completed. The fire originated under the floor of the working platform, and was apparently caused by the breakdown of the insulation in a joint-box, in which a concentric cable from a turbo-alternator was split up into two single cables passing on to the switchboard. The arc was apparently maintained for some minutes before the plant could be shut down. Owing to its position and the resulting fire, it was impossible to get to the control board immediately, and the fire quickly assumed such proportions that the fire brigade had to be called in. Considerable damage was done to the control board of the new switchboard, the fire following the run of the cables. The supply of electrical energy was completely stopped for one night, but the duration of the stoppage would have been much shorter had not water got on to one section of the high-tension switchgear—a part of the old board which had not been replaced—necessitating a complete drying out before re-starting. Although the switchboard was chiefly affected, the fire was not caused by any fault in the design. Incidentally, the fire showed the value of teak as a material for switch-room floors. The floor, which was of this material, although burned away where the arcing occurred was, at a short distance away, practically undamaged, and did not lead to any extension of the fire. As the joint-box at which it was supposed the breakdown originated, had been tested a few days previously to three times the working pressure, the cause of the breakdown is unexplained.

The second fire occurred in a direct-current station giving a three-wire supply and a supply for traction. The fire originated below the switchboard gallery where the cables emerge from the cable trench and rise up the wall to the switchboard, and where also the shunt regulators were placed. It does not appear to be known precisely where the fire originated, but it quickly spread amongst the cables, and following them up through the space between the switch gallery floor and the wall practically destroyed the main three-wire switchboard on the gallery. In this case the arrangement of the cables and wires below the switchboard platform was very crowded, owing to the growth of the station since the supply was first commenced, some 12 years earlier, and gave little chance for saving the situation in the event of a fire once starting. This fire also resulted in a total cessation of the electricity supply and involved the hasty erection of a temporary switchboard pending reconstruction.

The third fire appears to have been primarily due to a man, working at the back of a traction switchboard, making a short circuit to the earthed metal framework. The switchboard was in a room adjoining the engine-room and on a higher level, and on the opposite side of the room was the three-wire general supply switchboard. The man was severely burned by the resulting arc and the coverings of adjacent cables caught fire. This fire was, however, put out by the staff, by means of chemical extinguishers. A few minutes afterwards, an alarm was given that smoke was coming up from the basement—two floors below—where the cables from the generating plant and the feeders passed through to the switchboards and to the street. It was found impossible to enter the basement on account of the smoke, and very quickly a fierce fire was raging. The fire followed the cables leading up to the switch-room, passing through the space between the floors and the walls left open for their accommodation, and completely destroyed both the traction and the general supply switchboards. The latter board was quite new, having only just been completed and put to work at a cost of several thousand pounds. There was nothing whatever of an inflammable nature about this switchboard, the fire feeding entirely on the insulating coverings of the cables. A battery was connected to the traction board, and no doubt contributed to the spread of the fire, as it was subsequently found to be completely discharged. The rate of discharge of the battery appears, however, not to have greatly exceeded the normal maximum rate of discharge, as the main circuit-breaker, which was on another switchboard and was found to be in order had not come out. How the fire amongst the cables in the basement started is not apparent, but it may have been due to breakdown of insulation owing to momentary rise of pressure following on the original short circuit at the traction switchboard. The complete breakdown of the electricity supply in this case involved more serious consequences than in the others owing to a number of works being dependent upon it for power purposes. Temporary switchboards had again to be hastily constructed.

These fires, especially as coming after several years of apparent immunity from such disasters, afford object lessons of great importance to those in charge of or who are responsible for the equipment of electrical stations. In all three cases, it was the covering of the cables that burned and spread the fire, and although some of the cables were in so-called "fireproof" composition tubes, these appear to have been of little, if any use in checking the spread of the fire. That where the cables are in a covered trench or under a ceiling or roof, they are most readily attacked, has been further clearly demonstrated in the case of a fourth station fire which has occurred since the period covered by this report. In this last case the cables were in a subway some 6 or 7 ft. in height and were laid on insulators on racks on each side of the gangway. All the cables within about 2 ft. of the roof of the subway had their insulation completely burned off, but those nearer the ground were practically undamaged. In many of the older stations the cables and wires behind the switchboards and in cable trenches and subways are hopelessly mixed up, so that should a fire be started at any point it would be impossible to prevent it from rapidly spreading and involving the whole. It is a common practice in electrical stations for the cables to be taken from trenches or subways up the wall of the building to the switchboard gallery, the floor of the gallery being cut away, leaving a permanent opening some 12 in. wide all along for the cables to pass through. Two of these fires show the danger of this opening in the floor allowing the fire to pass upwards and involving the switchboards in the gallery or room above. So long as cables with inflammable insulation are used in electrical stations, it is obvious that some safer system of isolating and protecting them is necessary if the possibility of such disasters is to be prevented. There are no doubt difficulties in many stations on account of the large number of cables which have to be accommodated, but it might be practicable in many cases to separate the cables in channels of brick or stoneware in such a way as to prevent the spreading of a fire from cable to cable. The small wires for instruments, regulating resistances, &c., are often a source of danger, being poorly insulated and looped about anyhow at the backs of the switchboards. It is generally recognised that inflammable woodwork, particularly soft wood, should not enter into the construction of switchboards, yet I recently found a new high-tension three-phase switchboard in a public supply generating station practically enclosed in woodwork; the bus-bars were just below a matchboard ceiling, and the whole passage-way at the back of the open-fronted cells was enclosed by deal boarding.

(To be concluded.)

THE CAUSES OF FIRES IN CENTRAL ELECTRIC LIGHTING STATIONS, AND THEIR REMEDY.*

By ANDRE GERARD.

Cases of the total or partial destruction by fire of central electric lighting stations have recently been somewhat numerous, especially in the United States and Switzerland. The repetition of serious fires, which deprives towns, and sometimes whole districts, of light and power during more or less extended periods has led those responsible for the management of generating stations to seek to discover the most probable causes of fire, and the remedies to be adopted for their removal.

The majority of modern central stations, whether hydraulically or steam-operated, are constructed of fireproof or incombustible materials—ironwork for the roof beams, tiles or slates for the roofing, and bricks, stone, or cement for the walls and floors. It would, therefore, seem, *a priori*, that only the machinery and accessories can act as feeders to a fire should an outbreak occur. It must not be overlooked, however, that iron and steel roofing material exposed to a violent fire is easily dislodged, owing to twisting under the action of the heat of the parts comprising it, and, in becoming dislodged, whole sides of walls may be dragged down.

Apart from the switchboards, there is little cause for fire in the power house of central stations. The windings and cables of the

* *La Lumière Electrique.*

machine may, possibly, catch fire, but such outbreaks are easily localised, and do not give rise to great heat.

In many recently-constructed power houses, a change more to be feared has been introduced by the adoption of filters to filter the air employed for the cooling of the alternators. These filters, composed of strips of cloth stretched across wooden frames form excellent additional fuel for fires, they being easily ignited. The flame, sucked along by the alternators, which play the part of huge fans, may quickly destroy the whole windings, and, owing to the excessive heat, cause seizing of the bearings of the steam turbines and generators, and so possibly bring about the destruction of the turbines.

In order to prevent such serious accidents, the filters should be placed some distance away from the alternators, which they keep free from dust, in a special fireproof compartment, which the station staff should not be allowed to enter. It is also well to cover the external air inlets to the filter chamber with wire gauze, as in this way the risk of the filter catching fire should an outbreak occur at the station, is diminished.

The conductors, which transmit the electrical energy for the auxiliary services and lighting of the station, should be carefully insulated, and enclosed, if possible, in metal tubes. The insulation of these circuits should also be frequently tested. The current should preferably be conveyed from the generators to the switchboard by copper bars arranged in perfectly watertight and fireproof channels. By adopting this method, the possibility of short circuits, which may arise in the armoured cables often employed for this purpose, and which frequently form long sustained arcs—one cause of fire—are avoided.

The section of central stations most liable to fire is the switchboard, where are usually grouped a large number of particularly inflammable materials, such as the oil of static transformers, the insulating blocks of measuring transformers, and the rubber with which the cables are covered.

A modern innovation in central station construction is to completely separate the switchgear from the power house, and to locate it in a separate and independent building. If the switchboard catches fire the power house is preserved, and a temporary system of cables can be quickly rigged up to maintain a supply of current to consumers. On the other hand, if an accident, such as the bursting of a steam pipe, occurs in the machine room, no harm is done to the switchgear. It is, unfortunately, not possible to adopt this excellent arrangement in existing stations, and, consequently, all that can be done is to make the switchgear as fireproof and incombustible as possible. If static transformers—which are particularly dangerous from a fire point of view, as they practically constitute oil reservoirs—are employed, it is advisable to shift them to a specially isolated part, the compartments in which they are placed being protected from any possible falling walls. The front of these chambers should be provided with folding iron gates. Contact thermometers, or thermo-electric couples. would inform the switchgear attendants as to the temperature of the oil in the transformers at work, and they could be given a warning of any excessive heating of the oil by means of an electric bell arrangement.

The oil switches and the alternator and feeder connections of switchboards also form an element of danger. From various tests that have recently been carried out, it appears that the oil of these switches may catch fire in either of the two following ways:—First, by progressive heating, due, for example, to a bad contact at the jaws of the switch, this leading to the rupture of the normal load of the alternator or of the feeders; under the action of the arc set up by the rupture, the oil, already highly heated, ignites. This firing does not, however, take place unless there is a shortness of oil, or unless there are openings in the switches, as, to cause combustion, there must be some air in the vicinity of the oil. Switches ought, therefore, to be kept well sealed and fitted with a visible oil-level indicator.

It has been noted that ignited oil tends to extinguish itself so long as it is not in contact with any wick. Therefore, anything that might act as a wick to feed the ignited oil should not be included in the construction of switches, and, above all, care should be taken to see that the cables leaving the switches are not covered with insulating material. A similar remark applies to the cables leaving static transformers. This first way in which the oil of switches may become ignited may be easily overcome if the station attendants will make themselves acquainted with the smell arising from the progressive heating of oil.

The second cause of trouble is the sudden heating up of the oil. This may take place when a short-circuit, broken by a switch, is not proportionate to the power lost on the short-circuit. There is little to be feared on this account between the switch and the alternator; indeed, it is almost impossible if the precaution is taken to equip the machines with instantaneous-acting reverse-current relays. It is, however, different as regards the break between the switch and the feeder. In case of a short circuit in a feeder, the automatic switch breaks not only the total energy being transmitted at that moment, but that multiplied by a coefficient of between three and four. Again, the extension, often rapid, of the capacity of central stations, is not always accompanied by a replacement of the switches originally installed, whereas their capacity ought to be changed to correspond to the increased capacity of the plant. The consequence is that more energy is transmitted through the switches than that for which they were designed, which may give rise to the sudden heating up of the oil already mentioned. Should the oil fire, it is possible for the switches to explode or burst, so spreading the flaming oil, and should any of it come in contact with combustible material, it will not only set fire to it, but the material will act as a wick to the oil, and so keep it burning. To prevent such accidents, each switch should be proportioned to the total power of the plant; in the case of large, modern central stations, this necessitates switches of a somewhat imposing size, with the result that, with the object of reducing the dimensions, what are known as armoured switches, enclosed in thick steel plates, and also compressed oil switches, which require less oil for an equal capacity, are being introduced.

It is always necessary to see that there are no combustible materials in the neighbourhood of the switches. The panels of the switchboard should be made of cement, or some similar material. The conductors should be bared to prevent the spreading of a fire. The wrapping of asbestos round rubber insulation should not be allowed, as asbestos forms an excellent wick for burning oil. The switchboard should be divided into several sections, completely separated one from the other by iron doors. The passages, where the switch panels are all on one floor, and the staircases, where they are on different floors, should be outside the building. If a fire breaks out in one of the sections of the switchgear, it could, in this way, be completely isolated from the neighouring sections, and the area of the fire confined. At the same time, it is advisable that the iron doors should be kept open, so that the attendants may be warned of any danger by the smell associated with copper and burning oil.

A feature of many central station fires, is that great clouds of dense smoke are rapidly produced, which quickly invade the whole building; this smoke, which arises from the numerous resinous materials involved in the fire, greatly impedes the work of the firemen, or the station staff, who are unable to enter the building to stop the machines or to switch off the cables and feeders. Every station should, therefore, be equipped with apparatus to enable men to enter buildings filled with smoke or unbreathable air. Some of the apparatus made for this purpose necessitates so long an apprenticeship on the part of a staff and so long a period to put on, that apparatus into which air is pumped is to be preferred. The helmets for central station use should be made of an insulating material; the pipes which convey the fresh air from the outside to the interior of the power house may be metallic, but that leading to the switchroom should be of rubber. According to this plan there would be in each station a double set of piping for each apparatus.

At the side of each machine in the power house, and also in the switchroom, there should be kept ready for use a number of hand fire-extinguishers. Apparatus of the liquid-jet type cannot, of course, be used if pressure still exists at the terminals of the machines or at the bars of the switchboard. In this case extinguishers of the powder type are to be preferred.

The location of the water hydrants for the fire service should be carefully studied. If a pressure water supply is not available, it will be necessary to construct a water tower, and, in addition, to provide auxiliary pumps equipped with self-contained motors.

In conclusion, it may be pointed out that it is not altogether advisable, for the simple purpose of reducing production expenses, to establish generating stations on too large a scale; from a fire point of view, it is preferable to divide a district up into sections, each with its own generating station, the network being, however, so connected up, that in case of a fire at one of the plants, the mains usually fed from it can be supplied from one of the other stations.

French Trade with the Electric Furnace.—The *Génie Civil* states that the exportation of bauxite, the source of aluminium, was 144,000 tons in 1912, as compared with 154,000 tons in 1911. England took 40,000 tons; the United States, 33,000; Holland, 31,000; and Russia and Germany, 26,000 tons each. The export of anhydrous alumina was 8,300 tons, against 8,800 in 1911, and of sulphate of alumina 423 tons, against 978. Aluminium was exported amounting to 6,600 tons, compared with 4,000 tons in 1911 and 4,100 in 1910, mainly to Germany and Switzerland. The export of calcium carbide increased from 5,058 tons to 6,225, largely for acetylene lighting in the French Colonies; 3,302 tons were imported. Over 3,000 tons of nitrate of lime and cyanamide were imported, the former coming from Norway and the latter from Switzerland. Ferro-silicon exports amounted to 3,766 tons, and various iron compounds to 6,531 tons, most of the former going to Germany and Belgium, and of the latter to England and Switzerland. The exports of chlorate of potash were 1,746 tons and of chloride of lime 13,000 tons.

Troubles Due to Non-Use of Circuit-Breakers.—In the *Electrical World*, F. W. Harris points out that a common source of complaint is the heating of the contacts of circuit-breakers after the instrument has been in service for a long period. These breakers, as commonly constructed, have a laminated brush made up of thin leaves of copper, and any temperature over a certain very well-defined maximum will result in the brush becoming soft and losing its elasticity. Therefore the heating becomes very much worse, rapidly approaching a crisis which results in a more or less total ruin of the brush and sometimes a shut-down of the plant. In a certain case an examination of conditions showed that the troublesome circuit-breakers were connected on a circuit that was never opened except upon dead-short-circuit conditions, and these conditions did not obtain more than once or twice a year. The whole trouble was traced to a gradual oxidation of the contacts and to the fact that the troublesome circuit-breakers were never opened and closed to rub off the oxide. It was found that if the instruments were opened and closed a few times on Sundays it was possible to keep the contacts bright.

EDUCATING THE PUBLIC IN THE USE OF LIGHT.

The Illuminating Engineering Society of New York has recently published a booklet entitled "Light: Its Use and Misuse," which is designed to educate the public in the principles governing good lighting, and in the nature and defects of bad lighting. Under a slightly extended title the Illuminating Engineering Society of London has since published essentially the same work "slightly modified to suit the needs of this country." It is hard to see why a treatise of this description should require adapting to the needs of this country in contradistinction to those of America, and such differences as actually exist between the two editions lie in the arrangement of the text and blocks, and are of no vital importance. Nevertheless, the phrase quoted is unfortunate, and is likely to remind readers of the fate awaiting the patient when doctors disagree. In respect of grammar and arrangement of matter we prefer the English edition, and the latter is certainly more accurate in its technical statements and advice.

In both editions the matters dealt with include a brief discussion of the mechanism of the human eye and the effect on it of various lighting conditions; the dangers of flicker and glare; the distribution of illumination; the choice and arrangement of globes, shades and reflectors; and the amount of illumination necessary. These matters are dealt with very satisfactorily, but we find no reference to the evil effects of "cut-glass" bowls (as distinct from glassware scientifically designed on the Holophane principle), or to the dangers of heating the eyes by lamps placed near them—which danger often exists though the luminous radiations are properly screened. As regards the illumination necessary for reading, it is interesting to note that 2 or 3 ft.-candles are now held to be desirable. It is not long ago that 1 ft.-candle was the standard reading allowance.

A special feature in both editions are the illustrations, which are intended to present to the reader concrete ideas on the subject in hand. The choice of illustrations is rather better (from the point of view of instructing and convincing the reader) in the English than in the American edition, but a number of the figures are the same in both cases. The photographs reproduced illustrate the arguments and recommendations made in the text, but they do not always do so fairly. The use of photography in representing lighting conditions is open to grave risks. Quite apart from the fact that the photographic plate "sees" rays which are invisible to the eye, and is unaffected by other rays to which the eye is sensitive—quite apart from this important difference in colour-sensitivity, it is practically impossible to secure on a photographic plate or print that impression of light and shade which would be received by the human eye viewing the actual scene represented.

Consider, for instance, the dining-room scene reproduced in fig. 1. It is impossible that in any room thus lighted the eye should find the surroundings so inky and the shadows so deep as they are shown in this illustration. The lighting is undeniably bad, but, whereas the human eye is by nature very accommodating, the camera lens takes in the whole scene under certain conditions, fixed in each case, and were a sufficient exposure given to bring out those background details easily visible to the eye, the light from the lamp itself would fog hopelessly the whole upper portion of the photograph. Suspending chains above inverted lighting fittings are completely "fogged out" in a photograph given sufficient exposure to record the less intensely lighted parts of the field. In the American illustrations, details thus lost have been (rather crudely), sketched in before making blocks, while in the English edition they are left invisible. Actually, of course, the eye would have no difficulty in seeing the parts in question. The human eye has a very much smaller field of focus than the camera lens, and the violent contrast shown within the few square inches of a photograph is far less noticeable to the eye when viewing a "life size" object (only part of which can be clearly focused at any one moment) than when regarding a small print, practically the whole of which can be sharply focused at once by the eye. Any reader viewing the illustration in question will readily agree that the lighting shown is heinous, but few will realise that the conditions represented are identical with those prevailing in their own rooms, and therein lies the root of our objection to many of the illustrations not only in these but also in other illuminating engineering publications.

A further danger, to which illustration of lighting conditions by half-tones is exposed, is that there may be a marked distinction between pulls from the same block. For instance, in illustrating two adjacent cabinets—equally lighted but respectively lined with light and dark materials—the English brochure shows much worse conditions in the dark-wall room than does the American print from the same block. A similar distinction is noticeable between the blocks illustrating diffusion by opal and ground-glass spheres in the two publications. On the whole, the English illustrations represent interior lighting conditions more nearly as they would appear to the eye.

With the general statements and recommendations made in the text we are in agreement, though, in the American edition, statements, which appear conflicting to the layman, are made in various places without its being clearly explained what different conditions and needs have to be covered in the several cases. In seeking to appeal to the lay reader, the American treatise perpetrates several unnecessary technical inexactitudes. For instance, the optic nerve does not "send along the picture" (on the retina) "to the brain for notice," nor, in the dim light, does "the focusing muscle vainly hunt for some focus which may make objects look clear." Again, the American author attributes the harmful effect of reflection from glossy paper to the unusual direction from which it proceeds: it would have been more correct and useful to have attributed the evil to the high intensity of the specular reflection and the uneven illumination of the field of view.

Both the booklets under review are printed with non-glossy ink on unglazed paper. This is a practice which we trust will extend; the examples before us prove conclusively that excellent half-tone reproductions can be made on unglazed paper, and it has hitherto been an anomaly that illuminating engineering journals have employed the glossiest of papers while pointing out its defects in their columns.

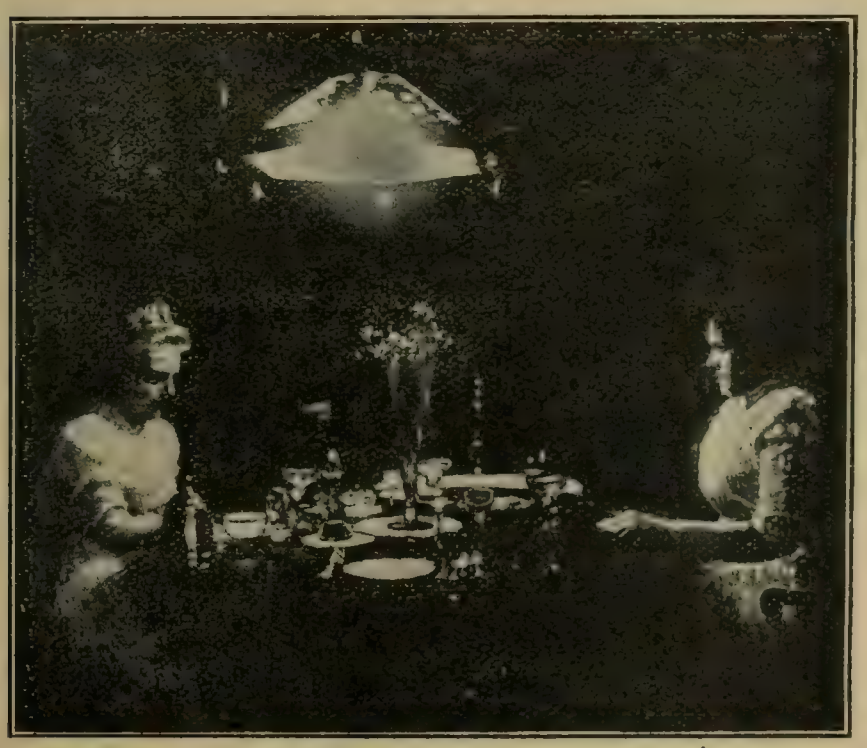


Fig. 1.



Fig. 2.

The lamp arrangement shown in fig. 2 herewith is given in the American edition as being good for reading purposes; it is stated that "no light directly hits the eyes, and no glare is reflected from the book." In our opinion, the arrangement is distinctly bad. The lamp is too far to the front; it should be behind and above the reader. Under the conditions shown, a very trying side light enters the reader's left eye; if the book paper is glazed, it will certainly "glare," and the illumination on the pages is patently uneven. Unless the reading lamp is above and behind the reader's shoulder, it should be square in front of him, and the lamp should be provided with an opaque diffusing reflector of such depth that the lamp cannot be seen without actually looking up into the shade. It is practically impossible to avoid glare or specular reflection from glazed paper, except by preventing the incidence on it of any undiffused light.

The authors of these books have wisely avoided any discussion as to the relative merits of various types of lamps; this controversy, though of prime importance in a deeper study of the subject, need not be brought into a treatise designed to educate the public in the first principles of good lighting. We are in entire agreement with the general aims of these pamphlets, and, because we

consider the work embarked upon to be of national importance, we have discussed at some length the most serious of the imperfections in the publications. We consider the English edition to be distinctly the better, and we hope and believe that this treatise and the ones which are later to appear, dealing with different applications of illuminating engineering more specifically, will direct widespread attention to the evils attending bad lighting and lead to the general attainment of good illumination.

THE "PARAGON" PETROL-ELECTRO-MECHANICAL TRANSMISSION SYSTEM.

The tremendous revolution in street and railway transit brought about by the use of electricity for motive power has for years led to investigations by many accomplished engineers throughout the world, and in connection with the application of the internal-combustion engine to transport purposes, the work of Mr. William P. Durtnall has exhibited a striking novelty and a high degree of ingenuity born of practical experience. Many patents, both British and foreign, go to make up what Mr. Durtnall has been pleased to name the "Paragon" system; one of the most interesting is British Patent No. 6,758/1909, a practical description of which, and of the method of operation, is given below.

Fig. 1 shows the general lay-out of the plant as proposed for the propulsion of motor vehicles such as omnibuses, road lorries, and other vehicles where light weight and high efficiency are of supreme importance.

As will be seen in this lay-out, the prime mover A consists of a six-cylinder horizontal opposed "Paragon" cycle (silent) petrol engine, which we shall deal with further in a future issue; this engine is fitted with the most modern improvements, including ball bearings of a special type. The engine runs at 800 R.P.M., and in the instance drives a four-pole synchronous three-phase alternating-current generator B, through the coupling C. The engine shaft

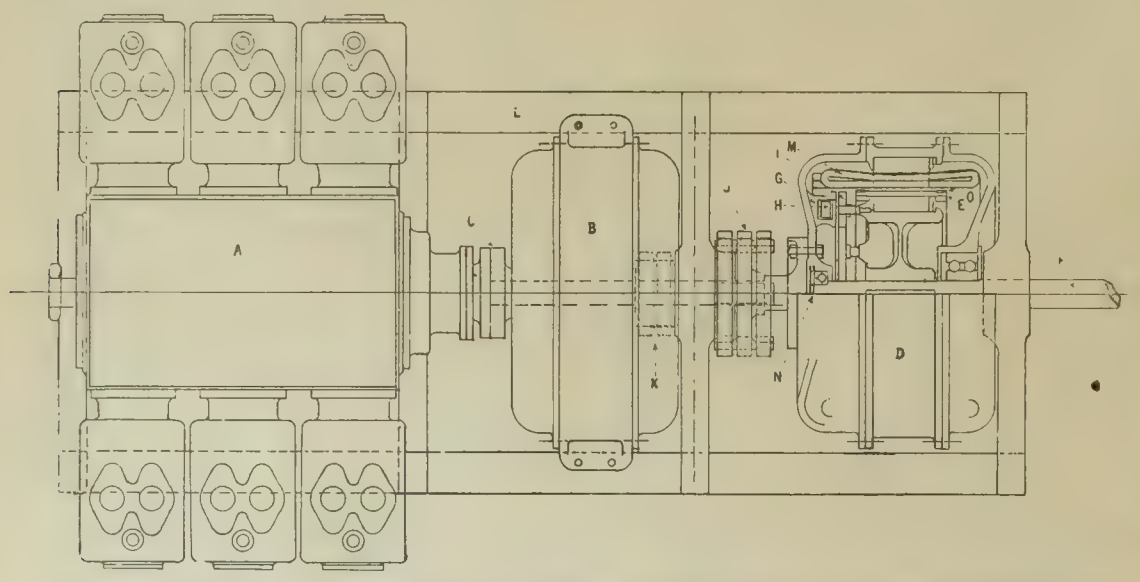


Fig. 1.—"Paragon" Petrol-Electro-Mechanical System of Transmission.

is continued through to the machine, which Mr. Durtnall calls the clutch-motor D, and to its revolving outside cast-steel case the engine is also coupled. Separated by an air-gap shown at O, there is inside the case D a squirrel-cage rotor or secondary member E, which is mounted by means of ball journal and centring bearings shown at N, on the driven or cardan shaft shown at F; this shaft is coupled by means of the ordinary final drive to the axle, and in connection with this final drive there is a very interesting reverse motion brought about by two bevel wheels, always in mesh, one on each side of a driving pinion, the axle being given an ahead or astern motion as may be desired, by simply engaging either driven bevel wheel with a dog clutch mounted on a squared part of the main axle. The clutch is operated by means of a fork and a lever which is carried right forward to the driver's seat, from which it is easily operated when desired. Mounted inside the power-driven clutch-motor case is a small, but powerful, magnetic-clutch coil half shown at G, in which is the exciting coil H; it will be observed that the air gap shown at O, allows the engine to run without driving the cardan shaft F, when there is no excitation, and it is arranged that by means of the magnetic clutch G, the clutch armature shown at I, can be drawn over against the coil half G, and so mechanically short-circuit the air gap O; when so connected the engine can deliver its mechanical power direct to the final drive and axle—the electrical machines, and the slip-rings shown at J, then running only as fly-wheels, and unexcited. The slip-rings shown at K, take the exciting current to the four-pole revolving magnet of the synchronous generator, whose frame is fixed to the chassis frame L; the slip-rings J are electrically connected with proper connections through a hollowed portion of the engine shaft, and up through the casing of D, to the eight-pole three-phase star-connected winding shown in the case at M, which is, of course, laid in slots in the laminated core.

The manner in which this combination operates is as follows:—It must be assumed that the engine A is running at 800 R.P.M., and is driving the revolving field of the synchronous generator B, together with the slip-rings J and K, solid with the cast-steel case of the clutch-motor D, and for the sake of clearness we will assume that, looking at the plant from the engine end, the revolutions are in the counter-clockwise direction; no movement is given to the vehicle owing to the fact that no excitation has, so far, taken place, and therefore the magnetic effect is absent at the air-gap O.

For the first speed, direct-current is put on the slip-rings K from the exciter, which is not shown here; three-phase alternating current at, say, 26 cycles, is taken off from the generator armature of B, and is coupled to the slip-rings J, which are electrically connected to the eight-pole winding M; the current is set in such a direction, that the consequent magnetic flux travelling in the mechanically-driven laminated core of the clutch-motor D, is revolving in a clock-wise direction at just half the speed at which D is being mechanically driven. It must be remembered now that the rotor E up to now has been stationary, but at this moment it is suddenly surrounded by eight powerful magnetic poles, which are being driven mechanically by the engine, at a revolution speed of 400 R.P.M. only, owing to the fact that the four-pole generator (driven at 800 R.P.M.), is supplying the exciting current, producing the clock-wise revolving magnetic field in the core of D, which is being mechanically driven by the engine in a counter-clock-wise direction. Consequently in the squirrel-cage winding a high E.M.F., and current is generated at a frequency of, say, 13 cycles, with the result that the rotor and, consequently, the cardan shaft is started and pulled round by the engine in a counter-clock-wise direction; the arrangement thus takes the form of a very efficient magnetic clutch, with a high torque at starting, gradually falling off as the rotor runs up to just behind the synchronous speed of 400 R.P.M., which would represent a vehicle speed of, say, four miles per hour.

The vehicle being accelerated to the above speed, and having kinetic energy in itself, the exciter is taken off the slip-rings K, and consequently the whole system falls to a no-voltage condition; in that state the leads from the generator B to the slip-rings J, are disconnected, the member D is still driven by the engine at 800 R.P.M., and the rotor E is driven round in the same direction counter-clock-wise by the vehicle by means of the cardan shaft F. The exciter is then connected to the clutch exciting coil H, by means of one only of the slip-rings J (frame return), with the result that the clutch armature, which is mounted on suitable pins on the rotor E, is attracted against G, and the vehicle is consequently further accelerated to a speed of eight miles per hour; the engine is then driving direct through to the axle at the engine speed of 800 R.P.M. This is, of course, the most efficient speed, and in town work is almost always in action.

For the third speed the exciter is taken off the exciting coil H, and the clutch armature flies back into its off position; both the rotor E and the case D are running then at the same speed of 800 R.P.M., the rotor being driven by the vehicle and the case by the engine. The connections are now made from the three-phase armature of B, to the slip-rings J, but in this instance two of the phases or leads are reversed by means of a change-over switch arranged for in the controller. The exciter is put on the slip-rings K, and three-phase current at, say, 26 cycles is connected to the eight-pole winding in the case D, but in this case the resulting magnetic flux travels or revolves in the laminated core of D, at a speed of 400 R.P.M. ahead of the engine or core speed, in the counter-clock-wise direction looking at same from the engine end; the result is that the rotor E is accelerated in speed and runs up just below the synchronous speed of 400 R.P.M., compared with the mechanically-driven case D, or 1,200 R.P.M. absolute speed, which represents a vehicle speed of, say, 12 miles per hour, the proper top-speed of such a vehicle as a 3½-ton motor omnibus.

The action at this speed is very interesting owing to the fact that part of the mechanical power of the engine is being transmitted across the air-gap, and part of the work is then being done by the rotor E, climbing (as it may be put) round magnetically by means of the revolving flux in the core of D. About ·6 of the mechanical power is so delivered mechanically, and ·4 is delivered electrically, truly an electro-mechanical combination.

It will be observed that no fly-wheel is shown, nor is one required; as stated above, the members B, J, and D, have more than enough fly-wheel effect. The clutch-motor is driven round at 800 R.P.M. and is sure of very effective cooling, consequently the electrical machinery is very light per unit output for a given heating limit; there is no question concerning the efficiency of the power transmission, and consequently the total weight per horse-power transmitted is extremely and unusually low, and the mechanism is, comparatively speaking, cheap.

Although this lay-out of the "Paragon" system is shown as an ingenious "electro-mechanical" power transmitting system for the purposes named, we shall, at a later date, describe another lay-out for the application of this system, in which the whole power can be transmitted entirely electrically in connection with the "Paragon" gas-electric tram-and-rail-car system which, by a judicious combination of Mr. Durtnall's inventions, promises to be of great interest to those who have the problem of town and city transport under consideration.

PROCEEDINGS OF INSTITUTIONS.

Faraday Society.

DEMONSTRATION OF THE HERING "PINCH EFFECT" ELECTRIC FURNACE.

DR. CARL HERING, the well-known American electrochemist, who has been on a visit to Europe, gave a demonstration recently to the members of the Faraday Society of a small working model illustrating the principle of his application of the pinch effect to the heating of furnaces. The demonstration took place at the Northampton Polytechnic Institute.

In every conductor carrying an electric current, there is a force tending to crush the conductor, and if this conductor is a liquid, its cross-section will contract. The force is proportional to the

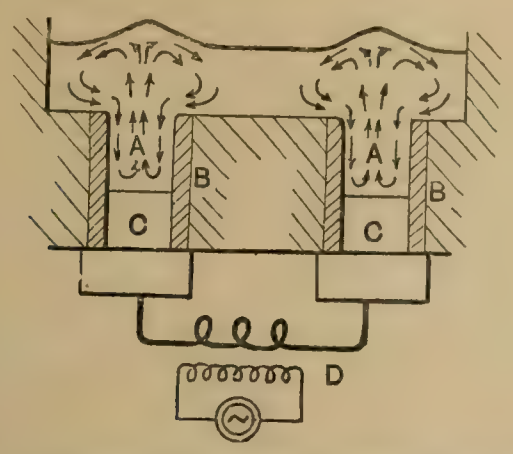


FIG. 1.—PRINCIPLE OF THE HERING FURNACE.

square of the current, and it consequently attains considerable magnitude when large currents are flowing. The tendency of modern engineering practice is entirely in the direction of extremes of magnitude, so that the employment of enormous currents in the electric furnace is only one further interesting illustration of that tendency. To return to the pinch effect, if the liquid conductor carrying the big current is in a tube with open ends, the liquid will be squeezed out at the ends; and if, by the action of gravity, for example, more liquid can flow in to take the place of that squeezed out, a continuous circulation of hot liquid will be kept up. It is this effect which is made use of by Dr. Hering for converting electrical energy into heat in his furnace and conveying that heat rapidly and automatically into all parts of the molten substance under treatment in the furnace.

The principle of the furnace is clearly shown in fig. 1, where A A represent diagrammatically the tubes in which the pinch effect takes place, and C C are the electrodes. The small experimental furnace shown in operation at the Northampton Institute is represented in fig. 2. It was merely used for melting lead, and was only intended to illustrate the action of the furnace and to show the pinch effect in operation. The feature that particularly struck one was the obvious rapid circulation induced in the body of the lead, and the ease, smoothness and uniformity with which the little furnace seemed to operate, but nothing can of course be said about efficiency as a result of these casual observations. One certainly was left with the impression, however, that heat was being generated and diffused as quickly as possible, and this by allowing little opportunity for losses is a necessary condition of high heat-efficiency. It was further noticeable that the temperature of the furnace was under good control, and it would appear that one could without difficulty get just the temperature required, and no higher. The actual limit to temperature was stated to be only determined by what the refractory material of the tubes—usually made of magnesite—could stand, and we were told that a dazzling white heat had been attained. The current density in the resisters was stated to reach a magnitude of something like 6,000 amperes per sq. in. One would imagine that the weak point in the furnace would be the resister tubes, but Dr. Hering assured us that there was very little wear on them in practice, and in any case they were easily replaced during a week-end close-down.

At present no figures as to efficiency or costs are available; a 3-ton furnace is in course of construction, and presumably the tests made with this will be published in due course. Until we have such figures no final opinion can be expressed as to the possibilities of the Hering furnace. As to its uses, Dr. Hering stated that it had been used to refine steel, and he gave instances where it had easily eliminated the whole of the sulphur from the charges. It should be noted that the furnace can be worked with either an oxidising or a reducing atmosphere. If the high temperatures claimed, and the rapid circulation noted in the small furnace can be attained in practice on a large scale, there ought to be little difficulty in obtaining a homogeneous steel free from "mechanical" impurities. It is, however, a little difficult to understand how "chemical" impurities are going to be removed by slag-action, seeing that the heating takes place from below the slag, and that the latter will always be at a lower temperature than the steel. Dr. Hering stated that resister tubes could easily be fitted to existing open-hearth furnaces, and if this is found to be practical and healthful it may be that the principle of the furnace will have a future in conjunction with other forms either of combustive or of electrical heating. Other

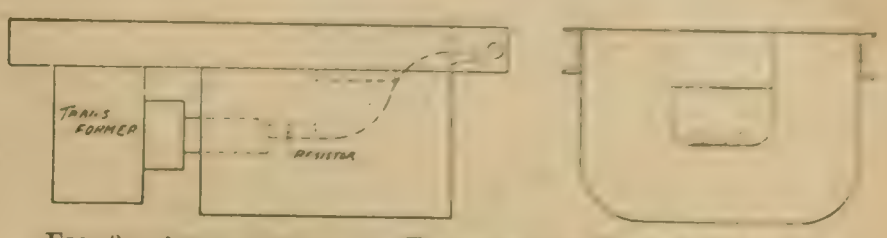


FIG. 3.—ARRANGEMENT OF THREE-PHASE HERING FURNACE.

uses suggested, some of which have been tried on a small scale, are for melting brass and bronze and for zinc reduction. As to the novelty and ingenuity of this application of the "pinch" effect there can be no question, and all electro-metallurgists will await with very great interest the results of the tests that will be made with the process when the large furnace contemplated shall have been built and tried.

Fig. 3 shows diagrammatically the form of the furnace as it will be used in practice, in this case arranged for a three-phase current

Electric Marine Propulsion.

AT the summer meeting of the INSTITUTE OF NAVAL ARCHITECTS, at Glasgow, Messrs. John Reid and H. A. Mavor presented "A Case for Electric Propulsion." The writers urged that the development of the canal barge presented a problem of much greater interest and importance than might at first sight appear. No one who travelled on the great rivers of Europe could fail to observe the immense traffic which they bore and the remarkable way in which the vessels employed in such traffic had been designed to suit local conditions and requirements. It was so also on the great North American inland waterways, the importance of which, as affording the only system of transportation which could compete with the railroad, had been very generally recognised. The functions performed by electric equipment were thus defined: (1) It adapted the speed of the engine to the speed of the propeller; (2) it combined the power of separate engines and applied the whole to a single propeller, with perfect freedom to use either or both power units; (3) it provided a simple and easy reversal of the propeller, while leaving the engines running in one direction at constant speed; (4) it also provided ready means of distant control, should this be required. It would be seen that mechanical gearing could perform only the first of these functions, and for this reason it was anticipated that, compared with a mechanically geared or direct-connected Diesel engine equipment, the electrical equipment would offer very material advantage in the operation of the vessel in the special circumstances under which it was placed. In the United States, Mr. Emmott, of the General Electric Co., had

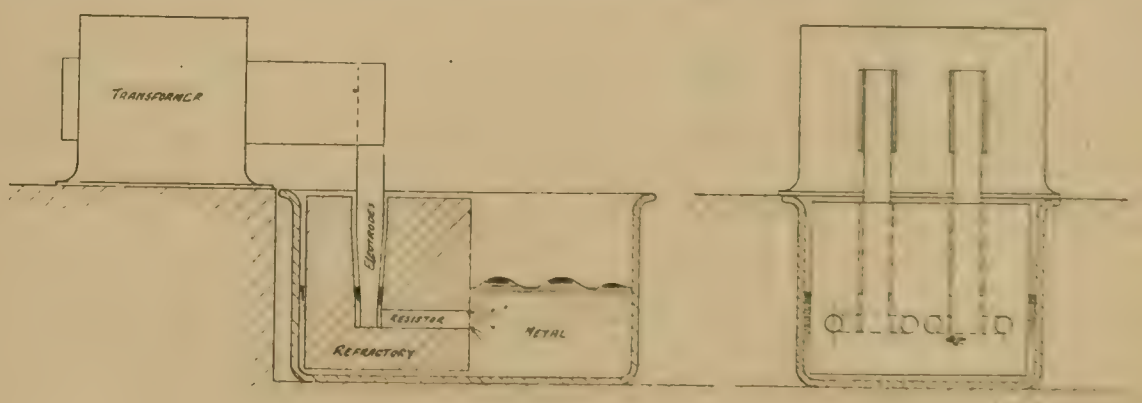


FIG. 2.—SECTION OF EXPERIMENTAL FURNACE.

shown the suitability of electric propulsion for a deep-sea collier of 7,000 H.P., for which the equipment had already been completed and tested, with the most brilliant results. The success which had attended the introduction of the geared turbine and the hydraulic transformer was of good augury for similar success with electric transmission. Electricity seemed to offer a means of solving certain difficulties in the power question which were, after all, only components of a problem which, in one form or another, long confronted the marine engineers, viz., how to generate power in a given vessel independently of the means used for propulsion, enabling the sources of power for all purposes to be concentrated in a central station with a single economical and easily controlled system of distribution, by which the power generated for any particular purpose might be exactly adjusted to its requirements.

Whitefield (Lancs.) Electric Lighting.—The Council has decided to apply for sanction to borrow £735 to cover new buildings and alterations, including electric lighting.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,433. "Lamp-making machines." Allgemeine Elektricitats Ges. (Convention date, June 21st, 1912, Germany.) June 23rd. (Complete.)

14,459. "Operating mechanism of sand-discharge valves for electrically-propelled vehicles." J. F. Simpson. June 23rd.

14,473. "Automatic electric fire detector, extinguisher, and fire brigade call." T. G. V. Blakey and W. Fish. June 23rd.

14,475. "Control of electric lighting and other circuits by means of a relay and switch or switches." J. F. Hough. June 23rd.

14,487. "Circuit arrangements for automatic and semi-automatic telephone systems." Siemens & Halske Akt.-Ges. (Convention date, July 22nd, 1912, Germany.) June 23rd. (Complete.)

14,518. "Method for the electrical welding of metals by means of increased resistance." Allgemeine Elektricitats Ges. (Convention date, June 21st, 1912, Germany.) June 23rd. (Complete.)

14,524. "Telephone systems. W. Aitken. (Addition to 16,906, 1912.) June 23rd.

14,532. "Device for controlling the speed of, or stopping by means of automatic contact with signalling apparatus, fog signalling, and improvements in and relating to signalling, and the application of same to railway trains, motors, locomotives, and like means of transit." A. Findlay and J. D. F. Findlay. June 24th.

14,562. "Electric liquid heaters." E. A. Raves. June 24th.

14,567. "Incandescent lamps." British Graetzin Light, Ltd., and H. J. Meads. June 24th.

14,587. "Electrostatic apparatus for separating and cleaning grits, grain, and the like." J. Kraus. (Convention date, May 9th, 1913, Germany.) June 24th. (Complete.)

14,591. "Electric gas lamps." F. Skaupy. (Addition to 29,104/12.) (Convention date, November 27th, 1912, Germany.) June 24th. (Complete.)

14,614. "Number dial for automatic and semi-automatic telephone exchanges." Siemens Bros. & Co., Ltd., and E. A. Petithory. June 24th. (Complete.)

14,628. "Switch keys for telephonic installations." International Electric Co., Ltd. (Akt.-Ges. Mix & Genest, Germany.) June 24th. (Complete.)

14,631. "Microphones." International Electric Co., Ltd. (Akt.-Ges. Mix & Genest, Germany.) June 24th. (Complete.)

14,633. "Apparatus for winding electrical machines." Maschinenfabrik Oerlikon. (Convention date, June 24th, 1912, Germany.) June 24th. (Complete.)

14,653. "Means for and methods of changing the frequency of alternating currents." A. M. Taylor. (Addition to 8,853, 1911.) June 25th.

14,699. "Electric heating apparatus." A. F. Berry. June 25th.

14,729. "Loud-speaking telephone stations." H. Wade. (Elektrizitäts Akt.-Ges. Hydrawerk, Germany.) June 25th. (Complete.)

14,741. "Regulator for charging accumulator cells for use in motor-car lighting and starting and similar applications." W. H. Scott. June 26th.

14,742. "Electric starters for internal-combustion engines." W. H. Scott. June 26th.

14,760. "Lamps for artificially producing daylight effects." F. R. Boardman, R. V. Boardman and F. Boardman. June 26th.

14,771. "Electric signals for railways." A. R. Mutton. June 26th. (Complete.)

14,780. "Telephone table instruments or the like." G. Meyer. (Convention date, August 1st, 1912, Germany.) June 26th. (Complete.)

14,795. "Apparatus for sintering metals." R. B. Walling. (Convention date, October 7th, 1912, United States.) June 26th. (Complete.)

14,796. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 26th.

14,807. "Manufacture of metallic filaments for incandescent electric lamps." J. A. Scoular and Dick, Kerr & Co., Ltd. (Addition to 11,455/12.) June 26th.

14,816. "Electric switches." M. S. Conner and A. R. Kahl. June 27th.

14,824. "Metal clip to attach safely flexible metal tube or other tubing or rodding, or cables, to tables or similar fixtures, as desks or cupboards and the like." R. Eckles. June 27th.

14,892. "Vacuum tubes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 27th.

14,909. "Electric heaters." W. R. Ridings. June 28th.

14,910. "Electric arc lamps." W. R. Ridings. June 28th.

14,927. "Arrangements for producing electro-magnetic oscillations particularly for use in radio-telephony." W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. June 28th.

14,929. "Indicator, being a method of, and means for, more effectively attending to calls, signals and the like conveyed electrically." A. N. Drummond. June 28th.

14,930. "Sterilising appliance for application to telephone mouthpieces and the like." S. L. Lightfoot and C. W. Akers. June 28th.

14,933. "Safety device for high-tension cables." W. Voigt. June 28th.

14,941. "Apparatus for cooling electrical machines." Akt-Ges. Brown, Boverie et Cie. (Convention date, February 24th, 1913, Germany.) June 28th. (Complete.)

14,942. "Electric or other horns for motor-cars and the like." A. Goodwin and C. A. Vandervell. June 28th. (Complete.)

14,951. "Arrangements for controlling the feed of recording-instruments." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) June 28th. (Complete.)

Correction.—In No. 13,980, appearing in our last issue, for W. C. Tucker read W. C. Turner.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Electrically-controlled Point or Switch Operating Mechanism for Railways and the Like. R. V. Collins. 5,703. March 6th. (November 10th, 1911.)

Method of Joining Metallic Tungsten to Copper. British Thomson-Houston Co. (General Electric Co.) 10,988. May 1st.

Receiving Apparatus for Electric Telegraphs and Electric Selective Systems. W. J. Lyons. 10,911. May 8th. (Cognate application, No. 13,599 of 1912.)

Vacuum Cleaners. British Thomson-Houston Co. (General Electric Co. 13,374. June 6th.

Insulators for Securing and Hanging Electric Flexible Cords, Wires and the Like. W. Scholes. 13,401. June 7th.

Process and Apparatus for Refining Metals by Heating. A. Helfenstein. 13,577. June 10th. (June 10th, 1911.)

Acoustic Signalling Devices. A. Meckel. 13,615. June 10th. (June 10th, 1911.)

Fans or Ventilators Driven by Electric Motors. J. Stone & Co. and A. H. Darker. 13,785. June 12th.

Lamps or Lanterns. H. D. Wight, W. Blair and Sunderland Forge and Engineering Co., Ltd. 13,797. June 12th.

Swivel Joint, particularly Applicable to Electric Lamp and other Similar Supports. J. Gourdon. 13,804. June 12th.

Construction of Electric Ceiling Rose. G. Markt. 13,865. June 13th.

Electric Starting and Regulating Switches. G. O. Donovan. 14,086. June 17th.

Switches or Switch Arrangements such as Used for Starting or Controlling Electric Motors. F. Broadbent. 14,088. June 17th.

Commutating Devices for Dynamo-electric Machines. M. Deri. 14,236. June 18th.

System of Electrical Welding by Means of Induction Current. W. Sokoll. 15,216. June 29th.

Electrical Heating Elements. Simplex Conduits, Ltd., and L. M. Waterhouse. 15,275. July 1st.

Name Plates and Electric Press Buttons. B. Bonnin. 15,841. July 6th.

Distribution of Electricity by Alternating Currents. A. W. Ashton. 17,386. July 26th.

Self-Regulating Dynamo-Electric Machines. C. A. Vandervell and A. H. Midgley. 17,838. August 1st.

Lamp or Flash Signalling Apparatus. A. H. Hunt. 17,849. August 1st.

Automatic Electric Cut-Out Switches. R. Winterhalder. 19,164. August 21st.

Automatic Regulating Devices for use in Connection with Variable-Speed Dynamos. Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. 19,537. August 26th.

Shade Supports for Electric Incandescent Lights. J. N. Mollett and E. E. Edwards. 19,621. August 28th.

Electric Arc Lamps. A. H. Railing and A. E. Angold. 21,411. September 20th.

Dynamo-Electric Machines. British Thomson-Houston Co. and F. P. Whitaker. 21,762. September 24th.

Sparking Plugs. W. J. Charles. 22,387. October 2nd.

Mechanical and Electrical Fog-Signalling Apparatus. T. Gibson, G. A. Farmer and E. Read. 22,494. October 3rd.

Addition to Sparking Plugs. F. A. L. Johnson. 23,605. October 16th.

Signalling Installations, more particularly adapted for Fire Alarms. Siemens & Halske Akt.-Ges. 24,037. October 21st. (October 21st, 1911.)

Safety Device for Electric Machines. Siemens Schuckertwerke G.m.b.H. 28,483. December 10th. (December 11th, 1911.)

Electrode for Treatment of the Interior Cavities of the Human Body. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 28,645. December 12th.

Illuminated Fountains. J. Pietsch. 29,099. December 17th.

Railway Signalling Systems. C. A. Allison. (Wooding Railway Warning Device Co.) 29,238. December 19th.

Method of Adjusting Electric Meters. O. T. Blathy. 29,566. December 23rd. (June 20th, 1912.)

1913.

Submarine Signalling Apparatus. S. Lake. 26. January 1st.

Electrical Testing Apparatus. A. W. Brown. 178. January 3rd.

Disinfecting Apparatus for Telephones and the like. L. Block. 411. January 6th.

Electric Ignition Systems for Internal-Combustion Engines. C. T. Mason. 4,670. February 21th. (April 22nd, 1912.)

Automatic Regulating Devices for Use in Connection with Variable-Speed Dynamos. Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. 5,020. February 27th. (August 26th, 1911. Divided application on No. 19,537 of 1912, August 26th.)

Portable Electric Battery Lamps. A. Menzel and B. Pordes. 6,573. March 18th.

A New Form of Illness?—The L.C.C. minutes this week contained the following very interesting particulars of the absence through illness of motormen and conductors during the months of February, March and April of this year, compared with similar information in respect of the same period of last year :—

	No. of men employed.	No. of men ill.	Total period of illness.	Average period of illness per man employed per month.
February, 1912...	5,313	457	5,435 days	1·02 days
February, 1913...	5,565	693	6,104 ,,	1·10 ,,
March, 1912 ...	5,325	343	3,557 ,,	·67 ,,
March, 1913 ...	5,636	709	7,380 ,,	1·31 ,,
April, 1912 ...	5,317	278	2,854 ,,	·54 ,,
April, 1913 ...	5,691	556	6,090 ,,	1·07 ,,

How much more interesting these figures would be if we could only know what was the nature of the illness which has, by its awful ravages, lead to so great an increase in casualties between the March of one year and the March of the next! If we only knew, *perhaps* we could find a remedy. Perhaps not! It has been suggested in some quarters that many people are now being "treated" for complaints that prior to the coming into force of a certain Act they stifled, or nipped in the bud, or neglected. But the L.C.C. men, on the whole, are a decent set of fellows, and the least we can say is that we hope that they will soon be well again.

THE

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VOL. LXXIII. JULY 18, 1913. No. 1,560.

ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

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BRITISH TRADE WITH CANADA.

THE rapidity which has characterised the expansion of trade in Canada during the last few years is shown by the fact that since 1902 imports have trebled and exports have increased by 73 per cent. In view of this expansion in the total trade, it might have been expected that British trade would take its fair share, but, unfortunately, this has not been the case. In fact, prior to 1897, when the Canadian Government decided to give preferential Customs treatment to British goods, the volume of imports from the United Kingdom had steadily declined from year to year for a number of years. As a result of the preference, imports from the United Kingdom began to increase, but this increase has not by any means kept pace with the increase in the total trade.

We have repeatedly pointed out in these columns that all was not well with our Canadian trade, and we are again constrained to call attention to the matter by reason of the publication by the Board of Trade of a report by Mr. Hamilton Wickes, H.M. Trade Commissioner in Canada, on the trade of that Dominion. This report, from which we quote at some length elsewhere in this issue, is stated to be a report on the trade of Canada for the year 1912, but in reality it is a careful outline of the general factors bringing about the present position of Canadian trade, with suggestions as to the best way in which the British position in the Dominion can be improved. For this reason we commend it to the careful attention of all British firms who are interested in, or who might become interested in, the Canadian market.

Mr. Wickes has not been in Canada very long, but it is clear from his first report that he is determined to get to the root of the trouble in that Dominion as he did in Australia, and then to bring his findings forcibly to the notice of firms on this side. Our readers should be particularly interested because an analysis of the trade statistics of Canada shows that it is in metals, machines and machinery that our position in the Dominion is worst. Of the total imports into Canada in the year ended March, 1912, the British share was only 22 per cent. as compared with a United States share of 63 per cent., and though the actual volume of the imports into Canada from the United Kingdom has increased yearly during the last few years, the percentage of the total has declined. On the other hand, the United States percentage has increased along with a large increase in the actual volume of American trade with the Dominion. As Mr. Wickes points out, the decline in the proportion of imports from the United Kingdom, which has been gradual and consistent, is a serious matter. The trade so lost has not been divided between a number of other countries, but has been almost entirely absorbed by the United States, as the figures of imports from that country show. The resultant strength of the United States position in Canada may be judged by the fact that the total of single items of trade in which the United States share exceeds 75 per cent., represents a trade of $274,754,000, or nearly 53 per cent. of the imports of all classes of goods.

The most important section of our business with Canada is the dry goods trade, in which our position is very satisfactory, the British share of the total being over 65 per cent. As we show above, our percentage of the total trade is only 22 per cent., so that just as in the dry goods trade our position is much better than the total figure would lead one to expect, so in other sections, and notably in the metal and machinery section, is our position much worse. Calculations which have been specially made show that if we eliminate the trade in dry goods from the total trade, our share of the remainder is only 15 per cent. And, as a matter of fact, our actual share of the trade in metals and machinery is only 14 per cent. This is an extremely poor showing, which it ought to be possible to improve. Undoubtedly American firms have a great advantage over us in trade with Canada. In the first place, Canadian tastes are very similar to American tastes, and American methods of doing business would, in most cases, appeal to the Canadian mind. Again, a very large number of engineers in Canada are either of American nationality or have been trained on American soil, a fact which naturally influences business in favour of United States firms.

These are more or less abstract advantages, but there are other, what we may call concrete, advantages, which vitally affect our trade with Canada, and notably the trade in goods of interest to readers of the Electrical Review. Some months ago we were able to print in full a report by Mr. Hamilton Wickes on the operations of the Chicago Underwriters' Laboratory, which showed how great a handicap these operations proved to the extension of British trade in electrical goods in Canada. Mr. Hamilton Wickes, in the report with which we are now dealing, again refers to this matter in the following terms :—

> This institution (*i.e.*, the Chicago Underwriters' Laboratory) owes its inception to the fire insurance companies, British and American, who, in face of the appalling losses from fire in North America (many of them felt to be due to the use of improper material) provided the funds and staff for a testing laboratory in Chicago. Speaking generally, these fire insurance companies will not insure a building unless samples of the articles, appliances or material affecting the fire hazard to be used, have first been tested, and the bulk subsequently manufactured under the supervision of inspecting officers of the Laboratory, who affix a transfer, label, or tab indicating that such material, device, &c., has been tested and passed by the Laboratory's inspector. The operation of the Underwriters' Laboratory Corporation, so far as British trade is concerned, is, in practice, to shut them out from a very considerable business. British goods are not refused—in fact, British firms are invited to send material, appliances, &c., to the Laboratory to be tested. But that the article has simply been tested is not sufficient, and there are no inspectors in England to see that the bulk manufactured at the factory is similar to the sample, and to affix the necessary Laboratory label, or tab, or transfer.

It has been recommended that some similar institution should be started in this country with the object of removing a grievous disability under which British manufacturers in the electrical trade labour in attempting to do business with Canada, and we believe that the matter has received full consideration at the hands of some of our representative industrial leaders. Whether, sooner or later, anything will be done along the lines suggested, we cannot say, but our readers will have observed in our last issue an announcement of the appointment of Messrs. Heap & Digby, of Westminster, with authority to approve British manufactures, on the Underwriters' behalf, before they leave the factory.

Our Canadian correspondent advises us that this appointment has been made as the direct outcome of the recommendations of Mr. Hamilton Wickes, and on account of the wishes of a number of English electrical exporters. Our correspondent adds : "Thus is opened yet another path whereby the entry of British goods into this country is facilitated, the other one being that recently mentioned in these pages as applicable to Ontario, viz., the approval of the Hydro-Electric Power Commission."

We trust that this new arrangement will be followed by that advance in our electrical exports for which we all hope.

Another concrete advantage which American firms have over British is the cheapness with which they can deliver owing to their proximity to the market. This is another factor which particularly affects trades like the electrical and machinery trades. We noticed above that our share of the total trade in metals and machinery was 14 per cent. ; further calculations made by Mr. Wickes show that in lines which may be called "simple forms of metal manufacture" our share is 22 per cent., whereas, in "machinery and finished articles" our share is only $9\frac{3}{4}$ per cent. Leaving out of account for the moment American enterprise, the adoption of American standards and similar factors contributing to American success in Canada, there can be no doubt that an important reason for our low share in the trade in machinery is the wide difference in freight rates from this country and from the States, and the larger cost of packing entailed here by our distance from the market ; in this connection it will be noticed that in "simple forms of metal manufacture," for which freights, comparatively speaking, are low, our position is much better.

In spite of our rivals' advantages there is no doubt that our position could be much improved if the will to do it were there, and as Mr. Hamilton Wickes points out, it is only by recognising the natural advantages which American firms enjoy that British manufacturers and merchants, desiring to open up or to extend business in Canada, can properly appreciate the difficulties they have to meet and overcome, and can realise how necessary it is that they should avoid handicapping themselves in other ways. The report now before us shows how best firms may approach the market, and what mistakes they should avoid. In future reports we hope that Mr. Hamilton Wickes will deal at greater length with specific trades, and from certain remarks made in this report we gather that this is his intention. Judging by the careful analysis of the general trade position which he has already made, he has obviously set himself a big task, but it is a task which ought to be performed in the interests of British trade in the Dominion. Meanwhile, the work which this report must have entailed should have given a sound basis for further investigations, and the results already set out will certainly be helpful to firms interested in the market pending the further and more specific information which should soon be forthcoming.

In Camera.

On Friday last, at the express invitation of the Hon. Secretary of the I.M.E.A., we attended the adjourned meeting of the Association held to discuss the model general conditions of contract drafted by the B.E.A.M.A. The invitation contained the following paragraphs, drafted, we understand, after consultation with the Hon. Solicitor :—

> "In view of the fact that some of the speakers may, to explain their views upon contract conditions, speak somewhat pointedly as to their experiences—I should only like to suggest that a considerable amount of discretion should be exercised by your reporters in quoting their remarks."
>
> "I consider it quite sufficient to make this suggestion to you, rather than that the Association should ask you not to report the meeting."

When the proceedings began it was almost immediately apparent that there would be some opposition to the presence of outsiders at the meeting, and Ald. Bruce, of Sunderland, moved a resolution that this meeting, as was the case with the previous one, should be held *in camera*.

The hon. secretary, Mr. Faraday Proctor, offered good and sufficient reasons for allowing the representatives of the Press to remain, and was supported by Mr. J. E. Edgcumbe, the president who has just retired. The meeting, however, by a large majority decided to hold the meeting *in camera*, thus ignoring the official invitations issued by the secretary.

While it is obviously within the assumed powers of the Association—despite the fact that it represents *public* not private undertakings—to hold secret conclaves, the procedure followed in this instance (and previously) as far as the Press is concerned, was a direct slight to the latter, and an unwelcome reminder of some municipal methods of bygone days.

Moreover, it would reasonably appear to be in the interests of the Association, that the Press, after being invited, should be allowed to form its opinion on the merits of the case, even though no details were published.

A Keighley Report.

Among the numerous annual reports on electricity undertakings which have reached us, one of the most interesting is that of Mr. Harry Webber, the Keighley borough electrical engineer. It gives one an insight into the difficulties encountered, the past progress and the future prospects of his undertaking, which is more than we can say for the general run of such documents.

It is only within the last few years that the Keighley undertaking commenced to hustle, and now it would appear to be making such rapid headway that the Council has some difficulty in keeping pace with its development.

This is primarily due to the adoption of modern generating plant and the cultivation of the local power load—a procedure which sounds easier than it really is when a start has to be made with an out-of-date works and an annual deficit.

At any rate, the policy, which Mr. Webber sums up as one of "small profits and quick returns," has resulted in increasing the output of units sold by 50 per cent. in one year. Forty-one agreements—13 for H.T. supply—have been entered into with local mills and engineering shops for periods of five years and upwards, and under the terms arranged the department is guaranteed an annual sum of £4,300. These accounts are paid monthly, not quarterly, an arrangement which provides the department with a regular supply of money, which is available for the settlement of current accounts.

With a power load of 3,000 H.P., and a summer peak load considerably in excess of the previous winter's peak, Mr. Webber naturally looks ahead. He anticipates at least twice the present power load during the next two or three years, but a further paragraph, which states that he considers "there is about 20,000 H.P. of industrial work done within easy radius of the power station which will yet be catered for by the Corporation, if they will only provide efficient plant and mains . . . .," indicates more clearly his idea of the future of the Keighley undertaking. The population being under 50,000, the lighting units sold were less than a quarter of a million last year, while motors absorbed $2\frac{1}{2}$ million units, these two supplies giving an average revenue of ·86d. per unit; the total output sold was just over three million units, and the total revenue under 1d. per unit.

Against these low figures must be placed extremely low working costs—·39d. per unit for generation and distribution, and total works costs of just over $\frac{1}{2}$d. These results fully justify the policy which has been adopted, and should materially influence the Council in favour of Mr. Webber's proposals for future development, not only in the matter of local power supply, but also in connection with supply to adjoining local authorities.

The Motor-'Bus Question.

We have received from Mr. T. B. Goodyer, tramways manager to the Corporation of Croydon, a copy of a circular which he has distributed to Members of Parliament and to the local authorities of the Metropolis, and in which attention is drawn to the urgent need of legislation to place the motor-omnibus companies on terms of equality in respect of public obligations with the municipal tramway authorities in the Metropolitan area. Mr. Goodyer states that practically every municipal tramway undertaking in that area will have to be assisted from the rates next year, and illustrates his remarks by an extract from his annual report, showing that while the Croydon tramways last year contributed more than £11,000 to the local revenue, mainly by way of rates on track and maintenance of the roads, the omnibuses have paid practically nothing into the local treasury.

We are bound to sympathise with Mr. Goodyer's attitude. It is true that the 'buses are free from the manifold restrictions and burdens imposed upon the tramway undertakings; the only tax of any importance that they have to pay is the petrol tax. The tramways cannot be laid without the sanction of Parliament—the 'bus can go anywhere; the tramcar has to pave and maintain the roadway which is used by its rival, besides maintaining its own expensive track; the car has to carry workmen at fares far below cost—the 'bus pays no such subsidy; and the car pays rates on the track.

We are emphatically of opinion that tramway undertakings ought not to be called upon to maintain the roadway, which they do not wear out, and, on the other hand, that if the tramways cannot be relieved of the heavy burden of workmen's fares, the motor-buses should be compelled to share that burden with them. The present state of affairs is intolerable.

We are not advocates of the municipal control of trading concerns, but we are advocates of fair play; and in view of the enormous capital invested in tramway undertakings, whether municipally or privately owned, we consider that the unjust handicap imposed upon them by Parliament ought to be removed so as to give them a fair chance in competition with their young rivals. It is ridiculous to say, as the *Daily Mail* has said, that the tramways are a failure—when they have not had a fair chance. It would be as reasonable to pit an athlete, laden with a 20-lb. weight, against a racer running light, and to say that the former was beaten on his merits.

Electrical Accidents.

Elsewhere in this issue we conclude the report of Mr. G. Scott Ram, H.M. Electrical Inspector of Factories, on the accidents which occurred in electrical works in 1912. Mr. Ram's report is always interesting, and this year we have reproduced it almost *in extenso*.

As usual, many of the accidents were due to the negligence or inadvertence of skilled men, who were perfectly acquainted with the nature and extent of the dangers amongst which they were working. It is impossible entirely to eliminate this class of accident; risks must be taken in almost every branch of engineering, and they are daily faced by our engineers with a cool daring which at times verges on foolhardiness. Unfortunately, there is still no effective means of distinguishing the live wire or switch from harmless, uncharged metal; various detectors have been invented, but in practice they are seldom used, even in the rare event of their being at hand. Some automatic device is badly needed, similar to the paint which changes colour when it is heated, so that live metal could be distinguished at a glance. Perhaps such a device will one day be forthcoming.

Far too many accidents are due, year after year, to the careless or improper use of portable apparatus supplied through flexible conductors. The Home Office has done its best to guard against such accidents, but it is clearly impossible to prevent occasional infraction of the rules, and the only course that appears to offer any prospect of improvement is the rigorous prosecution of the responsible authorities whenever the breach can be brought home to them. The convenience, which is so valuable a characteristic of electricity, carries with it the inherent liability to abuse on the part of ignorant or careless users, and the penalty, unfortunately, is too often a heavy one indeed. Frequent and regular inspection of *all* electrical apparatus ought to be an imperative rule in every workshop where motors and portable apparatus are employed.

Failing the prevention of accidents, the next best thing is to mitigate their consequences as far as possible. As Dr. Reginald Morton has pointed out, death from electrical shock is only an apparent death at first, and there is almost always a period, long or short, during which it is possible to resuscitate the victim by immediate recourse to artificial respiration. We are pleased to notice that Mr. Ram, in his report, recognises the efforts that we have made for nearly 20 years to acquaint electrical engineers with the most effective measures to be taken in case of shock; there are few central stations in this country where our "Shock Sheet" is not to be seen on one of the walls. But the mere presence of the instructions is useless—they must be studied beforehand, for when the need arises for their application it is already too late to begin their perusal. We therefore earnestly commend to the notice of station engineers the remarks of Mr. Ram, urging them to see that the staff are properly drilled in the methods of artificial respiration and able to apply them at a moment's notice. The matter is truly a question of life or death.

TRAMCAR GEAR-WHEELS AND PINIONS.

Tramway engineers have been long interested in systems of hardening by which the life of pinions and gears is prolonged. Hitherto, however, all tempering has been confined to the pinion, but the drawback urged against case hardening, which is the method mostly known in this country, is that a somewhat poor quality of steel has been necessary in order readily to take the process, and as soon as the thin skin is worn through a soft material is reached, which has no wearing capacity. Many attempts have been made to apply the same process to the gears, but these have been only partially successful by reason of the distortion which is set up when a somewhat large mass is submitted to special tempering. Oil tempering has been used with considerable success on the pinion, but this again has been only partially successful when applied to the gear.

It is clear that on account of the severe conditions met with on many tramways and railways, the prolongation of the life of a gear-wheel and pinion is a desideratum of the first importance.

Curiously enough, the life of a gear varies at times in a most unexpected manner. It could be fairly assumed that a hilly district would lead to an abnormal wear on the surface of the teeth, but in some of the hilliest districts in this

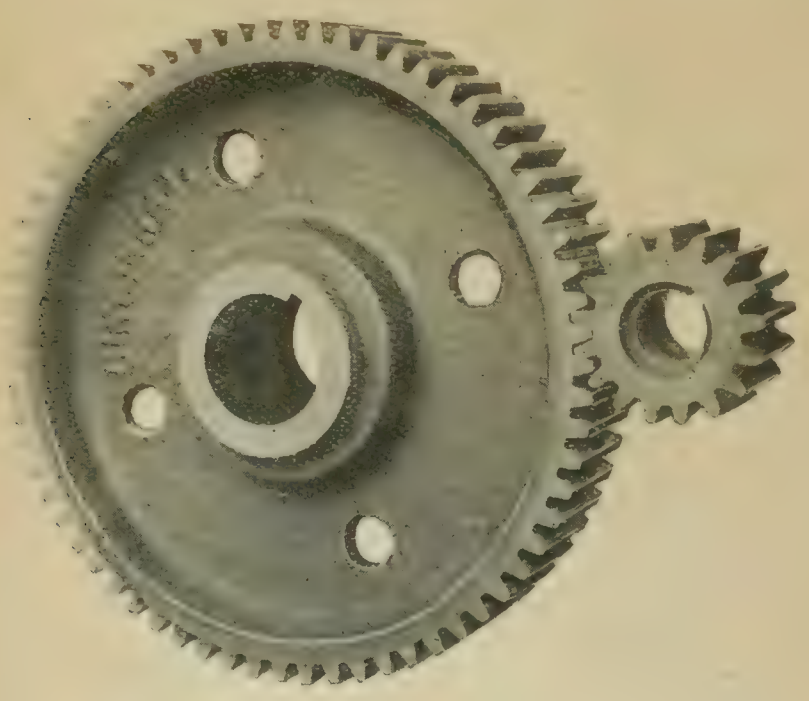


Fig. 1.

country it has been found that the life has been somewhat beyond the normal. On the other hand, on systems where there are practically no gradients, the life has been in some cases unusually short, which shows that there are other causes of wear at work besides the gradients. It is usually found, however, that gear-wheels and pinions have the shortest life in hilly districts.

One of the most remarkable developments in tramway work which we have investigated for some time is the tool steel process, under which wheels and pinions are treated to ensure an abnormally long life as compared with ordinary materials.

Clearly, to prevent wear, the treatment must have for its object a hardening, but the drawback hitherto urged against any such process is that it only hardens the skin, and to obtain this a quality of steel is employed which in itself may be abnormally soft. The process now to be described is one which converts the wearing portion into tempered tool steel. The noteworthy feature is the depth to which the treatment extends. It would appear that this can be made entirely to suit the wearing condition, and in the case of an ordinary three-pitch pinion, which is the one most commonly used on English tramways, the depth of hardening or tempering (whichever the correct term may be) is something over one-eighth of an inch, and this actually corresponds to the wearing limits of the pinion. In the case of $2\frac{1}{2}$ and 2-pitch, the depth is increased to the degree of wearing. It is important to note that the steel which is treated in this way is specially cut from material which will stand the strains involved in the treatment. To make this clear it may be mentioned that objections are sometimes urged against a hardening treatment in that the steel is liable to be distorted during the process, but in the case of the material under discussion it is entirely obviated by the use of a special quality of steel. In connection with this system it is to be carefully borne in mind that, unlike all other methods of hardening, the process is applied to the gear-wheel equally with the pinion. Hitherto, hardening has been confined to the pinion, and it, therefore, follows that if the gear can be treated to the same degree of hardening, a condition of things is obtained which is new and promises at the same time to give a life that has been previously unknown.

The inventors of the process experimented for seven years before arriving at a satisfactory result, and though the process is only gradually coming into use in this country the products manufactured under the system mentioned have been in use on the majority of American tramway systems for more than six years. In fig. 1 is shown an example of a wheel and pinion after a long service. These gear-wheels were put into service on May 12th, 1909, and on September 23rd, 1911, were actually in the condition shown in the illustration after running 124,685 miles. The value of the record is shown by the fact that the wheel had worn at the pitch line only 6 per cent., while the pinion had worn 43 per cent. of the allowable wear. It may be urged that this is an exceedingly good case, and to meet this objection a second illustration (fig. 2) is given, showing the com-

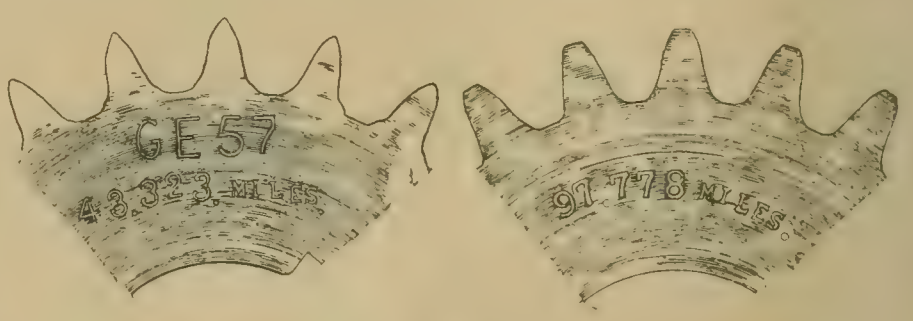


Fig. 2.

parison between a tool-steel pinion and an oil-tempered pinion operating on the same tramway. These were obtained from actual rubbings at the end of each pinion ; it will be noted that while the oil-tempered pinion after 43,323 miles is worn to a knife edge, the tool-steel pinion after 97,778 miles is less than half worn out.

As a further proof of the value of the process, and one which places the records upon the highest possible plane, a series of tests may be taken which was instituted by a large traction company to try and settle the question of gear-wheels and pinions. It equipped 18 double-truck cars with three different grades of gear-wheels, and 13 grades of pinions bought from the six largest gearing manufacturers in the world. There were three grades of materials tested : the ordinary soft pinions and gears, oil-tempered pinions and the tool-steel gears and pinions. There was a certain degree of variation even in the same material, but it is easy to strike an average. To arrive at something like a definite figure of merit, careful measurements were made to show the mileage obtained with a certain definite wear. The figure taken was one-thousandth of an inch wear at the pitch line. The average for untreated pinions was about 140 miles, and for specially treated material 160 miles, while the pinions manufactured under the process now described gave 1,220 miles. The same story can be told in regard to gear-wheels. Untreated wheels ran about 540 miles per thousandth of an inch wear, but tool-steel gears ran 4,696. Such figures incontestably prove the value of the material, and it is clear that from the £ s. d. point of view, which, after all, is the all-important one, it would be worth while paying enhanced prices to obtain such results. There are scores of similar records, but it is not necessary to reproduce them ; the whole point is that the tool-steel material, from the indisputable evidence put forward, should give about five or six times the life of ordinary gear-wheels and pinions, and that alone should be sufficient to arrest the attention of tramway authorities.

The photographs which we reproduce of sections of the gearing clearly demonstrate the depth of hardening. It may be

mentioned that figs. 3 and 4 are reproduced from untouched photographs, and show very clearly the actual wearing depth. The peculiar grained appearance is, of course, due to filing. It should be understood, however, that this



Fig. 3.

section of a pinion has undergone precisely the same process as is applied to ordinary pinions and gear-wheels. The point has been raised as to whether this degree of hardening makes the metal brittle. Clearly, if that were the case,

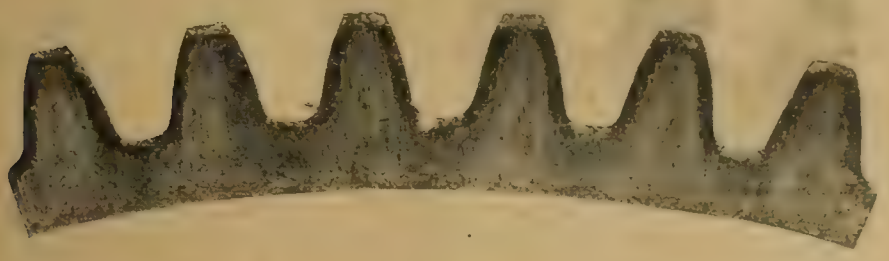


Fig. 4.

much of the value of the material would be discounted, but under the hardest service the gear-wheels and pinions manufactured under the tool-steel system have never been known to break.

FURTHER PROGRESS IN THE DEVELOPMENT OF THE ELECTRIC VEHICLE BUSINESS IN AMERICA.

By DOUGLAS SUTHERLAND MARTIN.

(*Concluded from page* 47.)

As a further instance, we must make at least some mention of the garage question—a matter which has presented the vehicle people with a host of difficulties, and which is still far from settlement. There is no doubt that in many cities in this country the lack of adequate facilities for charging is militating very seriously against the further adoption of the electric by the residents and merchants of these cities; but it would be difficult to cite any instance of a town where some genuine effort has not been made to line up the various electrical interests, and to see how this lack of charging stations can be made up. A few weeks ago Mr. W. C. Anderson, the president of the Anderson Electric Car Co., met the managers of the New York Edison Co. (the power supply company) in a discussion which resulted in the decision to appropriate $30,000 for the establishment of an all-electric garage in New York City. This appropriation will be expended at the rate of $10,000 a year toward the rental and promotion of an electric charging station where any owner of an electric can be assured of expert attention; and, so far as New York is concerned, this will go far towards removing one of the chief obstacles which the vehicle salesman has encountered in his canvassing calls upon the down-town merchants.

Or again, we may cite another example from Boston. Last fall the Electric Motor-Car Club in that city issued a booklet giving the names and addresses of all the principal charging stations in Massachusetts, some 70 municipalities being covered by the list, which included 105 charging points, 75 establishments where batteries might be charged at any hour of the day or night, and 15 places giving emergency service only. It is hardly necessary to dilate on the value which would attach to such a publication in the mind of the owner of an electric, if he were planning a week-end jaunt from, say, Boston to Pittsfield and back; while it is easy to see that, if you were canvassing a man in Springfield or any point midway between these cities, with a view to convincing him that the electric was just the thing he wanted, your task would be considerably simplified if you could prove to him that he was never going to be landed on a dark night miles out of the reach of any electrical service.

It is the same thing in Chicago, and, indeed, in all of the big cities. "The need of a large down-town garage was conceded by all. One speaker remarked that there were often 900 electric vehicles standing at one time on the down-town streets of Chicago. One large garage could be used for the storage of pleasure vehicles during the daytime, and for the charging of commercial vehicles at night. A Committee was appointed to arrange for a joint meeting with the Garage Owners' Association, at which this subject could be discussed further." Is there any need to add anything by way of comment on the nature of the difficulty, and the inevitable necessity for this "get-together" attitude in overcoming it?

Just one more—this time from St. Louis. Early in 1906, when there were but 11 electric vehicles in St. Louis, and a woeful lack of expert and intelligent attention to the subject, the central-station company began an aggressive educational campaign, which included the opening of garages and taking the local representation for some well-known types of pleasure and commercial cars. Largely as the result of this policy, the use of the electric vehicle in St. Louis has expanded very rapidly, until to-day (end of January, 1913) there are more than 700 electrics in operation on the streets of that city. Does the lighting company, in these circumstances, decide to reap some of the harvest from the seed which itself has sown, gathering in the fat season something of the first fruits which should, by all justice, accrue to it, in payment for its pioneering and trust service during the period of leanness? No; but it decides that the time has now arrived when it should withdraw from active competition with others in selling and garaging. It has, therefore, given up its agencies and will close its public garage as soon as its customers can be accommodated elsewhere. The charging stations will now pass into private hands; while the larger makers of vehicles will themselves come in and see that their product is duly displayed before the merchants of the city. That is a pretty broad-minded sort of policy; and the result will be a big increase in the sales of electrics in St. Louis, as well as the fostering of just the right spirit of co-operation between the garage, central station, and manufacturer. They all stand to gain by co-operation, and they know it.

That the electric vehicle men of America are now taking a very broad view of the road transportation question, and that they have implicit faith in the ability of their vehicle to make good on its own merits, is shown in their willingness to concede a place in the sun to the gasolene vehicle. Up till within quite a recent time the boosters of the electric seemed to imagine that they could not conscientiously concede any points of merit to any vehicle except their own, in spite of the marvellous engineering progress which had been made in the gasolene engine, and in spite of all kinds of evidence that, for many classes of service, commercial as well as pleasure, the latter was enormously superior to any electric car which was available, or which was likely to be available for a very long time.

This, of course, was an exceedingly narrow view to take, and could never redound to the credit or profit of the

electrical interests responsible for its advocacy. Fortunately, it was not persisted in, and it has now been supplanted by a much broader policy. At recent meetings in this country the field of the gasolene vehicle has been clearly defined, and the electrical men are no longer blinking the fact that at present they stand to gain nothing from engaging in any competition with the gasolene people in services involving runs of over, say, 40 miles with infrequent stops. Future progress in the manufacture of electric vehicles and equipment, and normal advances in the central-station art whereby the provision of charging stations will be on a much more extensive scale than it is at present, may in course of time provide a realisation of the dreams of those who predict a complete usurpation by the electric of the place now held by the gasolene car, for pleasure touring as well as for all kinds of commercial delivery. But at present that time has unquestionably not yet arrived, and it were wiser for the electric people to confine the best of their energies to the urban districts, where the strength of their position is overwhelming. It is very interesting to note the latest departure of the General Vehicle Co. For many years they have held the leading position in the manufacture of all kinds of electric delivery trucks, and have acquired a substantial reputation for the quality of their product. In many instances, after having filled the orders of a given commercial house for a fleet of electric vehicles, they have been compelled to stand by and watch their customer go elsewhere for the supply of a few gasolene vehicles, to take care of the longer hauls and to bring up the whole of his road transportation equipment to the point of maximum efficiency. After standing off for some years and studying the engineering of the matter very closely, the General Vehicle Co. have been, of course, driven to the conclusion that there is a logical reason for this, that there is a field for the gasolene vehicle which, at any rate for the present, cannot be filled by the electric, and that, to administer to the wants of the market adequately, they must be prepared to supply the best kind of wagon for any condition of service, irrespective of whether it is an electric or a gasolene machine. They are, therefore, now embarked on a policy which frankly admits the superiority of the combustion engine for the longer hauls, and which, indeed, is established on the principle that the horse can only be driven from the streets by a frank admission of the relative fields of the two types of self-propelled truck, and an intelligent application of the known facts in regard to the operation of each. They are now marketing the Mercedes gasolene truck in this country, and in a short time will have a factory of their own in regular operation, for the building of Mercedes trucks in accordance with the German drawings.

ELECTRIC POWER FOR LOADING AND STACKING COAL.

One of the great difficulties in handling large quantities of coal, ore or other loose material, is the necessity for storage at convenient points. Obviously, it is impossible so to regulate supply and demand that there shall not be any point between the pit mouth or the mine, and the customer, at which an accumulation occurs, and as the cost of the delivered product depends very largely on the labour charges and transport costs, it is evidently a matter of very great importance that the problem of stacking coal or other minerals should be very carefully considered. In a good many schemes which have been devised for this purpose, the mechanical arrangements are all that could be desired, but the initial cost of preparing the ground and erecting the plant represents an important charge per ton of material handled in order to meet depreciation and increased interest on first cost. On the other hand, the storing of any loose material in the ordinary way by stacking by hand on unprepared ground represents a very heavy cost per ton in hand labour. The problem is a very real one, because not only the mine and the customer, but also the railway companies, find it necessary to store loose material in bulk in large or small quantities at various times and in various places. This material will probably be brought by truck or wagon and stacked by hand, and when the time comes for its removal, it is again replaced in trucks by hand. Anyone familiar with railway and dock work will know what this entails. It may add anything from 4d. to 1s., according to circumstances, to the cost of every ton handled, and this is an absolutely waste expense.

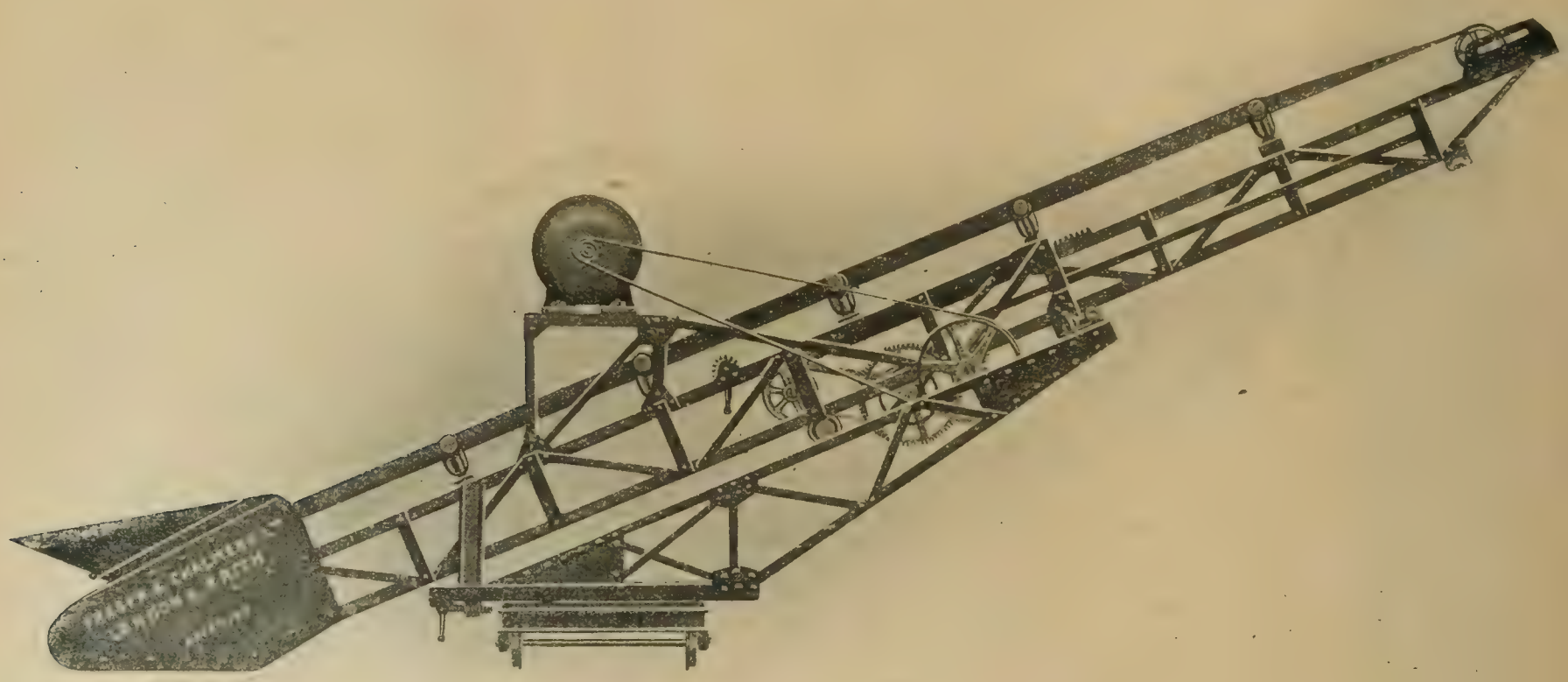


Fig. 1.—Electric Stacking and Loading Machine

A simple apparatus, however, which is shown in the illustration, and is known as Mitchell's stacker and loader, has been developed by Messrs. Fraser & Chalmers, Ltd., of London, to meet the case, and it is claimed that it saves from 80 to 90 per cent. of hand labour costs upon this class of work. It is a very simple machine that can be handled by the roughest unskilled labour, and requires very little power. In construction it consists of an ordinary belt conveyor mounted in such a way that it can be extended in either direction, revolved to any position in plan, racked to any angle of inclination, and wheeled along to any required position. Its flexibility is, therefore, practically complete, and within the limits of its power capacity it performs most valuable work. The telescopic movement is effected by an ordinary rack and pinion, and the changing of the inclination is also effected by rack and pinion. The revolving of the machine around the centre pin can be easily performed

by one man, and one man can also wheel the whole arrangement along the track provided. The driving of the conveyor belt is performed, as shown in the illustration, by an electric motor centrally mounted; the belting has a capacity of 200 tons per hour, and will take material of any size.

In order to illustrate how adaptable this simple machine is to stacking and loading purposes, figs. 2 and 3 show the position of the conveyor when stacking from the truck and when loading a truck from the store pile respectively. In fig. 3 the dotted lines show the fully extended position of the conveyor. When used as a stacker, the receiving hopper is placed closely adjacent to the door of the truck, and the discharging end is extended as required. The material to be stacked is then raked from the truck to the hopper, from which it is conveyed to the heap by the belt. Tracks can be placed parallel to one another at regular intervals, so that a continuous heap can thus be formed. When used as a loader the machine is simply turned round and the hopper is allowed to bear against the heap. All the material above the level of the hopper is then raked down into it, and all below (about 2 ft.) is shovelled into it.

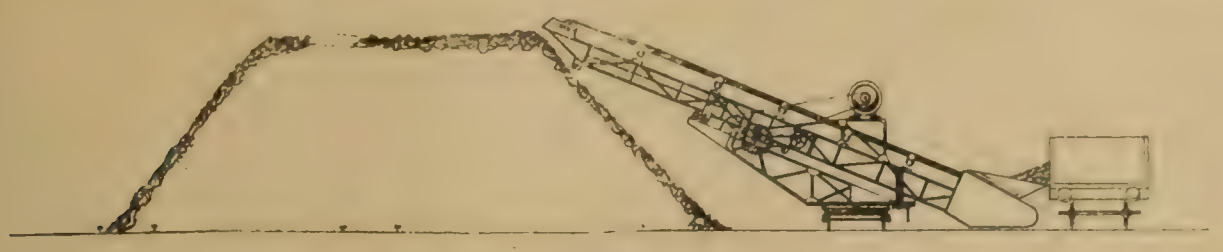


Fig. 2.

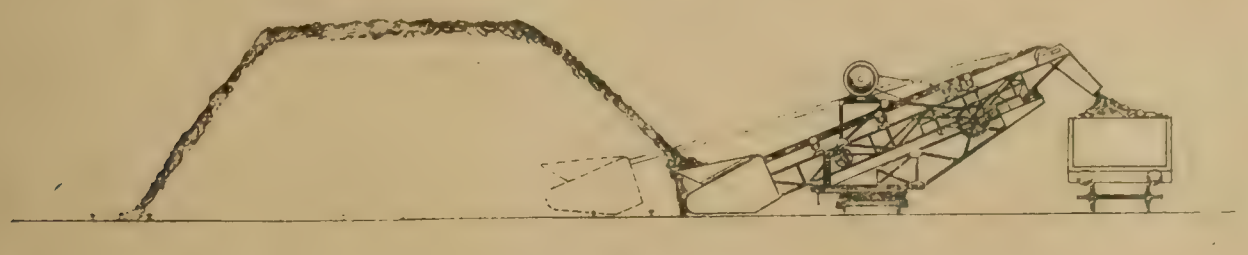


Fig. 3.

As the heap recedes, the conveyor extends automatically by its own weight, so that the hopper is always kept tight against the heap. The only material that has to be shovelled is that actually below the hopper level, and the work on this small quantity represents only the actual filling of the baskets in the old method, the carrying and lifting being saved. The cost of upkeep and depreciation is less than on the number of baskets required to do the same amount of work manually. The largest lump that can be handled by a loader having a 30-in. belt is 15 in. cube. The capacity of this belt is 4,200 cubic feet per hour. The loader has a length of 30 ft. minimum and 40 ft. extended, the height of the discharge point varying from 14 ft. to 18 ft. above ground level. In this way it is easy to deal with the standard 10-ton trucks, even when the boom is closed, and the motor required to drive the machine of this size is only 3 H.P. It is therefore a particularly valuable piece of portable equipment and should meet with a considerable amount of favour.

NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

An important announcement has been made by the United Provinces Government inviting applications for licences for the supply of electrical energy, in accordance with the provisions of the Indian Electricity Act of 1910, within the municipalities of Allahabad, Lucknow and Bareilly. Firms desiring to get further information should apply to the Secretary to the Government P.W.D. Buildings and Roads Branch, Naini Tal., U.P. On receipt of *bonâ fide* applications, and a deposit of £5, copies of the reports by the Government Electrical Inspector, showing probable expenditure and estimated profits on each scheme may be had.

Probably several home firms through their representatives in India will make application for licences. With careful handling and sufficient guarantees from Government, the schemes might be made to pay. In such cases as Nagpur, Lahore and Dacca, where the undertakers made hard bargains with Government by getting them to guarantee a sufficient consumption for Government purposes alone to pay all standing charges, success is almost assured from the start. Firms interested in these concessions should go cautiously to work and obtain all local information possible so as to check the Electrical Inspector's reports, and ascertain on what grounds he bases his figures, and what actual experience he has had with similar undertakings to justify the probabilities of his estimates of expenditure and income being fairly correct. Cawnpore, which is a big industrial centre, has not yet shown any very startling results by way of income to its Electric Supply Co. Lucknow, the biggest city in the United Provinces has, as was recently remarked, been considering a scheme for years back, and its municipality seems afraid to go ahead on its own, but must needs invite outsiders to take the risks.

The Madras Electrical Supply Co. are again this season advertising for sale 2,000 electric fans at cost rate. If these are the same fans which were advertised last season the Madras consumer must be very unappreciative or suspicious; if they are a fresh supply from home it would be more to the point if the supply company kept to its legitimate work of supplying current instead of infringing in the domain of the contractor.

On Sending Catalogues Abroad.—Many very excellent catalogues of English manufacturers and much postage are simply wasted by firms at home in sending their catalogues and advertising lists to firms in India without giving the matter much thought. A director or business manager gives an order to send catalogues of his firm's specialities to, say, all the engineering firms in India which are listed in the "Universal Electrical Directory"; the order is carried out after much trouble, and no little expense, and hopes are built up on volumes of orders following in due course. The catalogues are delivered at this side, the outside wrapping being mostly in a very bedraggled condition; they are looked at very often with eagerness, are equally often admired, and almost invariably shelved or "put aside for future reference." It would appear that there should be some strange reason for this apparent want of appreciation of a good thing: there is a reason, but it is not strange. The secret of the seeming indifference is that in some instances catalogues only give "prices on application," in other instances prices are listed but no discounts are given. As discounts vary from 75 per cent. off lists for Birmingham screws, to, at any rate, 10 per cent. as a minimum on most things, one can at once see the uselessness of a catalogue, no matter how well produced it may be—and some of them are works of art—without prices, and especially without discounts. In a country like India, of, as yet, comparatively few engineering houses, and especially where trade is increasing by leaps and bounds, and, consequently, engineering wants are many and multifarious, an engineering firm, well equipped with all sorts of catalogues well priced, can do all sorts of business. It does not pay to be a specialist in one line only in India; no firm can pay its way by selling, let us say, motors and dynamos only. This is evidenced by the fact that half a dozen of the big engineering firms in Bombay, Calcutta, Madras or Rangoon can supply you with a railway engine or a turbo-alternator as well as insure your life or your motor-car, or, for that matter, book your passage, or send home your Christmas presents. This being so, it is necessary for any progressive firm to have a multitude of catalogues, and, in order to make the best use of them, to have them well priced and arranged for easy reference. Home firms seem a bit conservative about giving away prices, "except on application"; this can be understood of firms bound down to agencies

here, but it is the firms who are not represented by agents here that seem to catalogue and circularise most lavishly. These notes are not intended for firms who have agents here, they are able to look after themselves; they are rather intended for the firms who seem to have good useful saleable articles, but who do not go the right way about pushing them in India.

The primary necessity of sterling business is, first of all to have a genuine article, be it an engine, or a motor, or a switch, so that having sold one, its excellence and usefulness will bring repeat orders—if this happens at home it will happen in India. The next best thing is to sell at a fair, not a fancy, price—the pagoda tree has been well shaken in India by now, and very few Rajahs are left who have not a keen eye on price—give the middleman who can influence customers a margin for also a fair profit. The next important point is time of delivery from the date of receipt of order in England; and having given a stated time it should be adhered to scrupulously. A reputation for prompt delivery to promise, is a tremendous asset to a home firm. The worries and tribulations of an agent who has to go on from week to week or from mail to mail for perhaps three solid months, hoping, promising, inventing, apologising, fearing cancellation of orders and so on, are indescribable.

Another important point to be observed is that catalogues should not be sent broadcast to India. All sorts of native firms with high sounding names get themselves into directories, and again all sorts of requests for catalogues are sent home by private natives who want pretty picture books cheap. The reputable firms are easily located; the amateur inquirer or others can be politely but firmly put off by referring him to any well-known firm who is recorded as having received a copy of the catalogue (with prices and discounts) asked for. Firms who are known to be in the habit of sending their catalogues broadcast all over the country are not at all popular with the local firm here, whose legitimate preserve is being trespassed upon.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Supply Authorities' Regulations.

The article, "Notes for Installation Inspectors," by "Element," in the current issue of your paper, raises the interesting question as to what the position of the various supply authorities is in connection with the enforcement of their rules and regulations.

In conversation with the chief engineer of a large City undertaking, I mentioned to him that I thought it was curious he did not insist on screwed tubing and absolutely refuse to connect any work carried out on the slip-joint system. He replied, that although he drew up a set of rules and regulations, he had absolutely no authority to enforce them so long as the insulation resistance came out at a reasonable figure, but they certainly proved useful, as in a number of cases he was able to enforce them by bluff.

The only desire of the average engineer is to carry through each of his jobs in a thoroughly satisfactory manner, so that absolute safety is ensured both from fire and life, but when one comes up against an inspector with a bee in his bonnet—unfortunately they are far too numerous—it is difficult to know exactly what position to take up.

Provincial Cinematograph Theatres, Ltd.
E. R. G., *Engineer.*

[The reply of the engineer quoted by our correspondent was, of course, perfectly correct. Supply engineers may make as many "rules" as they think fit, but they can only enforce one of them—that if there is "a leakage from the consumer's wires exceeding one ten-thousandth part of the maximum supply current to the premises," the authorities can refuse to give or to continue a supply of electricity to the premises. There is a general provision in the Act of 1899, that the undertakers are not obliged to give a supply of energy to any premises unless they are reasonably satisfied that the installation is "in good order and condition, and not calculated to affect injuriously the use of energy by the undertakers or by other persons"—any dispute on this question to be settled by arbitration—and no doubt this clause can be made to go a long way towards compelling observance of the undertakers' regulations. But in the absence of special powers, "bluff" is their chief weapon.—Eds. Elec. Rev.]

Proposed Engineering Staff Association.

The leader in your current issue states that "hitherto the attempt to form an Association has failed." But one should not take such words as an indication of our success in this instance. To do so would be to stray quite wide of the facts. There is no reason for any single engineer to suppose that our pioneers are disheartened in any way. But there is every reason, indeed, for every engineer to believe that there is no such thing as failure in the minds of the gentlemen behind the movement, and that the proposed Association will soon be established on proper lines.

One or two correspondents still consider, by the way, that our acting Council should publish their names at once. As it is not, by far, the general opinion, however, the policy, *sub rosâ*, cannot obviously be abandoned just yet. If there were really conclusive evidence that our attitude is unwise, we could not, of course, assure your readers, in all good faith, that quite a large percentage of our letters are from highly-successful members of our profession, and that support is being given and promised by every kind of engineer, from manager to student.

Again, so long as we receive fair play, we do not mind, in the least, if our efforts are occasionally coupled with the name of "Trade Unionism." We merely suggest that such unions are entitled to fair play also. Deeply-rooted as may be the objections to the conduct of some of them, and however inconveniently their proceedings may interfere with our work now and then, impartial critics are bound to confess that they have justified their existence many times.

Our legal and medical friends, for instance, cannot possibly deny that their very status is part and parcel of the fundamental law of "unionism," or that each year, through their Associations, they are working to strengthen this law. In fact, such professional devotees would doubtless be the last to deny that it is now the turn of the engineer, who rightly sees that something similarly protective must be cemented into the structure of our own profession as well.

So, in a word, we want 20,000 members, at least, by the end of this year. And we want more workers instantly, and the names of interested engineers sent in. Other requirements should then follow in due course.

The Association simply has to live now. It is the one absolute necessity.

For the **Acting Council of the Association.**
L. H. Fletcher, *Hon. Secretary.*

31, Queen Victoria Street,
London, E.C., *July 14th*, 1913.

[The "gentlemen behind the movement" are quite within their rights in withholding their names from publication. Whether, however, they are consulting their best interests in refraining from taking the Press into their confidence, is less certain. As we know nothing about the promoters and objects of the proposed Association, beyond the statements contained in the letters from Mr. Fletcher which we have published, we are not in a position to comment on the merits or demerits of the scheme.—Eds. Elec. Rev.]

A One-Day Sale.—By a one-day special-offer sale at St. Louis, the Union Electric Light and Power Co. added 1,875 electric irons to its local circuits, securing this 1,031 KW. of connected load at a total outlay of only 84·6 cents per KW., including all expenses for advertising, post cards, delivery of irons, &c. The annual energy consumption of these 1,875 irons is estimated at 215,625 KW.-hours; hence this one-day campaign will bring the central-station company an increased revenue of $15,093.75 per year.

The irons were offered to customers at a special price of $2.95 for only one day, May 13th. Each iron purchaser also received a small shirt-waist ironing board. These boards cost approximately 30 cents each, manufactured in quantities. The expense of delivering irons and boards to customers was 12 cents each.—*Electrical World.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Siemens Combined KW.-hour and Demand Meter.

This meter has been designed to enable central station engineers to charge consumers, particularly power consumers, on a load-factor basis—the load recorded being an average load taken over 15, 30 or 60 minutes. Thus, in addition to the ordinary unit dials, there is a load pointer moving over a divided scale of 300°.

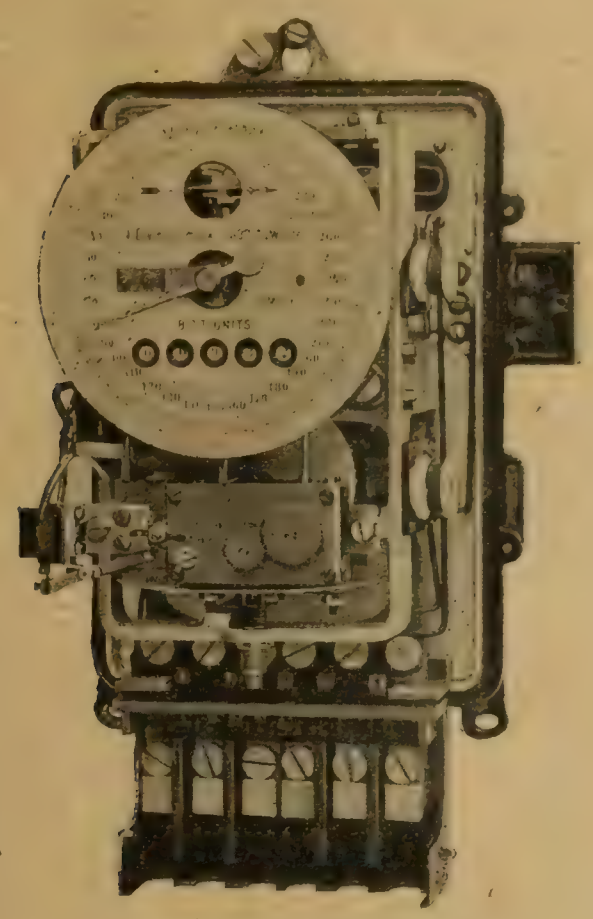


FIG. 1.—KW.-HOUR AND DEMAND METER.

The diagrams, figs. 3, 4 and 5, refer to a three-phase three-wire meter; fig. 5 is a diagrammatic sketch view showing only the essential parts and their relations in order to make the construction and operation clear.

In this diagram the induction meter system of a single or poly-phase meter will be recognised in the spindle and disk, magnet, and counter system, A, M_G, S_1, S_2, W. A pinion on S_2 drives through V, wheel B, which normally gears with wheel M forming the connecting link between the meter and demand indicator pointer Z.

Turning to the lower part of the diagram, the induction motor element E, armature disk B_1, wheel-train and tripping cam C, controlled by a hair-sping and escapement H_S, form a timing gear, which, through a trip rod, momentarily lifts A_B at predetermined intervals of time, thus disengaging B from M for the instant. M carries a pin S_T which, in moving, pushes the demand pointer Z round until the tripping action takes place, when spring R retains the pointer—which is otherwise free on its fulcrum—in its then position, while at the same time the spring R returns wheel M and pin S_T to its zero position ready for the cycle of operations during the next time interval. Obviously, if the average load of the next time interval is greater, the demand pointer Z will be carried a little further over the scale, and, in fact, it will remain at the highest average load indication, until reset.

It will be noted that the position of pointer Z is directly dependent on the revolutions made by the meter armature in the chosen time period. The uses of this instrument are particularly valuable:—

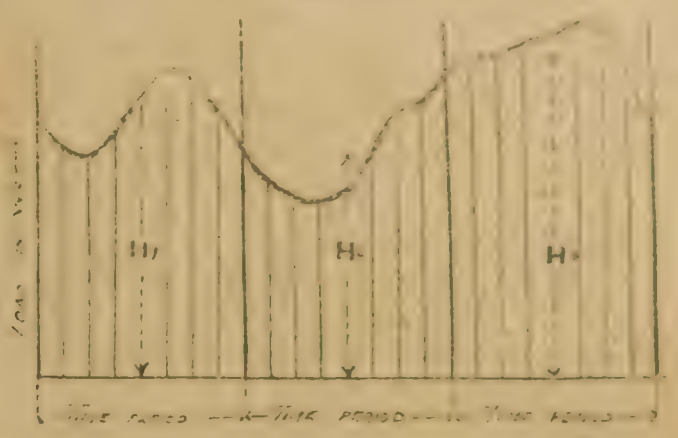


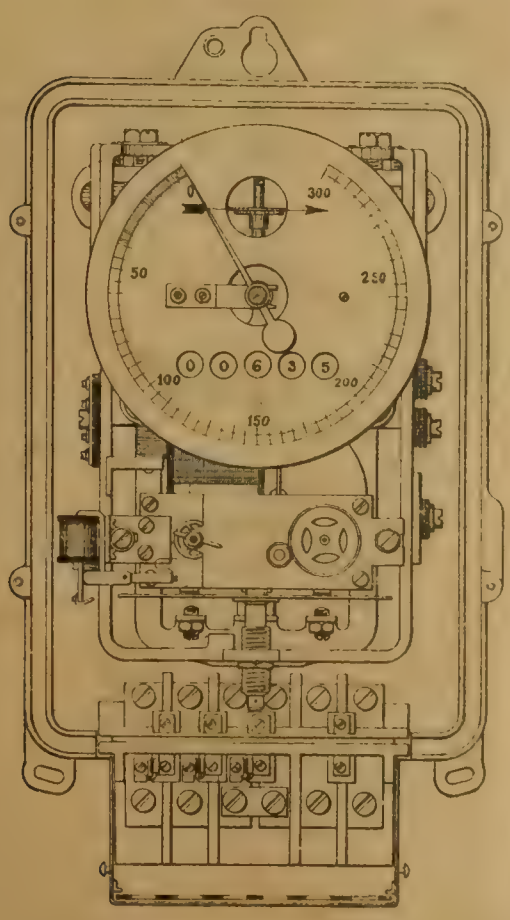
FIG. 2.—SHOWING A LOAD CURVE, H_1 H_2 H_3 BEING AVERAGE LOADS, OF WHICH THE HIGHEST WOULD BE INDICATED.

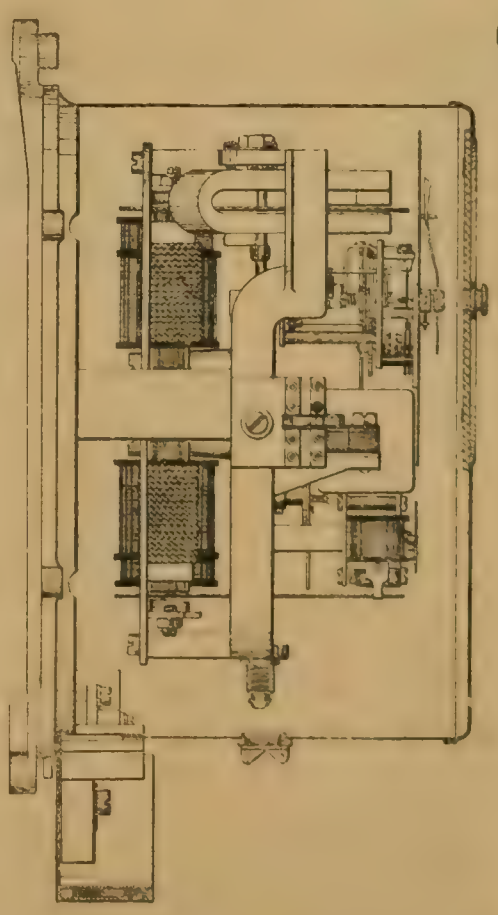
1. In Great Britain the charge is based on so much per kilowatt demanded, as registered on the demand indicator, this charge being arranged to cover capital cost of the station. A charge of so much per unit is then made to cover running charges and profit. The usual time period is a quarter of an hour. There are several cases, however, of 10, 20 and 5 min. periods. On the North-East Coast a 60 min. demand period is used. This, however, in the opinion of most engineers, is rather too long, except in the case of very steady loads. The general rule is that the less steady the load, the shorter the period should be. The 15 or 20 min. period, however, is the favourite, and seems to cover the general run of requirements.

2. On the Continent the same system, as outlined above, is used, but a more favourite form is to divide the KW.-hours as recorded on the unit dials by the kilowatts as recorded on the demand scale, since the kilowatts cancel out, the hours of use over some definite time period as then given. For example:—

$$\frac{\text{KW.-hours}}{\text{kilowatts}} = \text{hours of use.}$$

A standard rate per kilowatt is charged, with a discount which increases in progressive steps as the hours increase, or in other words, the discount increases as the load factor increases.





FIGS. 3 AND 4.—FRONT AND SIDE VIEWS OF METER.

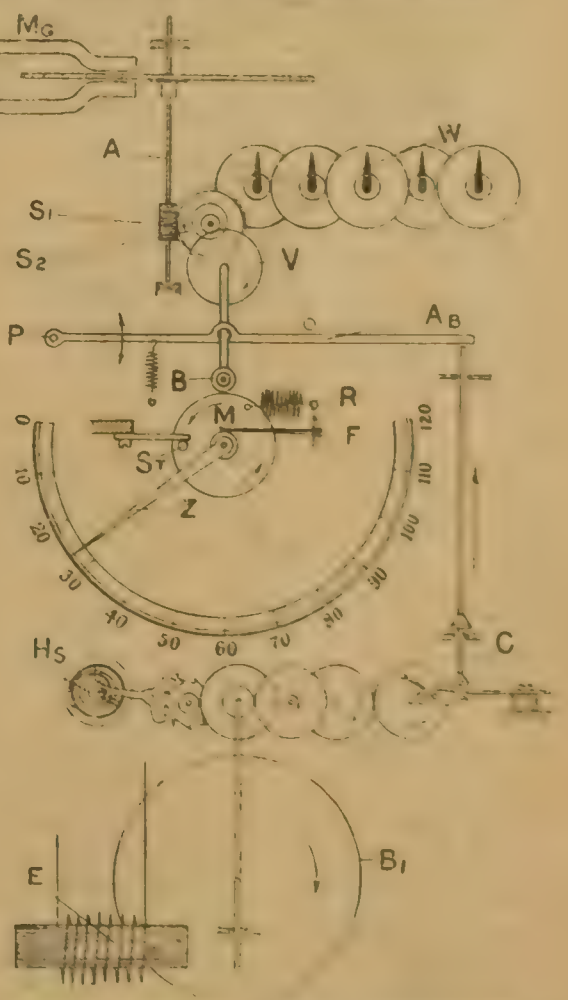


FIG. 5.—SHOWING METER MECHANISM DIAGRAMMATICALLY.

3. In U.S.A. and Canada they do not usually use the KW.-hour dials at all—*i.e.*, the unit dials—but simply charge so much per annum per kilowatt. As a rule in Canada, about $30 per year per kilowatt is charged, and a shorter time basis is taken, usually 5 or 10 min. The units are read off, however, and this information is kept for adjusting the charge per kilowatt, as in that way each individual consumer's load factor is on record. In

water-power stations, where long transmission lines are employed, an additional price per kilowatt is also charged, according to distance from the hydro-electric station.

The feature of the instrument, which is supplied by Messrs. Siemens Bros. Dynamo Works, Ltd., of Upper Thames Street, E.C., is that it enables energy to be sold on a true load factor basis, and it is essentially an instrument for selling energy to power consumers, or those who are large enough to be classed as such.

An Electric Motor Dust Cart.

In a recent issue we referred to the fact that an electric motor dust cart had been put into service by one of the municipalities near Berlin, Germany. The example thus set has been followed by the Third Avenue Railroad Co., of New York. In railway and tramway work there is always a large amount of carting work to be done. Dirt that accumulates along the track must be conveyed to the docks, ashes must be removed, and coal handled. The railway company above mentioned has hitherto employed eight two-horse and a number of single-horse vehicles for this purpose. Some time ago, however, the engineers of the company decided to make a trial of electric traction. Taking one of the old "dump" or dust carts, the shafts were removed and an iron frame added to support the battery, and a single motor wheel, made by the Couple Gear Co., of New York, was mounted just forward of the driver's seat. The result was the three-wheeled cart shown in the accompanying illustration. The vehicle, which is propelled by a 4-H.P. electric motor, built up with the hub of the single front wheel, has a capacity of 2 cb. yd., equal to a load of about 2 tons. The battery is of such a size as to enable the vehicle to be kept at work all day, and the motor is stated to be powerful enough to negotiate hills easily, even with a full load, The machine requires much less room for handling than the old horse-drawn carts, since the front driving wheel, which is also the steering wheel, may be turned at right-angles and the machine pivoted in its own length. In the short time that it has been in service, it has been put to some very severe tests, and so satisfactory has it proved that it is probable the remaining horse-drawn carts will shortly be converted to electric traction. For our illustration we are indebted to the "Edison Monthly."

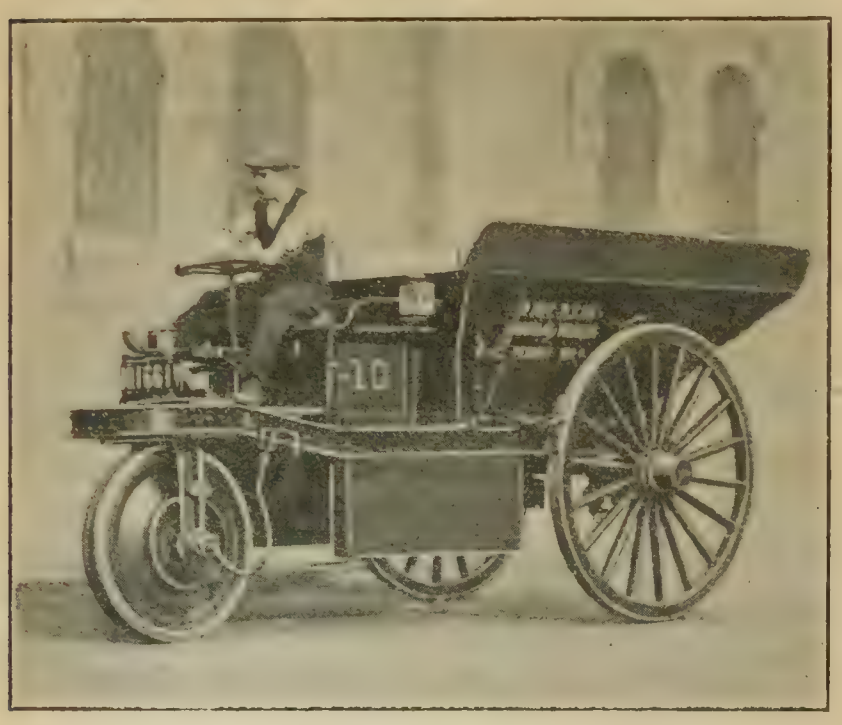


Fig. 6.—An Electrical Dust Cart.

Bennis Grates at Neasden.

At the Metropolitan Railway Co.'s Neasden power station the boiler house has recently been extended, and now accommodates 20 water-tube boilers. The grates of these boilers are now being renewed with the Bennis patent chain-grate stoker link, several of the furnaces having already been fitted. The full order is for 40 grates to be fitted with Bennis-Miller-Bennett links, including change speed continuous driving gear. This link, which is made by Messrs. Ed. Bennis & Co., of 28, Victoria Street, S.W., is specially adapted for slack coals, and can be applied to any existing chain-grate frames; the links are so constructed that they are halved together, and rounded at their ends. The upper surface of the grate therefore remains continuous across the junction of each pair of links, and there is no opening through which ashes or clinker can fall, or an excessive quantity of air gain admission, even at the ends, where the chain passes over the revolving mechanism. The air space is graduated by means of a serrated link, and a larger amount is provided per square foot of grate than is possible with a straight link. The result of this is that each part of the fire get its due proportion of air.

In an ordinary chain grate the portion at the rear is covered by the dumping bars, which also act as an air seal and safety device, and prevent clinker falling into the chinks between the ends of the links as they turn over. At the front end of the stoker much useful space is lost for a similar reason, fresh fuel having to be fed on to the grate at a point where the bars have closed. The length of the grate has therefore to be made longer than would otherwise be requisite. By the simple device of halving the width of the link at the point of juncture with the succeeding link in series, an uninterrupted sequence is obtained with the Bennis link, which prevents the admission of excess air, while it ensures a sufficient supply for perfect combustion, and increases the grate area as much as 30 per cent. Dumping bars, which constantly burn out, are not required. Ashes and clinker are tipped by dumping plates, placed below the level of the upper run of grate,

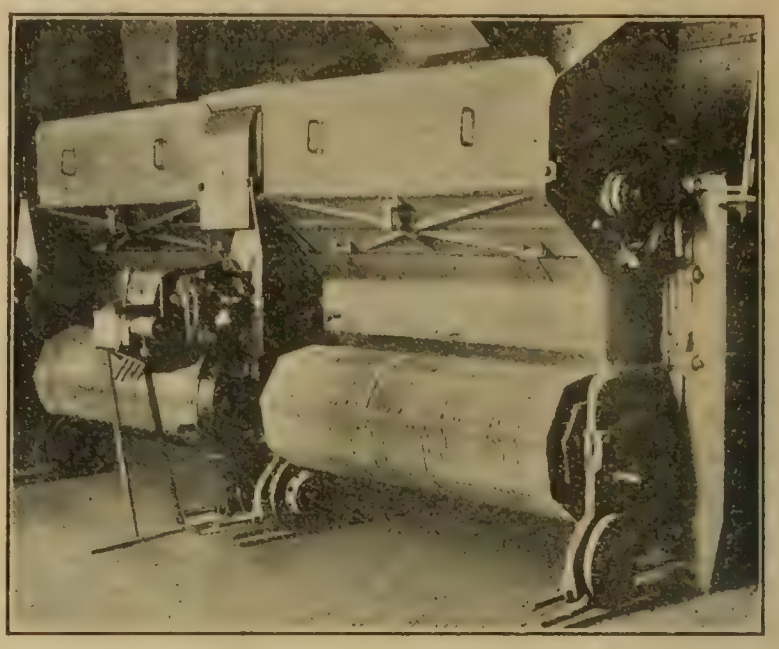


Fig. 7.—Bennis Chain-Grate Links, as Fitted at the Neasden Power Station.

on to a dumping valve, whence they can be removed as required without stopping the stoker or interfering with its mechanism. The dumping plates and valves are so arranged as to prevent the ingress of excess air at the back of the grate. By means of Bennis air seals, fitted at the side of the grate, between the frame and sill plates and between the frame and side links and at the back of the grate, the entry of excess air at these points is altogether prevented.

"Geeko" Intercommunication Telephones.

The new "Geeko" double-line intercommunication telephone, which will shortly be placed on the market by the General Electric Co, Ltd., London, requires only one operation for selecting and ringing; in other words, "push one button once only."

Besides being simple in operation, these telephones have been improved in construction, so that they are free from all "cross-talk" experienced with single-line telephones. The "Geeko" double-line auto-reset wall and table intercommunication telephones

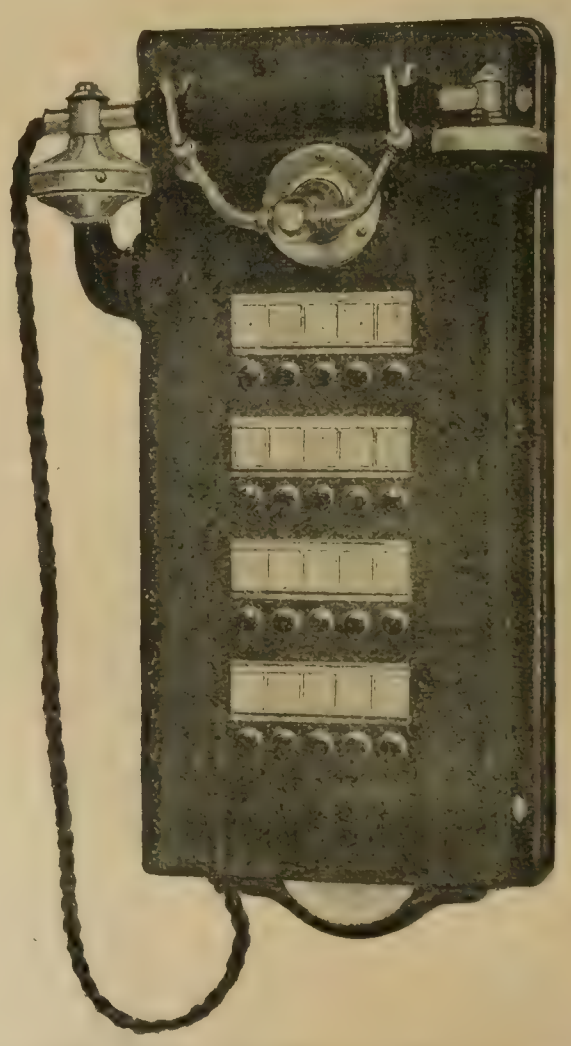


Fig. 8.—Geeko Intercommunication Wall Telephone.

comprise a hand combination fitted with Hunningscone-Deckert transmitter, equipped with an induction coil, circular bell, automatic cradle switch, and specially designed combined line selecting and ringing auto-reset push-buttons. All terminals are enclosed, and the external metal parts are nickel plated. The woodwork is of well-seasoned polished walnut. The table set is provided with a cord and wall rosette. The wall type is shown in the accompanying figure.

A New Oil-Testing Machine.

The British Oil and Turpentine Corporation, Ltd., of Hayes, Middlesex, has recently introduced in connection with its business in lubricating oils, a machine, constructed to Hislop's patent, for testing the suitability of oils both for bearing and cylinder lubrication. The machine, which we illustrate in figs. 9 and 10—the former view showing the arrangement for testing oils for bearing lubrication, and the latter, the apparatus for testing cylinder lubricants—is carried on a cast-iron frame and worked by a steam or petrol engine. For the former purpose, the machine consists essentially of a revolving spindle and tachometer, the spindle being of steel, gun metal, &c., and arranged to run in two detachable half bearings or dies of such metal as will approximate to the conditions of use of the lubricant under test.

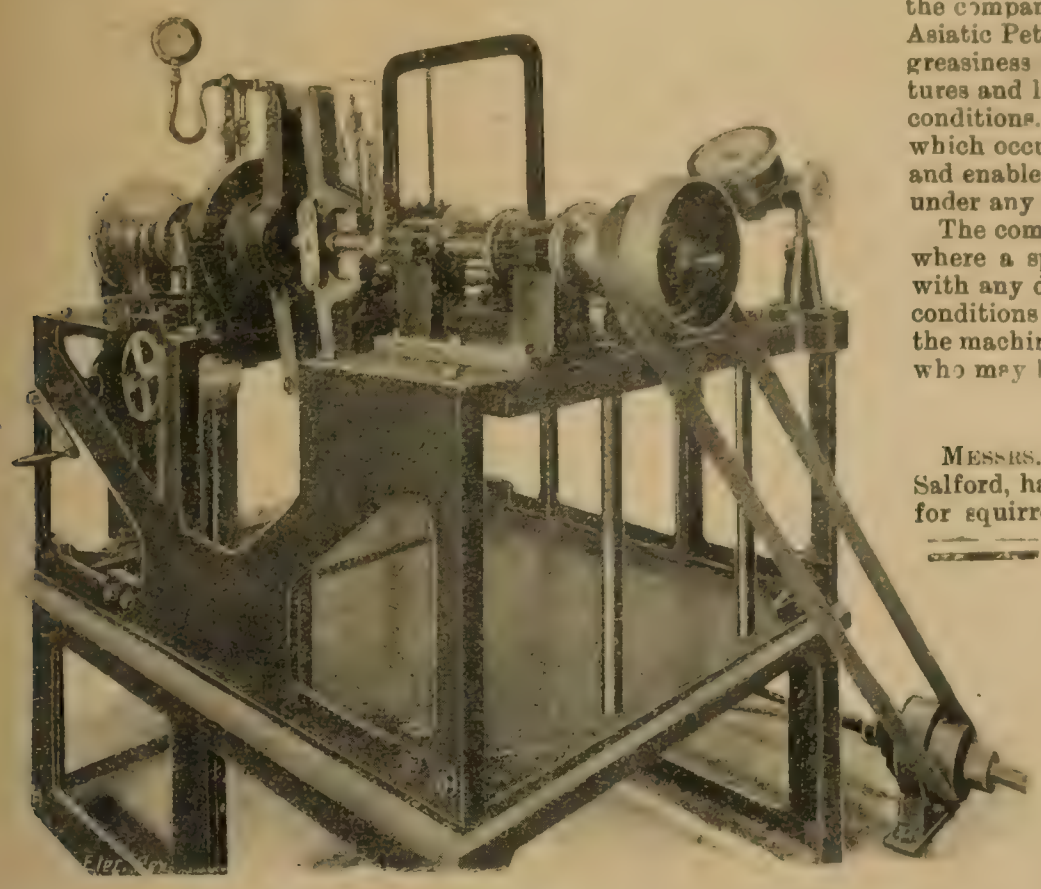


Fig. 9.—Oil-Testing Machine, showing Arrangement for Testing Bearing Lubricants.

The dies are held on to the spindle by means of the pressure, applied through bell-crank levers, of a heavy spring carried in a hollow casing, projecting arms from which bear on the ends of the levers. The spring pressure is put on by means of a screw and gearing, its amount being registered by a dial. Any friction between the spindle and dies tends to rotate the latter, together with the bell cranks and casing, this movement being controlled by a spring and referred by a suitable pencil attachment to a paper chart carried by a slowly revolving drum.

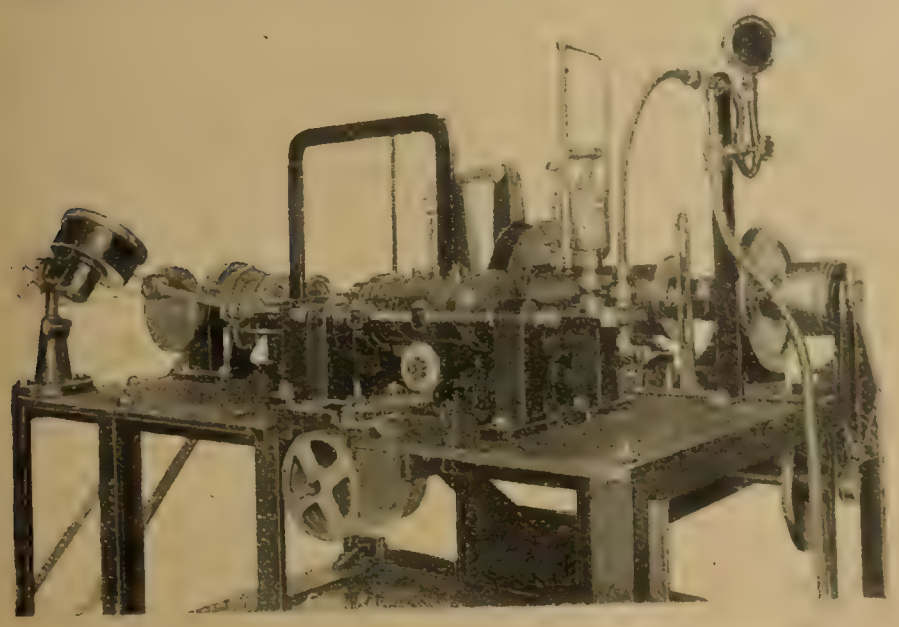


Fig. 10.—Arrangement for Testing Cylinder Lubricants.

In the case of a suitable lubricant, for instance, under the given conditions, the friction load would remain nearly constant, despite increasing temperature and a fairly straight line would be traced round the circumference of the revolving paper drum; on the other hand, a very unsuitable lubricant would result in curve tending towards the axial direction.

For obtaining tests on thrust lubrication, the spindle and bearing dies are replaced by polished face plates, one taking the thrust, directly, of the spring, and the records are obtained as before. Ball thrust bearings are fitted and thermometer pockets are provided in the stationary friction members for obtaining temperature records. The other portion of the machine for dealing with cylinder lubrication consists primarily of a small cylinder carried and arranged to slide on horizontal guide rods, one on each side, and fitted with an adjustable expanding piston worked by means of a crank and connecting rod. Steam or burnt gas at required temperature is introduced through a pipe at the back cylinder cover, the pipe being provided with a sight feed lubricator for introducing the oil under test, pressure gauge, &c.

Assuming conditions such as would result in considerable friction, the cylinder, if free, would reciprocate with the piston. The cylinder movement is however controlled by a spring controlled ratchet device preventing forward movements, while backward movements take place against compression springs and (being a measure of the friction, and therefore suitability of the lubricant) are transferred by a suitable pencil attachment to a slowly revolving graphic recording drum similar to that used on the other portion of the machine

The machine is the invention of Mr. R. C. Hislop, a director of the company, and lately chief engineer in the Far East of the Asiatic Petroleum Co. By its use it is possible to show the initial greasiness of an oil, its viscosity and life under varying temperatures and loads, and the quantity of oil required under the specified conditions. The cylinder shows the great increase of friction which occurs when a cylinder oil is used that readily carbonises, and enables the users to obtain the most suitable lubricants for use under any conditions in petrol, gas, oil or steam engines.

The company has already proved its value in one or two instances where a special oil was called for, which could only be supplied with any degree of certainty after testing various samples under conditions approximating to actual use, which were obtained on the machine, and it is prepared to undertake such testing for others who may be interested in obtaining more efficient lubrication.

A New Star-Delta Starter.

Messrs. Switchgear & Cowans, Ltd., of Springfield Lane Salford, have recently developed a self-operating star-delta starter for squirrel-cage induction motors, designed to meet the Home Office requirements as regards both factories and fiery mines; it possesses, in addition to the usual overload and no-volt trips, features which make it capable of protecting motors and plant against mishaps through handling by unskilled persons and from damage by any but the most violent forms of mischief. To start a motor it is merely necessary to switch on by means of the handle, all further operations being left to the control of the starter.

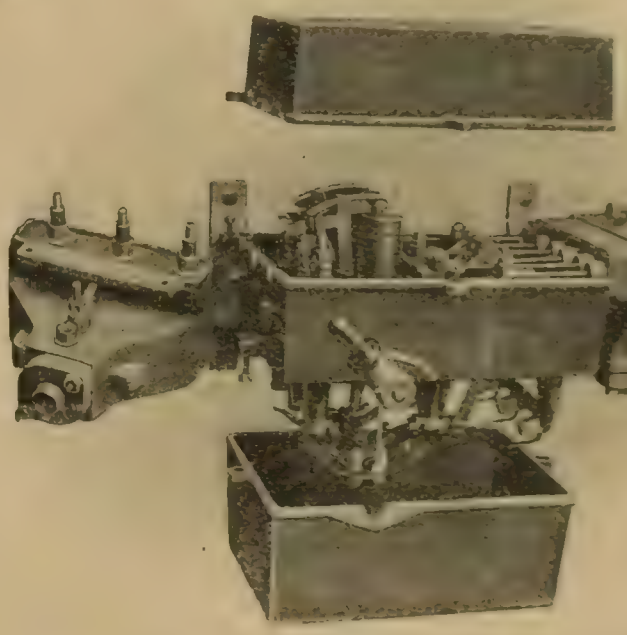


Fig. 11.—Self-Operating Star-Delta Starter, showing Mechanism.

The action of switching on closes the circuit and sets the change-over switch on "star" connection (the laminated copper brushes and the knife type change-over switch with their substantial



Fig. 12.—Complete Starter, with Cable Boxes.

auxiliary contacts are clearly seen in fig. 11). When the motor has attained a predetermined speed, the switch automatically changes over from "star" to "delta," sufficient adjustment being provided

to allow change-over to be at normal working current or below it, or, as is sometimes necessary, above it. Switching off is either by hand, or, in the event of overload or loss of voltage, automatic.

It is impossible to close the switch on a short circuit; moreover, if for any reason such as an excessive starting load or a seized bearing, the motor fails to attain within an adjustable limited time the speed at which the change from "star" to "delta" is arranged to take place, the circuit is broken. This feature is obtained by an ingenious application to the overload trip of the well-known Statter time lag, together with a simple magnetic arrangement by which the pull for a given current value, tending to operate the overload release in the "star" position, is less than half the pull for the same current value tending to operate the overload release in the "delta" position, thus providing perfect protection against overload both in starting and in running. All contacts are oil immersed. The makers supply the starter with or without cable boxes, or with inlets and outlets either screwed for conduit or merely bushed.

The "Horophone" Wireless Receiving Set.

The accompanying illustration, fig. 13, shows an entirely new departure in wireless receiving sets, which the Synchronome Co., Ltd., 32, Clerkenwell Road, E.C., have placed on the market. The apparatus is appropriately called the "Horophone," and has been introduced to enable watch and clock makers to take the time signals under the new international arrangements which came into force on July 1st. In the centre is a large inductance with two sliders, which will enable stations of long wave length to be picked up on small aerials. A variable condenser is provided, also a blocking condenser, and a buzzer is fixed inside the case, with a press-button to operate it on the outside for testing purposes. In addition to the necessary terminals, a plug is provided for the purpose of earthing the aerial during thunderstorms.

The crystal detector shown on the right is of new design, the top and bottom castings giving it a rigidity which prevents it easily getting out of the adjustment. Another important feature is the use of ball-and-socket joints, which enable any part of the crystal to be selected. The crystal itself is similar to silicon, but is more sensitive and reliable, and does not require a local battery; in

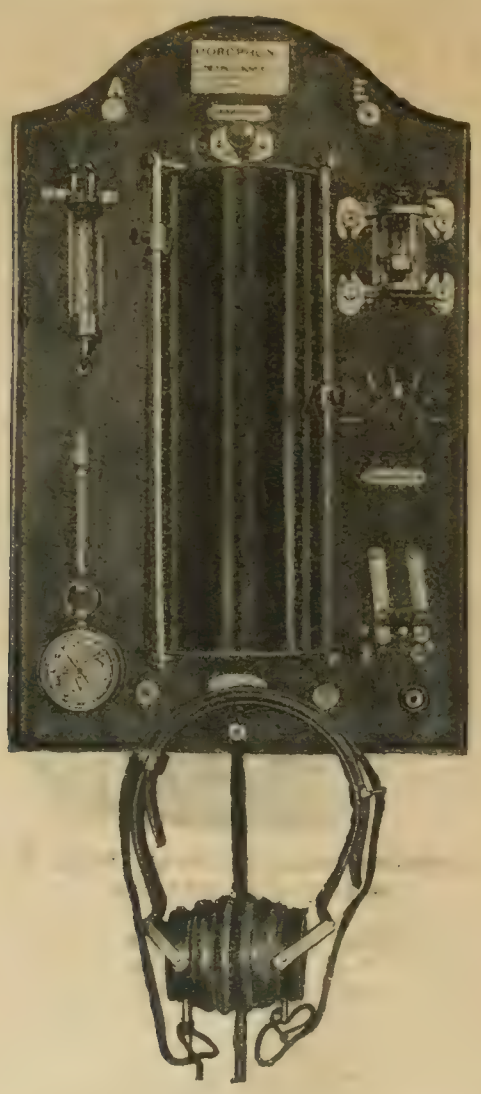


Fig. 13.—"Horophone" Wireless Receiving Set.

fact, it has been found that applied E.M.F. renders it less sensitive. The crystal, &c., is enclosed in a glass cylinder, thus affording protection against dust, &c., and the whole detector can be taken to pieces in a few seconds by simply loosening the four clamping screws.

The apparatus is made in two different types, Type A comprising all the instruments mentioned above, while Type B, which has been selected for illustration, has in addition an electrolytic detector, potentiometer and dry cells, and a change-over switch for selecting either detector; double headgear telephones of 2,000 ohms resistance are always provided. When not in use, they are replaced on a hook, which in Type B takes the form of a switch; thus when the telephones are replaced, the local battery current through the detector is automatically switched off. If desired, a high-class chronograph watch is supplied with this set at an extra charge.

The whole apparatus is neatly mounted and joined up on a polished hardwood board, and, being listed at a moderate price, should appeal to those who are taking up the study of wireless telegraphy, as well as to professional men.

The Blackman Intermittent Fan.

We have received from the Blackman Export Co, Ltd., of Blackman House, 374, Euston Road, N.W., particulars of their new intermittent fan, which they have just placed on the market. This fan, which embodies all the latest improvements in fan construction, is unique and differs greatly from other fans of this class, because, in place of the usual continuous draught, it creates breezes of continually varying intensity, which come and go at intervals

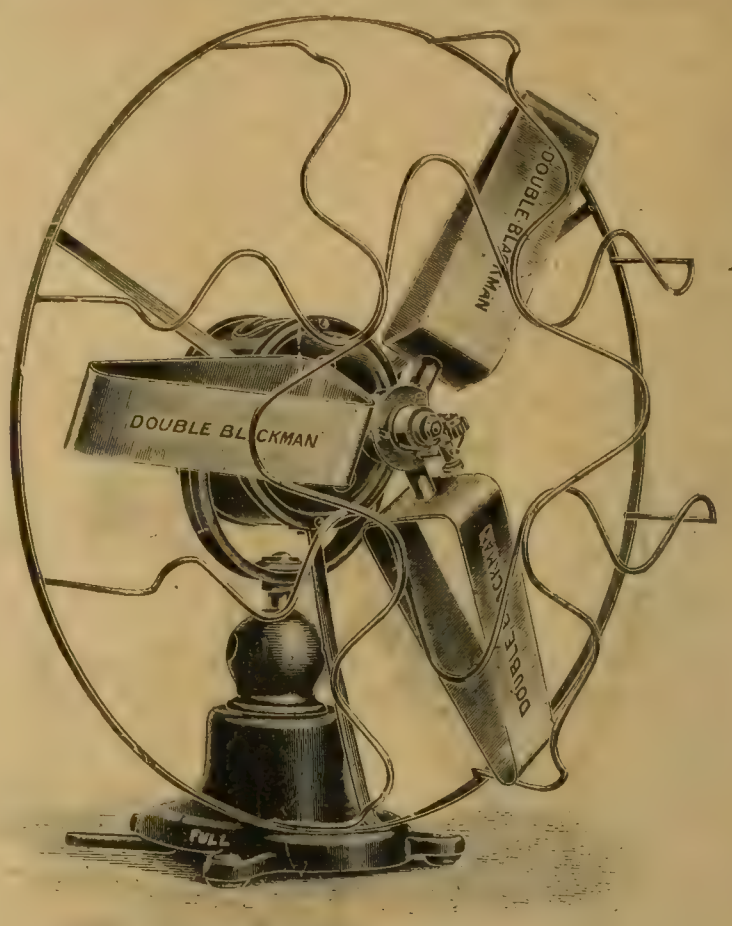


Fig. 14.—Blackman Intermittent Fan.

which can be changed at will; they can also be made to blow in one direction intermittently or in both directions alternately. In the latter case, the effect is similar to that of the punkah. The reversing of the air current and the changing of its intensity are accomplished by means of a gradual alteration in the angle of the fan blades, which are automatically and noiselessly controlled by a simple mechanism requiring no attention.

Although these fans are not intended to be used as ventilators, they may advantageously be placed near open windows or other air inlets to modify the inflowing current of air, so that a dangerous draught may be transformed into a beneficial breeze.

A Handy Wire Drum.

Mr. H. W. Brotherton, of Brocklesby, has devised an apparatus which should be found useful by contractors. As illustrated herewith, it consists of a series of detachable drums on a stand; the sides of each drum are separate from the drum, and the latter consists of a sleeve, which can be chosen of the right diameter to fit

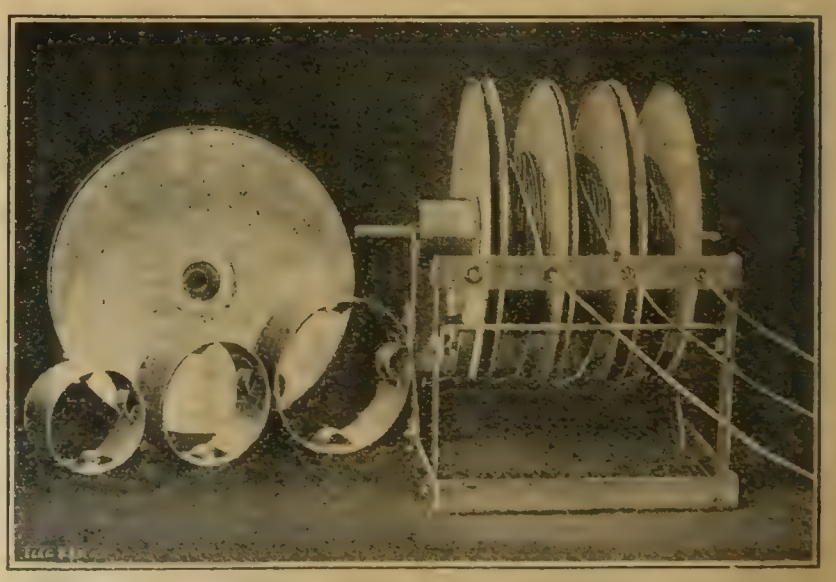


Fig. 15.—Safety Multi Wyrdrum.

any maker's coils. The coil of insulated or other wire is placed on the drum and the latter is put together and mounted on a spindle, each of the four drums shown being independent of the rest. Any length of any of the wires can thus be drawn off as required, passing through a bushed guide. Kinks are done away with, and the wire is unwound without twisting. Damage to the insulation is avoided, and the wires, when drawn into conduit in the straight condition, can be withdrawn easily in case of need. The device is made

entirely of metal. Besides the advantages above-mentioned, the damage so often inflicted on wires left lying on the floor, due to damp or workmen's boots, is obviated, and there is a marked economy of time and labour in wiring.

MR. ALEX. SHAW, of 18, Story Street, Hull, has been appointed selling agent.

Drum Controllers and Starters for Slip-Ring Motors.

The accompanying illustration shows one of the E.A.C. rotor-controllers, which are all of the oil-immersed type, and are intended for use wherever the duty is severe, as, for instance, in mine haulages or some textile operations. They are fitted with the E.A.C. finger,



FIG. 16.—E.A.C. DRUM CONTROLLER.

shown in fig. 17, and are insulated throughout with moulded mica. The resistances in the case of starters are usually immersed in the same oil tank as the controller proper; in the case of controllers, separate ventilated grid resistances are supplied. The contact fingers being identical with those used in E.A.C. oil switches and

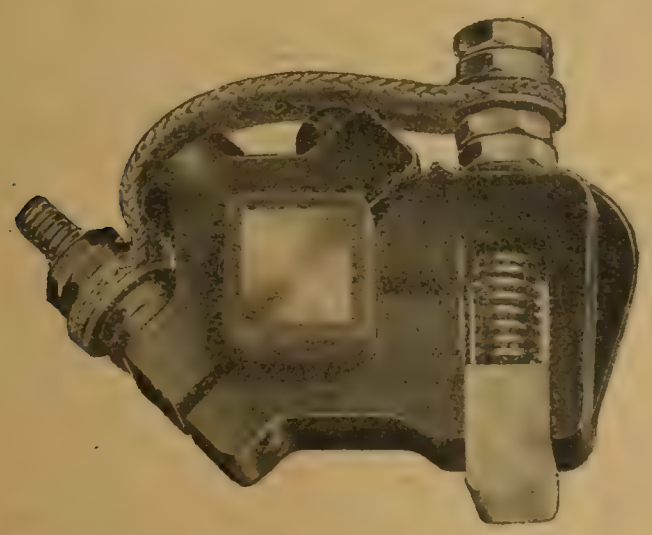


FIG. 17.—E.A.C. CONTROLLER FINGER.

squirrel-cage starters, a single stock of spare parts is sufficient for a complete installation comprising oil switches and starters of all types. Fig. 16 shows a controller, mounted together with its resistance, on a cast-iron pedestal. This switchgear is made by the ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W.

The Motograph Sign.

One of the novel outside electrical features which aroused widespread interest among hundreds of N.E.L.A. Convention delegates at Chicago was the "motograph." This is a panoramic "talking sign" operated by perforated paper rolls. Each letter appears at the extreme right, travels the entire length of the sign, and disappears at the extreme left. There is a continuous flow of letters, three or four words being visible constantly. The installation was made by the MOTOGRAPH CO. OF AMERICA, Detroit, Mich.

The motograph displays the advertising bulletins under a moving washing machine and figure of a woman operator.

The installation consists of a bulletin panel containing 1,360 10-watt, 115-volt tungsten lamps, arranged in 10 horizontal rows of 136 lamps each. The lamps are 4·5 in. apart. The total length of the bulletin panel is 51 ft. The height of the letters produced is 4 ft. The entire electrical display is 65 ft. long and 70 ft. high.

The perforating machine will produce old English, script or block letters, and even complicated characters, such as Chinese symbols, if desired.

The operating device is an automatic motor-driven controller of special design, which operates the perforated tape and effects a quick succession of "makes" and "breaks." The paper tape is said to run through the controller at the rate of [illegible] ft. per minute. The roll used in this particular installation contains 100 words, operates continuously for 3 min., and then repeats.—*Electrical World.*

New Thrust Bearing.

A new type of thrust bearing, invented by Mr. Albert Kingsbury, of Pittsburg, is described in the *Electrical World*. The defect of ordinary thrust and footstep bearings is that the wedge-shaped film of oil which ensures the lubrication of cylindrical shafts cannot be formed between two continuous flat surfaces. Mr. Kingsbury gets over the difficulty by dividing the stationary part of the bearing into six independent sectors, each of which is free to rock a little on its supports, so as to adjust itself to the best conditions. The bearing runs in a bath of oil, which penetrates between the surfaces and forms the oil wedge which is essential to effective lubrication. The bearing is made by the WESTINGHOUSE CO., of Pittsburg.

LEGAL.

BRITISH INSULATED AND HELSBY CABLES, LTD., *v.* LONDON ELECTRIC WIRE CO. AND SMITHS, LTD.

As reported last week, this matter was concluded in favour of the defendants.

We have received the following copy of the judgment given by Vice-Chancellor Dudley Stewart-Smith, Esq., K.C., at the Chancery Court at Liverpool on July 7th.

The VICE-CHANCELLOR: This is an action for infringement of two registered designs for trolley wire, to which the defences are want of novelty and non-infringement. One of such designs, numbered 521,209, was registered on March 7th, 1908, and has been called in the case Design A. The other, numbered 522.640, was registered on April 9th, 1908, and has been known as Design B. The registered design in each case shows the wire in perspective, with a full cross section. Both wires are grooved. In A, the part above the grooves is nearly semi-circular. The part below forms the segment of a larger circle. The grooves are semi-circular. and their shoulders parallel. Design B differs slightly in that the shoulders of the grooves are not parallel, but open outwards, and the bottoms of the grooves are flat and not semi-circular. Both wires are about ½ in. broad between the lower shoulders at their broadest part, and are rather less from the top of the semi-circle to the lowest part of the segment. In support of the defence of want of novelty, particulars have been delivered of a large number of previously-published designs. That made by the Trefileries et Cie. of Havre (No. 1 in the particulars), the other made by Thomas Bolton & Sons, Ltd. (and numbered 2 in the particulars), which were selected by the defendants and principally relied on, are distinguishable from Design B only in this, that the lower part of the wire is slightly smaller in relation to the upper part, and the lower part is slightly more circular, and the grooves have a circular bottom instead of a flat one. Judging by the eye alone, I think the differences are so slight and unimportant as to bring the case within the principle laid down in Le May and Walsh, 28 Chancery Division, 24, and that the plaintiffs' designs are not novel The main contention of the plaintiffs, however, is that the plaintiffs' design is functionally more perfect, and though it is conceded that utility as such is immaterial, the Court is bound to consider the reason for making the design of the shape and configuration which is to enable it to judge whether differences which appear minute are not in reality substantial. The claim in the present case is for novelty of shape. Lord Herschell, in the Heda Foundry Co. *v.* Walker, 6 Patent Office Reports, 554, says:—"I do not think the object which the designer has in view in adopting the particular shape, or the useful purpose which the shape is intended to serve, or does serve, ought to be regarded in considering what the design protected. The scheme of this part of the Act is entirely different from that relating to patents for inventors, and, adopting the words of Lord Shand, in Walker *v.* The Falkirk Iron Foundry, the Act in this branch gives only protection to the shape or configuration in such a case as the present. The result of such protection may be, however, to secure . . . if this should be the result, directly and indirectly, of the shape or configuration . . . but this is a mere incident. If such advantages are obtained, it is only because . . . and which is, therefore, not an improvement, will achieve the same end." The plaintiffs' design is for a useful article, and it is said that wire made in accordance with it has a greater functional value than any other, and the case of Tyler *v.* Sharpe, 11 Patent Office Reports, 357, was relied on. The design in that case was for a water-closet basin, the feature being that it enabled the siphons to be made separately, and to be joined at any angle suitable to the outlet pipe. In giving judgment, Mr. Justice Romer says:—"In my opinion, on the evidence it is established that the plaintiffs' design has distinct advantages over the prior designs for similar articles which have been put in evidence for the defendant . . . advantages—that is to say, in this respect, advantages of importance to the manufacturer on the question of utility, such advantages as cheapness of manufacture, strength of the article, and so forth." As I understand the design, the learned

Judge was satisfied that, independent of these special considerations, the plaintiffs' design was novel in shape and in no way purports to depart from the principle of the Heda Foundry case. On this contention the history of the design becomes important. The wire is of copper, and is used for overhead tramway systems to convey electricity to the car. This is effected by suspending the wire in clips or ears, and the communication is made by a grooved wheel on the summit of an arm extended from the car, the groove pressing against the wire. The plaintiffs put their case thus:—In 1903 they turned out a large quantity of ordinary circular copper tramway wire supported by ears soldered to the wire. The effect was that the grooved wheel jumped and hammered as it passed under the ear. There was an uneven transmission of current, shaking and additional wear and tear were caused, and the wire was frequently broken. Endeavours were made to produce a non-fouling wire—one on which the ear did not protrude beyond the wire. The first attempt was to cut a V-shaped groove in the middle. Then the wire was cold drawn into a figure 8. This form was common in 1904. The dumb-bell shape was then adopted, which did not prove satisfactory. The object to be attained was perfectly smooth working, a complete support to the wire by the clip, which made it necessary that the neck should not be too narrow, that the end of the clip should not protrude beyond the lower segment of the wire, so that there should be no contact with the ear in case of tilting, and that there should be the largest possible contact surface between the wire and the grooved wheel. It is claimed for wire made on the plaintiffs' designs that it fulfils these conditions, and that no previous wire had done so, that the ear can support the wire, when protruding over it the neck formed by the grooves is sufficiently strong for support, and that the lower segment of the wire, being relatively larger than those previously in use, affords a wider contact surface. It appears from a work published by Mr. Phillip Dawson, an engineer of distinction, in 1903, that down to that date the figure 8 wire had not proved satisfactory, and that the circular wire with grooves had given a better result. This passage was put to Mr. Swinburne, a witness for the defendants, and he said, whilst disclaiming any special knowledge, that he did not know of anything which happened between the years 1903 and 1908, which would make this description inaccurate in 1908 if it were accurate in 1903. Then Mr. Higginson, who is an engineer with a special experience in tramway work, and whose company manufacture tramway wire, says that the non-fouling problem had been solved before 1908 by grooved wire and other designs in which there were slight variations in the depth of the groove and the size of the head, and I think that this evidence is in accordance with the facts. No evidence was called showing that an alleged increase of contact would make any appreciable difference in the volume or strength of an electric current conveyed to a trolley wheel. To cold draw a wire into Design A is a more difficult and expensive operation than to draw it to Design B. As in the first case, the groove is narrower by reason of the upper and lower sides being parallel, and in the latter the sides of the groove open outwards. The plaintiffs appear to have supplied wire on Design A only to the Yorkshire Woollen District Tramways once in 1908, and a repeat order in 1911. It has not otherwise been used. There is no evidence that a groove flat at the bottom has any greater utility than a groove which is circular at the bottom. In a design so minute the difference must necessarily be small, but applying the eye, with the special instructions given by the expert witnesses, I am unable to conclude that there is any special advantage which wire, manufactured on the plaintiffs' design, gives which is not given by Nos. 1 and 2 in the particulars of objection, and probably many others. I think it is probable that Design B does give all the advantages of 1 and 2, but there is no evidence that it does in fact give greater advantages. So that, applying all the tests of advantage referred to by Mr. Justice Romer, the plaintiffs' wire, tried by those tests, does not seem functionally better than many of its predecessors. I am, therefore, driven back to the eye alone, and, judging by that, I am unable to see such a distinction between the plaintiffs' design and Nos. 1 and 2 as will enable me to say that the plaintiffs' designs are novel. As, however, another Court may take a different view, I will deal with the other points raised in the case. It is contended that, even if Design A could be otherwise supported as a novel design, it was, in fact, published by plaintiffs prior to registration. Between September, 1907, and February, 1908, the plaintiffs were endeavouring to obtain an order for trolley wire from the Yorkshire Woollen District Electric Tramways by correspondence with Mr. Goldston, their engineer. The order was obtained, and on February 25th, 1908, the plaintiffs sent a sample of the wire they intended to supply. It was in the form of Design A. Mr. Goldston wrote criticising the design, and making suggestions as to shape which were not given effect to by the plaintiffs. The wire was delivered in accordance with the sample. On February 29th the plaintiffs wrote confirming the price, and said that the design was duly registered. This was not quite accurate. A letter of inquiry had been sent to a patent agent asking advice, but the drawings were not sent to him for some days afterwards, and the design was not actually registered until March 7th. There is nothing in the correspondence to show that the communication of that design to Mr. Goldston was confidential. He could, without breach of faith, have shown it to his employers or anyone else. He did, in fact, show it to Mr. Paris, the managing director of the tramway company, but there is some uncertainty as to the exact date. I think these facts amount to publication by the plaintiffs before March 7th. A communication was made for a particular purpose, and effected that purpose. If this order had been obtained, I doubt if this particular design would have been registered. No intention to register it was communicated to Mr. Goldston until after the negotiations for purchase were at an end. The registration was held bad on Winfield *v.* Snow, 8 R. P., 15, a case very like the present. On this special ground also I think the registration of Design A invalid. On the question of infringement of B, if valid, the plaintiffs are in this difficulty. If the differences between that design and numbers 1 to 2 are sufficient to give novelty to B, the differences between B and the alleged infringements gave novelty to them. The diagrams and specimens of wire have been put in, and the only difference, not within working limits, between 1 and 2, Design B, and the infringements, is the flat bottom of the grooves in B, which is not shown to have any functional value. Even in supplying the same order—sometimes for several miles of wire—it is impossible to ensure absolute uniformity in shape throughout as the wire is cold drawn through dies, which wear with use, and this fact may account for some of these slight differences on which stress has been laid. If Design B is valid I hold that there has been no infringement. There will be judgment for the defendants.

POULSEN TELEGRAPHONE PATENT.

(*Concluded from page* 51.)

MR. COLEFAX said that the attempt to put the invention to a commercial use had been the serious difficulty of the companies concerned. It was patented practically throughout the whole world and nearly all the patents were in force at the present time. The time allowed for the British patent was the shortest period for any of them. Proceeding, counsel dealt exhaustively with the history of the companies which had been formed from time to time to work the patent. The invention, he said, was brought out in 1899 and the complete specification was not accepted until March, 1900. Mr. Poulsen had devoted much time and had spent a great deal of money on his invention, and with two more gentlemen, named Fogg and Ludd, he formed the Danish company, which he would call the parent company, in April of 1900, with a capital of 2,000,000 kroner. That capital was entirely in shares, Mr. Poulsen retaining one quarter. Shortly after the promotion of the company efforts were made to deal with the invention in the U.S.A., in Great Britain, Canada and Mexico. Counsel proceeded to show what had happened to these and to some other companies, some paying no dividend and some being defunct. The Telegraphone Co., of Columbia, was formed with a capital of $10,000,000, of which 4½ million dollars worth of stock was issued to the parent Danish Co. In 1905 the Telegraphone Corporation was formed, and that was the petitioning company. Demonstrations of the invention were given to his Lordship, one of the witnesses addressing him through the telephone.

MR. JAMES SWINBURNE then gave expert evidence. Before this invention, witness said, Edison had invented the phonograph and gramophone, but there were drawbacks to those machines from the point of view of reproducing the human voice because of a nasal twang and distortion which was inseparable with such machines. Then came Poulsen with the invention now before the Court. He had produced a record of the human voice by means of magnetising a piece of steel. It was not at all an obvious idea, in fact, it was so much the reverse that he did not think any electrician would expect the apparatus to work. But it did, and Mr. Poulsen had made a machine which reproduced the human voice without the nasal twang and distortion of the phonograph and gramophone. Furthermore, it was worked by a long strip of wire, which was capable of recording long speeches and conversations.

His LORDSHIP: You can record a conversation of any length, I take it, if you have the wire long enough?

MR. SWINBURNE said there was a limit to the length of the conversation, because there was a limitation in the accuracy of movement. It was a remarkable invention in this respect: nine-tenths of the patented inventions were inventions which came along in the ordinary course of development, but this was not an invention of that character. It was something which struck out in quite a new direction, which no one had thought of before. It was a very difficult idea to work out but it was put in a far more practical way than Edison had worked out his first phonograph invention.

Examined by SIR J. SIMON witness said he heard about Mr. Poulsen's machine during the Paris Exhibition of 1900.

Have you ever known these machines to have been bought and sold commercially, or used in any business?—No, I never saw one of these machines until this application for extension of the patent.

Witness admitted that the machine had a drawback from the commercial point of view on account of its expense, but, mechanically, there was no reason why it should not be used commercially. The market was more prepared for such an invention than had been the case, because recently people had been attempting to adapt the gramophone for the purposes of dictation.

MRS. FLORENCE IDA ESLER, assistant secretary and auditor of the American Co., having given evidence.

MR. SCOW, engineer in the employ of the Danish Manufacturing Co., was called. He said he had been engaged in developing the invention. The company were first engaged on a disk machine and manufactured a quantity of them, but afterwards they started making the improved piano-wire machine, which was the latest type. He thought it would prove a commercial success. The Danish Co. were selling this latest pattern machine at 600 kroner, or £33.

In giving judgment, his LORDSHIP said there was no doubt that the invention was a very brilliant one. The idea of storing up sound, not by physical means, but by the peculiar effect of an electromagnet on a steel wire or strip, was an idea which no one

except the most skilled inventor would have thought of. But there was this difficulty, that this invention had proved of no practical utility not in the sense of not producing a profit to the persons who worked it but in the sense that people had not been found to use it. It was admitted on all hands that up to the present moment there had been no demand for the machine, and that was a strong circumstance against the petition to prolong the patent rights. He was bound, in the circumstances, to refuse the petition on the ground that the patentee had not made out his claim that the patent was of sufficient public utility to justify an extension of the patent rights, and also on the ground that the petitioners had failed to show any sufficient reason for the non-attempt to make the machines in England.

MARCONI v. HELSBY WIRELESS TELEGRAPH CO., LTD.

IN the Chancery Division on July 9th Mr. Justice Eve had before him an adjourned summons in the above matter. The action was brought by the Marconi Wireless Co. against the Helsby Wireless Telegraph Co. Ltd., to restrain an infringement of patent rights taken out by Mr G. Marconi for which a certificate of validity had already been granted in an action by plaintiffs against the Radio-Wireless Telegraph Co. The summons before his Lordship asked for leave to administer interrogatories in respect of the examination of defendants' apparatus which defendants had installed at a wireless station at Milton Road Liverpool. The interrogatories which plaintiffs desired to put to defendants were: did the defendants install and use the plant in question, and, if so, was it of the same construction as that inspected by plaintiffs' representative at a previous date? If the said plant was not the same, had the construction been altered, and, if so, at what time or times, and in what respect? No objection was raised to the interrogatories, with the exception of the concluding question in the last, viz., "and in what respect." It was complained that such an interrogatory was too wide and should be disallowed.

LORD TIVERTON, who appeared for the objectors, submitted that by means of an interrogatory the plaintiffs were seeking to obtain a knowledge of the exact construction of defendants' apparatus. Assuming that his clients had made an infringing apparatus and a writ was issued, then supposing defendants made up their minds not to infringe any longer and to cease making the apparatus complained of, plaintiffs might inspect the different apparatus at the defendants' works and ask whether that was the one they complained of. The reply to that would be that it was not. There was no objection to that, but they had no right to ask a fishing interrogatory, "In what way does it differ?"

MR. GREY, who appeared for plaintiffs, said it would be no advantage to his clients to have got inspection after the writ unless they were told whether the process was the same as that which they complained of and saw at the previous inspection, and if not in what respect it differed. Where inspection was granted after the date of the writ, it was only for defendants to say "we have changed the apparatus," but unless plaintiffs were informed of what had been done the whole object of the examination was gone. He did not ask "What were you doing before the issue of the writ?" That would be fishing. All he asked was, "Did you make a specific alteration after the issue of the writ and, if so, what?" The defendants were not asked to describe their apparatus. He simply wanted to know in what respect the apparatus differed from the apparatus complained of, if it differed at all, and so prevent the whole of his examination being futile.

After considerable legal argument, his LORDSHIP held that the interrogatory ought to be allowed.

MINERS PROSECUTED.

AMONG a number of prosecutions for contravening the Coal Mines Act, tried by the Sheriff at Dunfermline last week, was the case of two miners who were fined 15s., with the alternative of six days' imprisonment, for travelling on an electric haulage road while the haulage was in motion, contrary to the rules.

GRIFFITH v. WEBB.

IN the Sheffield County Court on 11th inst., Rose Griffith, a married woman, claimed from Henry J. Webb, trading as the Mechanical and Electrical Engineering Co., of Hereford Street, Sheffield, a sum of £50 for personal injuries sustained through the negligence of one of the defendant's servants in repairing an arc lamp at 62, South Street, Moor, as the result of which the lamp fell on plaintiff's head. From the hearing, as reported in the *Sheffield Daily Telegraph*, it appeared that, on January 6th, and as she was passing Mr. E. L. Dean's shop, a boy was taking down a large electric lamp hanging in front of the shop. The boy, who was a servant of the defendant, was standing on the top of a ladder and was taking down the lamp with a hook. The whole thing gave way, and the lamp fell on plaintiff's head. She was rendered unconscious and was occasioned severe injuries, which had affected her health since. For the defence, it was argued that the accident was not caused by negligence, as the hook unexpectedly broke down, and he contended that the plaintiff's condition before the occurrence was delicate. In any case, the claim for damages was excessive. It was denied that plaintiff was rendered unconscious.

His HONOUR held that there was negligence in the fact that the boy was not supplied with proper apparatus with which to remove the lamp, and he awarded plaintiff £26 3s. 4d. damages.

THE GLOBE ELECTRIC CO., LTD.

IN the Chancery Division on Tuesday, Mr. Justice Neville had before him a summons in the matter of the Globe Electric Co., Ltd., on behalf of a creditor asking that a four-day order should be made to supplement an order of December 13th, 1912. The company are makers of arc and other electric lamps. Under the order of December last, counsel explained, the two signatories of the company appointed on a voluntary winding up were ordered to deliver up a consignment forthwith of arc lamps and accessories which had been deposited under an agreement.

HIS LORDSHIP: Have they not been delivered?

COUNSEL replied that part of them had and part had not. The liquidators contended that they were not obliged to deliver over those goods which were in the hands of agents. The articles in question were deposited by a Mr. Wilmer the applicant, in the hands of the company under the agreement of 1910.

COUNSEL for the liquidators said that respondents had handed over all the stock in their hands in compliance with the order with the exception of a certain portion of it which was in the hands of agents in all parts of the world. It would be impossible to get those articles back without incurring expense, and the liquidators were not in a position to spend money on recovering them. They had done what they could to comply with the order.

His LORDSHIP thought there had been substantial compliance with the order, and made no order on the summons. If the liquidators had informed themselves more fully how matters stood in the first place, his Lordship remarked, the order of December would not have been drawn up in the terms it had been.

THE NATIONAL TELEPHONE CO.—DISTRIBUTION OF ASSETS.

IN the Chancery Division on Tuesday, July 15th, Mr. Justice Sargant had opened before him a summons taken out by the liquidator of the National Telephone Co. for the direction of the Court as to the distribution of surplus assets between the various classes of contributories.

MR. DANCKWERTS, K.C., who, with Mr. Percy Wheeler, represented the liquidator, said that the summons was an originating summons taken out under the company's Acts by the liquidator to obtain the direction of the Court as to the disposal of certain funds in his hands. He explained that the matter had been before Mr. Justice Swinfen Eady and was argued for two or three days, but then the Railway and Canal Commissioners had not made their award as to the amount the Postmaster-General had to pay for taking over the company's undertaking, and his Lordship adjourned the matter so that he could make a final order disposing of the whole matter. Recent changes had prevented the judge from dealing with it, and the matter, therefore, came *de novo* to his Lordship. The point which the Court had to decide was what was to be done with the surplus in the liquidator's hands? Surplus as applied to a company's assets was used in two senses. First, surplus assets were what was left after the payment of all the outside liabilities of the company, but in another sense, surplus assets were what was left after payment of all debts and liabilities of a company and returning to the shareholders all the money they had subscribed for their shares. It was in the latter sense that the word surplus was used on the question which his Lordship had to consider. The question was who was entitled to a sum of £200,000, which roughly represented the surplus of assets of the Telephone Co. in the sense he had told his Lordship the word was used in this case. The parties interested were set forth in the affidavits of the liquidator, and they were, first the holders of 15,000 first preference shares of £10 each, carrying interest at 6 per cent. They were represented by Mr. Butcher, K.C., and Mr. Cartmell. Secondly, there were the holders of 15,000 second preference shares which were also £10 shares. They were represented by Mr. P. Ogden Lawrence, K.C., and Mr. Beebee. Council explained that representation orders had been made so that each was represented as a class. Then they got to a much larger class, namely [illegible] per cent. preference shares of £5, who were represented by Mr. Jenkins, K.C., and Mr. Tomlin, the preferred holders, who represented £[illegible], and the deferred shareholders, who represented the amount of £3,725,000, were represented by Mr. Frank Russell, K.C., Mr. Whinney, Mr. Younger, K.C., and Mr. Herbert Asquith respectively, and there were also [illegible] per cent. debenture stockholders to the amount of £1,537,464. Pursuant to orders made by Mr. Justice Swinfen Eady all the stockholders had now been paid 20s. in the £, the preference shareholders receiving in addition what was due to them for dividend. The way in which he could most conveniently put the matter before his Lordship was to deal with the facts in their historical order, as set out in the affidavits of Mr. Franklin, the liquidator. What was really material was, that there were two sets of capital. The company was formed in the year [illegible], with a capital of £6[illegible],000 divided into 15,000 preference shares of £10 each and 90,000 ordinary shares of £5 each. It would be found that the ordinary shares in this company had from time to time been converted into stock of the preferred and deferred order. The preference shares were entitled to receive a preferential cumulative dividend of 6 per cent. and no more, and a preferential repayment of the amount paid up on each share, but no other participation in the profits. Some slight alteration was made in the holding, but it would be found that the preference shares remained substantially the same to the end. Clause 34 of the articles gave power to the board, with the assent of a general meeting, to increase the capital.

MR. JUSTICE SARGANT asked whether the question would arise as to what were annual profits and what were not.

MR. DANCKWERTS thought not. He did not think that there would be any question as to the value received being annual profits after payment of all proper charges and outgoings. Clause 34 gave the power to create stock, and under it 15,000 second preference shares of £10 each were issued. They were preference as to dividend only when created in 1885, but in 1889 when the articles were changed, they were made preferential as regards capital also. They were entitled to a preferential dividend of 6 per cent., and after the ordinary shares had received a dividend of 6 per cent. out of the profits for the year, these second preference and the ordinary shares participated in surplus profits ratably in proportion to the amount subscribed on each share. On that clause there was a question whether surplus profits meant annual profits, and he believed the second preference and the preferred stock holders were going to contend on the assumption they did not; that they were entitled to this £200,000. These two classes claimed the right to divide the whole of the £200,000 between them.

MR. JUSTICE SARGANT said he understood that the deferred shareholders also claimed. Did not all the preference shareholders come in that claim?

MR. YOUNGER said that he was going to contend that these were not surplus assets at all, and the articles did not confer any right to profits on the second preference shareholders when the company was wound up. When the company was wound up the assets should be applied first in repaying the whole of the preference shares, and after that the preference shareholders had no claim to anything.

(*To be continued.*)

PARLIAMENTARY.

Rhondda Tramways Bill.

THE Bill promoted by the Rhondda Tramways Co. for the construction of a railless traction system, which has already passed the House of Commons, was before a Select Committee of the House of Lords last week, Lord Ribblesdale presiding.

MR. VESEY KNOX, K.C., for the promoters, explained that the proposed route would be a continuation of the present tramways from Williamstown South to Gilfach Goch and Nichols Terrace. It was proposed to give a half-hour service, and the fare would be only 8d., as against 2s. 3d. by train.

MR. TALBOT, K.C., who represented the Llantrisant Urban District Council, said he wished to make it plain that his opposition arose solely on the point as to the amount of contribution which the tramway company should pay for the upkeep of the roads.

MR. VESEY KNOX said that the House of Commons' Committee had decided that if the Urban District Council had to spend £4,000 or less on widening, the promoters were to pay one-third, and in addition they were to pay annually one-third of the extra cost of maintaining the roads, not exceeding three-eights of a penny per car-mile run. The promoters did not see why they should be singled out of all the users of the roads to pay. He asked the Committee to remove that clause from the Bill.

Replying to the CHAIRMAN, MR. VESEY KNOX said that if the figures regarding contributions were increased, the Bill would have to be abandoned.

After hearing evidence for and against the scheme, the Committee decided that the Bill should be allowed to proceed in its present form, but refused to give the Llantrisant Council powers to purchase.

Metropolitan Electric Tramways (Railless Traction) Bill.

LORD RIBBLESDALE'S Committee of the House of Lords have just concluded their consideration of the above Bill, by which the promoting company seek power to manufacture, provide and work trolley vehicles in Tottenham, Wood Green and Walthamstow. The Middlesex County Council appeared in opposition to the scheme.

MR. G. M. FREEMAN, K.C., who represented the promoters, explained that it was proposed to run vehicles on the railless trolley system along a route commencing in the Green Lanes at Turnpike Lane, Wood Green, through West Green Road across High Road, Tottenham, and along Broad Lane and Ferry Lane, Tottenham, to a point at the boundary of Middlesex and Essex. The route was a most important one, as it would give communication between Tottenham and Middlesex, and would be a great convenience to the travelling public. Certain difficulties had been encountered in connection with crossing over the River Lea at Tottenham and certain mains of the Metropolitan Water Board, but satisfactory arrangements had now been concluded.

After hearing considerable evidence, the Committee ordered the Bill to be reported to the House, with the addition of an agreed clause between the parties increasing the length of notice to be given to the local authorities of the company's intention to proceed with the works, from 12 to 18 months.

Mexborough and Swinton Tramways Bill.

LORD NEWTON'S Committee of the House of Lords were engaged several days last week in considering this Bill of the Mexborough and Swinton Tramways Co. for railless traction routes in the borough. The Bill, as already reported in the ELECTRICAL REVIEW, passed the House of Commons' Committee some weeks ago.

Evidence in favour of the scheme was given by MR. W. B. COWNIE, the managing director of the promoting company.

Evidence was also given in support of the Bill by a number of local residents, including representatives of the miners in the district.

MR. WEDDERBURN, K.C., who appeared for the Mexborough Urban District Council, appealed to the Committee not to pass the scheme, on the ground that if they did so it would prevent the local authorities coming forward with a comprehensive scheme more suited to the needs of the district than the present proposal. All along the local authorities had been opposed to the present Bill, and he was authorised to say that next year they would bring forward a better scheme, but if not Mexborough would do so alone.

After hearing a considerable body of evidence against the scheme, the Committtee found the preamble of the Bill proved.

Various Bills.—In the House of Commons, on Monday, the Kent Electric Power Bill was read a second time.

Metropolitan Railway Bill.—A Select Committee of the House of Commons, presided over by Sir F. Lowe, have approved the preamble of this Bill by which the undertaking is transferred to the Great Northern and City Railway Co. The Bill also provides for the extension of the line from Finsbury Pavement to Lothbury, to link it up with the Waterloo and City Railway.

City and South London Railway Bill.—Sir Francis Lowe's Select Committee of the House of Commons has passed the preamble of the Bill, by which the company are authorised to widen the tunnels to bring them into conformity with the other tube railways in London constructed at a later date.

BUSINESS NOTES.

The B. and K. Electric Restaurant.—We recently received from the BROMPTON AND KENSINGTON ACCESSORIES CO, LTD, of Earl's Court Road, London, S.W., specimen copies of the bill of fare of the "B. & K." Restaurant (close to Earl's Court Railway Station) where they do everything electrically, also of menu cards for tea, luncheon and dinner respectively. If only the "B. & K." can do a large enough traffic at the fares stated, shareholders in the B. & K. Electricity Supply Co. may feel the benefit in the shape of higher dividends, and some of the desirable West End residents whom we want to interest in electric cooking so that they will adopt it in their homes, may be won over. Electrical men should take note that it is part of the business of this restaurant to specially cater for luncheons and dinners, and a telephone message will reserve tables for parties or engage private rooms. Our readers will remember that all roads lead to Earl's Court Electric Restaurant, and we hope they will take an early opportunity of patronising the very excellent repasts prepared for them by Mr. R. S. Downe and his enterprising staff.

Catalogues and Lists.—MESSRS. W. H. WILLCOX & CO., 38, Southwark Street, London, S.E.—This is a very fine catalogue of 736 pages of illustrated matter describing all kinds of engineers' stores, tools and machinery. By the aid of a full index appearing at the front, you can easily find anything from acid to zinc, between these two coming a host of such various materials and manufactures as belting, barrows and boilers; calipers, cocks and cranes; dies, drills and dynamo brushes; engines, electricians' gloves and enamels, and so on all through the alphabet. There is no need to attempt to enumerate even a sufficient number of items to be a respectable representation of the vast host included in the book, for we believe most of our buying readers know how, for many years, Messrs. Willcox have made a speciality of the whole gamut of engineers' tools and stores. Prices appear to be given everywhere throughout this big and useful book.

MESSRS. HOGAN & WARDROP, 2, Gresham Buildings, Basinghall Street, London, E.C.—Illustrated leaflet describing their Calten's patent engine-room telegraphs, steering telegraphs, rudder tell-tales, and indicators for cranes.

THE CREDENDA CONDUITS CO., LTD., Chester Street, Aston, Birmingham.—12-page pamphlet containing illustrations, brief details and prices, of "Credenda" electric kettles, warming plates, cooking plates, boiling pots, electric irons, and stoves.

MESSRS. ERCOLE MARELLI & CO., 26, Garlick Hill, Queen Victoria Street, London, E.C.—Catalogue No. 8, I, giving very full tabular information, also descriptive matter, concerning the firm's centrifugal pumps driven by three-phase and D.C. motors. Notes on construction, installation and starting of pumps, friction in pipes, loss of pressure, weights and dimensions and prices of pumps are included. A separate pocket-size pamphlet describes the "Marelli" electric bolt for securing and opening doors and gates from a distance.

THE BRIMSDOWN LAMP WORKS, Kingsway House, Kingsway, London, W.C.—Folder giving latest prices of "Wirum" lamps.

THE ARMORDUCT MANUFACTURING CO., LTD., London.—Folder announcing that during the last few weeks seven municipal supply authorities have placed their annual contracts for "Armorduct" cables.

THE BLACKMAN EXPORT CO., LTD., 374, Euston Road, London, N.W.—Illustrated priced leaflet describing the Blackman inter-

mittent fan (1913 model), which is claimed to "create breezes which gently rise and fall as in nature." A description of the fan is given in our "New Devices" to-day.

Mr. Chas. H. Blume, The White Buildings, Fitzalan Square, Sheffield.—Revised leaflet relating to "Megomac" and "Insulac" insulating varnishes and giving prices of same. Copies will be sent on application.

Messrs. Thos. Whittle & Sons, Ltd., Warrington.—20-page illustrated catalogue describing their Whittle patent endless link-grip belting, showing its application to driving different classes of machinery and giving a number of hints for users.

Messrs. Alfred Herbert, Ltd., Coventry.—Catalogue fully illustrating and describing the "Photostat" for quickly copying drawings, plans, documents, &c.

Messrs. Turners and Manville, Ltd., Hopetoun House, Lloyd's Avenue, London, E.C.—16-page pamphlet containing information relating to prices of their "Sindanyo" fireproof substitute for wood, slate, marble and fibre in electrical insulating service; also, for fireproof doors, cabinets, &c. We understand that owing to its high mechanical strength and high electrical insulating properties, the material—which is supplied in two grades: plain grade and ebony grade—is replacing slate and marble for switchboard panels in mines, and in places where moisture and rough usage are experienced.

The Emanda Engineering Co., Ltd., of Peckham, are bringing their name before the public by means of boxes of cigarettes.

The Atlas Electrical Co., Ltd., 33, Tothill Street, Westminster, London, S.W.—Illustrated price leaflets respecting their "Atlas" carbon lamps, wires and cables, lampholders, switches, and other accessories; also wood blocks and switchboards.

The General Electric Co., Ltd, 67, Queen Victoria Street, London, S.W.—Price leaflets have been issued relating to the "Victor" electric bell, the "Santo" electric vacuum cleaner, and the "Defiance" electric flash lamp (pistol shape).

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London.—Price list No. 9 (20 pages) contains illustrations, prices and other details, of a selection of fittings for semi-indirect and inverted illumination. The glassware used consists of opal, Holophane, ceonix and alabaster, and a number of inverted pendants and fittings in enamelled iron are also included. The designs include fittings suitable for small areas, private house, shop, office and station lighting, while several of the larger types of fittings are specially applicable for use in picture theatres, public halls, hotels, &c. Price list D 8 (20 pages) is devoted to illustrations with brief particulars and prices of a variety of electric signs including box, bracket, shop window, theatre, hotel, and ship signs. Thermal and mercury flashers and motor-driven automatic sign switches are also particularised. The majority of the signs listed can be supplied with either of the several patterns of glassware described in the list, but special reference should be made to oplex glass. Oplex (registered) glass panels are produced by a special process which enables a coloured ground to be "fired" on to a sheet of white opal glass. By this means the precise effect of duplex glazing is obtained by the use of one sheet of glass only. Oplex panels, therefore, enable the weight of the complete sign to be considerably reduced. Cloisonné and cloiglasic panels, although slightly more expensive in initial cost, are, we understand, effective for working out coloured designs or brilliant colour schemes. The firm will supply a copy of this list on receipt of inquiry.

Book Notices.—*Manual of Electrical Undertakings and Directory of Officials*, 1913-14, by Emile Garcke. London: Electrical Press, Ltd. 21s. net.—Christmas comes but once a year, but when this volume reached us recently we felt that "Garcke" came oftener. Of course, as a matter of fact, it does not do so, but those who use the *Manual* for ordinary non-financial purposes hardly know when it gets out of date, so they do not wonder when the new one is coming along, as they do in the case of some reference books. It comes at the middle of the year, when most people are beginning to think about holidays, and, not being "light" literature in any sense, it is preserved for reference when in deeply serious mood, the reader having recognised of old that it is one of those books of which much study is a weariness to the flesh. Fancy taking "Garcke" to read on a holiday train journey! It is even difficult to write a review of a book of this kind this weather, and one dozes off dreamily after noting again that the statistics regarding the finances, &c., of companies, undertakings and firms, bring one down to so recent a date as March or June last year, and, in some cases, even the end of the previous year. The compiler does not claim this as a merit, and, of course, it is in no way his fault, or the fault of his staff. No doubt the date of publication, and the failure of those responsible for sending in information, are two of the reasons. However, most of the later information regarding these undertakings can be obtained from the files of the Electrical Review, or from the directors' reports or engineers' reports and accounts, if these happen to be at hand. But, putting aside this point, disappointing as it must be both to editor and user, the *Manual* is really a most valuable publication. Indeed, for statistical matter other than mere general and central-station information of a purely directory character, it is *par excellence* the book of the year, and if we did not think that most of our readers already knew nearly as much as we do ourselves about it, we would enter into a detailed recital of its sections, classifications, maps, and numerous other features. As it is, all we need now remark is that good wine needs no bush, and a "Garcke," up to date is worth two of last year.

Year-Book of Wireless Telegraphy and Telephony. London: Marconi Press. Price 2s. 6d. net.—This encyclopædic volume differs widely from one's usual conception of a year-book, containing as it does a number of articles of the "text-book" class by such authorities as Fleming, Erskine-Murray, Sankey and [illegible] to pick a few at random from the contributors. No attempt is made to frame these articles in the terse phraseology to which one is accustomed in year-books. In fact, the work is a species of encyclopædic text-book rather than an elaborated pocket-book. Whether this is altogether wise is doubtful. Will, or can, the layman read these articles intelligently? And, on the other hand, can the expert wait for a year-book to find information of the nature, and will he look for it there, anyhow? The descriptive matter should be curtailed, and rather more of that dry-as-dust but indispensable, matter included, which it is at present difficult to obtain elsewhere. Possibly it is the publishers' intention to follow this course in subsequent issues—making this edition an introductory manual. No one could cavil at the value given in the present work, but it would certainly have been better if the name Marconi had appeared in the title, for the bulk of the matter presented is exclusively Marconic. Following a calendar is a chronological record of progress since 1896. Most technical readers will wish that this list had been extended backward to a few years prior to 1896. In justice to the early workers in the field, this should be done, and taken as a whole, the record should be amplified and made more readable. The administrative section of the volume, containing the findings of the 1912 Convention and the wireless laws and regulations of the principal countries in the world, is most important, and would alone be worth, to many readers, more than the price asked for the whole volume. The complete list presented of land and ship stations, with their wave lengths, ranges, call letters, hours and nature of service, and charges per word (in the case of public stations), is supplemented by a large map of the world showing existing, and a number of proposed stations. A glossary of technical terms in English, French, German, Spanish and Italian, and a collection of technical data and formulæ are other valuable features to which attention must be called. Illustrated biographies are given of a number of wireless experts. The book is excellent value, and it is to be hoped that it can, and will, be published annually.

The Uses of Electricity. Part I, Electric Lighting (price 1d.); Part II, Electric Cooking and Heating, &c. (price 2d.); Part III, Works Driving. London: Kilowatt Publishing Co., Ltd.—These three booklets are published for the purpose of explaining to consumers the various applications of electricity, and the manner in which electricity supply may be utilised to the best advantage. The first, after briefly explaining the convenience, healthfulness and economy of the electric light, gives hints as to the best disposition of the lamps, describes the various modes of wiring houses and shops, and gives useful advice on shop and window lighting. Part II contains an article on Electric Cooking by Messrs. A. Hugh Seabrook and H. H. Holmes, whose names alone vouch for the value and interest of the information given; other articles deal with electric irons, radiators, vacuum cleaners and various domestic applications of electric heating. The third booklet, by Messrs. H. H. Couzens and F. Farndon, is devoted entirely to the use of electric power in works, with some illustrations of motor drives, and comparative figures of cost. A few letters from users who enthusiastically endorse the claims of the advocates of electric power are inserted with telling effect. These booklets should prove useful to central-station engineers, contractors and others interested in the development of the electrical industry.

Wade's Tables for Wooden Poles. Hull: Richard Wade, Sons and Co., Ltd. Price 2s. 6d.—The reduction of the wind pressure in the Board of Trade Regulations from 30 to 25 lb. has necessitated the revision of the tables issued by Messrs. Wade, whose customers can obtain copies free on application. The book is an excellent time-saver for engineers about to erect overhead lines, as it contains 16 tables, giving in great detail the standard sizes of telegraph poles, the wind-pressure on high-pressure overhead power lines and poles for a wide range of conditions, sizes of single and A poles for power lines, similar data for telegraph lines, the gross safe loads that may be applied to poles, and the elastic deflection of wooden telegraph poles, with explanatory remarks. There is no superfluous matter, and the advertising element is hardly discoverable.

The Modern Bioscope Operator. London: Ganes, Ltd. Price 3s. 6d.—Since its first appearance in 1910 this manual has arrived at its third edition, and has been revised throughout. Naturally a large proportion of the work is devoted to the electrical apparatus, which is described in detail, with clear instructions as to the handling of the various parts. As we said in our review of the second edition, the book can be confidently recommended to bioscope operators, as well as to contractors concerned with the installation of electrical apparatus in picture theatres. The text is very good; it would be an advantage if it were more fully illustrated. We believe there is not a single view of an arc projector (except in a diagram) or of a motor-generator in the book.

Logarithms for Beginners. By C. N. Pickworth, Wh.Sc. London: Whittaker & Co. Price 1s. net.—This handbook, now in its fourth edition, is designed to help the tiro over the difficulties usually met with in the use of logarithms, and gives numerous worked examples as well as problems, with answers. Tables of four-figure logs and antilogs, and hyperbolic logs, are included.

Engineering Tables and Data. By W. W. F. Pullen, Wh.Sc. Manchester: Scientific Publishing Co. Price 1s. 6d. net.—This is the third edition of a useful little collection of tables for use in the laboratory and drawing office. The latest data for steam are included, in °F. and °C. Rules for mensuration, mathematical tables and data, and standard integrals are given.

"Polytechnicum" is the name of a new Spanish-American technical review, dealing with science and industry; it is published monthly by Nicolas M. Rivero, 7, Pral, Madrid: annual subscription, 18 pesetas, in Spain. It is a high-class journal, well printed

on good paper, and contains a variety of articles of engineering interest.

"*Journal* of the Institution of Electrical Engineers." Vol. LI, No. 220. London: E. & F. N. Spon, Ltd. Price 5s. The issue for June, 1913, contains the following papers:—"Power Supply on the Rand," by A. E. Hadley; "Self-Synchronising Machines," by Dr. E. Rosenberg; "Independent Steam Condensing Plants," by W. A. Dexter; "Applications of Electricity on Warships," by A. P. Pyne; "Electric Heating and Cooking," by T. P. Wilmshurst; "Economies in the Use of Electric Power," by W. E. Milns; "Deposits in Oil-Cooled Transformers," by Dr. A. C. Michie; "Improvements in Continuous-Current Meters," by W. E. Cooke; "Air-Cooled Jacketing in Hollow Walls by Electric Fans," by J. W. Meares.

"*Journal* of the American Society of Mechanical Engineers." July, 1913. New York: The Society. Price 35 cents.

"*Transactions* of the New York Electrical Society." No. 4. 1913. Easton, Pa.: The Society.

"School of Mines Quarterly." Vol. XXXIV, No. 4. July, 1913. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. I, No. 5. June, 1913. Lancaster, Pa.: The American Physical Society.

"The Selection of Explosives Used in Engineering and Mining Operations," by C. Hall and S. P. Howell; "Coal Mine Accidents in the United States, 1896-1912," by F. W. Horton; "National Mine-Rescue and First-Aid Conference, Pittsburg, Pa., 1912," by H. M. Wilson; "The Commercial Trend of the Producer-Gas Power Plant in the United States," by R. H. Fernald; "Monthly Statement of Coal Mine Accidents in the United States, January and February, 1913," by F. W. Horton; "Wastes in the Production and Utilisation of Natural Gas and Means for their Prevention," by R. Arnold and F. G. Clapp. 1913. Washington: Government Printing Office.

Lead.—The market continues to exhibit firmness, which finds but little reflex in other sections of the metal trade, and which sufficiently demonstrates the soundness of the position. While the imports for the first half of the year showed a reduction compared with 1912 of about 2,700 tons, the exports increased by 4,100 tons, so that the quantities available for the home trade were actually nearly 7,000 tons deficient compared with a year ago. The June imports, indeed, show an alarming falling-off at 13,362 tons compared with 16,224 tons last year and 20,455 tons in 1911. The total imports for the six months were 104,779 tons against 107,445 tons in 1912 and 106,922 tons in 1911. While there has not been so much anxiety on the part of consumers to purchase spot and prompt deliveries, the supplies available remain of a restricted character, and any renewal of the demand would certainly leave its mark on prices, which stiffen whenever a buyer comes forward. With consumption proceeding on a satisfactory scale, and the prospect of short supplies from Mexico, where, although things are mending, the improvement is very gradual, there can hardly be much difficulty in maintaining prices, the more so as lead at present differs from most other metals in that there are not any stocks to be financed. It is the problem of finance which has been the dominant factor in many commodities lately, and wherever there have been surpluses to be nursed, the reaction in prices has been rather severe. It was finance that brought about the liquidation of tin by the large Continental holders, and which has caused a drop in prices of unparalleled severity from £232 a ton early in May to £177 last week with hardly even a momentary reaction. Lead will probably keep quite a good market until the signs become apparent of a radical alteration for the better in Mexico, but even with this the price of lead for near delivery might remain at a comparatively high figure. The demand from the electrical trades is better than that from the rollers, the latter, in fact, being rather indifferent for the time being.

The average price for June was £19 10s. 8d. against £18 14s. 3d. for May, and £17 11s. 7d. in June, 1912, and £13 5s. 5d. in June, 1911. The highest average last year was £21 8s. 11d. in September.

In their report dated July 12th, Messrs. James Forster & Co. state:—"As we anticipated, of the large quantity of lead arriving this week, little or none of it has come on the market; much of it has been shipped abroad and to provincial ports, the remainder relieving the necessities of local consumers. Monday's market opened easier, July lead selling at £19 7s. 6d. to £19, and August at £18 17s. 6d. Since then £19 15s. has been paid for prompt lead, £19 10s. for July, £19 for August, and £18 10s. for September. At the close prompt lead is a little easier at £19 10s., after £19 7s. 6d., with buyers for August at £19, September at £18 12s. 6d., and October at £18 7s. 6d., after £18 5s. There is a good inquiry for forward, for export and home consumers. The strength of the position is shown by the fact that lead alone has remained firm, in face of a heavy fall in other metals during the week. Lead is wanted for export and by the home trade, and there is not too much coming in, so that we anticipate a steady market with more pressure for early lead. English lead £19 15s."

Edison Cars.—The Mayor of Blackburn, Alderman S. Crossley, has used an Edison electric car in his attendance upon his Majesty the King during his recent visit to the borough of Blackburn.

Works Closed for Holidays.—The works of Messrs. Mawdsley's, Ltd., of Dursley, Glos., will be closed from the evening of Friday, August 1st, until Monday morning, August 11th. Only urgent correspondence will be dealt with during this period.

Messrs. A. P. Lundberg & Sons, of Liverpool Road, N., announce that their works will be closed from Saturday, August 2nd, until Monday, August 11th, for the employés' annual holidays.

Consular Reports.—Spain.—The French Consul at Santander calls attention to the growing importance of the importations of electrical material into the region behind this port, owing to the substitution of electricity for steam in various local industries. This movement is favoured by the wealth in water power of this region, inducing such installations as that at Artillero, in the middle of the Santander mining field, where the Societá Electra de Viergo has built a large generating station, supplying three-phase current at 220 volts and a periodicity of 50. Six years ago none of the mines in the province made use of electricity, whereas last year 67 motors of a total of 3,024 H.P. were employed, 46 motors of 2,119 H.P. by iron mines and 21 motors of 905 H.P. by zinc mines, in the extraction, washing and transport of ore. Noteworthy among these installations are that at Camplemento, 350 H.P.; the Heras Mines, 350 H.P.; the San Salvador Iron Ore Co., 300 H.P.; the Entrambasaguar Mines, 100 H.P.; the Cartes Mines, 100 H.P.; and the Cabariéna, 50 H.P. Among local industries in Santander and its neighbourhood which have substituted electricity for steam may be named the Société Générale des Cirages Francais; the engineering works of Corcho Sons, San Martin, Lavin & Co.; the petrol and oil refinery of Deutsch & Co., and the Austriaca and the Cruz Blanca breweries. Other establishments, such as the soda works of the Societá Solvay at Baneda, and the Nueva Montana Ironworks Co. (which likewise supplies current to the Societá Cementos de Portland and to the tramways of Santander) produce their own motive power. There are, besides, a variety of minor industries—such as chocolate factories, bakeries, &c., whose numbers are daily growing, making, or about to make, use of single motors. The importations of electrical material into Santander during 1912 were as follows:—

Dynamos and motors of less than 100 kg.	9,638 kg.
" " of 101 to 400 kg.	10,541 kg.
" " above 400 kg.	99,562 kg.
Switchboards less than 400 kg.	14,769 kg.
Accumulators	2,903 kg.
Conductor cables above 0·01 cm.	5,034 kg.
" less than 0·01 cm.	265 kg.
Telegraph and telephone apparatus	2,652 kg.
Arc lamps	99 kg.
" carbons	15 kg.
Fitted electric bulbs	1,261 kg.

The Consul points out that only one case is known of French firms supplying the equipments of any of the mines cited, that of the mines of Heras, by the firm of Fabius Herion, of Nancy, and one English firm, which furnished the equipment of the mines of San Salvador. The bulk of the installations, as also of the imports, are furnished by German houses, owing more to the superiority of their commercial organisation than to the superior quality of their goods. The two powerful firms who represent the German electrical industry in Spain have created two Spanish branches, with stocks of types in different sizes, thus offering to the purchaser the greatest facilities in drafting plans, with rapid delivery. They have even established engineering works, which are in reality only erecting shops for the material imported from Germany. Moreover, they push their goods by advertisement in local journals to the utmost. In conclusion, the Consul tenders the following advice: It is needful to have on the spot active and intelligent agents, knowing Spanish and furnished with sufficient power to negotiate without delay; catalogues should be clear and detailed, and allow of settling schemes of installations by their information alone; there should be local stocks kept, if possible, of types constructed in graduated sizes; delivery of orders should be prompt and facilities offered for payment. Publicity should not be starved.

Japan.—The following information is from the report by H.M. Commercial Attaché at Yokohama (Mr. E. F. Crowe) on the trade of Japan in 1912, which will shortly be issued:—

The business in insulated wires has continued very large, the value of the imports in 1912 amounting to no less than £571,000. Of this the bulk came under the tariff heading, "Armoured with metal, other than submarine," and the United Kingdom and Germany divided this between them, each taking about £250,000.

At present, to the traveller who is paying his first visit to Japan, one of the most striking things is the appalling amount of wires which criss-cross over the streets of the large cities. This is gradually being done away with and underground wires substituted, and until the process is completed the imports from abroad will remain fairly large.

The other chief reason for the increase in the imports of this class of goods is the demand from the hydro-electric power companies. Although the Japanese electric wire works have developed to a considerable extent during the past few years, they are as yet unable to produce satisfactory high-tension cables.

Electrical Exhibition in Spain.—The scheme of organising an International Electrical Industry Exhibition in Barcelona is going ahead very rapidly. It has been decided that it shall be held in the Palace de Bellas Artes y Salon de San Juan in the autumn of 1914, and that to render it suitable for all classes of exhibitors, continuous current at 110, 150, 220 and 300 volts, as well as three-phase high-tension current, shall be available.

Dissolutions and Liquidations.—Prested Miners' Gas-Indicating Electric Lamp Co., Ltd.—A petition for winding up this company, presented by Messrs. George Reynolds, Ltd., of Stepney Green, London, is to be heard on July 22nd.

Anglo-Norwegian Aluminium Co., Ltd.—Creditors must send particulars of debts, &c., to the liquidator, Mr. F. C. Potter, 28, Victoria Street, S.W., by July 25th.

Rubber Exhibition in London.—We have received from MR. A. S. MANDERS (75, Chancery La[illegible], W.C.), the managing director, particulars of the International Rubber and Allied Trades Exhibition, which will be held in London at the Royal Agricultural Hall, from June 24th to July 9th next year. As the name of this event implies, it will not be a purely rubber show like that run under Mr. Manders's guidance in 1911, but it will throw open its doors to cotton, fibres and other tropical agricultural products as well. The Exhibition will be under the patronage of His Majesty the King. In addition to the promotion of trade and commerce, it should also afford opportunities for producers, manufacturers, chemists, scientists, makers of machinery and others to meet and interchange ideas. Between the opening and closing dates, the International Conference of Tropical Agriculture and the Fourth International Rubber and Allied Industries Conference will be held in the Exhibition building. There will be special lectures and demonstrations, and moving-picture shows of production, packing, shipping and manufacturing of crude products. There will be a number of trophies and prizes for competition. Copies of the prospectus can be obtained from Mr. Manders.

The Lighting of an Indian Public Garden.—The "Eden Gardens," often described as the Hyde Park of Calcutta, and the fashionable society *rendezvous* when the band is playing, are under the control of the Public Works Department. For some time the illumination has been by means of arc lamps, but these have been recently replaced with 600-C.P. Osram lamps, which have been fitted in cast-iron water-tight fittings, the arc lamp poles still being utilised.

Trade Announcements.—The address of the Sheffield Branch of the BRITISH THOMSON-HOUSTON CO., LTD., will, after August 1st, be 8, East Parade, Sheffield, instead of as at present, 41, Church Street, Sheffield.

MORRIS & LISTER (LONDON), LTD.—The company's telephone number, which is not yet in the telephone address book, is 5134 Kensington.

THE WHARRAD ENGINEERING CO., which commenced business at Victoria Street, Redditch, a year ago, for the manufacture of small steel parts, motor accessories, &c., found removal to larger premises necessary six months later, and a site has now been taken on Hewell Road; the erection of new works is proceeding.

Owing to increased business, THE IMPERIAL LIGHTING CO. have taken larger premises, and in future their address will be :—2, 4 and 6, Pocock Street, Blackfriars Road, S.E. Their various workshops have modern equipment for the manufacture of every description of electric signs, electrical stage equipment, and Fairyland strip. New telephone number : "3931 Hop."

F. and S. Ball Bearings.—The Gnome engine used in the recent flight of Mr. Brindejonce in the Paris, Berlin, Warsaw, &c., circuit back again to Paris, was fitted exclusively with F. and S. ball bearings.

Bankruptcy Proceedings.—WYNDHAM WADSWORTH, engineers' agent and dealer in electrical accessories, 16 John Dalton Street, Manchester.—Receiving order made July 9th, on a creditor's petition.

T. A. FLATHER, electrical engineer, Leeds.—Bankrupt discharged on June 9th conditionally.

FREDERICK JOHNSON, electrical engineer, 60, Eltisley Avenue, Newnham, Cambridge.—Receiving order made July 12th on a creditor's petition.

LIGHTING and POWER NOTES.

Australia.—During the year to December 31st last, the Melbourne City Council sold 14,774,000 units, its consumers numbered 5,419, and its total connections 15,124 KW. at the end of the year. The latter figure includes 6,935 KW. of lighting, 6,705 KW. of power, and 1,484 KW. of heating. Large extensions of plant have been made and authorised recently, including four boilers, one 2,500-KW. Belliss Siemens and two 4,400-KW. Willans-Siemens turbo-alternators; a 1,000-KW. and four 1,500-KW. Westinghouse rotary converters, this plant being in connection with the 6,600-volt three-phase system which it is expected will be brought into use next month, when the Municipalities of Brunswick and Port Melbourne will be supplied.

The W.A. Government has accepted tenders for three 3,000-KW. Willans-Brown, Boveri turbo-alternators for the new Perth power station. The Perth Council's electricity and gas supply department shows a net profit of £11,137 for the half-year, of which £5,250 has been appropriated for sinking fund. The net balance on the undertaking, after meeting financial charges, since it was taken over by the Corporation in February, 1912, amounts to £20,804.

Owing to the bursting of a main steam pipe at the Melbourne Electric Supply Co.'s power station at Richmond recently, many suburban streets and houses were left in darkness, and the local tramways were stopped for about five hours.

Boston.—Messrs. Crompton & Co., Ltd., have informed the R.D.C. that they intend applying for a prov. order for electric light in Skirbeck Quarter, Wyberton, Brothertoft, and from Wrangle to Skirbeck inclusive.

Bath.—ANNUAL ACCOUNTS.—At a meeting of the E.L. Committee, the detailed accounts for the year ended March last were presented. They showed a deficit on the year's working of £1,145, compared with £1,321 in the preceding year. For the 12 months the total revenue was £22,130, compared with £21,247 in 1911-12. The income from private lighting was £11,966, against £11,477, an increase of £[illegible] from power and heat, £4,401, against £[illegible], an advance of £[illegible]. Public lighting brought in £200 more, and in other sources of income the increase was £73, making a total advance of £1,161 compared with the previous year. Expenditure went up, the total expenses being £11,816, against £11,[illegible] an advance of £[illegible] was due to the increased cost of coal. The gross profit was £366 more than 1911-12, but £331 of this was absorbed for interest on additional loans, and £81 for an additional sinking fund payment, leaving the net deficit as stated.

Barrow-in-Furness.—WORKHOUSE LIGHTING.—The B. of G. has passed a resolution that the electric light be installed at the workhouse and infirmary at a cost not exceeding £750.

Barwell.—The Midland Electric Light and Power Co., of Leamington, has informed the local authority that it intends applying for a prov. order for electric light for Barwell and other parishes. At the present time the Leicestershire and Warwickshire Electric Power Co. and the Parish Council are in negotiation as to terms for public lighting by electricity.

Bedford.—DIESEL ENGINE LOAN.—Regarding the recent inquiries into the application of the T.C. for a loan of £11,590 for electricity purposes, the L.G.B. has informed the Council that "in view of the facts ascertained by the Inspector at the inquiry," the Board is not prepared to sanction the loan of £9,790 for the purchase of a Diesel engine, &c. At the same time sanction to a loan of £1,800 for services was forwarded. The E.L. Committee is considering what steps shall be taken in the matter.

Belfast.—The Tramways and Electricity Committee is to ascertain from the Harbour Commission the terms on which the site for a generating station on the harbour estate could be obtained by the Corporation.

Beverley.—At a meeting of the T.C. on Monday, notification was received from Messrs. Foote & Milne, of London, of their intention to apply to the B. of T. for a prov. order for electric light.

Bradford-on-Avon.—Mr. J. H. Edwards has informed the U.D.C. that he intends applying to the B. of T. for a prov. order for electric light.

Brandon (Co. Durham).—The U.D.C. has decided to have the new hospital lighted and heated by electricity.

Bradford.—The Chamber of Trade is not satisfied with the response made by the Corporation to its request for a reduction of the electricity charges to shopkeepers to ½d. per unit, and the adoption of a system of cash discounts on accounts, instead of the existing system of free lamp presentation. A speaker admitted that some of the suggestions of the Corporation were good; he did not, however, think the rateable value system at all fair.

The Corporation, it is understood, considers the Pudsey Gas Co. unreasonable in its dealings with the Corporation in regard to the supply of a certain amount of gas for street lighting in the district between Bradford and Leeds, and the decision of the Corporation to light some of the streets in the Thornbury district by electricity is looked upon as a hit back. It has often been threatened that similar action will be taken against the Drighlington Gas Co., who supply some gas at Tong.

Bury St. Edmunds.—The working of the electricity department for the last year shows a net profit of £20.

Bushey.—The U.D.C. has received intimation that prov. orders for electric light are to be applied for by the Watford U.D.C. and the Colne Valley Electric Supply Co., Ltd.

Cheshunt.—The U.D.C. having declined to establish electricity works on the ground that it would involve too great an expense to the ratepayers, the Traders' Association has decided to request the Council to reconsider the matter.

Carnarvonshire.—The National Electric Construction Co. has secured the contract for electric lighting at Madryn Castle, and is carrying out the lighting of Carnarvon Workhouse and Bangor New Workhouse Infirmary.

Continental Notes.—BELGIUM.—A colliery company —La Société des Charbonnages des Quatre-Jean, of Quene-du-Bois —has submitted the lowest tender to the municipal authorities of Romsée (province of Liége), for the concession for the supply of electrical energy for lighting and power purposes in the town, quoting 13 centimes (about 1·3d.) per KW.-hour, for a high-tension supply.

FRANCE.—La Société Hydro-Electrique des Basses Pyrenées has just entered into a contract with the Société Concessionnaire de l'Eclairage Electrique de Biarritz, to supply the necessary electrical energy for the lighting of the town of Biarritz. At present single-phase alternating current is being supplied, but this is to be altered to triphase.

Cornforth.—The P.C. has decided to approach the Cassop and Coxhoe Parish Councils and Messrs. Bell Bros., Ltd., with the object of obtaining a supply of current for the combined district for public lighting

Crewe.—The abstract of accounts show that in the electricity department, notwithstanding increased cost of fuel and other materials, there was a surplus of £1,199 on the last year's working. Receipts from the sale of current, public lighting, &c., amounted to £8,744, and from interest £198. Working expenses were £4,506, and loan charges £3,237. To relief of rates £600 was contributed, and a further £740 was placed to the reserve fund.

Dromore.—Street Lighting.—The Council has accepted the tender of Messrs. Allen & Grosse, Belfast, for electric street lighting at £124 for the season, and 11 lamps of 200 c.p., 17 of 50 c.p. and 48 of 25 c.p. are to be erected. The tender was in competition with gas and oil lighting.

Ealing.—The L.G.B., respecting the application of the B.C. for sanction to borrow £4,000 for the purposes of extending the Town Hall, providing, in particular, for increased accommodation for the electricity department, has replied that the proposals were generally satisfactory, but that it proposed to defer its decision till tenders had been obtained. The borough surveyor is to advertise for tenders at once.

Edinburgh.—Annual Accounts.—According to a report by the Corporation's electrical engineer, during the last year of working, 17,047,645 units were sold as follows:—For lighting, 9,861,180; power, 5,095,656; public street lighting, 1,959,548; and for traction, 131,261. This is an increase of 830,224 units. Power showed an increase of 16½ per cent. During the year the motors connected amounted to 783 h.p., making a total of 12,186 h.p. In the revenue account there was an income of £131,678, and a credit balance of £2,179. Working expenses totalled £67,509; interest, £18,709; and sinking fund, £41,225.

The Electric Lighting Committee received a deputation regarding the rates charged for current to city picture houses for projector purposes. Mr. N. A. Paton, Glasgow, electrical adviser to the Cinematograph Exhibitors' Association, and others, contended that the current used for projector purposes should be charged at power rates instead of at lighting rates, as was done at present. Concessions had been granted in other towns, and particularly in Glasgow, where there was a flat rate of 1½d. per unit for all current used for projector purposes. The Committee promised to give the matter its consideration.

Goole.—The Gas Committee has received a demand from the Aire and Calder Navigation, as the largest consumers of the gas of the undertaking, for an additional allowance of discount, accompanied by a threat that otherwise the Navigation would seriously consider the adoption of electricity. It is understood favourable terms have been offered by the Yorkshire Electric Power Co.

Havant.—The R.D.C. has received notice that a private company is to be formed to apply to the B. of T. for a prov. order for electric lighting in the Council's area.

Hove.—The T.C. has appointed a Committee to consider and report as to the relative advantages and disadvantages of the various methods by which, under the provisions of the Corporation Bill, 1913, or otherwise, electric light can be supplied in the borough.

Hereford.—The R.D.C. has granted the T.C. permission to supply current in the parish of Holmer, on condition that the Corporation takes no steps to include the parish in the city boundary at any future time.

Hetton-le-Hole.—Public Lighting.—The U.D.C. has asked the Newcastle-on-Tyne Electric Supply Co. to submit terms for public lighting by electricity, both by means of overhead and underground cables.

Heywood.—A Sub-Committee has been appointed to consider and report upon terms offered for the supply of electricity in bulk to the Corporation. At a meeting of the T.C. on July 9th it was stated that the matter could not yet be reported upon.

It was mentioned at the T.C. meeting that a considerable amount of money would have to be spent shortly on the battery, and that the cable in Bamford Road would have to be replaced by a new one.

Huddersfield.—Workhouse Lighting.—The B. of G. has decided to engage an expert to report with reference to the substitution of electricity for the present system of illumination by gas at Crosland Moor workhouse.

Hunsworth (Yorkshire).—Street Lighting.—The D.C. last week agreed to prepare a statement of the cost of the street gas lighting of the whole district for the past 12 months, with a view to asking the Bradford Corporation how much it would charge to light the streets by electricity, and comparing the two costs.

Ilford.—The U.D.C. has under consideration the question of installing electric baths.

Kendal.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to loans of £800 for mains, £100 for services, and £100 for meters.

Kenilworth.—At a meeting of the U.D.C. on July 8th, notice was received of the intention of the Midland Electric Light and Power Co. to apply for a prov. order for electricity. The Council referred the matter to a committee.

Keighley.—The Borough Education Committee has decided to have the E.L. installed at the Education Offices.

Kirkcaldy.—In the Corporation electricity department, the gross profit carried to net revenue account for the last year, was £3,712, or 4·8 per cent. of the capital expenditure, as against £3,313, and after payment of interest and sinking fund charges, there was a net deficit of £26 on the year's working. During the year the sale of current for private lighting increased by 10·64 per cent., and for motive power by 31·43 per cent. In the tramway department the gross profit carried to net revenue account was £6,158 (or 6·4 per cent. of the capital expenditure), as against £6,089 last year, and after payment of interest, sinking fund and depreciation, there was a net profit of £1,370.

Ladysbridge.—The Banffshire Lunacy Board has received an offer of £1,068 from Anderson & Munro, Ltd., for wiring the asylum. Before this offer is accepted, an independent electrical company is to be consulted in regard thereto.

Littleborough (near Rochdale).—The U.D.C. has decided at a special meeting to extend the mains and to apply to the L.G.B. for sanction to borrow £3,000 to carry out this work and other extensions in the future.

Liversedge.—The U.D.C. has passed plans for a new sub-station to be erected off Valley Road by the Yorkshire Electric Power Co., Ltd.

Leigh (Lancs.).—Annual Accounts.—During the last year's working 1,086,297 units were sold, or 58,000 more than in previous year. The total revenue was £9,347, and the gross profit £4,544; and after meeting all charges, a net surplus of £1,080 remained, being the largest so far obtained. Expenditure on both fuel and water was reduced, as compared with the previous year, due largely to the introduction of more modern condensing plant. The borough engineer, Mr. A. T. Smith, urged his Committee to create a renewals fund from the surplus money in hand, and £1,261 was transferred for this purpose.

London.—Bethnal Green.—The Council has accepted the offer of the Stepney B.C. for the supply of electricity in bulk, but the terms of the agreement are stated to be not definitely settled.

Bermondsey.—Annual Accounts.—The Electricity and Street Lighting Committee of the B.C. has submitted the annual accounts for the past year. The total units sold were 4,582,155, an increase of 552,995 over the previous year. The total income, £27,196, showed a gross profit of £12,779, which was 6½ per cent. on the capital expenditure. The net surplus balance, after crediting special items, and making provision for £924 to meet accrued proportion of loan charges due to date but not paid, was £80. This small surplus on the year's working was due to various causes, amongst which may be mentioned (*a*) the extra expense caused by the increased price of coal owing to the strikes; (*b*) a slight fall in the expected increased revenue; (*c*) a larger proportion of the first instalment on the last loan came into the financial year than was anticipated; and (*d*) reduction in the loan period. Notwithstanding the higher price of coal, the total working costs per unit were reduced from ·7d. to ·67d., and the undertaking was still the fourth lowest in London, including the companies.

The Finance Committee, in commenting on the accounts, points out that the surplus estimated 12 months ago was £1,546, whereas it was found to be at the close of the year only £79, and this on a capital expenditure of nearly £200,000, of which £165,000 was still outstanding. The units sold for street lighting were 545,854, thereby showing a profit of £900. A further profit made by the sale of current to the Council's various buildings and works was included in the sales to private consumers, and the accounts, as presented, did not permit the amount of this additional profit to be stated. It had previously pointed out that caution should be exercised in fresh borrowings, and now repeated and emphasised that advice, and suggested that no fresh loans be sanctioned unless a sufficient price be obtained from private consumers to put the undertaking upon a paying basis. The charge for street lighting and other services connected with the Council should be in close relationship to the cost price.

Shoreditch.—Proposed Plant Extensions.—The Electric Lighting Committee has approved an important scheme of extensions, involving the provision of buildings at Whiston Street, suitable for 10,000 kw. of additional plant. One 5,000-kw. set is proposed to be installed before March, 1915, and a similar one in the following year. It is proposed to dispose of five dryback boilers and two Willans generating sets at Coronet Street, in order to provide space for rotary converters for the h.t. supply. The Committee considers also that negotiations should be at once opened with the Stepney B.C. for a trunk connection with that Council's generating station to give at least 1,500 kw. stand-by supply, and the first plant to be provided should be the rotary converters at Coronet Street and Whiston Street stations. A summary of the cost shows expenditure on buildings, foundations, &c., £22,800; on turbines, boilers, pumps, pipes, &c., £56,050; on h.t. mains and switches connecting Whiston Street and Coronet Street stations, £5,000; on rotary converters, £10,000; and on the Stepney trunk connection £5,000, making a total of £98,850. The additional loan charges will not have to be fully met until 1916-17; they are estimated at £7,817, and against this the borough electrical engineer considers that the saving in fuel cost will amount to some £5,000. The balance of the loan on the plant which is to be disposed of will be met from the reserve fund.

Shoreditch.—Annual Accounts.—The accounts of the electricity undertaking show that during the year ended March 31st last the income from the sale of current amounted to £58,815, as compared with £54,355 in 1911-12, an increase of £4,460. The number of units sold was 8,774,653, against 7,896,710. The average price obtained per unit was 1·609d. per unit, instead of 1·655d., owing to the system of discounts adopted by the Council 18 months ago, which has reduced the price for power purposes. There was an increase of 23 per cent. on the cost of coal during the year, which had the effect of reducing the gross profit for the year by £1,639, in comparison with the figures for 1911-12. The charge for supplying electricity to public arc lamps again showed a reduction, the cost being £4,869, as against £5,337 for 1911-12. After meeting all charges for interest and repayment of loans, &c., there was a surplus of £3,728, to which must be added the balance brought forward, £195, making a total of £3,923, and this is to be disposed of as follows: Transferred to reserve fund account, £3,500; to change of pressure account, £369; carried forward, £54. The current generated from destructor steam during the 12 months was 715,823 units, of the value of £1,461, the comparative figures for 1911-12 being 729,745 units, and £1,167.

Fulham.—New Generating Plant.—The Electricity Committee reports having had under consideration the necessity for further extensions to the generating plant at the borough electricity works. The plant at the present moment, the report states, consists of slow-speed horizontal engines, high-speed vertical, and the turbo machines, with a total capacity of 4,450 kw. Shutting down one set (say of 1,500 kw.) for even one night, would leave the station with two Musgrave sets of only 600 kw. capacity as a stand-by. Having regard to the increasing load on the mains, the Committee considers it desirable to at once install an additional turbo-alternator of 2,500 kw. capacity. With regard to alternative suggestions for the provision of engine-room accommodation, it will be in the best interests of the undertaking to adopt one which provides for the taking out of the two Musgrave sets which occupy practically half of the existing engine-room, and which would provide space for three 2,500-kw. turbo-alternators, the eventual provision of three turbo-alternators being all the additional plant which is likely to be required for many years to come. Continuing, the Committee states that at the present time it is only proposed to take out one Musgrave set. Subject to adoption of this proposal the estimated cost of installing the new plant works out as follows:—Main turbo-alternator complete with condenser and air filter, £7,500; motors for water and steam, &c., £300; pipe, water and steam connections, £300; instruments, gauges and sundries, £100; foundations, alterations and additions, £350. The Committee recommends the approval of an expenditure of £8,550 for carrying out the above scheme, and that the borough engineer be instructed to take the necessary steps to complete the proposed extension accordingly. In order that power consumers, who have a high load factor, may be able to secure the benefit of a cheaper rate, the Committee has decided to make a charge of £4 10s. per kw. of maximum demand, plus ½d. per unit for all units registered by the consumer's meter, as an alternative to the present charge for energy of 1d. per unit, which is considered as unsatisfactory to large manufacturers who are able to generate their own electricity at a cheap rate.

Newcastle-on-Tyne.—Tariff Discussion.—At a meeting of the Electrical Section of the Newcastle and Gateshead Chamber of Commerce on the 9th inst., the question of a uniform tariff for lighting, heating and power purposes was discussed. In addition to the members of the Section, there were also present several of the distributors of electric power in the counties of Northumberland and Durham. What it is sought to attain is a means of agreement upon principle for a uniform tariff. Information from the various distributors in the two counties was placed before the meeting, and it was arranged that this should be sent to each member for consideration, and subsequently another meeting will be held.

Newport (Mon.).—The working of the Electricity and Tramways undertakings during the year ended March 31st last has resulted in losses of about £1,093 and £2,327 respectively.

Turbo-Alternator Fire.—Recently a 1,500-kw. turbo-alternator at the Corporation power station was burnt out, and Mr. C. P. Sparks has since reported on the matter. Having regard to this report, the Council has decided:—(1) To invite alternative tenders for (*a*) reconstructing the present alternator, (*b*) a new alternator; (2) that the alternator should be fitted with an air filter; (3) that the alternator should be cleaned and inspected quarterly, a written report being made as to the condition of the plant; if the inspection is not satisfactory, the period of inspection should be shortened; the engineer to make personal inspection if anything of a special nature is reported; (4) that the three-phase 6,000-volt system should be worked in future, with the neutral earthed through resistance; (5) that as an additional turbo-alternator is on order, the switchgear should be modified, the generators being protected on the balanced-protective system.

Paraguay.—The electric street lighting of Asuncion is to be increased by the addition of 300 arc lamps.

Queen's Ferry.—A motion was introduced at the meeting of the Hawarden (Cheshire) District Council by Mr. R. G. Roberts that the subject of the electric lighting of Queen's Ferry be postponed indefinitely. He said that the time was not ripe for the scheme to be taken up by the Council. Mr. Millington said it was not wise to delay. They should hasten on and get a provisional order through this Session. The motion was lost.

Rochdale.—Annual Accounts.—The published returns of the electricity department for the year ended March last show a total revenue of £27,066, working expenditure amounting to £15,326, and a gross balance of £11,740. In disposing of this balance, the sum of £9,025 represents interest, loan charges, income-tax, depreciation (£1,241) &c., leaving a surplus of £2,[illegible] to be added to the appropriation account, bringing the latter up to £5,493. The rates received £2,500 and the reserve fund £110; and the department now has £7,2[illegible] placed to reserve, £4,[illegible]7 in the depreciation fund, and £2,[illegible] unappropriated. Nearly ¼ million units were generated, and 4,823,000 sold, including 575,[illegible] for lighting, 1,813,758½ (!) for power, 2,413,294 for traction, and over 20,000 units to the Littleborough area. An all-round average of 1·3d. per unit was obtained. The department is on the eve of great extensions which will increase its plant capacity from 2,476 to 5,476 kw. None of this new plant has been brought into use, but applications have been received for half its capacity. For the first time, the general supply for lighting and power is slightly in excess of that supplied for traction.

Rochester.—Street Lighting.—The T.C. has sanctioned lighting experiments in the High Street by the Kent Electric Power Co. The installation will be given a six weeks' trial to enable the Works Committee of the Council to form an opinion as to the efficiency of the proposed system and to form a basis of an estimate for the cost of the whole scheme.

Ramsbottom.—The Lighting Committee of the Corporation has had an interview with Mr. Taite, manager of the Lancashire Electric Power Co., upon the lighting of street lamps by electricity at Summerseat, and the lighting of the railless traction route. Consideration of the matters has been deferred, pending the receipt of a further report from Mr. Taite.

Rye (Sussex).—Messrs. Foote & Milnes, Ltd., have informed the T.C. that they intend applying for a prov. order for E.L.

St. Annes-on-Sea.—L.G.B. Inquiry.—An inquiry has been held by Mr. T. C. Ekin, on behalf of the L.G.B., into the application of the U.D.C. for sanction to borrow, among other amounts, £3,000 in connection with the electricity undertaking. It was stated that last year the profits were £2,298; a sum of £5,365 had been set aside for depreciation and £5,529 had been handed to the relief of the rates.

Stalybridge.—L.G.B. Inquiry.—Application by the Joint Board for sanction to borrow £22,550 for additional plant at the generating station of the Joint Board, formed the subject of a L.G.B. inquiry on July 9th. Mr. Schofield (commercial manager) gave details of the proposed expenditure, and said the additional plant was needed to enable the Board to supply the customers with electricity. Mr. Blackmore (engineer-in-chief) said the maximum demand was 5,800 kw. in 1912, and 7,300 kw. in 1913. For the first three months in 1913 the number of units sold was 5,225,729, as against 3,605,000 in the corresponding period of 1912, being an increase of nearly 40 per cent. The maximum load had gone up 500 kw. on a summer's consumption, which meant 1,200 kw. on a winter's consumption. They had reached the capacity of their generating plant with the present application. There was some opposition on behalf of the Hyde Property Owners' Association, but the Inspector (Mr. T. C. Ekin) said, on the evidence, he thought additional plant was required. It was then intimated that if the Inspector thought it was a necessity to have the money, the opposition of the Association would be withdrawn. The inquiry was closed, and the Inspector subsequently visited the works.

Swanage.—Mr. A. P. Trotter, on behalf of the B. of T., held an inquiry on July 8th relative to the proposal of the Swanage Electricity Supply Co., Ltd., to construct a generating station on a site at Court Hill. Opposition was offered by residents on the Court Park Estate. Dr. Purves, consulting engineer to the company, said there was no foundation for the suggestion that the plant would be a nuisance or annoyance to anyone. The inspector pointed out that with a well-constructed station it was hardly possible standing in the road to know whether the machinery was running or not.

Swansea.—The B. of G. has decided to have the electric light and fans installed at the Union Offices.

Taunton.—Annual Accounts.—The electricity undertaking for the year ended March 31st, shows a gross profit of £5,044, which, with other amounts included, makes altogether £5,642, which has been disposed of as follows:—Interest, £1,431; redemption of loans, £2,739; transferred to renewals, £212; transferred to capital account, £190; transferred to free wiring purchase account, £1,067. The sum of £1,067 paid out of revenue to the National Electric Construction Co. in settlement of all claims in respect of free wired installations has made it necessary to withdraw the sum of £510 from the reserve account.

Thornton (near Fleetwood).—The U.D.C. has received notice from the Bispham U.D.C. of the latter's intention to apply for a prov. order to supply electric energy to the West Ward of Thornton.

Thornley.—The Weardale Coal Co. has agreed with the P.C. to provide and maintain metal-filament instead of carbon-filament lamps at the old price of £2 per annum for each lamp.

U.S.A.—The Treasury Department has ordered that carbon and metallised carbon-filament lamps should not be used in Government buildings, and these have been replaced by 25-watt tungsten lamps.

Wallasey.—L.G.B. INQUIRY.—An inquiry has been held into an application by the T.C. for borrowing powers to the extent of £28,289, including a sum of £13,500 for purposes of the Corporation electricity undertaking. The Town Clerk explained that of the £13,500, £3,659 had been spent in anticipation of the sanction, and the remainder was in respect of prospective expenditure during the next four years. The inspector pointed out that the Board would not give sanction for more that three years, so that the Council would have to be satisfied with £7,381. This would make the total amount in respect of that application £11,040. The Town Clerk, in his statement, said an application was to be made to the Board for power to borrow the sum of £65,000 for the establishment of a new electricity station on another site than the present station.

Waterford.— ELECTRICITY SUPPLY SCHEME.— The Lighting Committee of the Corporation has decided to take steps to promote a municipal electric lighting scheme. Arrangements are to be made for procuring the prov. order, and the services of an expert are to be obtained.

Watford.—The U.D.C. has sealed an agreement with the Northwood E.L. and Power Co., Ltd., for a bulk supply of current to Northwood.

Whitstable.—Mr. G. Stainton has informed the U.D.C. that he intends to apply for a prov. order for electric lighting.

Westgate-on-Sea.—Owing to concessions made by the Westgate Gas Co., the Isle of Thanet R.D.C. has withdrawn its opposition to the company's application for electric light powers for Westgate and Birchington.

Walsall.—It has been decided by the T.C. that the price of current supplied to the Corporation tramways be as from January 1st, 1913, 1·68d. per unit, which would represent an increased annual payment by the Tramways Committee of over £1,500. The E.L. Committee reports that it cannot comply with a memorial from the Tradesmen's Association to alter the price of electricity for lighting purposes at present. The Committee declines to entertain a suggestion made to negotiate for the sale of the undertaking to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Winchester.—L.G.B. INQUIRY.—On Monday a L.G.B. inquiry was held into the application of the T.C. for a loan of £1,800 for extensions to the generating station. There was no opposition.

Warminster.—The U.D.C. has received notification of the intention of Mr. J. H. Edwards, of Bristol, to apply for a prov. order for electric light.

TRAMWAY and RAILWAY NOTES.

Argentina.—La Sociedad Empreza de Luz y Fuerza Buenos Ayres y Mendoza has recently considerably extended the plant at its hydro-electric generating station. It has also recently completed and put in operation 10 miles of electric tramways in the town of Mendoza.

Bournemouth.—In connection with the scheme for the reconstruction of the tramways from the cemetery to Winton and King's Road, the T.C. has decided to apply to the B. of T. for sanction to substitute double lines in place of the existing single line and loops, and also for permission to obtain a loan for the difference in cost between relaying the original line and the proposed double line. The general manager has been instructed to prepare the specification and obtain tenders for the work.

Bradford.—Though no official intimation was made, it is generally understood that, at its meeting last week, the Tramways Committee decided to grant the application which has been made by the Amalgamated Society of Tramway and Vehicle Workers for advances in wages of Bradford tramway employés. These advances are not to interfere with the general revision, which is due early in the next municipal year.

Chile.—The *Diario Oficial* publishes a decree under which an electric tramway service is to be provided in the town of Talca, in conformity with the plans and specifications as approved. Work must be completed before May 23rd, 1914.—*Board of Trade Journal.*

Ealing.—L.U.T. LEASE.—The B.C., at its meeting last week, again considered the proposal to extend the London United Electric Tramway Co.'s lease for a further period of 14 years. A deputation of ratepayers was received, which urged that the company's proposals were to be viewed with grave suspicion. If extension of the lease was inevitable, the deputation submitted that one of the conditions of the lease should be the provision of halfpenny fares. After the deputation had retired, a number of recommendations were submitted by the Tramways Special Committee, the most important being that halfpenny fares should not be sought for; that the annual amount to be paid by the company for the right of way be increased to £750 during the first seven years of the extended lease and to £1,000 from the expiration of the seventh year until the purchase of the undertaking by the local authority; and that the whole of the tramway rails and wood paving, for which the company is now responsible, be relaid by the company. It was stated that the question of removing all or some of the centre standards had been adjourned, and in the circumstances, further consideration of the above matters was deferred until such time as the Committee is ready with a final report.

Edinburgh.—Several proposals for tramway extension were before the Tramway Committee last week. The Committee was asked to consider the advisability of promoting a provisional order at the earliest opportunity for the extension of the tramways to Redford. Another proposal was to consider and report as to the expediency of making extensions beyond the city boundaries, and it was also proposed to seek powers for an extension to Corstorphine. The proposals were sent to a sub-Committee for consideration.

The Committee also discussed matters relating to the Colinton tramways and a sub-Committee was appointed to consider what steps should be taken.

Ilford.—The Seven Kings Ward Association has written the Council, enclosing a copy of a resolution passed by the Association, which expresses the opinion that if a universal halfpenny fare were introduced throughout the Ilford tramway system, it would be the best remedy for motor-omnibus competition. The matter is under consideration. Tenders are being invited for different types of motor tower wagons.

London.—CAMBERWELL.—The L.C.C. has lodged an objection against the assessment of its tramways, which the B.C. had included in the provisional list at a reduction of £1. The B.C. considers the case presented by the County Council as very serious, and a revaluation of the lines is to be made.

Mexboro' and Swinton (Yorks.).—The Sheffield and South Yorkshire Navigation Co. and the West Riding County Council have lodged petitions against the Mexbro' and Swinton Tramways (Railless) Bill. The Highways Committee of the County Council has expressed the opinion that the clauses relative to widenings and maintenance of main roads are highly objectionable from the Council's point of view, it being an unwarrantable innovation to require the road authority to bear the greater part of the cost of widening and adapting roads to the peculiar needs of such a commercial undertaking.

Morecambe.—Unable to, as yet, persuade the Corporation of the advantages to be gained by changing its ancient horse tramway system into an electrified one, the section of the community which is maintaining an unceasing agitation in the hope of lifting the town out of its antiquity in this respect, has now turned its attention to the Tilling-Stevens petrol-electric tramcar as a solution of the question. It is pointed out that this type of car is on trial by the L.C.C. and is easily adaptable to existing horse cars.

Oxford.—THE TRAMWAY QUESTION.—The T.C. on July 9th adopted the system of tramways and 'buses proposed for the city, as outlined in a recent issue of the ELECTRICAL REVIEW, and which will be carried out by the National Electric Construction Co., Ltd.

Ramsbottom.—In the matter of the installation of railless trolley cars, there has been considerable delay, but the Council has now secured a promise that at any rate two cars will be delivered before the end of August.

Reading.—The T.C. has referred to the whole of the members of the Corporation, as a Committee, a scheme for the provision of railless cars for the borough at an estimated cost of £23,839.

Rotherham.—The R.D.C. has appointed a deputation to confer with the Rotherham Corporation as to the running of motor-omnibuses to Dinnington.

Teddington.—As it is considered that the existing through service and through fares should not be upset, the District Council is, at the instigation of the Middlesex District Councils' Association, supporting the action of the House of Commons Committee in inserting a clause giving running powers to the L.U.T. Co. over the lines which the L.C.C. is about to acquire in the Hammersmith and Shepherd's Bush area.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—Last year a wireless station was established on the Island of St. Caterina, in the State of that name in Brazil, near the city of Florianopolis, by the Berlin firm of C. Lorentz Aktiengesellschaft, for the Government, and was equipped on the alternating-current "Vielton" system. It was intended to provide communication with the shipping to Buenos Ayres, La Plata and Cape Horn, and with neighbouring land stations. The power in the antenna is 2 KW., the sender having waves of 1,400, 1,700 and 2,800 metres length. Ranges of between 600 and 700 miles have been attained, reciprocal communication having been established with the São Thomé station at Rio de Janeiro. The station differs essentially from other wireless stations in the use of the Vielton system. While other stations can only make use of one tone, and only in exceptional cases resort to a more complicated arrangement to secure two or three tones, the St. Caterina station, by a special disposition of the "Vielton" system, can make use of eight different tones in close succession. The apparatus which effects the tone variation is like a piano keyboard, the tones being produced by the pressure of the different keys. The command of a

number of tones is of great importance in South America, owing to the frequent atmospheric disturbances there prevalent, as the choice of a suitable tone, or the avoidance of the change of a tone during the transmitting of a message, can be more easily effected than with the ordinary stations having command only of a single tone. The plant consists of two 18-H.P. oil motors and two A.C. generators, one set being held in reserve. At a distance of about 100 metres are erected two wooden masts, over 50 metres high, which, with ten smaller masts, carry the net-like antennæ.—*Telegraphen und Fernsprech-Technik.*

Barnsley.—The Corporation Electricity Committee has given its engineer, Mr. Barker, permission to fix, at his own cost, a wireless telegraph antenna to the chimney stack at the electricity works.

Cable Cession.—The Black Sea Telegraph Co. has transferred its cable between Constantinople and Odessa to the Eastern and Indo-European Telegraph Companies, which will work it in common.—*Journal Télégraphique.*

Colonial Wireless Stations.—On Wednesday last week Mr. Harcourt stated that a low-power 5-KW. wireless station was being erected in the Bahamas, and contracts were being entered into for the erection of similar stations at Barbados, Mombasa, Singapore, Penang and Hong-Kong.

German Colonies.—It is expected that a wireless connection between Germany and her Colonies will be established in the near future. According to an arrangement made with the Imperial Colonial Office, the Telefunken Co. has dispatched an expedition to Togoland, which is already in the interior of the Colony and which is making experiments to communicate by wireless with the Nauen station, near Berlin. The trials have been so far successful that long messages have been received in Nauen from the expedition, whilst efforts to transmit telegrams to the expedition are being continued. Experiments are also being made to place Togoland in wireless communication with German South-West Africa and the Cameroons. As it is desired to bring these schemes to a successful issue as soon as possible, the trials made early this year between Nauen and Sayville, Long Island, U.S.A., have been temporarily suspended, although they will be resumed on the completion of the connections with the before-mentioned Colonies. In the case of Samoa, the Telefunken Co. has acquired a site at Tajaigata, which is not far distant from the Samoan capital of Apia, for the erection of a station which is to have a range of 1,860 miles, and the work is to be commenced immediately. At the same time, stations are to be established at Rabaul, the capital of German New Guinea, and on the German island of Nauru, and all these stations will be placed in intercommunication.

Stonehaven.—It is stated that negotiations are proceeding for the erection of a wireless telegraph station near Stonehaven.

Trans-Atlantic Wireless Telegraphy.—Mr. Marconi, whilst in the United States last month, stated that all the European business intended for the United States would come through the Belmar, N.J., station when the plant was completed. The distance from the Belmar station to that at Carnarvon, Wales, is 3,000 miles. The Glace Bay, N.S., station would be reserved for Canadian and Pacific wireless business. A speed of 60 words per minute would be attained between Carnarvon and Belmar.—*T. and T. Age.*

The Telephone System.—On Thursday last week, the Postmaster-General stated in the House of Commons that the total cost of the Post Office telephone exchange system, including private lines and land and buildings, on December 31st, 1912, was £7,992,078. The purchase price of the National Telephone Co.'s system was £12,470,264, that sum representing its depreciated value; the original capital expenditure might be placed at about £16,000,000.

The Imperial Wireless System.—Answering questions in the House of Commons last week, Mr. Samuel said that the Imperial system could not be thrown open to public tender because financial guarantees were useless; certainty was essential, and the only system that could be said with certainty to be capable of fulfilling the requirements of the Imperial chain, as stated by the Scientific Advisory Committee, was the Marconi system, which alone had demonstrated its capabilities under actual test. He had asked the representatives of the Goldschmidt system to arrange for an official demonstration, but so far his request had not been acceded to. His expert advisers had not recommended a change of plans on account of the reported success of the Goldschmidt system.

In reply to further questions, Mr. Samuel stated that if proof were forthcoming in the course of the next few months that the Goldschmidt system could fulfil the required conditions, he would be pleased to consider its employment for the second three Imperial stations. Nothing could be done before the rising of Parliament. The Canadian agreement with the Poulsen Co. was of a wholly different character to the Imperial contract; the stations would be the property of the company, and would be worked by the latter at its own risk and for its own profit. No firm but the Marconi Co. possessed the necessary staff and equipment to carry out the scheme, without very considerable delay.

On Thursday the refusal of the P.M.G. to consider other tenders was debated in the House of Commons at considerable length.

Writing to the *Times*, Prof. J. Milne enters a strong protest against the granting of a monopoly to any firm, in view of the rapid development of wireless telegraphy, and the probability of fundamental changes in the near future. A "Member of Parliament," in reply, points out that nothing in the nature of a monopoly is to be conferred on the Marconi Co.; the stations, when built, become the property of the Government, which can adopt any system it pleases, and will not have to pay royalty unless the unexpired Marconi patents are used in them. It would be useless to await finality, and the provision of wireless communication is an urgent necessity on strategic grounds.

Wireless Litigation.—The case of the Marconi Co. against the National Electric Signalling Co., of Pittsburg, Pa., on Marconi patent reissue No. 11,913, the patent of Sir Oliver Lodge, No. 11,914, being also included, is being heard before Judge Veeder in the United States Court in Brooklyn. The case was delayed, awaiting the arrival of Mr. Marconi, who was detained by the Parliamentary inquiry into the matter of the distribution of Marconi stock to officials in Great Britain. The point involved is the tuning of various elementary parts of the wireless circuit at both the transmitting and receiving stations so as to secure the maximum effect from any given series of impulses. It is understood that immediately following this effort, other patents owned and controlled by the Marconi Co. will be put at issue.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Alford (Lincs.).—July 28th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

Australia.—VICTORIA.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

August 19th. 105 miles paper-insulated, lead-covered cable. See "Official Notices" to-day.

September 9th.—Common-battery multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 19th. Switchgear and accessories for an electric power station at Perth. See "Official Notices," June 27th.

SOUTH AUSTRALIA.—August 13th.—Common-battery switchboards and telephone parts for Adelaide. See "Official Notices," July 4th.

NEW SOUTH WALES.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

August 27th. Telephones, switchboards and incandescent lamps, for the P.M.G. See "Official Notices" to-day.

ADELAIDE.—August 19th. Steel poles for the Municipal Tramway Trust. No date.—Copper cable and wire.

Belfast.—July 21st. One 3,500-ampere traction switchboard panel, for the Corporation. See "Official Notices" July 4th.

Blackburn.—August 2nd. Steam coal for the Electricity Committee, for 12 months ending August 31st, 1914. Mr. P. P. Wheelwright, engineer and manager.

Blackhill (Co. Durham).—July 19th. Electric light equipment, Richard Murray Hospital (dynamo, battery, switchboard, and about 200 lights); Mr. Ernest Caldwell, secretary of the hospital (returnable deposit of £1).

Bosnia.—The municipal authorities of Doboj, North Bosnia, have just invited tenders for the establishment of a central electric lighting station in the town.

Bristol.—July 24th. Unwashed small coal for six or 12 months for the Corporation electricity works, Avonbank. Mr. H. F. Proctor, engineer and general manager (returnable deposit of £2 2s.).

Chile.—September 13th. (1) An electric generating plant with distributing system; (2) an electric lighting installation—both for the harbour of Valparaiso. Tenders to "Al Sr. Secretario de la Comision, Comision de Puertos, Calle Santo Domingo No. 1,147," Santiago de Chile, where the specifications, &c., may be consulted.

Eccles.—July 21st. Mechanical stokers for four Lancashire boilers at the electricity works, Cawdor Street, Patricroft. Borough Electrical Engineer.

Germany.—July 30th. The Prussian State Railway authorities at Munster, Westphalia, are inviting tenders for four 5-ton electrically-operated travelling cranes.

Hull.—July 25th. Machinery oils for the Corporation electricity works. Mr. H. Bell, electrical engineer, Sculcoates Lane.

Italy.—July 24th. The municipal authorities of Alcaneo (Trapani) are inviting tenders for the concession for the public and private electric lighting of the town during a period of 15 years.

London.—Hackney.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" June 20th.

H.M. Office of Works.—July 18th. Supply of electric cable and wire during one year from September 1st, 1913. See "Official Notices" July 4th.

L.C.C.—July 22nd. Switchgear for tramway sub-stations. See "Official Notices" July 11th.

July 23rd. Electrical installation (235 points) at Tollit Street School, Mile End, E. See "Official Notices" July 11th.

Rotherhithe.—July 31st. Electric light re-wiring and other work at the Infirmary, Lower Road, Rotherhithe, S.E., to the specification of Mr. A. H. Newman, F.R.I.B.A. Forms of tender, &c. (£5 note deposit) from Town Clerk, 283, Tooley Street, London, S.E.

Middleton.—July 28th. Lighting switchboard and renewals to traction switchboard for the Corporation. See "Official Notices" to-day.

Newport (Mon.).—July 19th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" July 4th.

Re-winding 1,500-kw. three-phase alternator. Mr. A. N. Moore, electrical engineer, Town Hall.

New Zealand.—September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of energy from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Norwich.—August 12th. One 3,000-kw. turbo-alternator and surface condensing plant; rotary converters; E.H.T. switchgear for the Electricity Committee. See "Official Notices" to-day.

Sherburn (Co. Durham).—Extension of electric lighting system along Park Road and Littletown Road for the P.C. Clerk to the Council, 112, Anderson's Terrace, Leamside, Fence Houses.

Shipley.—July 22nd. Two 1,000-kw. steam turbines, two 1,000-kw. alternators, two surface condensers, and one controlling switchboard, for the U.D.C. See "Official Notices" July 11th.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Bloemfontein.—August 21st. Tenders are called for supply and equipment of electric tramways (railless) within the city. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C., on and after July 19th. Tenders to the Town Clerk, Town Hall, Bloemfontein (or by noon, August 1st, to Messrs. Davis & Soper).

Swindon.—July 26th. Steam coal for the electricity works of the Corporation. See "Official Notices" July 11th.

Todmorden.—July 26th. 300-kw. converting plant, H.T. switchboard and cables, mechanical stokers and superheaters, for the B.C. See "Official Notices" July 11th.

Warrington.—August 6th. (1) E.H.T. feeder panel; (2) earthenware conduit for one year, for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Bettws-y-Coed.—The tender of Mr. Osborne Yale (£60) for installing electric light at Bryn Mawr Chapel has been accepted.

Cheltenham.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Cannop coal for the electricity works, at 12s. 11d. per ton.

Croydon.—The T.C. has accepted the tender of Le Grand & Sutcliffe, of London, for a deep-well pump for the electricity works, at £435.

Elland.—The U.D.C. received tenders from the following firms for the supply of 20 street-lighting lanterns:—

Hinchliffe Green Manufacturing Co.
British Thomson-Houston Co. (Accepted.)
Wardle Engineering Co.
British Westinghouse Co.
Harry Moss.
Drake & Gorham.
The Electrical Co.
Reason Manufacturing Co.
Veritys, Ltd.
General Electric Co.
Electrical Engineering and Equipment Co.
British Economical Lamp Co.

Heston and Isleworth.—The following tenders have been received by the Education Committee for installing electric light at the Hounslow Heath Schools:—

		£	s.	d.
S. N. Virgo	(accepted)	72	0	0
Harris & Gubbins		81	5	0
H. Beard & Co.		82	3	6
R. Langston, Jones & Co.		84	0	0
J. McDonald		85	0	0
Grant & Taylor		118	7	6

Harwich.—The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for the installation of electric fire alarms, at £231.

Lamp Contracts.—The Brimsdown Lamp Works, Ltd., have received the Brighton Corporation and Bridlington Corporation's annual contracts for supplying "Brimsdown-Wirum" metallic-filament lamps for street lighting, &c. Other annual contracts received during the past few weeks are for the Great Eastern Railway, Midland Railway, Colchester Corporation, Tunbridge Wells Corporation, and Bray U.D.C.

Leyton.—Mr. J. T. Halsey having intimated to the Urban Council that, in his tender of £376 for the electric lighting of Church Road School, he omitted to make allowances for contingencies or profit, and that the correct figure should have been 10 per cent. higher, or £414, the Council has accepted the next higher tender, namely, that of Messrs. Ryan & Son, of Leytonstone, at £425.

London.—Bermondsey.—The tender of the British Insulated and Helsby Cables, Ltd., has been accepted by the B.C. for supplying two eight-way feeder pillars, at £45 6s. each; one 10-way feeder pillar, at £52 1s.; and one 12-way feeder pillar, at £57 13s.

Hornsey.—Messrs. Herbert Clarke, Ltd., have successfully tendered to the B.C. for the supply of 1,000 tons of wharf slack coal to the electricity department, at 13s. 5d. per ton; and Messrs. Charrington, Sells, Dale & Co. for 1,000 tons of large steam coal, at 15s. 10d. per ton.

Malay States.—Messrs. Hick-Diesel Oil Engines, Ltd., have received an order for one 320-B.H.P. Hick-Diesel oil engine for driving a generator at the Lahat Mines, Ipoh.

Newport (Mon.).—The tender of the General Electric Co., Ltd., has been accepted by the T.C. for rewinding the turbo-alternator. The tenders of Bertram Thomas have also been accepted, at £213 and £56, for extra high-tension and low-tension switchgear, with British Thomson-Houston switches; as well as the tender of Walter Scott, Ltd., for 100 tons of tramway rails, at £7 15s. per ton.

Ramsbottom.—The Traction Committee has recommended the Council to accept the tender of the Lancashire Electric Power Co. for a switchboard at the depôt in Stubbins Lane.

Rhyl.—The Council has accepted the tender of Messrs. Foote & Milne for a new overhead cable for lighting the marine lake pleasure grounds.

Southampton.—The T.C. received the following tenders for wiring the School Clinic:—

		£	s.	d.
A. T. Wells & Co.	(accepted)	29	9	0
W. Dibben & Sons		29	10	0
A. Kingman & Co.		36	0	0
I. Groves & Co.		45	0	0
F. W. Cook & Co.		49	17	6
H. M. Ashton, Ltd.		69	0	0

Swansea.—The T.C. has accepted the tender of Messrs. Furneaux & Thomas, at £775, for electrically lighting the Training College. Other tenders were received from Collings Bishop, Ltd.; Thomas & Evans; Ellis & Ward; A. Paxton & Co.; Blackburn, Starling & Co.; H. J. Cash & Co.; Troup, Curtis & Co.; W. C. Tackley & Co.; Saville & Walton; Oliver Bros.; R. Alger and Sons.

Walsall.—The Corporation Electricity Committee has accepted the following tenders:—

Harris Patent Feed-Water Filter (1910), Ltd.—A water softener, for £345.
Norman, Ltd.—New steel and iron building for the additional boiler house, for £3,974.

Watford.—The U.D.C. has sealed the following contracts:—

Union Electric Co.—Motor-generator.
W. T. Henley's Co., Ltd.—Cables.
Electric Construction Co.—Switchgear.

West Bromwich.—The Electricity Committee of the T.C. has accepted the tender of the Vulcan Soot Cleaner Co., Ltd., for a patent boiler cleaner, at £81.

West Ham.—The T.C. has accepted the tender of Messrs. J. Baker & Co. (Rotherham), Ltd., for a supply of 32-in. steel tires to the tramways department.

Winchester.—The T.C. has accepted the tender of Mr. R. G. Gifford for about 1,000 tons of Norton Hill slack coal for the electricity works; and that of Bradbury, Son & Co., Ltd., for about 750 tons of Camerton slack coal.

Wolverhampton.—The Corporation Electricity Committee has accepted the tender of Messrs. Hayward & Sons, at £87, for the necessary steelwork for an ash hopper.

Willesden.—The U.D.C. has accepted the tender of Mr. J. McManus for the erection of a sub-station in Acton Lane, Harlesden, at £2,037. From eleven tenders for a motor lorry for the Electricity Department, the lowest, that of the Hillman Motor Car Co., Ltd has been accepted

FORTHCOMING EVENTS.

Commercial Vehicles Exhibition.—Friday, July 18th. At 11.30 a.m. At Olympia. Opening by Prince Arthur of Connaught.
Imperial Motor Transport Conference.—Friday, July 18th to 25th. At Olympia, London.

NOTES.

National Telephone Co.: Distribution of Assets.—Since the closing of our legal proceedings on page 95, the Court has given its decision in this case, under which the whole of the remaining assets, amounting to approximately £1,131,250 will be divisible among the deferred stockholders only. Mr. G. Franklin, the liquidator, announces that, pending the result of a possible appeal, he has been authorised to make an early distribution to the deferred stockholders of approximately £820,000. This will mean a payment to them of 4s. 4d. in the £. They have already received payment at the rate of 15s. in the £.

Half-Watt Lamps.—It appears that the half-watt per candle lamps, referred to in our last issue as about to be placed on the German market, do not concern the ordinary classes of lamps of from 10 to 100 C.P. The lamps in question are of high candle-power, about 1,000 C.P. and over, and are therefore intended as competitors of arc lamps.

Appointments Vacant.—Charge engineer for the Erith U.D.C. electricity department (40s.); assistant electrical engineer for the Great Indian Peninsula Railway Co. for the power houses at their Parel and Matunga workshops, Bombay; switchman for Corporation Road power station, Newport, Mon. (25s.); electrician-Attendant for the County Asylum, Rainhill, nr. Liverpool (£50+). See our "Official Notices" to-day.

I.M.E.A.—An adjourned meeting of the Association was held on Friday last at the I.E.E., at which the new articles of association, discussed on June 20th, were adopted. The principal object of the meeting, which was numerously attended, was to further consider and discuss the proposed model general conditions of contract, which matter was discussed *in camera* during the recent convention.

The president, Mr. Chattock, suggested that the proposed clauses should be discussed *seriatim*. Alderman Bruce, Sunderland, noticing that the Press were present—an invitation having been issued to them by the hon. secretary, Mr. Faraday Proctor—moved that the meeting be held *in camera*, as on the previous occasion.

Mr. Faraday Proctor explained why the Press should be allowed to be present, pointing out that the hon. solicitor's advice had been taken on the matter, and Mr. J. E. Edgcome, the late president, supported the proposal. Various speakers argued against this, including Messrs. Tapper (Stepney), Roles (Bradford), and Dykes (Messrs. Handcock & Dykes), and on a show of hands it was decided, despite the official invitation to the Press, that the meeting should be held in private.

Annual Outings and Sports.—The staff of the London United Electric Tramways held their annual sports at Griffin Park, Brentford, on Wednesday last week, under the presidency of Mr. W. M. Acworth, chairman of the company. The function, which was capitally organised, attracted over 2,000 spectators, who enjoyed over five hours' continuous sport, the finishes in many of the events being exceedingly close. Perhaps the greatest interest was displayed in the tug-of-war tests, which are a feature of the meeting. In the tug-of-war open to tramway teams of the United Kingdom, for the "Lady Clifton Robinson" Challenge Cup, London United (Hanwell) in the first round beat City of Hull Tramways by 2 pulls to 1; London United (Fulwell), matched against Bournemouth Tramways, beat the visitors by 2 to 0; and in the final, Hanwell outmatched Fulwell by 2-0. The same depôts competed with similar success for the "Clifton Robinson" Challenge Shield. Another interesting event was the 3 miles scratch race for the "Acworth" Challenge Cup, which was won by H. E. Palmer, L.G.O.C.; B. E. Tayett, District Railway A.A., being placed second, W. Hawkins, London Electric Railway A.A., 3rd, and G. H. Grice, London Electric Railway A.A., 4th.

Mrs. Devonshire, introduced by the chairman of the company (who expressed his regret at the absence of Mr. J. Devonshire, managing director), distributed the prizes, and was thanked by Mr. J. B. Mackinnon, chairman of the Committee, for her presence, and presented with a charming bouquet by Miss Purvis. Amongst others present were Messrs. R. Smith (vice-chairman), A. H. Pott and A. F. Andrews, who ably discharged the duties of hon. secretary. The fine band of the Metropolitan Electric Tramways played selections during the afternoon, and the proceedings wound up with dancing on the lawn.

The annual outing of the White Electrical Instrument Co. took place on Saturday last, and a most enjoyable day was spent at Burnham-on-Crouch. The weather proving propitious, a delightful country walk in the morning was followed by yachting in the afternoon. Dinner was served at the White Hart Hotel, and the customary speeches followed.

The annual staff picnic of the St. Helen's Cable and Rubber Co., Ltd., took place on the 12th inst., a party of over sixty joining in a motor char-à-banc ride from Warrington through Delamere Forest to Chester. Dinner was served at the Hop Pole Hotel, and a trip up the Dee in boats (with a motor launch for the lazier ones) followed. Tea was served in *al fresco* fashion on the banks, and after visiting Eccleston Ferry, and participating in impromptu donkey races, the party made the return by water and road. Mr. C. Ford was in charge of the arrangements, which were admirably carried out, and the picnic tea itself was superintended by Mr. S. H. Lee, whose fertile mind, we are informed, adapted itself to the problems of making bricks without straw that occasionally occur on picnics.

The Kelvin Window in Westminster Abbey.—The memorial window to Lord Kelvin, which, as already stated, has been subscribed for by British and American engineers, and of which we gave some particulars last week, was dedicated on Tuesday afternoon by the Dean of Westminster in the presence of a very large and representative gathering of engineers and scientists of eminence. These included presidents and others from all the well-known engineering institutions (Mr. Duddell representing the I.E.E.), as well as Sir J. Larmor, Sir W. Crookes, Sir J. A. Ewing, Dr. J. T. Bottomley, Sir Douglas Fox, Mr. Alex. Siemens, Sir Henry Mance, Prof. G. Carey Foster, Prof. S. P. Thompson, &c. Before proceeding with the dedicatory service an address was delivered by the Dean relating to some of the outstanding features of Kelvin's career and character.

Inquiries.—A correspondent wants particulars and prices of automatic and semi-automatic coil-winding machines for large and small wires, suitable for winding all kinds of field coils and solenoids. An electric type-metal melting apparatus is inquired for.

Bedford Strike Ended.—It is reported that the strike at the works of Messrs. W. H. Allen, Son & Co., at Bedford, came to an end on 14th inst., when about 1,000 men returned to work. It is stated that the A.S.E. advised the men to return without the three men who had been dismissed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. O. BUCKINGHAM, A.M.I.E.E., recently representing Messrs. Siemens Bros. Dynamo Works, in London, left yesterday for the Argentine. Mr. Buckingham will represent Messrs. McCarter & Kerr-Bock, consulting engineers, on the important engineering works being carried out by the Hidro-Electrica de Tucuman.

In the annual report of the working of the Wolverhampton Corporation electric light undertaking the Committee express their high appreciation of the very valuable services rendered by MR. SHAWFIELD during the past 17 years. The present efficient state of the undertaking affords in itself the best evidence of his able and successful management. Mr. Shawfield carries with him the best wishes of the Committee in his new sphere of labour. The present engineer, MR. ALLEN, has made, adds the Committee, an excellent start, and they feel confident he will make a worthy successor of Mr. Shawfield.

The appointment of MR. W. A. JOYNSON, referred to in our last issue, is that of foreman fitter (not mechanical engineer) at the St. Helen's electricity works.

MR. L. E. COMLEY has resigned his post on the staff of the Devonport Corporation Electricity Works, in order to take up the post of publicity engineer to the Torquay Corporation electricity works.

MR. L. C. HOPKINS, assistant mains superintendent of the Swansea undertaking, is to be granted an honorarium of £5 for extra work performed by him in connection with the duties of mains superintendent prior to the appointment of Mr. J. B. Sparks to that position.

The Willesden U.D.C. has decided to advance the salary of the chief electrical engineer, MR. A. W. BLAKE, by £100, in increments of £50 now, and £50 on April 1st, 1914.

General.—A dinner and smoking concert was held on Friday, July 4th, at the Queen's Hotel, Cardiff, to bid farewell to MR. A. E. GRANT, late manager of the Cardiff office of the British Insulated and Helsby Cables, Ltd., who was leaving the district to take up the managership of the Canadian British Insulated Co., Ltd. The chair was taken by Mr. Morley New, deputy electrical engineer of Cardiff. In proposing the toast of "Our Guest," Mr. New commented upon the good spirit which prompted so many of Mr. Grant's competitors to be present, and of the able way in which he had handled the business of the district, making for himself many private as well as business friends. Mr. New then presented to Mr. Grant, on behalf of many friends, a leather suit case, a bowl case, and a gold bangle watch for Mrs. Grant. The toast was seconded by Mr. Dalley. Mr. Grant's late position in Cardiff is being filled by MR. F. WYNDHAM LEWIS, who has for some years acted as his assistant.

Hearty congratulations to the Lord Mayor of Liverpool upon the honour conferred upon him by the King on the occasion of His Majesty's visit to Liverpool last week. SIR J. S. HARMOOD BANNER, M.P., is a director of the British Insulated and Helsby Cables, Ltd., the Midland Electric Corporation for Power Distribution, Ltd., the Automatic Telephone Manufacturing Co., and a number of other electrical companies.

The *Mining Engineering Review*, Melbourne, says that MR. HAROLD W. SMITH has been appointed engineer in charge of electrical work under the Home Affairs Department.

MR. W. E. HART, who has just been elected town clerk of Sheffield, had been for the past six years solicitor to the National Telephone Co.

Mr. Stanley L. B. Lines, managing director of the Chamberlain and Hookham Meter Co., Ltd., Canada, is due to arrive in England this week on his annual visit to headquarters.

Mr. A. M. Simpson is proceeding to Pelotas, Rio Grande do Sul, South America, as resident engineer on the electrical undertaking, on behalf of Messrs. Kincaid, Waller, Manville & Dawson, consulting engineers, of Westminster, having severed his connection with the Brush Co., with which firm he has been connected for the past seven years as their agent and engineer in India.

Mr. E. Goolding, who has been for the last seven years in the electrical department of the L.C.C. Tramways, has rejoined the British Thomson-Houston Co. and is sailing on 24th inst. for the Argentine in connection with railway-electrification work. Mr. E. Goolding was with the B.T.H. Co. during the N. E. Railway Co.'s electrification scheme, and previous to that he was in the Electrical Department of G. N. Railway Co. (1).

On the occasion of his marriage at Melbourne (Derbyshire) on July 8th to Miss Alice Gregory, Mr. Maurice Edward Fox was presented with a silver entrée dish by his colleagues and the employés at the Edison Accumulator Works, London, and with a silver epergne by the firm of Thos. A. Edison, Ltd.

The *Evening Standard* understands that although the report of Sir Alexander King's coming retirement is unauthorised, it is substantially correct, and that he will vacate his post of Secretary to the Post Office very soon. On inquiry at the Post Office our contemporary was informed that Sir Alexander's retirement had been pending for some time. Sir Alexander became Secretary to the Post Office in 1911, having previously served as assistant secretary from 1903 to 1905. The post carries with it a salary of £1,750.

Sir Henry Norman has gone to Vienna on behalf of the Wireless Committee, of which he is chairman.

Obituary.—We regret to read in the *Times* "Deaths" columns that Mr. William Francis Melhuish, late Deputy Director-General of Telegraphs, India, passed away at Folkestone on July 5th at the age of 71 years.

Mr. R. Hind.—The death occurred on Monday of Ald. Richard Hind, J.P., a leading resident of Stockton-on-Tees, and who had for many years been the principal of the firm of Hind & Son, electrical engineers, Little Brown Street. The deceased was in his 75th year. He was the eldest son of the late Mr. John Hind, founder of the business, in which he served his apprenticeship, and to which he succeeded on his father's retirement. He was a leading public man, having participated in local government work for 38 years.

CITY NOTES.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on Thursday last week at Salisbury House, London Wall, E.C.

Mr. P. D. Tuckett, who presided, in proposing the adoption of the report (see Electrical Review, page 26), said he hoped to be able to satisfy the shareholders that substantial progress had been made during the past year. Dealing with the profit and loss account—that of dividends and interest received and accrued was sub-divided under three heads. The first item, that of dividends and interest from investments in, and advances to, subsidiary and other companies, showed the comparatively large increase of £4,704, an increase which was all the more gratifying in view of the dislocation of business and the heavy expense directly and indirectly resulting from last year's coal strike. Their coal bill alone increased by over £8,000, compared to what it would have been had prices remained the same as in the previous year, and in a good many instances, and for some considerable time, this increase in price was accompanied by a deterioration in quality. In face of this heavy burden, he thought they would agree that the increased profit of £12,414, which enabled the subsidiary companies to make them an increased distribution of £4,704, was eminently satisfactory. The second and third sub-divisions, viz., dividends and interest from investments in British, Colonial and railway stocks, and from temporary loans, &c., showed a reduction of £1,216, owing to the realisation of the investments and the reduction of the loans in connection with the redemption of the prior lien debenture stock, the interest on that stock being more than correspondingly reduced from £2,870 to £775. The gross trading profit had decreased by £2,816, from £11,678 to £8,861, but inasmuch as this decrease was entirely attributable to the smaller capital expenditure of the subsidiary companies—the profits of the private lighting department having increased—and as, moreover, this trading profit was one which they at present regarded as only to a small extent available for distribution, it was not a feature which caused them any concern. The loss on working the local authority and other undertakings was reduced by £2,029, a decrease which was all the more satisfactory in that it followed on a decrease of £1,080 in the previous year. The past year's improved results were, however, only partly accounted for by the increased working profit of these undertakings. To the extent of £750 they were due to their acquisition of the Frome undertaking and the consequent change in the form of the accounts. Administration expenses were £1,145 up, owing principally to the increase in the directors' fees in accordance with the resolution passed in June last year, the increase in the other items being due to the Insurance Act payments and to the normal growth of the business. There was a reduction of £2,095 in the prior lien debenture stock interest consequent on the redemption of that stock, and in future the item would no longer appear. Interest on the first mortgage debenture stock was less by £86, the redemption provision being correspondingly increased. The premium and expenses on redemption of the prior lien debenture stock, £1,206, was an entirely special item, which might perhaps have been more appropriately charged direct to reserve, but as they were proposing to carry a larger amount to reserve, its allocation was a matter of no real moment. The net result of the year's business was that they showed a net balance of £18,900 compared with £16,114 a year ago, an increase of £2,785; or, disregarding the special item of £1,206, to which he had just referred, and the drop of £2,816 in the gross trading profit, which for the reasons he had mentioned was of no real importance, an increase of £6,807. Having regard to the difficulties with which they had had to contend and to the fact that the only direct benefit they now derived from the increased profits of the Urban Company was in the form of a comparatively small amount of additional interest on further advances made to them, he thought they might consider this result quite satisfactory. During the past year the additional interest derived from the Urban Company amounted to £1,357 out of a total increased profit of £6,616, the whole of which would have been reflected in their accounts prior to the expiry of the guarantee two years ago. Fortunately, active trade and a miserable summer enabled them more than to counteract the adverse influences with which they had to contend, but it was only by the most unremitting attention that these improved results had been attained. Of the balance of £18,900, the dividend on the cumulative preference shares absorbed £12,000, leaving £6,900 which they proposed to carry to reserve. They believed the company to be now fairly launched on a course of steadily increasing prosperity, but it still behoved them to proceed with the utmost caution if they were to avoid any untoward setbacks. What they all desired and aimed at was to restore to the non-cumulative preference shares their cumulative rights at the earliest possible moment, and the quickest and surest method of attaining that end was to proceed slowly and avoid any risk of straining their resources. In the balance-sheet, the share capital was now shown in its reorganised form, with the ordinary reduced and the preference split into cumulative and non-cumulative, whilst on the other side the assets had been written down by £366,838, the item of goodwill, which stood at £25,000 in the last balance-sheet, having been entirely eliminated, not because they considered the goodwill of the business to be valueless, but because they felt it was much better to get rid of an intangible item of this kind whilst they were dealing with the situation. Proceeding to explain the terms on which the corporation had acquired the Frome undertaking, he said that they were simply stepping into the shoes of the Frome Urban District Council and excluding the free wiring and other capital found by them, were acquiring for £47,000 what cost them £55,000. Other items which showed considerable variation from a year ago were work in progress and the liquid assets, temporary loan and cash. Owing to the completion of a very large contract during the year, the amount of work in progress had dropped nearly £11,000, whilst the liquid assets showed a shrinkage of, approximately, £30,000. A year ago they totalled to over £66,000, whereas this year they were little more than £27,000. He might tell them that it had been no easy matter to provide for the capital requirements of their various subsidiary companies, as they had done during the past five years to the extent of several hundred thousand pounds, and it was, therefore, with considerable reluctance that they felt bound to save them an extra interest charge of £2,360 per annum by redeeming the prior lien debenture stock last July. In regard to the subsidiary companies, speaking generally, the progress was good. With a 3 per cent. increase of £83,508 in capital expenditure, the profits had increased £12,414 or 9 per cent., a yield on the additional capital of 15 per cent., which would have been 23 per cent. but for the increase in the price of coal. For the two previous years the corresponding increases were for 1911 £8,721, a 7 per cent. increase, yielding 9 per cent. on the extra capital for the year, and for 1910 £6,330, a 5 per cent. increase, yielding 7 per cent. on the extra capital for the year. The improvement, therefore, had been steadily progressive. The connections had increased by the equivalent of no less than 161,782 33-watt lamps, as compared with 126,522 for 1911; 107,299 for 1910; and 88,935 for 1909. This represented an 11 per cent. increase for the year, and afforded the best possible evidence of the healthy condition of the business and of the activity with which it was being pushed. Every year an increasingly large proportion of the connections was for power, but except that they might be affected to a greater extent by periods of slack trade, there was nothing unsatisfactory in this feature. The output showed a correspondingly enlarged increase of over 6,500,000 units, the lighting units having increased 6 per cent. and the power units 50 per cent. The average price for lighting was 4·7d., and for power 1d. with a combined average of 2d., the extra units sold during the year having realised an average of 1·13d. per unit. The only other matter to which he need allude was the progress of the Lancashire Power Co. For the past year it realised a profit of £15,000, against a profit of about £11,000 for 1911, practically no profit for 1909 and a loss of over £4,000 for 1908, whilst for the current year its profits should fall not far short of £20,000, so that here also steady progress was being made with much more encouraging prospects than at one time appeared probable. Generally, their progress and prospects were satisfactory and encouraging, and though, as he had on previous occasions explained, their progress was bound to be somewhat slow owing to the character of the business, there was little to complain of in a

development which had converted a profit of £20,000 five years ago into the profit of nearly £45,000 shown this year.

Mr. A. A. Campbell Swinton seconded the motion, and the report was adopted without discussion.

General Electric Co., Ltd.

The annual meeting was held at the Cannon Street Hotel, E.C., on Thursday of last week, Mr. H. Hirst presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 70), said that they were once more in the fortunate position of having a report which showed satisfactory progress. The net trading profits and income from investments amounted to £145,261 as against £133,564, to which must be added the balance brought forward, namely, £32,050, as against £12,214, which gave a total of £177,311 as against £145,777, to be dealt with. The interest on preference shares would in future years amount to £24,000. This year the amount claimed by the preference shares was only £19,878 as the new issue of these shares last year had only been paid up gradually throughout the period under review. The expenses of the new issue were £10,275, and they proposed to write them off out of this year's results. They were glad that in spite of this they could put to reserve the sum of £30,000, and beside this, they proposed to create a new kind of reserve under the heading of "Staff Benevolence," for which they put aside conditionally this year £3,000. This was a new feature in the balance sheet. The company had been in existence approximately 26 years, although only since 1900 in its present form. It counted among its staff a goodly number of members who had been in its service various periods from 10 to 25 years. It was not given to every member of a big organisation to draw a salary which enabled him to make provision for old age. They proposed to study, within the next few years, whether something in the way of a contributory superannuation fund might not be started, and, if found possible, they wished to send it into existence with a sound start-off. Whether or not they might succeed in so ambitious a scheme he could not predict to-day, but, in any case, one thing was certain, each year that went by brought them nearer to the time when demands on them were certain to arise, and they thought it only proper to provide in some form or other a fund so that they should not be found unprepared, and not be influenced in their grants during possible periods of momentary depression. They proposed to pay 10 per cent. on the ordinary shares, as against 7½ per cent. last year. He thought that students of their balance-sheet during the last 10 years would admit that the ordinary shareholders had pursued a most unselfish policy in the past. They had been satisfied with 5 per cent. for a considerable period, and with 7½ per cent. for the last year. Their principle aim had been to make the company's position sound, rather than to claim big dividends for themselves. Now that loose plant, tools, patterns and sundry utensils were written down to £1, fixtures and installations also to £1, goodwill and patents to the same figure, freehold land and buildings to £193,755, fixed plant and machinery to £76,500 (and by a recent valuation the last two figures had been shown to be over £100,000 less than actual value), they felt they were justified in returning to the dividend which they used to enjoy before they started their big manufacturing enterprises. Stock-in-trade and sundry debtors had increased by £87,290 and £62,211 respectively, but he could assure them that these increases were quite in proportion to the greatly-increased sales the company had effected. A few words in explanation of their investments standing at £293,447 was desirable. It was likely that this figure would still increase during the next few years without any immediate proportionate return. This item might be divided under four headings: First, investments in sundry works. Certain of their manufacturing departments producing specialities had been turned, for purposes of policy, into separate companies in most cases, so that they could take as partners, experts in specific lines. He referred in particular to their telephone, conduit and lamp works. These were entirely under their control, and their investments under this heading amounted to approximately £100,000. The second item, trading companies abroad, consisted of the General Electric Companies of South Africa, Australia, India, China, Argentine, France, Spain and Belgium. Some of these had started contributing towards their dividend, others had very considerable establishment charges to their debit, and would only contribute towards revenue when those establishment charges had been wiped off out of profits. The money invested in those companies was about £160,000. Regarding their investments in electrical supply companies, most of these were managed by them, and included the following undertakings: Madeira, Uitenhage, Bogota, Frinton, Barbadoes and Macclesfield. A number of those undertakings were already paying satisfactory dividends, others were of such recent beginnings that for the next year or two they would play a larger part in the company's capital expenditure than in giving returns under income from investment. Each one of them, however, had been embarked on only after careful thought and deliberation, and they had reason to believe that, with modest capital expenditure, each would, in due course, become a profitable investment. Regarding the item, sundry investments, some £10,000 or £12,000 were small ventures found desirable in the course of trading, but whether they were already dividend-earning or not, they all contributed in a lesser or greater degree towards the increased trading profits. The year, as a whole, had not been without its difficulties. They had borne the first brunt of the National Insurance tax, amounting to £3,000 or £4,000; they had suffered greatly through the effects of last year's coal and railway strikes. A consequence of those unfortunate strikes during a period which throughout the world was one of unprecedented enterprise, was great stagnation in the supply of raw material, and all prices were considerably above the average; copper, iron, coal, lead—everything during the last year seemed to have an inflated value. There was labour unrest and a great difficulty in securing efficient men in skilled trades. At the present moment that symptom of labour unrest was still very much to the front. Some 50,000 men were out on strike in the Midlands to-day, and their own people were out last month for over a fortnight. He was pleased to say that they had now returned to work. Were it not for this uncertain state of affairs the outlook in the electrical industry continued to be hopeful. There was an ever-increasing demand for electrical power for use in small and big industries. Every day brought forward some new useful apparatus which brought electricity more and more into the service of man. They were on the threshhold of a big development in electrical heating and cooking. The greater perfection of tungsten lamps, of which their Osram was so prominent a type, was giving the electric light a renewed stimulus in its fight against gas. Thousands of the most able minds were occupied in evolving newer and still more efficient illuminants, and success seemed very probable. The development of wireless telegraphy and telephony was making rapid strides; the electrification of railways was coming fast. A moment's thought must give the assurance that a company such as theirs, interested in every branch of electrical engineering, keeping a watchful eye on every new manifestation of electrical activity, must see a bright future in those new and far-stretching vistas of useful work and progress.

Mr E. G. Byng seconded the motion, and the report was adopted. Messrs. F. S. Sells and L. G. Byng were re-elected directors.

Electric Construction Co., Ltd.

The twentieth annual general meeting was held on Tuesday, July 15th, at Winchester House, E.C., Mr. P. E. Beachcroft in the chair.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 69), after referring with regret to the death of Sir Irving Courtenay, the late chairman, said he was very pleased that the hope expressed by his predecessor last year, that they would be able to submit a better report this year, had been fulfilled, the net profit having increased from £20,364 to £27,501. The works had been fully employed and better prices had prevailed. They had been able to handle an increased output at comparatively little additional cost in the way of fixed factory charges, and the profit and loss account, therefore, got the full benefit of the improved trade conditions. The gross profit upon manufacturing and contracting showed an increase of £8,954, but interest, dividends, &c., had produced £311 less, owing to their having realised part of their holding in the Madras tramways. The net increase on the credit side of the profit and loss account was £8,643. On the debit side of that account there was a saving in debenture interest of £290. General charges, however, increased by £1,854. This was due partly to increased expenditure incidental to a larger output, and partly to contributions under the National Health Insurance Act. They had experienced little difficulty in the administration of the Act, but it was too early to judge whether employers would benefit by increased efficiency on the part of their employés, as was claimed by its promoters. Directors' fees showed a reduction of £225, the number of directors being one less than formerly. Maintenance of plant and buildings had increased £168. The net increase on the debit side of the profit and loss account was £1,507, leaving an increase of profit for the year of £7,136. The net profit amounted to £27,501, plus £5,694 brought forward, making £33,194 available for distribution. The directors recommended that this amount should be appropriated as follows:—Dividend of 7 per cent. per annum on the preference shares, £4,395; dividend of 5 per cent. per annum on the ordinary shares, £11,210; transfer to general reserve fund, £10,691; leaving a balance to be carried forward to next account of £6,899. Turning to the balance-sheet, on the assets side, there was only one item to which he need refer, viz., shares in other companies. During the year they sold a small part of their holding in the Madras Electric Tramways (1904), Ltd. Their holding in that concern now consists entirely of 6 per cent. preference shares, which they had decided to hold as an investment. These shares were now quoted on the Stock Exchange, and they had therefore transferred the value of this holding from "shares in other companies" to "investments," increasing the amount of the latter, at market value, to £29,887. The greater part of the reserve fund, amounting to £46,000, was invested outside the business, and the whole of the securities being of a marketable nature, their financial position was therefore greatly strengthened. In pursuance of the policy intimated last year, they had redeemed £12,700 of their 4 per cent. debenture stock reducing the amount outstanding to £170,000. Dealing with the position generally, they were entitled to congratulate themselves upon the progress of the past three of four years, and he did not hesitate to say that on no previous occasion had they presented a balance-sheet of a more satisfactory character. Their improved position was due in a large measure to unremitting attention to costs of production. To this end the board had consistently supported the management by sanctioning the installation of modern tools, the provision for depreciation being year by year expended on new, up-to-date appliances. They had also had the services of a staff second to none in skill and assiduity, and further, they had enjoyed complete harmony with the general body of their workpeople. The electrical industry, in his opinion, had only touched the fringe of the future, and he believed they were on the threshold of an era of prosperity in the industry generally. In their own case they had the advantage of having their plant so up-to-date that they were able to compete for any work which came along. In his

judgment the electrical machinery would be the motive power of the world in the future, and they were there to pick up any business which came their way. When they came to realise the enormous amount of work that there was to be carried out by the various electrical companies in this country alone and the comparatively small percentage which they obtained, and the satisfactory results they were able to show thereon, they had every reason to hope and believe that the company would get the full benefit of any increase in trade that came along. He was at the works at Wolverhampton in the previous week and was very pleased with the progress of the extension. When the extension was completed the works would be in a position to considerably augment the business, and that was his justification for the belief he had expressed that although they had had an exceedingly good year during 1912, in the future their output would probably be doubled.

Mr. James Gray seconded the motion, and the report was adopted.

Newcastle-on-Tyne Electric Supply Co., Ltd.—Interim dividends of 2½ per cent. on the preference and ordinary shares respectively are announced.

STOCKS AND SHARES.

Tuesday Evening.

As sure as ever July comes round, so sure is the plaint certain to be raised that the Stock Exchange has never before, in all its existence, seen such times. Perhaps this year there is more reason than usual for the lament, because the prosperity of the country, the Balkan War, the tightness of money and the lack of confidence have all conspired to lay a depression upon prices such as the markets have not experienced for years past.

Investment business keeps the markets alive: of speculation there is next to none going on. The best illustration of this can be furnished by the American Railroad market. In normal days, or nights, many of the dealers remain until eight o'clock in the Street, tied there by orders arising out of the prices cabled from the Wall Street Stock Exchange. So listless has the American business become, that on Monday and Tuesday in this week the London market went home before half past five.

The Home Railway market is dull, though prices advanced on a sharp rally in Consols. Districts and Metropolitans show small recoveries. Central Londons are irregular. It will be noticed from reference to our price lists overleaf that there are now different quotations for the Ordinary stocks and the Guaranteed Assented stocks. The three Ordinary issues have become split into six sets of securities, and the Assented stocks all command higher figures than the others.

London United Tramways 4 per cent. Debenture stock continues depressed, and has fallen a further 2 points. The British Electric Traction group is also dull. Underground Electric Railways shilling shares are $\frac{1}{32}$ down, but the 6 per cent. Incomes are the turn b.tter at 90.

English electricity supply shares retain most of their strength, and Chelseas are ⅛ up at 4⅞. City of London Ordinary, however, reacted 10s. The few other changes which occurred are mainly on account of dividend deductions. Urban Debenture is a point to the good at 86½.

Affairs in Mexico are still very far from settled, and there can be no doubt that holders of Mexican investments are growing seriously uneasy at the protracted character of the country's troubles. Fresh falls have taken place this week in most Mexican descriptions, but Mexico Tramways Common shares rose superior, by ¾, to the general flatness in this group. The Company's 6 per cent. bonds are 2 lower, and by a rather curious coincidence, its three quoted securities all stand now at 89—92. Mexican Light and Power Common shares have slumped 6 points on top of their fall of 3 last week, and the Preferred are 5½ lower at 92½. Brazilian Traction shares more than recovered their previous drop of 1½, but it must be admitted that the market in these seems none too sure of itself, Brazilian things as a whole being at the moment somewhat clouded by the uncertainty respecting rubber and coffee. Anglo-Argentine Trams are steady, the only change being a slight fall in the price of the Second Preference shares. Singapore Trams Debenture stock has been wanted, and the price gained 1½.

The Telegraph market is extremely quiet. Westerns are ⅛ down, and Panama Ordinary fell ⅛ to 2⅜; further than these there are no changes worth mentioning. National Telephone Deferred moved more or less languidly between 25½ and 27¼, being better on the week at 27¼. New York Telephone Bonds are ½ higher. Marconis have been crumbling and recovering, the Ordinary and Preference showing falls of $\frac{1}{16}$ and ⅛ respectively, this on the prominence given to a competitive system of wireless telegraphy. No improvement has taken place in Reuters, the price remaining at 9½.

Prices in the manufacturing division showed trifling changes. Callenders gave way sharply upon an order coming in to sell about 500 shares on behalf of a deceased estate. The shares were placed, and the price recovered most of its fall. The Debenture stock is 1 down. Telegraph Constructions are quoted *ex* the dividend of 12s. Aron Ordinary and Preference are also *ex* dividend. The Rubber market, after a spasm of further weakness, pulled itself together, and its prices made a move upwards. The relative merits of Brazilian and plantation rubber are being hotly debated, and it would be of considerable practical value if those who are interested in rubber from the point of view of telegraph and other electrical works were to add the testimony of their experience.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅜d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21	£1 10s. dec.
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only) ..	„	7½d.	..
a Shellac	per cwt.	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	⅛d. dec.
c „ Tube (brazed)	„	9⅞d.	..
c „ „ (solid drawn) ..	„	8¾d.	..
c „ Wire, basis	„	8½d.	..
c Copper Tubes (brazed)	„	11½d.	..
c „ „ (solid drawn) ..	„	10⅝d.	..
g „ Bars (best selected) ..	per ton	£80	..
g „ Sheet	„	£80	..
g „ Rod	„	£80	..
d „ (Electrolytic) Bars ..	„	£66 10	£2 10s. dec.
d „ „ Sheets ..	„	£84 10	£1 10s. dec.
d „ „ Rods ..	„	£72	£2 15s. dec.
d „ „ H.C. Wire	per lb.	8½d.	⅛d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	3/10	..
j Iron Pig (Cleveland warrants) ..	per ton	55/6½	8½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 2 6 to £20 5	7/6-10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	5s. dec.
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£186 to £187	£9 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/6	1d. dec.
p White Anti-friction Metals ..	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

British Columbia Electric Railway Co., Ltd.—Dividend announced at the rate of 5 per cent. per annum on the 5 per cent. pref. ordinary stock for half-year ended June, together with an additional dividend at the rate of 1 per cent. per annum.

Marconi International Marine Communication Co., Ltd.—The Marconi's Wireless Telegraph Co., Ltd., has arranged for its shareholders to be able to apply for 94,395 shares of £1 each in the Marconi International Marine Communication Co., Ltd., at the price of £1 5s. per share.

Nairobi Electric Power and Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 6 per cent. on the cumulative preference shares, in respect of the year 1908.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less income-tax, payable on 26th inst.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	6	9½ — 10½	..	5 14 8
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8½ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 4⅝	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅜	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 16	— ½	5 12 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	118½ — 117½	..	4 5 1
Do. 4½ % Second Deb. ..	100	4½	4½	98 — 100	..	4 10 0
County of London, Ord. ..	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	11¼ — 11⅜	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 — 104	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4 — 4⅜ xd	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1¾ — 2⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	81 — 84 xd	..	5 7 2
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7¾	..	5 16 2
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	7½ — 7⅝	..	5 15 5
London Electric, Ord.	8	2½	2½	1½ — 1¾	..	4 7 9
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 91	..	4 8 0
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	7½ — 8½	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	5½ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛	..	4 14 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	6	6	2⅝ — 3½	..	7 7 3
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 8
South Metropolitan, 7 % Pref. ..	1	7	7	1 7/16 — 1 9/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	½ — ⅝	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	+ 1	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	6 1 9
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	108 — 112	..	6 5 0
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	5/16 — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	7/8 — 1	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 — 101	..	4 19 0
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 — 106	+1	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	57 — 60 xd	—6	6 13 4
Do. 7 % Cum. Pref.	$100	7	7	90 — 95	—5½	7 7 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	210 — 220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 — 107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	124 — 128 xd	..	4 5 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ — 106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 100	..	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11½d.	17½d.	1/16 — 1/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 — 108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 — 132	..	6 1 3
Do. Collat. Trust	$1000	4	4	89 — 91	..	4 8 0
Anglo-American Telegraph ..	Stock	8	8	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	107¼ — 108½ xd	+ ½	5 10 10
Do. Def.	Do.	30/-	30/-	28¼ — 28¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 — 106	..	4 15 3
Chili Telephone	5	7	8	7 9/16 — 7 13/16	..	5 2 5
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83 — 85	..	4 13 7
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15⅝ — 16⅜	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8⅛ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6½ — 7½	..	6 12 0
Direct United States Cable ..	10	5	4	6⅛ — 6⅝	+ ⅛	6 0 9
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	124½ — 127½ xd	..	5 9 10
Do. 8½ % Pref. Stock	Do.	8½	8½	73 — 76 xd	..	4 13 4
Do. 4 % Mort. Deb.	Do.	4	4	90½ — 92½	..	4 8 5
Eastern Extension	10	7	7	12 — 12½ xd	..	5 12 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ — 100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	5†	10⅝ — 11⅛	..	5 8 9
Do. 6 % Pref.	10	6	6	12⅛ — 12⅜	..	4 15 1
Great Northern Telegraph ..	10	18	20	80 — 82	..	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3 1/16 — 3 1/16	— 1/16	5 8 6
Do. 7% Cum. Partic. Pref.	1	17	..	2⅞ — 3⅛	— ⅛	5 8 9
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	+ ½	4 11 5
Oriental Telep. and Elec. ..	1	8	10	1⅜ — 1⅝	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	..	4 2 6
Reuter's	10	10	10	9 — 10	..	10 0 0
Submarine Cables Trust ..	Cert.	6	6	124 — 127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94½ — 96½	..	4 13 3
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5¼	..	4 11 0
West Coast of America	2½	2½	..	1 7/16 — 1 9/16	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	— ⅛	4 15 3
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	99 — 101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12½ — 13	— ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	93½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 15th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 35/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	..	..
Do. Do. Deferred	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	..	7 6 4
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	75 — 77	−2	..
Do. Gtd. Assented	100	..	..	79 — 81	+2	4 18 9
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Gtd. Assented	100	..	..	81 — 83	+1	4 16 5
Do. Def.	100	2	2	75 — 77	−1	..
Do. Gtd. Assented	100	..	..	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1908	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1 7/8 — 2 1/8	..	Nil
Hastings Trams, 6 % Pref.	1	5	6†	15/16 — 31/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 1/8 — 2 3/8	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	3/32 — 13/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/32 — 3/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	70 — 75 xd	..	6 0 0

NAME.	Stock or Share	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 15th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	57 — 61	−2	6 11 2
Metropolitan Railway Consol.	100	1⅞	1⅞	46¼ — 46¾	+ ½	3 9 6
Do. Surplus Lands	100	2⅞	2⅞	61 — 63	..	4 7 4
Do. 8½ % Deb.	100	8½	8½	83 — 85 xd	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Con. Pref.	100	8½	8½	78 — 80	..	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32¾ — 33¼	+1¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 8½ % Gtd.	100	8½	8½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	9/32 — 13/32	..	..
Do. 5 % Pref.	1	6	5	1/16 — 1/8	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3 3/8 — 3 5/8	..	Nil
Do. "A"	1/-	4½	..	13/32 — 1/32	—1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	1⅛	6	108 —110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	96 — 98	..	4 11 10
Do. 6 % Income	100	3	6 †	89½ — 90½	+ ½	6 12 7
Yorkshire (West Riding), Ord.	5	..	..	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	..	8†	8 1/16 — 3 1/16	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 3/4 — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4¼ — 4½	— 1/16	6 2 3
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	95½ — 97½	..	5 2 6
Auckland Trams, 5 % Deb.	100	5	5	99 —101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	+ 1/8	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	+1½	5 1 0
Brazilian Traction, Light and Power	$100	..	6†	87 —89	+2	6 14 10
Brisbane Trams Invt., Ord.	5	8	8	6 7/8 — 7 3/8	..	5 8 6
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	121 —126	..	6 7 0
Do. Pref. Ord.	100	6	6	110 —115	+1	5 4 4
Do. 5 % Pref.	100	5	5	101 —104 xd	..	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 8
Calcutta Trams, Ord.	5	7	5†	5 5/8 — 6 1/8	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½ xd	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	6	25 — 85	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	
Do. Pref.	1	6	..	29/32 — 1 1/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	5	4½d.	1 3/32 — 1 1/32	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1 1/8	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103 xd	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87½ — 90½	−2½	5 10 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com.	$100	7	7†	89 — 92 xd	+ ¾	7 12 2
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 92	..	5 8 8
Do. 6 % Bonds	100	6	6	89 — 92	- 2	6 10 5
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 — 6½	— ⅛	7 13 10
Do. 6 % Pref.	5	6	6	4¾ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ —105½	..	4 14 9
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	..	5 2 0
Do. 5 % Mort. Bonds	100	5	5	91 — 93	..	5 7 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 101	..	4 19 9
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	+1½	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	7	4 3/32 — 4 7/32	..	7 3 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	9/16 — 13/16 xd	..	7 7 8
Do. 6 % Pref.	1	6	6	23/32 — 27/32 xd	..	7 2 6
Babcock & Wilcox	1	28	16	2 1/16 — 3 1/16	..	5 4 5
Do. Pref.	1	6	6	1 1/16 — 1 3/16	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 8
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5 7/8 — 6 3/8	..	4 14 1
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb.	100	4	4	65 — 69	..	5 16 0
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	15	10 1/16 — 11 1/16	— 1/4	6 13 4
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	—1	4 10 6
Castner-Kellner	1	20	20	3 5/8 — 3 3/4	..	5 6 8
Do. Deb.	100	4½	4½	103 —106	..	4 4 11

Crompton & Co.	..	..	..	.. — ..	..	..
Do. Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/8 — 9/8	..	..
Do. Pref.	1	5	5	29/32 — 33/32	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62 xd	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3 3/4	5	1 1/2 — 1 3/4	+ 1/16	7 5 6
Do. Pref.	2	7	7	1 3/4 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9 3/4 — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	+1	4 5 1
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4 3/4 — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	34½ — 36½ xd	..	6 11 7
Do. Deb.	100	4	4	94 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

CABLE LAYING AND RECORDS.

By W. E. H.

My object in writing this article is to emphasise the necessity of employing some system in laying cables and the recording of such on suitable maps, and keeping a proper book to be used in conjunction with the maps.

The writer's first experience of actual records dates back about 16 years, when very little method was adopted, and the records kept were on all fours with those existing in the offices of gas and water companies. No doubt these people made very good records when the pipes were originally laid, but no notice was taken when road improvements, such as widenings, setting back pavements and alterations to frontages, took place. This method was generally practised in electrical main laying, and the records consisted of nothing more than measurements commencing at a street corner, with measurements at right angles, say, 20 to 40 ft. apart, where the depth of the conduit or main was taken. If the work was specified to be done by the contractors, as was done in a great many cases, very imperfect records were the result, and great was the trouble experienced by the mains department on such jobs. The writer knows of one such case where the work was part of the contract and one junior draughtsman was engaged. There were five gangs of men employed in different parts of the town, the work was done in a very slipshod manner, and the records were of very little use when completed. The positions were in some cases yards out, also the runs of cable were 3 or 4 ft. from the positions actually laid down on the maps; in addition to these slight errors the positions of the feeders were wrongly indicated. The latter were, however, put right when it came to coupling up at the station; had this not been done, it will be readily understood what might have happened when it came to opening up on some future occasion.

I have always made a point in recording of having every available piece of information entered up. First of all, the starting point is fixed from every conceivable position, taking measurements from the house line to the conduits or cable, and from the kerb line to the conduits or cable, picking up bench marks and fixing the depths from these. Where the crossings of roads come in, enlarged sections are made, giving full information of obstructions and positions, depths, size and nature of such obstructions and the dates when such work was carried out. From the above information the position of mains can be located at all times, for in every borough surveyor's or County Council's office are deposited the plans showing the nature of every roadway or building improvement, and from these records, together with the information originally taken, the mains departments of the future need have no fear of lost cables.

The writer some time ago had occasion to take up new duties upon a job where the mains were laid a great number of years ago, and the recording was placed in the hands of the cable-laying company; here it was found that the information was practically useless. The system was mainly armoured, laid direct in the ground and jointed by means of buried joint boxes, the positions of joints were given in a very vague manner, such as "18 yards from the entrance gate of the Laurels." The "Laurels" has now two gates (when the cables were laid it may have had only one). No mention was made of the direction, whether north, south, east or west of such a position. Another instance gives a joint as being outside "Manor House." "Manor House" has a frontage of 130 ft. No doubt this method was quite all right when the mains were laid, and the mains engineer was in close touch with all that was going on, and the whole job was an open book to him, but it is not quite fair to his successor, even granting that the successor was his assistant at the time the original work was done.

Another mistake that appears to have been made on the job in question were that of wrongly charting the direction of the feeders in a road where six or seven feeders branched off. The positions were, in the first place, wrongly marked, and secondly, wrongly traced.

When a break-down occurred, the department was informed that such and such a feeder had broken down. The maps were consulted and the direction noted, the original log-book was looked up, and joints noted; it was then found impossible to locate the joints from these records, so a start was made on the cable. The position of the fault was located by tests, and a jointer was dispatched to cut the cable. Strict instructions were given that great care was to be exercised, as doubt was very strong in the mind of the engineer as to the correctness of the information. It was found, upon cutting, that it was the wrong feeder. A joint was temporarily and quickly made, and another attempt was made; a second feeder was cut, and this proved to be alive. The faulty feeder was eventually found on the opposite side of the road. The engineer has since had the positions of the feeders definitely fixed at certain points of their routes. To do this it was, however, necessary to cut all the remaining feeders and test thoroughly.

To improve the records and make them more trustworthy, a card was introduced whereon all the information respecting cables, joints, and joint boxes is entered up from openings made by the service gang. The particulars consist of noting the number of cables, sizes and conditions found, particulars of joints made, and to which pole the connection is made, size of conductors of the mains cut into, position of joint from party walls of the property connected, together with distance from line of frontage and line of kerb.

The same method is employed in the case of openings of any kind that are made in the streets by any of the other companies. (Notices of all openings are sent to the department by gas, water, and telephone companies.) It will be seen that much valuable information is gained in this manner, and in a surprisingly short time fairly accurate records are prepared.



A great deal of time has, however, been lost owing to lack of information as to the direction taken by services in cases where the gardens fronting the properties connected are of considerable depth. Many instances have cropped up where a service tapping was made in the road fronting the house and the cable laid in a snake-like fashion, finally entering the house in the rear.

It is not the writer's object to advocate or institute a system of planning each house service, but, at the same time, he is of opinion that a carefully trained service layer can note in a few words the route taken, and at the same time place some mark upon the wall or kerb which will greatly assist should there be urgent need to open the ground at any time.

It has been the practice for a certain company to mark the position of each joint under the paving by inserting a small tablet in the pavement immediately over the joint. This system held good and was very useful until the time came for relaying the pavements. When the tablets came to be put back, they were placed in any position that took the fancy of the paviors—in many instances, some feet away from their original and intended positions.

Elaborate methods are sometimes used. I know of one job where the engineer's idea was to have the ordnance maps (88 ft. to 1 in.) mounted and feeders shown

thereon by means of coloured strings fixed by pins. This worked well for a time, until the system grew to such an extent that very little of the map was to be seen, and what there was resembled a crazy-work cushion. The most sensible diagram is one that is easily prepared and may be taken from the ordnance sheet, the direction and general features remaining, but the streets being widened to three or four times the width of those shown on the scale maps. Upon this class of map all the required information can be accurately placed, and it takes up no more space than the ordnance maps of the district. A sketch of such a plan is given on the preceding page.

CONDUIT LAYING, THEN AND NOW.

[COMMUNICATED.]

The method of laying cables is a question that crops up with every extension that comes up for consideration, and one that has been food for discussion for some years past. The early systems that adopted the draw-in method had to be content with either cast or wrought-iron, or a composite bitumen conduit built up to suit one's taste. The latter method was very good from the point of view of laying and jointing, but the trouble of getting cables in or out was endless.

The writer proposes to deal with the several types of conduit used during the last 15 years, the method of laying, and the ideas of those responsible for the laying.

On one of the London Borough Council's undertakings, where a draw-in system of Doulton cement jointed conduits was adopted, the consulting engineer (his first job of this kind) to ensure a fall between draw boxes, insisted that a level (not the ordinary spirit level, but a level of the Dumpy type) should be used on each duct before it was finally bedded down. Imagine the poor Clerk of Works spending the entire day gazing through a spy-hole and plotting the fall of each two-foot length of duct, on sheets of squared paper, to say nothing of the hindrance caused to the contractors, who had to lay about 20 miles of such ducts. The speed of laying was restricted to about 40 yd. daily per gang. Needless to say, after the first few days of such childishness, the Clerk of Works gave up the spying practice, and the rate of progress jumped up to about 100 yd. daily, which was in those days a capital day's run. The squared paper chart was, of course, kept going, but its accuracy was not vouched for.

The conduits laid were of a good size, and allowed of arge cables being drawn into them with perfect ease, which differed greatly from the writer's later experience of a consulting engineered scheme of conduit laying in another of our Metropolitan boroughs. The ducts specified were Doulton 2 in. square, jointed with a mixture of something like bitumen, sand, brimstone and other ingredients, which prevented speedy laying in warm weather. These particular ducts were laid into a cast-iron bed-plate ; a second casting fitted over the top of the duct, and together with the bottom half acted as a mould for the composition joint. Inside the duct was placed a mandrel which, when fitted and screwed up, prevented any of the molten composition from getting into the duct. Great care had to be used in drilling the men to do the right thing ; when, however, this was accomplished, a very satisfactory job was the result. The process of laying was a tedious one on account of the exceedingly warm summer—resulting in warm moulds and language. However, the troubles of duct laying were slight compared to what was to come. On another part of the system, where in the roadway 2-in. cast-iron pipes coated inside and out with the compound, were laid, and draw boxes 120 yards apart, a ·2 sq. in. concentric lead-covered cable, juted and compounded, of an overall diameter of 1·4 in., had to be drawn into one of the pipes. The first length that was attempted took one winch and eight men three hours to draw a distance of about 100 yards, when the eye splice on the cable parted. The ground had to be opened, and a further attempt was made, but to no purpose, and, finally, a brickbox was built at this point. The greatest amount of cable drawn in on any one day of 10½ hours was 320 yards.

On another job, where small ducts and large cables were specified, 2½ in. ducts were used for the purpose of drawing in a ·4 sq. in. segmental concentric lead-covered, juted, and compounded cable, the overall dimensions of this cable being over 2 in.

The draw-in boxes were 80 yards apart. A winch was used for the purpose of drawing in the cable, after many struggles, in one of which the winch collapsed when the cable was rather more than half way through, and, finally, after several attempts the pavement had to be opened up and a drawbox built.

I should like to mention that the specification called for drawboxes of two styles ; no dimensions were stated, but they were described as "square shape" and "long shape." The omission of definite dimensions led to trouble, and the consulting engineer agreed that the square-shaped boxes were to be 2 ft. 6 in. by 2 ft. 6 in., and the long-shaped boxes 2 ft. 6 in. by 1 ft. 6 in. The larger-sized boxes were built where the number of ways ranged from 6 to 18, and into these boxes had to be crowded an equal number of joints, and in some cases a low-tension disconnecting box. The look of some of the boxes when the whole of the cables were in beggars description.

This same engineer had rather curious ideas of service connection in conjunction with a draw-in system. The plan laid down was that the house side duct of a nest of conduits was broken away for a length of 2 ft. (one length of conduit), and the slack in the cable eased out so that a service box could be put on.

This being done, the duct was made good by means of a special earthenware cover designed to fit over the open duct and provided with a socket attachment for receiving the pipe in which the service cable was laid. What actually happened on this line of 2-in. conduits, in which was laid a ·2 sq. in. distributor, was that, upon opening the required amount of duct, no slack was to be had, and it was impossible to fix the service box until the inside duct was broken into ; this being done, the special earthenware attachment was found to be of no use, and a brick box was built enclosing the damaged duct. This, as the reader will have observed, partly destroyed the use of one way, and upon new cable being laid, some years later, it was decided to use the spare way, when it was found necessary to open up between 60 to 70 services for the purpose of rodding and afterwards drawing in cable—a very costly proceeding.

It had, however, the desired effect, and proved a valuable lesson to the individual responsible for the further extensions, in which ample room was allowed in conduits, and the draw-in boxes were like young dwelling houses.

To-day, as yesterday, engineers are divided on the type of duct to use and the method of laying. Some few favour the use of wrought-iron pipes ; I have seen some peculiar results with pipes of this kind that have only been in the ground eight to ten years. Others continue the use of cast-iron, well coated with preservative compounds. Also engineers who are faithful to earthenware ducts prefer to use single-way conduits, and build up to form nests of any number. The ducts used are 3 in. diam., with ordinary cement joints, and are claimed to make the best and cheapest job. This claim is open to considerable doubt ; in the first place, if more than one-way is being laid, it is a hundred to one that the pipe-layer does not make a perfect cement joint, and if the ground is charged with water, the result is a very leaky job.

Again, in forcing home the duct, small particles of cement get into it (we know that a mandrel is supposed to be used for the purpose of clearing away any cement that may get into the duct, but this is not often done). Also, where a nest of ducts are laid, it is necessary to concrete the whole lot together at specified intervals, otherwise they will spread with the sinking of the ground, and, consequently, get out of alignment ; if this is not done, they are a great trouble to other contractors opening trenches adjacent to the route.

The conduit that appears most suitable from all points of view is that with a self-centring joint. They make a good water-tight job, are most speedy to lay, and give perfect alignment. There is no cement to get into the ducts, and very little supervision is required on the part of the Clerk of

Works, and it is absolutely the cheapest earthenware duct to lay.

If single conduits are built up in concrete there is no doubt that the palm goes to the fibre ducts. They are light, the cost of cartage is small, they are the easiest to handle, and, provided a good mixture of concrete is used, a good all-round job is the result. The writer has had a good experience with this class, and the results have been satisfactory.

In passing, I strongly urge the use of liberal sizes of draw-in boxes; many of the boxes built in the early days were so absurdly small that even the beetles had difficulty in turning round in them, and the jointers had to perform all sorts of acrobatic feats to carry out the necessary work.

On one job in my experience large boxes were the rule, but absurdly small frames and covers, and these were placed in such a position that when the cable had to be drawn in, the whole frame and cover and part of the box had to be removed.

REVIEWS.

Psychology and Industrial Efficiency. By Hugo Munsterberg. London: Constable & Co., Ltd. 1913. Price 6s. net.

It is not so long since we were introduced to a new industrial science known as "Motion Study," which may be described as the scientific investigation of bodily motions as applied to industrial purposes. The book under review deals with what may be called the motions of the mind with a similar end in view.

Although the matter set forth is based upon a recent work written in German by the same author, both the experiments and the examples referred to are drawn from experience in the United States, where this movement seems to have originated.

After a somewhat lengthy introduction, the subject is treated in three sections, which deal respectively with psychology as applied to obtaining the best possible man (or woman) for any particular duty, the best possible work from employés, and the best possible effects with special reference to advertisements, display, &c.

The application of psychology to industrial problems will be more quickly understood from one or two examples than by any amount of explanation. For instance, some very interesting experiments were carried out bearing upon the getting of the best possible motormen for driving electric tramcars. Important though this problem is in this country, the number of accidents is much more serious in large American cities, and it is very desirable that good drivers be obtained.

The following passage explains the problem to be solved:—

"The companies claimed that there are motormen who practically never have an accident, because they feel beforehand even what the confused pedestrian and the unskilled chauffeur will do, while others relatively often experience accidents of all kinds because they do not foresee how matters will develop."

The apparatus used to test the men gives a very fair representation of the motorman's difficulties when driving through traffic, the street being represented by a series of cards showing the track, with numerous figures to represent pedestrians, horse vehicles and motor-cars. The figures which will cross the track are marked in red, and an opening in a black screen travels over the cards one after the other to represent the motion of the tramcar. The track is divided into spaces marked with the letters of the alphabet, and the motorman is asked to call out each space by its letter, where a red figure will strike the track as the cards are traversed. The results are measured by the time taken to go through 12 cards, and the number of places omitted where red figures would land on the track.

The capacity of the motormen to get through the cards quickly with few omissions was found to correspond with their ability to keep time and avoid accidents on the cars; moreover, the men themselves admitted that the apparatus gave them a similar feeling to that actually experienced when driving.

Some may contend that driving a car without accidents is entirely a question of training, but this contention is disposed of by the results from the author's advanced students in research work, which were better than any from the best motormen of many years' standing.

It may be easily understood that a test of this nature applied to candidates for employment as drivers would be invaluable, by excluding a number of men whose mental equipment was unsuitable for the duty required.

Experiments of a different type were tried with telephone operators, and here, again, the results tallied with the known capabilities of the persons experimented on. These investigations were particularly useful in weeding out unsuitable candidates, who would otherwise receive a long training at the expense of the telephone companies, who maintain a school for this purpose.

Rejection by psychological tests of this nature is no reflection upon the applicant's intelligence, it simply means that he or she can never become proficient in certain lines, hence any time spent on training would be wasted. If these principles can be carried to their logical conclusion immense benefits must accrue to industry in general, as each boy or girl can be tested before entering commercial life, and we shall have no more square pegs in round holes.

For obtaining the best possible work, it is rather difficult to define where "motion study" ends and the application of psychology begins. In so far as all muscular effort has its effect upon the brain, it would seem that the study of bodily motions involves some consideration of their effect upon the mind and *vice versâ*.

The teaching of telegraphy and typewriting offers favourable conditions for the application of psychology, and the training for typists has already been much simplified by a study of this nature. Almost all industrial operations lend themselves to similar treatment, varying in extent according to the amount of brainwork involved.

In a chapter on "The Adjustment of Technical to Physical Conditions," the author states that "the psychological effect of colours and noises has not been fructified at all for industrial purposes." . . . . "The labourer, for instance, usually believes that a noise to which he has become accustomed does not disturb him in his work, while experimental results point strongly to the contrary. In a similar way the effect of coloured windows may appear indifferent to the workman, and yet have considerable influence on his efficiency."

The effect of signals by eye, ear, or touch, is also dealt with, and it is urged that the conditions be kept the same where similar effects are desired. Railway signals are given as an example, the difference between arm signals by day and coloured lights by night being deemed a bad feature, and replacement of the lamps by lines of lights on the signal arms is suggested, so that the engine-driver will always have the same type of signal to read.

Under the heading of "The Economy of Movement," the importance of not suddenly stopping movements, if it can be avoided, is emphasised, as "Any interruption of a movement presupposes a special effort of the will which absorbs energy, and after the interruption a new start must be made of which the same is true. On the other hand, if chains of movements become habitual, the psychophysical effort will be reduced to the minimum, inasmuch as each movement finds its natural end, at the same time each movement itself becomes a stimulus for the next movement by its accompanying sensations."

Of particular interest is the problem of monotony in modern factories, which is dealt with at some length, and according to the author's investigations, the operators with the most monotonous jobs suffer no discomfort from this feature even when extended over many years, while "others who seemed to have really interesting and varied activities nevertheless complained bitterly over the monotonous, tiresome factory labour." These investigations were directed towards tests to show whether an individual will suffer from repetition in work.

The third and last section of the book treats of the satisfaction of the demands of the consumer, the effect of

advertisements and displays, illegal imitation and buying and selling.

Altogether this work contains a great deal of useful matter, although the subject is dealt with in rather too technical a manner to suit commercial readers. It must be remembered, however, that this new industrial science is only in its infancy; but sufficient practical application has, we think, been shown to justify further investigation.

Methods of Measuring Electrical Resistance. By EDWIN F. NORTHRUP, Ph.D. London: Hill Publishing Co. Price 17s. net.

There is probably no scientific operation performed more frequently than the measurement of an electrical resistance; and there are probably more methods of finding resistance than any other physical quantity.

But although other branches of physics of far less practical importance have bulky volumes devoted to them, the discussion of resistance and its measurement is usually left to the writer of the general text-book of electricity, with the result that only the main principles and a few important methods are described. It is, in fact, almost impossible to find a complete collection of the various methods of measuring resistance as applied to the multitude of different conditions under which such measurements have to be made in practice.

The book before us does provide such a collection, and while it is not claimed that the book is exhaustive, the author has selected "all methods which in his judgment are useful for commercial tests and measurements, for purposes of instruction in educational institutions, and for application in technical and research laboratories." He has felt justified in writing upon methods of measuring electrical resistance because he has been engaged in electrical measurement for over 20 years, first with an important American instrument company and later in the Palmer Physical Laboratory at Princetown University. Dr. Northrup has certainly used his wide experience with good effect in the production of this useful work.

In the introductory chapter some wise comments are made upon accuracy and method of measurement, and the question of sensibility is discussed. Another matter, too, which is of considerable importance in all physical measurement is treated at some length — the Theory of Errors— part of the section having been taken from "Instruments et Méthodes de Mesures Electriques Industrielles," by H. Armagnat.

Chapters II and III deal with deflection methods and null methods respectively, and provide a good general groundwork on which to base the more elaborate discussion of Wheatstone's Bridge methods. Although the Wheatstone network is treated with great thoroughness, and such modifications as the Carey-Foster method and the Kelvin-Varley slide have received space proportional to their importance, the English reader will be struck by the absence of any reference to the common form of Post Office Box, at least under that name. A paragraph on this essentially English method of measuring resistances would have assured Dr. Northrup's book of a better welcome in English institutions. The omission of any mention of such standard instruments because they are not American and the use of the painful contraction "thru" are among the few regrettable features of the book.

The measurement of low resistances is dealt with in a chapter of great practical value. The Kelvin double bridge method is applied wherever possible, "being pre-eminently the most accurate and elegant," and alternative methods are also described in some detail.

The chapter on "Conductivity" inserted at this point in the book seems to be unduly laboured and out of place, but the author probably considers it to be a necessary introduction to the study of high-resistance measurement, which in its turn leads to insulation testing—both of which are fully treated in separate chapters.

A very important subject which receives scanty attention in most text-books is the measurement of resistance to alternating currents and its application to electrolytic resistances. Two chapters are devoted to it in this book, and all the standard methods devised by Kohlrausch and others are described, as well as some of the more recent work.

Two other subjects are considered, viz., the localisation of faults and the measurement of temperature, and in these the general excellence of treatment is maintained. In the latter section we have the unusual experience of seeing a *correct* diagram of connections for a platinum resistance thermometer, and this in spite of the fact that the author considerably under-estimates the importance of Prof. Callendar's work on this subject. The "compensation" principle is not attributed to him as it should be, and no mention is made of either the Callendar-Griffiths bridge, or the Callendar continuous indicator.

The last chapter describes and tabulates the capabilities of the various types of deflection instruments in use for resistance measurements.

Altogether, this book deals with the subject in a complete and workmanlike manner, and will rank as a standard work on resistance measurement.—P. K.

BRITISH TRADE WITH CANADA.

THE following are extracts from a valuable report on the trade of Canada issued by the Board of Trade and prepared by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Montreal, to which we refer in our leader on page 81. The report itself can be purchased from Messrs. Wyman & Sons, at a cost of 3d.

TRADE STATISTICS.

Preliminary figures of the trade of Canada during the 12 months ended March 31st, 1913, show that, excluding bullion and specie, imports amounted to £141,100,000 as compared with £109,620,000 for the preceding year, an increase of about £31,500,000, or 28½ per cent. The value of the exports of merchandise was £80,800,000, an increase of £17,500,000 as compared with 1911-12. The value of the imports of merchandise from the United Kingdom was £28,700,000, an increase of £4,610,000, or 19 per cent. Goods imported from the United Kingdom free of duty were valued at £6,326 000, an increase of £700,000, or over 12 per cent., whilst imports of dutiable goods from the United Kingdom amounted to £22,380,000, an increase of about £4,000,000, or 21 per cent. over 1911-12.

The imports into Canada from the United Kingdom have steadily grown in value since 1897. In that year imports from the United Kingdom were at the low value of $29,400,000 (about £6,000,000). By 1902 imports from the United Kingdom had advanced to $49,200,000 (about £10,000,000), and for the fiscal year ending March 31st, 1912, to $117,000,000 (about £23,500,000).

Considerable as has been the rise in the imports into Canada from the United Kingdom in the last 16 years ($87,600,000), it has not kept pace with the remarkable expansion in the total value of imports into the Dominion from all countries. During the period 1873-1897, imports from the United Kingdom steadily declined from $68,500,000 to $29,400,000, *i.e.*, from 53·5 per cent. (1873) to 24·6 per cent. (1897) of the total import trade. In the following year (1898) the value of imports into Canada from the United Kingdom showed an increase of $3,000,000 (about £600,000), and has continued to advance annually since that year. In April, 1897, the Canadian Government inaugurated preferential Customs treatment for goods imported from the United Kingdom to the extent of ⅓th of the duties payable under the General Tariff (since increased to an average of ⅓rd), and it will be noted that imports into Canada from the United Kingdom began to show an increase in the year following, an increase which has been maintained without interruption year by year since that date; the expansion in the total imports into Canada began about two years before, *i.e.*, in 1895-96. Between 1896-7 and 1912-3 imports from the United Kingdom for consumption in Canada quadrupled in value, but, nevertheless, the proportion of imports from the United Kingdom to the total imports from all countries showed a decline of 7·3 per cent.

I am not, however, prepared to go so far as to believe that this loss of percentage by the United Kingdom in the import trade with the Dominion has been due to any general decrease in the competition for trade. In fact, certain individual firms of the United Kingdom have within the last three or four years not only taken their share of the increased trade but have actually secured trade which formerly went to the United States. British manufacturers are taking a greater interest and are watching this market with greater attention, but I fear a number have not realised the extraordinary expansion which has taken place in the last few years; and many lines have been either overlooked or the volume of business to be done has not been fully appreciated.

The Dominion of Canada in common with other countries felt the pressure of the financial situation towards the beginning of the autumn of 1912. Financial interests in the Dominion have steadily tightened the strings throughout the winter, and the effect has

been noticeable in the west as well as in the commercial centres of Montreal and Toronto; so much so that some of the municipalities in the west which had entered into contracts to purchase machinery and material have had to delay settlement, although the contractors have delivered or have been ready to deliver under the contracts made. In view of these conditions the facility with which some important western municipalities have raised loans in the London market is a matter for some surprise. A result of the land boom has been the locking-up of a great deal of capital in real estate, thereby hampering the conduct of ordinary business.

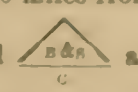
British Trade Methods.

Some British manufacturers have recently opened branch establishments in Canada, and others have been investigating the conditions here with a view to initiating similar enterprises. Representatives of British manufacturers in Canada, as well as Canadians, express the opinion that the starting of branch establishments in Canada will assist the importation of British goods and that, in some cases, it is almost essential to start branch works for the purpose of assembling and manufacturing, in order to secure a due share of the expanding trade of the Dominion. One or two British merchant firms, as distinct from manufacturers or their representatives, have opened branch offices in Montreal. That British manufacturers, so accustomed to rely on the merchant to handle their business in oversea markets, have failed to secure the share of the Canadian important trade to which they are entitled is partly due to the fact that so few of the British merchant houses have thought it worth their while to start offices in such centres as Montreal, Toronto and Winnipeg, to handle the trade between the two countries. The American manufacturer, on the other hand, has largely built up his trade in oversea markets by sending direct representatives from the works to study the conditions on the spot. With Canada at his door, so to speak (a night's journey only separating important manufacturing points in the United States from Montreal and Toronto), it is not surprising that the principal trading centres of Canada are overrun with the representatives of American manufacturers.

The trade of the United Kingdom with Canada has features which differentiate it in a marked sense from the export trade as commonly conducted between the United Kingdom and other self-governing Dominions and some foreign countries. The merchant in the latter instance occupies a predominant position and handles a very large proportion of the trade, although it is recognised that there has been for some time a growing tendency for manufacturers to establish direct relations with importers carrying on business in most oversea countries. In Canada, on the other hand, the merchant's presence is barely noticeable; direct trading between the wholesaler or retailer and the manufacturer is a marked feature and dominates the situation. Failure to appreciate this attitude has resulted in business passing the United Kingdom and going to the United States, so determined is the Canadian importer to trade only with the manufacturer. Even the commission agent or representative, resident and carrying on business in Canada (as distinct from a branch office of a manufacturer) comes in for a share of this dislike to trading with a go-between. This feeling of the Canadian buyer is very deeply rooted, quite as deeply, in fact, as is the custom or habit of the average United Kingdom manufacturer to rely on and employ commission agents and merchants for disposing of his productions in domestic trade and to utilise the services of the export houses for oversea trade. Accepting this view as correct, it will be understood how great are the difficulties underlying the situation and hampering the expansion of British trade with a market whose import trade has trebled itself in the short term of 11 years and which is as far as one can foresee only just beginning to give indications of its future value. It must be admitted that the majority of British manufacturers have not learned the essential details governing direct trade with an oversea customer, which it will take time to master, and to this fact may be traced the larger number of the criticisms directed by the Canadian against the British manufacturer, particularly criticisms having relation to circumstances attending the handling and forwarding of goods such as invoicing, packing, freighting, &c.

Attention may be called to certain factors which have repeatedly been brought to my notice as hampering many existing agents in their work on behalf of their principals in the United Kingdom.

The first is in regard to invoicing. Canadian money is in dollars and cents, but many British manufacturers apparently refuse to believe this and invoice their goods in English money to Canadian firms having little acquaintance with the intricacies of the British system. Not content with that, they will send perhaps four or five different invoices for different parts of the same appliance or machine, each one with different discounts and all in English money. The American manufacturer, on the other hand, invoices the whole machine or appliance in one sum, with one discount, in Canadian dollars and cents (which, it is true, is the same currency as his own). Another practice which is complained of is that adopted by many British manufacturers in altering their price or their discounts from time to time, simply notifying the change in the discount, 2½ per cent. or 5 per cent. up or down, as the case may be. The American manufacturer, on the other hand, fixes a price on many of his goods at the beginning of the year, and holds that price good for 12 months. It is, I am sure, only necessary to realise these striking differences between the methods of the manufacturers of the two countries to appreciate what the difference is in the work involved. When it is also realised that owing to the great expense of running an office and of living in Canada, clerks are few and far between in these agents' offices (the principals of many of them being their own invoice clerks, book-keepers, cashiers, as well as salesmen), the agent has directly brought home to him the extra amount of work involved in representing the average British firm. However great his inclination is to do this, it is gradually sapped and weakened owing to the time he has to spend in elucidating the problems and puzzles which the British manufacturer supplies him with but omits to remunerate him for. It is suggested that all British manufacturers should invariably provide invoices with one discount, and if they are unable to alter their practice of continually revising prices, at least to work out the revision themselves and supply the result in Canadian currency for their agent.

The second matter is the question of marking cases. It cannot be too strongly emphasised that the name of the Canadian town to which delivery is to be made, should be spelled out in full. It is not sufficient to indicate it by the first letter. To this matter I have drawn attention, as it has recently been repeatedly brought to my notice. The loss of a package is surely to be avoided, as well as the expense incurred in telegraphing and searching over large stretches of this Continent in order to find some two or three cases destined for, say, Calgary, some 2,000 miles from the landing ports. To send forward packages marked 

as was actually done some few months back, is asking for trouble.

I am inclined to believe that the practice of charging for packing cases adopted by United Kingdom firms is a mistake. The British manufacturer would be better advised to include the cost of the packing in the price of the article. He should also take care to avoid making the packing case unnecessarily heavy with thick sides as well as ends. For every part of the case which is even $\frac{1}{8}$½ in. too thick the importer here has to pay so much additional freight, whether by weight or measurement, and it must add to the final cost of the article and thus retard the development of the trade.

It is pleasing to note that inquiries from the United Kingdom are steadily increasing in number, both from firms desiring to obtain suitable representatives and also from firms inquiring as to the conditions affecting the sale of their goods in different parts of the Dominion. United Kingdom manufacturers will materially assist in the Trade Commissioner's work if they will see that he is placed on their mailing list for catalogues, price lists, and discount sheets. These catalogues serve two purposes:—(1) A reference for Canadian importers, and (2) an effective advertisement for the United Kingdom manufacturer.

General Market Features.

For the working of the Canadian market, several difficult problems present themselves which require to be overcome, if the distribution is to be adequately and economically carried out. The ribbon of territory forming the Canadian market is all one country, but may be divided into sections each of which has its own distinctive features—in the character of its inhabitants, their pursuits and their wants. The differences in these distinctive features require as much study as the differences in the conditions in the several European countries from east to west. The practice of many Canadian firms, based upon long experience, is to have branches established in at least four centres, for distributing purposes, in addition to Montreal. Some of these firms have gone so far as to establish branch factories in the west, having found it necessary to start these in order to hold their trade and, mainly, to save the long and expensive rail haulage from the extreme east of Canada. It is stated that experience has taught Canadian firms that to work a territory economically, it is wise to establish a separate branch in order to limit the distance to be covered by the traveller. This should not exceed an 18 hours' journey from wherever the branch is located. In accordance with this principle, many firms roughly divide the long ribbon of territory into the following distributing centres:—

1. Montreal—for the maritime provinces and about 80 miles west, to Cornwall.
2. Toronto—for the towns around Lake Ontario and the Niagara peninsula, to include Sault Ste Marie.
3. Winnipeg—for the western prairie, east and south to Fort William, west to a point about half way to Calgary.
4. Calgary—north to Edmonton, south along the Crow's Nest Railway to Nelson, west to the Rockies.
5. Vancouver—for British Columbia and Victoria, Vancouver Island.

The British merchant or manufacturer should realise that to place an agency with a Montreal firm without branch offices either east or west, as sole agent for the Dominion, can hardly result in the thorough distribution of his goods throughout this long, narrow ribbon of territory. It should also be borne in mind that even if the agent makes a tour of the Dominion once, or even twice, a year, he has to be absent for many weeks and incur very considerable expense, and it is doubtful whether the result is proportionate to the heavy expenses and loss of time involved.

The finding of a suitable agent is a very difficult problem, no matter how much care is taken. Where the article requires mainly salesmanship—by this is meant an article whose merits the average agent can speak of from literature or explanations supplied by the manufacturer—the task is a little simplified. Where, however, the article requires some technical knowledge on the part of the agent, the task of finding a suitable representative is made infinitely greater. To begin with, firms of manufacturers' agents with an established business are few in number, and are usually already provided with agencies of foreign manufacturers; they are, therefore, mostly barred from handling a British agency covering similar goods. Even when an agent is found who is suitable in

many ways, he will, in the majority of instances, be found to be quite unacquainted with the merits of the appliance or machine for which a market is to be developed. The British manufacturer is slow to recognise that his appliances and machines, unknown, or very little known, on the Canadian market, must require a good deal of missionary work to be undertaken, and heavy expense to be incurred, before they become known. When a British manufacturer determines seriously to develop this market for his products, he should be prepared to send a technically qualified assistant from his works to spend a year in the agent's office. The assistant might be paid partly by the home firm, and partly by the agent. At the end of some 12 or 18 months, the assistant having, on the one hand, thoroughly demonstrated the technical advantage of his firm's products to the agent, and, on the other hand, acquired information and experience of local conditions, unobtainable otherwise than on the spot, should, on his return, with the experience gained, prove of considerable value to his firm.

Another point to be remembered when endeavouring to introduce an appliance or machine of a technical character, or an article whose cost exceeds that of a similar article already on the market, is that Canada is an extremely expensive country to travel in—how costly, probably few firms in England appreciate. Now, it stands to reason that the agent will not incur the expense of the missionary work required to introduce such goods as are above described without sufficient incentive. It amounts to this, roughly, that either the British manufacturer must, the first year or two, pay for the pioneer work to be done, or, in the alternative, reduce the cost of the article desired to be introduced to a price equivalent to, or lower, than the competing article on the market, and leave the agent to go ahead, relying on his own ability to introduce and make a trade in the article.

ELECTRICAL ACCIDENTS IN 1912.

(*Concluded from page 75.*)

WHILST there has been a very great advance in the design of high-tension switchboards during the last few years, the same attention has not been given to the design of direct-current medium-pressure boards. These switchboards are commonly arranged so that it is impossible to do any work upon them without danger of making a short circuit. There is much room for improvement in this respect, not only in the relative arrangement of the conductors at different potentials, but as regards the conductors and the earthed metal framework which supports the slate or marble panels. Many of the short circuits due to men working on the live conductors have been between one conductor and the earthed framework. There is nothing impracticable in protecting the framework by slate or other suitable material and protecting bolt heads on the front of the panels in such a way as to overcome this danger, or in putting more divisions between conductors of opposite polarity, and the extra cost involved would be well repaid by the increased security against accident and breakdown. Some extra space would no doubt be required, but this again would be an advantage, as a common fault with these switchboards is that the apparatus and conductors are much too cramped together. Watt-hour meters in which the main current of the circuit passes through the instrument are not unfrequently found on switchboards. These instruments require periodical calibration or comparison with a standard instrument, often involving risky work at the back of the board in making the temporary connections for the standard and in reinstating, no provision having been made for the ready connection of the standard instrument. Some of the accidents from short circuits already referred to were due to this operation. Instruments having a current coil as a shunt to a resistance in the main circuit are to be preferred as tending to obviate the necessity for breaking and making main connections for purposes of calibration, with an additional advantage that the meters can be placed away from the switchboard where they are less liable to the influence of stray fields. In comparatively few stations are there provided any insulated spanners or special tools for use on live switchboards. Where any work has to be done, ordinary engine room tools are used with attendant risk of making short circuits.

Although my report, as usual, deals mainly with unsatisfactory conditions and dangerous apparatus which I have come across during my visits, I have also seen much that is excellent and which is very useful to point to as a standard in the less satisfactory places. In many cases the Regulations are well observed and precautions beyond those actually required have been adopted. In other instances, however, the Regulations have not been attended to, and engineers and others who should be familiar with the requirements have confessed to being totally unacquainted with them; others again seem to think that there is no need for them to take any steps to effect compliance until the matters have been pointed out to them by an inspector. Some also seem to take much trouble to work as near the border line as possible. Thus, new switchboards are erected with the bare minimum of space at the back, although there may have been several feet to spare at the front—a practice liable to lead to difficulties later on if any alterations or additions needing more space are required at the back. Others again fail to see that the Regulations are intended to provide for safety and are not merely arbitrary rules without a purpose. Thus, Reg. 17, which requires a certain minimum width of passage-way behind switchboards, is subject to exemption for low pressure. Some occupiers or their contractors, in putting up switchboards subject to this exemption, instead of providing some reasonable width of passage-way do not provide space at the back sufficient for ordinary convenience to say nothing of safety. In one case, a low-pressure three-phase board with iron floor plates front and back, had only 9 in. clear space behind, although there was room and to spare in front. In other cases, low-pressure switchboards are placed in inaccessible or dangerous positions, but are exempt from Reg. 25, which does not apply to low-pressure systems. In another case, also by a well-known firm, a number of 220-volt two-phase switch panels were placed in the pump room of a supply station over iron plating and without any protection. In other cases covers were provided, but constituted a trap. The switch and fuses were under the same metal cover. If a fuse should blow and require renewing, the metal cover would have had to be unscrewed and removed. The permanently live contacts of the switch were within ½ inch of the metal cover so that there would be great danger to the attendant of shock to earth should he allow the cover to touch the live conductors whilst removing it. Fortunately, such cases can be dealt with under Reg. 1, which provides for safety in general terms. That Exemption 1 is not intended to allow of unnecessarily dangerous conditions merely because the pressure happens to be below certain limits, is made quite clear in the Commissioner's Report on the Public Inquiry. The exemption as regards public supply stations was given merely because such stations are "generally well arranged and kept, but it does not exempt from the requirements of Regulation 1. The idea that where Exemption 1 applies, conductors and apparatus may be arranged totally regardless of danger, is entirely erroneous.

Transforming sub-stations are nearly always now constructed so as to be in accordance with the requirements. I found, however, one example of a new station which was very dangerous. The roof was only 4 ft. high, and there were bare high-tension fuse terminals totally unprotected close to the switch on the back wall. One of the high-tension accidents already referred to occurred in this sub-station. In another sub-station I found high-pressure grip fuses not protected by switches and having exposed live metal at each end, placed over a cement floor and no insulating stand or gloves provided.

I found during the year numerous examples of switches and switch-fuses, both in electrical stations and other works, not in accordance with the requirements of Regulation 3 (*c*), that is, that they were not so arranged that "the hand cannot inadvertently touch live metal." As I mentioned last year, several firms have taken up the manufacture of switch gear and other apparatus specially designed to meet the requirements and others are now doing so. Unfortunately there are firms who continue to advertise and sell apparatus that does not comply with the requirements, taking the view that it is none of their business where the apparatus is ultimately used, whether on factory premises or elsewhere.

Hand lamps which do not comply with the requirements are still to be found in use, and the readily contrived substitute for a properly constructed portable lamp, consisting of a lamp in an ordinary metal lampholder on flexible wires, is often used. There would be no objection to its use if the holder were earthed, which, however, is never the case, and it is, therefore, dangerous when used in places where the person handling it is not insulated from earth. Several of the fatal hand-lamp accidents during the last few years have been caused through the use of this makeshift

TABLE III.—ELECTRICAL FATALITIES REPORTED UNDER THE FACTORY ACTS IN 1912.

No.	Month.	District.	Voltage of system.	Voltage of circuit or probable voltage of shock.	System. A = Alternating, 1 = single-phase, 2 = two-phase, 3 = three-phase, D = direct.
1	Jan.	Dundee ...	630	630	A 1
2	Jan.	Glasgow ...	400	230	A 3
3	Feb.	Stockton ...	440	250	A 3
4	Feb.	Dublin ...	5,000	3,000	A 3
5	Feb.	Leeds ...	400	230	A 3
6	Mar.	N. London ...	10,500	6,000	A 3
7*	June	Newcastle ...	440	440	A 3
8	July	Edinburgh ...	2,000	1,150	A 3
9	July	Manchester	400	230	A 3
10	Aug.	Glasgow ...	440	250	A 3
11	Sept.	Sheffield ...	200	200	A 1
12	Sept.	Liverpool ...	220	220	D
13	Oct.	Glasgow ...	440	440	A 2
14	Oct.	Sheffield ...	500	290	A 3
15	Oct.	Derby ...	6,600	3,800	A 3
16	Oct.	Derby ...	6,600	3,800	A 3
17	Nov.	Manchester	6,600	3,800	A 3
18	Nov.	Wolver'hpton	460	460	D
19	Dec.	Newcastle ...	440	250	A 3

* Fall following shock.

arrangement. Several new and good patterns of safety type hand lamps have been introduced during the year. The construction of some of the safety type hand lamps now on the market is faulty, as they are not made to stand rough usage or use in hot places, such as engine rooms and boiler houses. Some of these hand lamps have metal guards so heavy and so insecurely attached to the body, that if they are dropped on the floor the guards will break away. The use of soft wood in the construction is also unsatisfactory, as it is liable to shrink and split from the heat of the lamp, and is particularly unfitted for use in hot places. Some of the best types have no wood in their construction, an insulating fire-resisting composition being used in place of it.

In an underground switch chamber not under the Acts, a man employed in cleaning was killed by contact with a live conductor. He had neglected to wear the rubber boots provided, and it was subsequently found that he had painted the soles of his feet with an insulating varnish, presumably thinking thereby to render himself immune from shock.

Of the above 18 fatalities directly due to electric shock, five were on high-pressure or extra-high-pressure alternating-current systems. Ten were on medium-pressure alternating systems; six of these were shock to earth on three-phase systems of which the pressure between phases was 440 volts or less, and as the neutral point was earthed in probably each case, the pressure received would not exceed 250 volts in any instance. One was from a 200-volt single-phase system. Of the two on direct-current systems, one was on a 460-volt three-wire system, but not having the middle wire earthed, and the other on a 220-volt two-wire system.

In only nine cases is it clear that any attempt was made to resuscitate the victim by means of artificial respiration. In several it was certainly not attempted. In the cases in which it was tried, the duration of the effort varied considerably. In one case it was kept up for two hours, in another for three-quarters of an hour, and in a third for 10 to 15 minutes, in each case with medical aid, whilst in a fourth it was continued until the arrival of a doctor, who pronounced the patient dead. In two further cases the patients were taken in ambulance wagons to the hospital, and in one of them only was the treatment continued during the journey. In two other cases the treatment was continued, apparently without medical aid, for half an hour, and in another for a few minutes only, as the patient "appeared to be dead."

Dr. Reginald Morton says:—There are only two fundamental facts that need be impressed upon the minds of everyone. The first is that death from electrical shock is only an apparent death at first; and, secondly, whatever the conditions or severity of the accident, there is practically always a time, varying from a few minutes upwards, during which it is possible to resuscitate the victim by artificial respiration if resorted to at once. So important is it to commence artificial respiration quickly, that it is the first duty of the bystander to see to this before everything else. He must not leave the victim to summon medical aid—it may be too late by the time the doctor arrives—but he should send for medical assistance if there is anyone else present.

Artificial respiration must be persevered with for at least two hours, or until the patient revives; in many cases it may be only a few minutes. After return to consciousness complete rest is essential for a day or two, and under no circumstances must the man be allowed to return to work at once, as he may wish to do if the shock has been a light one. With the prompt application of first aid practically every victim can be revived, and of these nearly all will make a complete and permanent recovery, provided they were previously in a normal state of health.

Instructions for the treatment of persons suffering from electric shock are required by the Regulations to be posted in every electrical station and factory using electrical energy at pressures above low pressure. For many years before Regulations came into force, thanks to the efforts of the technical Press, particularly the ELECTRICAL REVIEW, electrical station engineers were generally fairly well acquainted with the measures to be adopted; but, in other works, there may be no one who has even read the placard. To delay reading the instructions until an accident has occurred may render any attempt at resuscitation useless, as the patient may die in the interval, or the subsequent efforts at resuscitation may be so inefficiently carried out as to be futile. In all electrical stations and works where electrical energy is much used there should be persons who have been taught and practically drilled in methods of artificial respiration. It is most important, as pointed out by Dr. Morton, that no time be lost in getting to work after the accident, and there should be no cessation of the efforts for at least two hours. Owing to the comparative rarity of electric shock accidents, very few medical men can have ever had actual experience in their treatment, and it is quite certain that some at any rate do not realise the importance of perseverance in artificial respiration. In a number of fatal cases which I have investigated, the persons present have started artificial respiration and a doctor has been sent for, and on arrival has pronounced the patient dead, and has gone away all within half an hour of the accident. A case of this kind was cited by a witness at the public inquiry into the Regulations a few years ago where, on the doctor having pronounced the victim dead, the men returned to the patient and continued the artificial respiration and succeeded in bringing him round. In a recent case of death from a low-voltage shock, the doctor who was called in is reported as having said at the inquest that attempts to restore animation immediately after the accident would have been useless, as he was sure death was almost instantaneous. Whether the doctors are generally correct in pronouncing life extinct so soon after the accident is not for a layman to judge, but in view of Dr. Morton's letter, it does appear that some of the cases may have been given up too soon.

PROCEEDINGS OF INSTITUTIONS.

Copper and Aluminium Cables for Mining Work.

By BURKEWOOD WELBOURN, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF MINING ENGINEERS, June 5th, 1913.)

THERE is no inherent electrical reason why insulated aluminium conductors should not be used for all purposes and at all working pressures. As regards the use of copper or aluminium, every case should be settled on its merits.

The world's annual production of copper is about 1,004,485 tons, and of aluminium approximately 60,000 tons. For electrical work only about 15 per cent., or, say, 10,000 tons, of all the aluminium produced is used. Further plants are now being constructed, which will increase by 50 per cent. the present output of aluminium within the next two or three years; a reduction in the selling price should follow, and result in a considerable increase in its use for electrical work.

Electrolytic copper-wire bars contain about 0·2 per cent. of impurities, and should comply with the requirements of the Engineering Standards Committee of March, 1910; but there is no E.S. Committee's standard for aluminium. Aluminium bars usually contain 0·5 to 0·7 per cent. of impurities (chiefly silicon and iron), and these should never exceed 0·71 per cent., at which figure the conductivity of hard-drawn aluminium is 60 per cent. when compared with the British standard for hard-drawn copper at 60° F.; with 0·5 per cent. of impurities the conductivity will be as high as 61·7 per cent. If the impurities do not exceed 0·75 per cent., as can invariably be arranged, bare aluminium wires can be used in the United Kingdom in any situation in which copper wires can be employed.

For lines near coke ovens, aluminium should always be used, as it resists the action of sulphur dioxide products, whereas copper will not do so.

If equal sections of copper and aluminium are tested under equal conditions, it will be found that an aluminium conductor will carry 60 per cent. of the current that a copper conductor will carry with the same loss of energy. Conversely, the cross-section of an aluminium conductor must be 1·666 times that of a copper conductor if it is to carry the same current with equal drop of pressure.

For a given current-carrying capacity, theoretically only half the weight of aluminium is required as compared with copper, and in practice this is also nearly true.

The coefficient of linear expansion per degree Fahrenheit is 40 per cent. greater for aluminium than for copper.

Aluminium for overhead lines should always be cold-rolled, despite the greater expense. Cold rolling, coupled with improved manufacturing processes in England, has increased the breaking-strain of aluminium by 10 per cent. over that obtained only three years ago. Individual wires for overhead lines should be specified to comply, after stranding, with the tests given in Table I, without interfering with the electrical conductivity:—

TABLE I.—SUGGESTED TESTS FOR HARD-DRAWN ALUMINIUM CONDUCTORS.

Standard wire gauge.	Diameter of wire.	Breaking-strain.	Extension on a 5-in. length.	Wrapping test.
	Inches.	Tons per square inch.	Per cent.	
4	0·232	11·00	3·00	Three times round its own diameter on and three times off.
6	0·192	12·00	3·00	
8	0·160	13·00	3·00	
10	0·128	13·50	3·00	
12	0·104	14·00	2·50	
14	0·080	14·50	2·50	
16	0·064	14·75	2·50	

The breaking-strains agree very closely with the equation:—

$$T = 16{\cdot}5 - 24\,D,$$

where

T = Tensile strength in tons per sq. in., and
D = Diameter of wire in inches.

There appears to be no case in the United Kingdom in which aluminium cables have been used for shaft or in-bye work in a mine. In mines cables are almost invariably insulated with impregnated paper, or bitumen, and protected with wire armour and compounded tapes or jute.

The diameter of aluminium cables is greater than that of the equivalent copper cables, hence the cost of protecting an aluminium cable exceeds that of a copper cable. Investigation of cables protected with jute string shows that the jute opens at bends in the cable and allows the water of the mine, often corrosive, to have access to the armour. The writer is of opinion that compounded hessian tapes afford much more certain protection than jute string. The chief corrosive agents to be guarded against in vulcanised-bitumen cables are (1) caustic soda, due to the electrolysis of salt

on the occurrence of a leakage of direct current; (2) lime in concrete and mortar; and (3) alkaline waters, due to calcium carbonate.

There are very few corrosive agents which will attack lead. Those which do so form a protective coating on the lead, if not subjected to external electrolysis. There have been a few cases of corrosion of lead sheathing in mines, but expert examination always reveals (1) that the corrosion is the result of chemical action aided by electrolysis, and not of chemical action alone; (2) that corrosion is almost confined to direct-current circuits only; or (3) that the lead has not been made continuous and connected to earth. Corrosion of the lead sheathing due to electrolysis cannot occur on alternating or direct-current circuits if the Home Office requirements for the continuity and earthing of the lead and armour on cables are adhered to. The writer advocates the very highest standard of cable work in mines, whether copper or aluminium conductors are used, and indicates his personal preference for paper-insulated lead-sheathed cables.

All three-core lead-sheathed single and double-wire armoured cables, and all vulcanised-bitumen double-wire armoured cables built to the British Engineering Standards Committee's table of March, 1910, for all pressures up to and including 3,000 volts, and of all sections of copper (and equivalent aluminium) conductors from 0·025 to 0·30 sq. in. area, comply with the Home Office Rule 12 (*e*) (iv).

Tables have been drawn up here which may prove useful in deciding what type of cable shall be installed in any given case. The first table (II) compares directly the relative prices of low- or medium-pressure three-core copper conductor shaft-cables, double-wire armoured, taped, and compounded; (*a*) paper-insulated lead-covered, and (*b*) vulcanised-bitumen insulated.

TABLE II.

Area. Sq. in.	(*a*) Paper-insulated.	(*b*) Bitumen-insulated.
0·05	1·00	1·19
0·10	1·00	1·15
0·25	1·00	1·13

TABLE III.

Description.	Sectional area, in sq. in. 0·05	0·10	0·20
(*a*) Paper insulated with sector cores, lead-sheathed and single-wire armoured	1·00	1·00	1·00
(*b*) Paper insulated with sector cores, vulcanised-bitumen sheathed and single-wire armoured ...	1·10	1·08	1·06
(*c*) Vulcanised-bitumen insulated, with round cores and single-wire armoured	1·18	1·15	1·12
*(*d*) Paper insulated with sector cores, vulcanised-bitumen sheathed and double-wire armoured "leadless" cables ...	1·40	1·31	1·22
*(*e*) Vulcanised-bitumen insulated, with round cores and double-wire armoured	1·48	1·38	1·29

* These cables could also be used for shaft-work.

Table III gives the relative prices for various low or medium-pressure three-core cables with copper conductors for in-bye use, and shows the considerable saving in first cost of the lead-sheathed cable as compared with any form of bitumen cable.

The Home Office memorandum on Rule 12 clearly recommends that double-wire armour should be employed even on in-bye cables when no lead sheath is used. If this recommendation be followed the saving in first cost between items (*a*) and (*d*) or (*a*) and (*e*) is remarkable.

The most important cases in which aluminium cables have been used in this country are as follows:—

Manchester Corporation Electricity Department, over 11,000 yards of single-core cable, chiefly of 1·66 sq. in. area.

Bolton Corporation Electricity Department, 1,440 yards of single-core 1·66 sq. in. cable.

Metropolitan Electric Supply Co., Ltd., London, about 6,000 yards of 0·83 sq. in. concentric and triple-concentric. All the above are paper-insulated lead-sheathed.

The writer has seen a list of places in which over 800 miles of cable are employed at voltages varying from 240 to 60,000 (single-phase).

At the time of writing this paper (March, 1913) the market values prevailing have been used in working out the comparative prices of insulated cables as follows:—

	£	s.	d.
Copper (electrolytic wire bars), per ton of 2,240 lb.	69	5	0
Aluminium do. do. do.	90	10	0

For three-phase work at low and medium pressures, taking, for example, a copper cable of 0·1 sq. in. (aluminium 0·166 sq. in.), the aluminium cable is the cheaper:—

(*a*) In plain lead-sheathed cables whenever aluminium wire bars are less than £22 per ton above the price of copper bars.

(*b*) In single-wire armoured cables whenever aluminium wire bars are less than £10 per ton above the price of copper bars.

(*c*) In double-wire armoured cables whenever aluminium wire bars are lower in price than copper bars.

For continuous-current work, at low and medium pressures, a comparison between a 0·30 sq. in. copper single-conductor paper-insulated lead-sheathed cable and the equivalent 0·50 sq. in. aluminium cable, both being built to comply with the Home Office rules, shows that the aluminium cable is the cheaper:—

(*a*) In plain lead-sheathed cables whenever aluminium wire bars are less than £42 per ton above the price of copper bars.

(*b*) In single-wire armoured cables whenever aluminium wire bars are £22 or less per ton above the price of copper bars.

(*c*) In double-wire armoured cables whenever aluminium wire bars are £10 or less per ton above copper bars.

The latter comparison holds good when the conductors are insulated with bitumen instead of paper.

There are installations where economies can be effected by using unarmoured aluminium cables on the surface works only, especially when the generating station or sub-station is situated at any considerable distance from the shaft. With larger sizes of unarmoured continuous-current cables, the saving is greater, and unarmoured concentric and triple-concentric aluminium cables for pressures up to 650 volts usually show a considerable saving over the equivalent copper cables. One such case came under notice this year, where a triple-concentric aluminium cable showed a saving of 20 per cent. over the corresponding copper cable.

For 3,000 volts three-phase, in the case of a 0·20 sq. in. paper-insulated three-core copper conductor lead-sheathed and double-wire armoured cable, the aluminium cable cannot compete either in price or in weight.

The first cost of overhead transmission lines of stranded aluminium conductors of 0·10 sq. in. sectional area and upwards, with spans up to 400 ft. (the maximum usually employed in the United Kingdom), is less than for lines of copper conductors. A comparison of the cost of a 6,600-volt three-phase 25-cycle line to carry 1,000 KW. for 10 miles under British conditions, constructed of copper and aluminium, shows an approximate saving of 16·5 per cent. in favour of aluminium. In three definite cases in this country in which *bonâ fide* alternative tenders were given for lines with both aluminium and copper conductors, the tender for aluminium was accepted in each case.

Experience in North America has shown that there is much less trouble with aluminium than with copper from ice and snow collecting on the conductors.

For jointing insulated cables, the author cannot recommend either cast-aluminium joints or autogenous welding, owing to the effect of the heat on the insulation. But he can confidently recommend mechanical joints of the type illustrated in fig. 1.

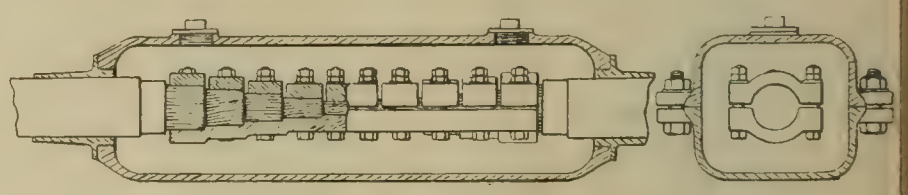


Fig. 1.

Copper joints can be easily made on overhead lines by means of flexible copper braid bound and soldered to the joint; this system has been patented by Mr. Chas. Vernier.

There are various ways of jointing aluminium conductors on overhead lines. Up to 0·25 sq. in. welded joints can be made. Another way of jointing large conductors is by means of the type of clamp-joint shown in fig. 1. These joints cannot be used under stress. A torsion sleeve-joint may be employed for jointing conductors up to about 0·30 sq. in., under strain, and a specially-designed joint for use under stress was employed on Messrs. Newton Chambers & Co.'s 1·4 sq. in. line.

Frequently on overhead lines it is necessary to employ lead-sheathed paper-insulated cables, supported by hangers attached to a steel suspending cable. With these, in the past, there has been much trouble, owing to the cracking of the lead sheath. The troubles have been eliminated by the use of the method of suspension covered by Mr. C. E. Elder's patent, and by the addition of 3 per cent. of tin to the lead sheath. The system consists of very short chrome-leather supporting hangers, placed 12 in. apart, and fastened to a stranded steel suspending cable in such a way that they have no longitudinal movement. At every tenth hanger, a sherardized flat-steel spring is sprung on the hanger for clamping it to the cable and so preventing any longitudinal movement of the cable relative to the hanger. In special cases, every hanger may be clamped to the cable. Clean, commercially pure aluminium scrap, as obtained from cables or from overhead lines, can readily be sold at about £22 per ton below the market price of aluminium-wire bars; the price of clean electrolytic copper scrap is about £6 per ton below the price of wire bars.

Aluminium is coming increasingly into favour. The initial difficulties have been overcome, and it can be safely used as a conductor on an equal footing with copper. For mining work in the United Kingdom, at the present prices of copper and aluminium, insulated cables with copper conductors and for all pressures are the cheaper, while, for overhead lines, aluminium conductors are the cheaper. Paper-insulated lead-sheathed cables are cheaper than bitumen-insulated cables, whether the conductors be of copper or of aluminium.

Association of Consulting Engineers.

The annual general meeting of the Association was held at the Institution of Electrical Engineers, London, on Monday, June 30th, 1913, Mr. G. Midgley Taylor (of Messrs. John Taylor & Sons) presiding.

The Chairman said that in accordance with the rules, a ballot had been held to decide the members of the committee who should retire, and Mr. W. T. Douglass, Mr. Baldwin Latham, Mr. E. L. Mansergh, Mr. E. H. Stevenson (London), Mr. J. H. Harrison (Middlesbrough), and Mr. T. L. Miller (Liverpool) were drawn out. The following had been elected on the committee to take the places of the members resigning :—Prof. David Capper, Mr. E. M. Eaton, Mr. Robert Hammond, Mr. A. J. Martin, Mr. H. S. Childe (of Wakefield), and Mr. W. L. Spence (of Glasgow). There was this year meeting at Ghent, from July 17th to 22nd, a Congress of Consulting Engineers in connection with the Ghent exhibition, when the bodies represented would include the Associations of Consulting Engineers of France, Copenhagen, Berlin, California, New York, Utrecht, Switzerland, and Zurich. He hoped their hon. treasurer, Mr. Lowcock, would be able to attend, and represent the London body. He thought this meeting in Ghent this year justified their existence, and that in view of what was being done in other countries, the time had arrived when they should have the support of every genuine and *bonâ fide* consulting engineer in this country. There had been a very large demand for the booklet setting forth the professional rules and practice of members of the Association, which, to his own knowledge, had been of material assistance to various members of this Association when dealing with the public bodies by whom they were employed in this country, and on more than one occasion the booklet had enabled a consulting engineer to have his own way with regard to his professional work and his fees. There was a balance in hand of £16 16s. 11d. at December 31st, 1912. At the present time there was £110 7s. 10d. He proposed the adoption of the report, which was seconded by

Mr. H. Percy Boulnois, who said 80 members were subscribers, and he had no doubt that in process of time they would quadruple the number. There were many men still standing aloof, but he hoped they would be able to show them that they had better belong to that Association. If it had not been for Mr. A. H. Dykes the Association must have failed.

The motion for the adoption of the report was carried unanimously ; Mr. C. F. Mendham and Mr. Arthur Preece were then proposed and appointed as auditors.

Mr. J. S. Alford proposed an amendment of Rule 2, which at present stated that members of the Association of Consulting Engineers must be Corporate Members of the Institution of Civil Engineers, or full members of the Institution of Electrical or Mechanical Engineers. He desired to add the words "or the Institution of Civil Engineers of Ireland." Mr. Arthur J. Martin seconded the proposition, which was carried unanimously, subject to confirmation at a special meeting called for that purpose.

Votes of thanks to Mr. Dykes, and to the Institution of Electrical Engineers for the use of its rooms, were then passed.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Landlord" writes :—"A tenant of mine recently received from the Electric Lighting Co. a letter to the following effect :—

"'Owing to the very small consumption at your premises, we propose to remove the meter and fittings after the expiration of seven days, as it is unprofitable for us to allow same to remain.

"'If you are likely to be increasing the consumption to any extent, or if you are agreeable to pay a rental for the meter of 5s. half-yearly in advance, kindly advise us, when we shall be pleased to reconsider the matter.'

"The tenant had signed an agreement which contained the following provision :—

"'In consideration of the Electricity Supply Co., Ltd., wiring eight lighting points in the premises known as —— —— which are now in my possession, and supplying plain drop fittings, I hereby agree to pay towards the expense of installing same the sum of 2s. 6d. (two shillings and sixpence) per point for such eight points. The said wiring and fitting to remain the sole property of the supply company.

"'I also agree during my tenancy or occupation of the said premises to take a constant supply of electric current for the lamps referred to below by slot meter, and upon the conditions herein set forth under the heading of general conditions, and I further agree to use no other illuminant in the rooms where electric light is installed.' There followed particulars of fittings."

*** It is difficult to say what is involved in an undertaking to "take a constant supply of electric current . . . by slot meter." Presumably it is something quite distinct from an undertaking to consume so many units. So long as the consumer uses the current which passes through the slot meter, and no other, for the purposes of lighting, it would seem that the company can have no possible right to complain. In any event, it is impossible to conceive what legal basis there is for the notice contained in the letter which forms part of the query.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

BRITISH GUIANA.—The Government of British Guiana have passed an Ordnance giving effect to the terms of the Canada-West Indies Treaty for the inauguration of preferential Customs treatment of goods from Great Britain or Canada on importation into that Colony. The following are the new rates of duty which are of interest to readers of the Electrical Review :—

	British preferential tariff.		General tariff.	
Electric machinery not admitted free of duty	12	ad val.	15	ad val.
Electrical dental appliances of all kinds	12	„	15	„
Wire	12	„	15	„

The following will be admitted free of duty :—Machine belting ; machines or sets of machines to be worked by steam or other power, or which before being brought into use require to be fixed with reference to other moving parts, and which are intended for electric lighting and power plant ; accessories for machinery and other appliances or apparatus which are intended for use in electric lighting and for railway power plant—viz., wire for use in electric street lighting and locomotion, motors and their parts, controllers and their parts, rheostats and rails and their appendages ; for use in connection with electric lighting when imported by the Mayor and Town Council of Georgetown or New Amsterdam for lighting any street or place belonging to them or subject to their control, viz., implements ; steam boilers of every description and steam boiler plates, fittings, mountings, tubes and lagging ; telegraph instruments and other materials imported by telegraph companies and necessary for the construction and use of their works, offices and stations in the Colony ; telegraph forms, telephones and materials necessary for the construction of telephones ; all materials for use in railways or other special works which, in the opinion of the Governor in Council, may be useful in the development of the resources of the Colony.

WEST INDIES.—In accordance with the terms of the Canada-West Indies Agreement for the granting of preferential treatment to British and Canadian goods on importation into the West Indian Islands, provisions have been laid down in some of the Colonies requiring the production of certificates of origin as proof of the British origin of goods for which a preferential duty is claimed.

All articles entitled to preference shall be accompanied by a certificate of origin in the form prescribed.

Certificates of origin, in order to be valid, must be attested to in British countries before a Collector or other principal Officer of Customs or a Justice of the Peace, and in other countries before a British or other Consul, notary public or other official authorised to administer oaths, and they must bear the autograph signature of the authority issuing the same, together with the seal of office, if any. No certificate shall be valid after the expiry of six months from the date of its issue.

Inasmuch as it is possible that articles entitled to preference may occasionally be landed before the arrival of the certificates of origin relating to the same, it shall be competent for the Customs authorities to authorise the delivery of such articles at the preferential rates of duty on the security of the deposit equal in amount to the difference in duty between the preferential and general rates, or on bond being given for such amount for the due production of the necessary certificates within a prescribed period, provided that a general bond may be entered into to cover a series of transactions, and in a penalty suitable to the extent of such transactions. Deposits made under the provisions of this paragraph shall be carried to account under the appropriate head of revenue at the end of a week after the expiration of the time allowed for the production of the certificatss of origin.

When goods accompanied by certificates of origin are not in conformity with the descriptions borne on the certificates, by reason of discrepancies as regards the marks or numbers of the packages, or the kind, quantity or value of the goods, they shall not be entitled to preferential treatment unless the Customs authorities at the port of destination are satisfied as to the origin of the goods, and that the differences are solely due to error.

Goods certified for entry under the preferential tariff shall be packed separately from other goods. The packages, however, may be enclosed with other goods, provided the certificate of origin is endorsed accordingly.

In order to obtain admission at the preferential rates of duty, British goods shall be imported direct from the United Kingdom.

The Canada-West Indies agreement came into force on June 2nd of this year, and the West Indian Governments which are parties to the agreement are as follows : Trinidad, British Guiana, Barbados, St. Lucia, St. Vincent, Antigua, St. Kitts, Dominica and Montserrat.

The British Fire Prevention Committee.—Electro-glazing by the Luxfer Prism Syndicate, Ltd., has been classified as affording "partial protection" Class A on a 1½-hour test at temperatures exceeding 1 500° F., followed by the application of water, for panels of 2 ft. × 2 ft. Impending tests for the summer season include a reinforced concrete floor, material suitable for light fire-resisting partitions and several fire-resisting doors.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,994. "Automatic electric switches governing dual-rate energy meters." H. H. PERRY. June 30th.

15,014. "Electrical heating units and resistance coils and method of manufacturing the same." L. W. CAMPBELL. (Convention date, November 13th, 1912, Australia.) June 30th. (Complete.)

15,040. "Incandescent lighting." J. T. SIBLEY. June 30th.

15,046. "Metal vapour arc lamps." DEUTSCHE GASGLUHLICHT AKT. GES. (Auerges.) (Convention date, February 4th, 1913, Germany.) June 30th. (Complete.)

15,060. "Contact relay devices for use in connection with electric circuits." MASCHINENFABRIK OERLIKON. (Convention date, March 7th, 1913, Switzerland.) June 30th. (Complete.)

15,061. "Voltage regulator for electrical machines." MASCHINENFABRIK OERLIKON. (Convention date, April 14th, 1913, Germany.) June 30th. (Complete.)

15,062. "Switch and like mechanism." MASCHINENFABRIK OERLIKON. (Convention date, May 20th, 1913, Switzerland.) June 30th. (Complete.)

15,067. "Resistance material for electrical rheostats and method of manufacturing same." N. HARVEY. (Convention date, July 8th, 1912, Australia.) June 30th. (Complete.)

15,074. "Lighting fixtures." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 30th.

15,086. "Connections for electric tariff meters." C. G. LUNDGREN. June 30th. (Complete.)

15,088. "Electrically-heated utensils." C. E. HUNTER and C. O. BASTIAN. June 30th.

15,097. "Electric telegraph receiving apparatus of the selective type." W. J. LYONS. (Addition to 10,911, 1912.) June 30th. (Complete.)

15,123. "Ships' telegraphs and the like." T. L. KNIGHT. July 1st. (Complete.)

15,133. "Casing for containing electric wires." A. BARBER and F. H. THORNTON. July 1st.

15,148. "Dynamo-electric motors." SIEMENS BROS. DYNAMO WORKS, LTD., C. A. B. D. KOETTGEN and E. O. KIEFFER. July 1st.

15,149. "Change-over arrangements for electric supply or control systems." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and C. E. FAIRBURN. July 1st. (Complete.)

15,164. "Methods for the construction of contact sets for the bank contacts of selectors." SIEMENS & HALSKE AKT. GES. (Convention date, July 4th, 1912, Germany.) July 1st. (Complete.)

15,175. "Sound-transmitting devices for talking motion-picture apparatus." W. G. HAMMACK. July 1st. (Complete.)

15,179. "Telephone relays." J. SCHIESSLER. (Convention date, July 15th, 1912, Austria.) July 1st. (Complete.)

15,199. "Systems of ship propulsion." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 1st.

15,218. "Electrically-operated drill of the percussion type." T. F. WALL. July 2nd.

15,235. "Union joints and couplings for electrical and other accessories." J. N. MOLLETT. July 2nd.

15,251. "Electric relay systems and apparatus therefor." A. W. HARRIS. July 2nd.

15,259. "Electric alarm for preventing the unauthorised opening of locks." O. SCHUMANN. (Convention date, August 5th, 1912, Germany.) July 2nd. (Complete.)

15,274. "Starting systems for internal-combustion engines and the like." H. LEITNER. July 2nd.

15,283. "Method of and means for determining the electrical characteristics of high frequency oscillation circuits." E. D. CARDEN. July 2nd.

15,284. "Charging and discharging electrical condensers or the like." W. J. MELLERSH-JACKSON. (Signal G.m.b.H., Germany.) July 2nd. (Complete.)

15,286. "Joining or bonding the junctions of metallic sheathing or armouring of electric conductors." L. SUNDERLAND. (Addition to 22,550, 1911.) July 2nd.

15,297. "Manufacture of electric incandescent lamps." F. SIMPSON. July 2nd.

15,318. "Electric lampholders or similar coupling members." G. ST. J. DAY. July 3rd.

15,327. "Lead accumulators." G. C. DYMOND. (Marquise des Ligneris née Charlotte Marie Berthe Tailhandier du Plaix, France.) July 3rd. (Complete.)

15,334. "Process and arrangement for suspending electric motors or the like permitting of absorbing all the vibrations." F. S. BOERRIES. July 3rd. (Complete.)

15,343. "Ignition generators." B. LAWRENCE. July 3rd.

15,348. "Electrically-illuminated letters." H. BEY. July 3rd.

15,360. "Process and device for the production of electric glow lamp bulbs with reflector." DEUTSCHE GASGLUHLICHT AKT. GES. (Auerges). (Convention date, November 16th, 1912, Germany.) July 3rd. (Complete.)

15,377. "Apparatus for registering telephone calls." J. J. ROWE. July 3rd.

15,379. "Furnaces for gaseous reactions at high temperatures." R. P. PICTET. July 3rd.

15,389. "Flash lamps." W. BALE and L. H. HOPKINS. July 3rd.

15,392. "Vapour electric devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 3rd.

15,411. "Boxes for holding accumulators and battery cells." C. H. WORSNOP. July 4th.

15,423. "Electrical lighting and starting mechanism for automobile vehicles." F. W. LANCHESTER. July 4th.

15,457. "Transmission of wireless signals." T. T. BAKER and GALLETTI'S WIRELESS TELEGRAPH AND TELEPHONE CO., LTD. July 4th.

15,463. "Galvanic cell." P. BURGER. (Convention date, July 6th, 1912, Germany.) July 4th. (Complete.)

15,485. "Telephone systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 4th.

15,502. "Series-connected electric consuming devices." R. FRANZ. (Convention date, July 4th, 1912, Germany.) July 4th. (Complete.)

15,516. "Means of using auxiliary petrol-electric supply for electric rail cars, trackless trolley vehicles, and the like." W. A. STEVENS. July 5th.

15,523. "Polyphase alternating-current motors and generators." CROMPTON AND CO., LTD., and H. BURGE. July 5th. (Complete.)

15,550. "Protective devices for electric distribution systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 5th.

15,556. "Ships' telegraphs and like apparatus." G. K. B. ELPHINSTONE. July 5th.

15,561. "Telegraphy." R. LOPEZ and CREED, BILLE & Co., LTD. July 5th.

15,566. "Radial selector switches." STERLING TELEPHONE AND ELECTRIC CO., LTD., and W. B. ALLCOCK. July 5th. (Complete.)

15,568. "Process and apparatus for making mica sheets." MEIROWSKY & Co. AKT. GES. (Convention date, July 22nd, 1912, Germany.) July 5th. (Complete.)

15,569. "Holders for electric incandescent lamps and the like." E. H. B. HUGHES. July 5th.

15,571. "Controlling means for electric motors." OTIS ELEVATOR CO., LTD. (Otis Elevator Co., Inc., United States.) July 5th. (Complete.)

15,579. "Automatic telephone exchanges." F. N. REEVES and A. E. LUNDELL. (Convention date, July 5th, 1912, United States.) July 5th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

ROTARY ANNULAR MULTIPOLAR MAGNETIC SEPARATORS. Maschinenbau-Anstalt Humboldt. 9,117. April 18th. (April 19th, 1911.)

SWITCHBOARD CONNECTING CORDS AND THE LIKE. P. P. Craven. 11,306. May 13th. (Cognate applications, 13,098 and 17,110, 1912.)

METHOD OF AND APPARATUS FOR TELEPHONICALLY ORDERING CABS, MESSENGERS AND THE LIKE. A. Hinzpeter. 13,207. June 12th. (Convention date not granted.)

TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,970. June 15th.

TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,971. June 15th.

SIGNALLING SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,972. June 15th.

TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,973. June 15th.

TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,974. June 15th.

TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 13,975. June 15th.

DASH-POT DEVICES APPLICABLE TO ELECTRIC CIRCUIT-BREAKERS AND OTHER APPARATUS. W. A. Harriman and A. Reyrolle & Co. 13,997. June 15th.

ELECTRIC WELDING. A. L. Johnson. 14,143. June 17th.

LIGHT REFRACTOR OR DIFFUSER. F. G. Brettell (Martenson). 14,192. June 18th.

MINERS' ELECTRICAL SAFETY LAMPS. W. Thomson and J. H. Rothwell. 14,202. June 18th.

LIGHT-PROJECTING APPARATUS FOR ATTACHMENT TO SMALL ARMS. Waffen-Technische-Ges. "Wespi." 14,269. June 18th.

ELECTRIC SWITCHES. H. Leitner. 14,270. June 18th.

TELEPHONE SUB-STATION SWITCHING SYSTEMS. W. Aitken. 14,317. June 19th.

MECHANISM FOR DRIVING ROTARY MAGNETOS ON INTERNAL-COMBUSTION ENGINES TO FACILITATE STARTING. B. Lawrence. 14,521. June 19th. (Cognate application, 21,582, 1912.)

SHIPS' COMPASSES. L. F. Fuchs. 41,339. June 19th.

CONTROL AND USE OF SERIES-WOUND DYNAMO-ELECTRIC MACHINES. H. F. Haworth and the Thomas Transmission, Ltd. 14,396. June 20th,

ELECTRO-MAGNETIC RELAYS. Siemens Bros. & Co., Ltd., and W. H. Grinsted. 14,564. June 21st.

ELECTRO-MAGNETIC MEASURING INSTRUMENTS. W. J. Davis and C. E. Hunter. 14,576. June 21st.

INCANDESCENT LAMPS WITH DRAWN-METAL WIRE FILAMENTS. K. Farkas. 14,655. June 22nd. (June 23rd, 1911.)

SUBSCRIBERS' STATIONS IN AUTOMATIC TELEPHONE SYSTEMS. Zivnostenska Banka v. Praze (Firm of). 16,374. July 12th. (July 12th, 1911.)

APPARATUS FOR FIRING OR EXPLODING FLASH-LIGHTS FOR PHOTOGRAPHIC OR OTHER PURPOSES. W. H. Balfour. 16,794. July 18th.

MEANS FOR AND METHODS OF CLEARING FAULTS ON ALTERNATING-CURRENT SYSTEMS." A. M. Taylor. 16,830. July 19th.

HEAT TREATMENT OF METAL BODIES. J. H. Barker and Birmingham Metal and Munitions Co. 17,756. July 31st.

ELECTRICAL MASSAGE DEVICE. W. Goy. 18,271. August 8th.

ELECTRIC LIGHTING AND IGNITION APPARATUS OF MOTOR-VEHICLES AND THE LIKE. B. Brooks and W. Holt. 18,764. August 16th.

MAGNETO-IGNITION APPARATUS. Hartmann & Braun Akt. Ges. 19,913. August 31st. (August 31st, 1911.)

ELECTRIC RESISTANCE GRIDS. Electric and Ordnance Accessories Co. and W. G. H. Cox. 20,252. September 5th.

TWO-RATE ELECTRICITY METERS. Landis & Gyr (Firm of). 22,592. October 4th. (October 6th, 1911; Addition to 1,010, 1912.)

PORTABLE APPARATUS FOR USE IN CONNECTION WITH AN ORDINARY BATH FOR THE APPLICATION OF ELECTRICITY TO THE HUMAN BODY. H. S. Turner. 22,807. October 7th.

PROCESS FOR THE MANUFACTURE OF HEAT-REFRACTORY ARTICLES FROM TANTALUM. Siemens & Halske Akt.-Ges. 23,050. October 9th. (October 21st, 1911.)

MANUFACTURE OF MICA PLATES FOR ELECTRICAL RESISTANCES AND THE LIKE. C. Fischer. 23,869. October 18th.

BRUSHES OR COLLECTORS FOR ELECTRICAL MACHINES. W. E. Lake. (Soc. Anon. le Carbone.) 24,349. October 24th.

ELECTRICITY METER. L. Scholler. 24,954. October 31st. (April 30th, 1912.)

ELECTRIC TIME SWITCHES. W. Huttmann and C. Haberl. 25,787. November 9th.

DEVICES FOR THE AUTOMATIC REGULATION OF ELECTRIC MACHINES. R. Bosch (Firm of). 27,961. December 4th. (November 15th, 1912.)

ADVERTISING AND DISPLAY CONTRIVANCES. W. H. Ell and J. Miller. 28,228. December 6th.

APPARATUS FOR HEATING LIQUIDS BY ELECTRICITY. J. von Hentzel. 28,359. December 9th.

ELECTROMAGNETIC RELAYS. Siemens Bros. & Co., Ltd., and W. H. Grinsted. 28,824. December 14th. (Divided application on No. 14,564 of 1912, June 21st.)

PORTABLE ELECTRIC LAMPS. S. Stern and The British Ever-Ready Electrical Co. 29,302. December 19th.

METHOD OF CHARGING CONDENSERS IN PARALLEL AND DISCHARGING THEM IN SERIES. Compagnie Générale Radiotélégraphique. 29,375. December 20th. (December 21st, 1911.)

1913.

ALARM DEVICE FOR ANNOUNCING FIRE AND BURGLARY. A. Bares and J. Weiss. 1,285. January 16th.

VENTILATION OF DYNAMO-ELECTRIC MACHINERY. Siemens Bros. Dynamo Works, Ltd., E. O. Kieffer and W. Parker. 3,324. February 7th.

PROCESS FOR THE PRODUCTION OF A BORON-TUNGSTEN COMPOUND. F. Hansen and W. F. Mohr. 3,525. February 11th. (Divided application on No. 9,941 of 1912, July 25th.)

MECHANICAL TYPE-PRINTING TELEGRAPHS, MAINLY APPLICABLE AS TOYS. F. C. Grasme. 4,665. February 24th.

ELECTRIC POCKET LAMP WITH COMPASS. Electromechanische Industrie Ges. 5,646. March 6th. (November 22nd, 1912.)

THE

ELECTRICAL REVIEW.

VOL. LXXIII. JULY 25, 1913. No. 1,861.

ELECTRICAL REVIEW.

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1913 EDITION.

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4, Ludgate Hill, London, E.C.

A WIRELESS ADVISORY COMMITTEE.

IN a long letter to the *Times* of Tuesday last, Prof. Larmor advances views on the subject of Imperial wireless communication which are worthy of more than passing notice. While disclaiming any special knowledge of the technical details of the various systems of radiotelegraphy, he strongly supports the proposal that the Government should itself construct the long-distance stations, and retain a free hand to use any system or any combination of systems that may be found most suitable for its purposes. Prof. Larmor admits that the Post Office staff is not at present equipped with the knowledge and experience required for this work, and appears to be more than doubtful as to the qualifications of the Admiralty to deal with the requirements of the future. Neither is there an adequate supply of men fundamentally trained in the principles of radiotelegraphy, though, in his opinion, the demand will create a supply by drawing competent men from other occupations.

Under these circumstances, Prof. Larmor puts forward the admirable suggestion that the Advisory Committee appointed in connection with the inquiry into the Marconi contract should be made permanent, strengthened by the addition of other eminent scientific men, and placed in relation to the Radiotelegraphic Department of the Admiralty and the technical engineering staff of the Post Office. The valuable assistance rendered to the Army Flying Corps by the scientific Advisory Committee on Aeronautics, which was appointed a few years ago, and has carried out important researches at the National Physical Laboratory, is cited in support of the proposal, which, moreover, would have the immense advantage of removing the problems of wireless communication from the floor of the House of Commons, where they have become the sport of party politicians, to the serene and impartial atmosphere of scientific investigation.

While the proposition on the face of things is highly to be commended, it cannot be denied that there are certain difficulties in the way of its achievement. Not the least of these is the heavy cost of practical research in long-distance work. Nothing can be accomplished without the possession of an experimental station, the cost of which alone could not be less than £50,000; the preliminaries would occupy at least six months, and the erection of the station would take a similar period, so that the practical research could not be commenced until fully 12 months had elapsed. Another year, at least, would be expended before an authoritative decision could be formed as to the very best system available *at that time*, for changes in the aerials, the towers, and the plant would necessarily involve a great deal of time and labour, so that the erection of the Imperial chain could not be begun for at least 2 or 2½ years from the appointment of the Committee on a permanent basis.

It may be argued that the experimental station, when thus tuned up to concert pitch, would serve as the first Imperial station, but it would be of no use without the rest of the chain. Moreover, we are told by Prof. Larmor, Prof. Milne, and the Advisory Committee, that the rival systems are in course of rapid development, and we imagine that they always will be in that state—just as the incandescent lamp, the steam engine, the motor-car and the aeroplane have been, for many years—so that it is more than doubtful whether the Committee would be any "forrader" in two years' time than when it began its labours.

Now, it is, and for two years has been, constantly urged by our Naval and Military authorities, that the provision of wireless communication with the rest of the Empire is a vital necessity and a matter of great urgency; the Government has declared that the stations ought to be erected for

this reason alone, regardless of commercial considerations, which are of secondary importance. Other nations are taking steps to a similar end, and we shall soon lose the advantages of priority in the field, which include the free choice of site and wave-length, unhampered by the propinquity of foreign stations, together with the temporary advantage, in the event of war within the next year or two, that we alone would possess a world-wide wireless service. If, therefore, we are to accept the views of these authorities, endorsed by the Select Committee and approved by the House of Commons—and we must either accept them or ourselves assume the responsibility for the defence of the Empire—we must recognise the necessity of immediate action. Whether the present systems will be obsolete in a few years' time, or whether the best possible terms, from a financial point of view, have been arranged, or not, it is, as Mr. Samuel recently said, high time to make an end, and to proceed with the work. Mistakes in these matters can be remedied at leisure in the future; the one mistake that can never be remedied is the fatal one of *being too late*.

But apart from experimental research on the grand scale—which may be undertaken, but ought not to be allowed to delay the erection of the Imperial chain—there is abundance of scope for the services of such a Committee as that suggested by Prof. Larmor. Not the least useful of its functions would be to investigate exhaustively the merits of each system, and to advise the Government with authority as to its proper course, purely from a technical point of view. At present, as Mr. Samuel is careful to impress upon the House of Commons, he is guided entirely by his expert advisers on the technical aspects of the question; the opponents of the contract now under discussion are not disposed to accept without question the opinions of those advisers, but they could hardly presume to flout the views of a body speaking with the weight of competent technical knowledge and high scientific reputation. Whatever the merits of the systems put forward, we cannot too strongly protest against the treatment of the subject as a bone of contention between the rival parties, when as a matter of national and urgent importance it ought to be dealt with solely with a view to safeguarding the highest interests of the Empire.

Electrical Development in Germany in 1912.

A survey of electrical progress was given by Geheimrat Christiani, president of the Verband Deutscher Elektrotechniker, at the general Conference of the Verband, which was held recently at Breslau. He stated, in the first place, that the spirit of enterprise in the electrical industry in 1912 was active, and the new promotions and increases in capital were considerably in excess of the average in recent years, whilst a similar observation was also applicable to the export trade. Proceeding to discuss technical questions, the president mentioned that there were no longer any special difficulties in the way of the transmission of high-pressure current by means of underground cables. An important event in the lighting department lay in the reduction in the prices of wire lamps, and electric cooking and heating increased in consequence of the introduction of lower tariffs. The endeavours made to extend electrical working on the railways were exceptionally noteworthy, the most important relating to the scheme for the conversion of the Berlin City and Circle railways. On the other hand, the number of electric motor-coaches was increasing and an expansion was also taking place in the use of electric motor-cars. The employment of accumulators in submarine boats, for wireless telegraphy, and for railway traction, also contributed towards the larger demand experienced by makers. The principle of reducing the cost of electrical energy was the basis upon which the use of electricity in mining and in iron and steel works was being built up, and in this connection the president submitted that Germany held the lead in the production of electric steel. After referring to competitions for miners' electric lamps, the president concluded by mentioning the introduction of underground telephone cables; the first of these has been laid between Berlin and Rhenish-Westphalia, and the section from the capital to Magdeburg has just been completed.

The Consequence of Negligence.

In these days about half the time of the judges of the King's Bench Division is occupied in trying cases involving charges of negligence. That there is so much negligence in the legal sense of the term is largely due to the fact that people are ignorant of their rights and liabilities. In a recent case, the Court may seem to the uninitiated to have come to the conclusion that those who hire out articles are virtually in the position of insurers, but it is important to notice that this proposition only holds good if the hirer knew, or ought to have known, of the potential element of danger. It was the case of White *v.* Steadman, in which Mr. Justice Lush gave judgment on May 26th. The male plaintiff hired a landau and horse from the defendant, a livery stable keeper, for the purpose of taking a drive. The female plaintiff, the wife of the male plaintiff, was one of the party who went in the carriage. The defendant provided the driver as well as the horse and landau. During the journey the horse showed considerable signs of restiveness, and on the way back it got out of control in passing a traction engine, shied, and the carriage was upset, both plaintiffs receiving injuries in respect of which they sued the defendant for damages. The jury found that the defendant knew, or ought to have known, if he had used proper care, that the horse was not safe at the time the landau was let out to the male plaintiff. It was held that the defendant was liable in damages not only to the male plaintiff, but also to the female plaintiff, first, because a person who lets out an animal which he knows or ought to know is dangerous is under a duty to warn not only the person who hires it, but any person who he knows or contemplates or ought to contemplate will use it, such duty existing independently of contract; and, secondly, because the defendant who kept control of the landau accepted the female plaintiff as a traveller or passenger, and was, therefore, bound to use due care to see that she was safely carried.

The whole point in the case is that the jury found that the defendant knew, or ought to have known, that the horse was vicious, otherwise the defendant could not in the circumstances of the case have been held liable. Applying this principle to machinery, it is clear that if a man were to hire out a machine which he knew was defective and injury was caused to someone, he would be liable but not otherwise.

Absorption of Wireless Radiations.

Many hypotheses have been advanced to account for the fact that the range of transmission from a given wireless telegraph station is generally so much greater by night than by day. The first explanation suggested—probably the one which has enjoyed most popularity—was that sunlight produced a deeper "layer of ionisation" in the upper parts of the atmosphere, and, by rendering this layer more or less conducting, increased the absorption of the radiations and thus decreased their effective range. This explanation, though sufficiently plausible at first sight, becomes less convincing when it is remembered that the difference between day and night ranges is less marked in an east and west direction than over a north and south route. On the other hand, tests referred to later indicate that this difference is not so great as has been claimed by some observers.

During the past few years, the United States Navy Department has been investigating the problem, and from the results recently announced by Dr. L. W. Austin, it appears unlikely that ionisation by sunlight is the true explanation of decreased daylight ranges of transmission. In the first place, the ground absorption over certain routes when working with certain waves is over 20 times as great as though the transmission were over sea water, yet on some nights this excessive absorption practically vanishes, and it can hardly be contended that the absence of the sun's rays is responsible for this change. Again, during the recent arc tests at Arlington, it was discovered that certain wavelengths were transmitted very much better than others. For instance, if reception were weak when using a 4,100-m. wave, changing to 3,950 m. would almost invariably result in

excellent reception ; and *vice versa*. In other words, there appears to be a selective absorption in action, and there can be little doubt that interference occurs between one train of waves travelling along the earth's surface and another train reflected from the conducting upper layers of the atmosphere. This hypothesis was first advanced by Dr. de Forest. By calculation it appears that the height of the reflecting surface would be from 40 to 60 miles, at which level conductance would be appreciable. The fact that the above phenomenon is not observed when using the spark system, is due partly to the short wave trains of the latter (making impossible any interference), and partly to the coarser wave adjustment employed in the spark system and the consequent impossibility of ascertaining the effect, beneficial or otherwise, of small changes in wave lengths.

We are thus led to the conclusion that at night the upper layers of the atmosphere are stratified so that, at a height varying from time to time, there is a sufficiently abrupt change in conductivity to make possible reflection and hence direction of additional energy to the receiving station. By day, owing to the more or less irregular ionisation produced by sunlight and owing to vertical convection streams, no such regular stratification is possible. The better results at night are due not to decreased absorption, but to the increase, by reflection, of the radiation received at the distant station. Where undamped wave trains are used, a small change in wave length gives greatly improved results by removing interference between the direct and reflected waves.

According to Mr. Marconi, reception at Glace Bay from Clifden is as good, or even better, by day than by night. Certainly the difference between the day and night transmissions is less marked in the case of radiations of long wave lengths, but the Navy Department's tests at Arlington (2,840 miles from Clifden) and Brant Rock (2,460 miles) showed much better reception of the Clifden 7,000-m. waves by night than by day. During the autumn and winter 35-55 micro-amperes were received by day at Brant Rock through a resistance of 25 ohms, but at night the current frequently exceeded 100 micro-amperes. During the summer the current received by day was from 7 to 12 micro-amperes, the signals being faint and often inaudible ; by night much better results were secured. Similar results were obtained at Arlington.

The Italian Electrical Industry.

According to a communication from Milan, the Italian electric manufacturing industry is labouring under two disadvantages at the present time. The first relates to the tardy settlement of accounts, both by private customers and by public authorities, and the second concerns the prevalence of keen competition, owing to the absence of agreement among the makers, thus causing depression in prices. The production of dynamos, motors, and transformers has made decided progress in recent years, and the export of small sizes has already been commenced, whilst the cable branch has been largely developed, and the quantity of cables exported in 1912 exceeded £280,000 in value.

Apart from the work proceeding on new hydro-electric stations in different parts of the country, and extending in various cases over a number of years, a partial standstill has been reached in regard to the promotion of entirely new schemes of this kind, although existing supply works are increasing their connections as far as is possible under present circumstances. The stagnation in new projects is due to the abundance of hydro-electric undertakings already carried out or still in progress, the effects of the economic crisis, and the reserve manifested by investors with respect to participating in industrial enterprises of all kinds. Nevertheless, the average dividend paid by 29 supply companies has risen from 6 per cent. in 1911 to 6·3 per cent. for 1912. It is expected that when the general economic crisis has been overcome, a development in new hydro-electric works will again take place, especially in the South, where large schemes are projected, and that electric railway work will also proceed at a greater speed than in recent years.

Lead.

There continues to be no abatement of the strong underlying conditions of the lead market, although prices fluctuate a little on occasion from local causes. The predominant feature is still the shortness of supplies coming to hand, and the exceeding probability that the scarcity will continue for some time yet, since the troublous state of things in Mexico continues without any abatement. When our imports and exports over the first half of the year are taken into consideration, the net result is that the total available for the home trade is less by nearly 9,000 tons than it was last year, and promises to be short for the rest of the 12 months. There is quite a fair demand for material from day to day, and it is clear that the export markets are not too well supplied, for there is a steady run of buying from Russia and some other important consumers. Where lead is wanted for early delivery, pretty stiff premiums have to be paid. The annual returns of the Metall-gesellschaft, of Frankfort-on-Main, have now been issued, and these, as suggested recently in our columns would be the case (June 13th, p. 966), indicate a reduction in the Mexican output for last year. The actual Mexican production of soft lead is estimated at 120,000 metric tons, a falling off of 4,600 tons, while, when the exports from Mexico to the United States refineries are considered, a further falling off of 6,700 tons is seen, the United States production from imported silver-lead from Mexico being 69,700 tons, compared with 76,400 tons in 1911. With a world's production of 1,189,100 metric tons, against 1,132,900 tons in 1911, the increase amounts to 5 per cent., while over the past ten years the average increase works out at 3·5 per cent. The following returns show the world's production in metric tons :—

	1909.	1910.	1911.	1912.
Spain	184,000	191,900	175,100	186,700
Germany	167,900	159,900	161,300	165,000
France	26,900	20,200	23,600	33,000
Great Britain	28,200	29,600	26,000	29,000
Belgium	40,300	40,700	44,300	57,100
Italy	22,100	14,500	16,700	20,500
Austria-Hungary ...	14,000	17,500	19,600	21,400
Greece	15,300	16,800	14,300	14,500
Sweden and Norway ...	200	400	1,100	1,300
Russia	800	1,200	1,000	1,000
Servia	1,400	—	—	—
Turkey in Asia	12,100	12,700	12,400	12,500
Europe total	513,200	505,400	495,400	542,000
United States	349,500	369,400	377,900	386,700
Mexico	118,000	120,700	124,600	120,000
Canada	20,800	15,000	10,700	16,300
North America total ...	488,000	505,100	513,200	523,000
Japan	3,400	3,500	4,200	4,500
Australia	77,200	98,800	99,600	107,400
Other countries	5,800	15,700	20,500	12,200
Total production ...	1,051,000	1,128,500	1,132,900	1,189,100

The world's consumption is as below in metric tons :—

	1909.	1910.	1911.	1912.
Germany	213,200	210,400	229,800	220,500
Great Britain	202,700	198,400	198,300	196,100
France	102,300	89,800	99,600	106,500
Russia	38,400	48,800	43,100	45,600
Belgium	43,600	32,000	53,600	50,800
Italy	31,400	28,200	36,300	32,000
Austria-Hungary ...	31,000	31,500	36,200	37,900
Holland	5,900	6,500	6,800	6,300
Switzerland	5,300	5,900	5,000	6,400
Rest of Europe	4,000	4,300	3,500	4,400
United States	339,900	378,900	365,200	397,800
Canada	21,400	17,800	21,100	30,000
Japan	11,900	16,500	18,900	24,500
Australia	4,900	7,200	9,100	10,100
Elsewhere	23,800	30,200	31,200	30,000
Total	1,079,300	1,116,400	1,157,700	1,198,900

The increased consumption during 1912—41,000 tons, is just about accounted for by the increase recorded in North America—32,600 tons in the United States, and 8,900 tons in Canada.

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NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

About 12 months ago the writer recounted some of the breakdowns on the transmission lines which supply the Toronto Electric Light Co. and the Toronto Street Railway Co. with current, whereby industries were on several occasions without power, street and house lights were out, and the trams were motionless.

This year it is the turn of the Hydro-Electric Power Commission to suffer. Three times within a month all power has been off the whole of the Commission's system for several hours at once in every case. The seriousness of such a state of affairs may be imagined when it is remembered that some 40 different cities, towns and villages derive their power and light principally, and in very many cases almost entirely, from this source, the maximum daily summer load averaging about 26,000 H.P.

The trouble appears to lie entirely in the failure of insulators, which has suddenly and without warning taken place in a wholesale manner, and the situation is rendered much worse than might have been expected, as the failures have occurred on the section which is in duplicate, and both lines have been put out of operation simultaneously.

In the province of Alberta, where there is a Government system of telephones, it is proposed to spend over two million dollars this year. Two thousand four hundred miles of wire will be strung on rural lines alone.

The town of Saskatoon, Saskatchewan, is in need of additional electric power, and three schemes are at present being considered.

MUNICIPAL HIGH FINANCE.

By "CYNICUS."

I had just been appointed engineer and manager of the Blanktown Electric Tramways, and, this being my first chief's job, I was determined to do well. Everyone knows that this system had the reputation of being one of the best managed municipal undertakings in England, and that it regularly for some years past had handed over £50,000 per annum for the relief of rates.

The day after my appointment I was called before the Borough Council, and the chairman proceeded to read the following from some newspaper (I seemed to have read the nonsense somewhere myself): "Municipal tramways and those owned by companies are on an entirely different footing. Whereas the latter must endeavour to make profits for the benefit of its shareholders, the former should not. A large sum regularly contributed to the relief of rates simply means that the tram-travelling public are paying the rates, to the exclusion of the owners of private conveyances. The working man is paying more than the wealthy capitalist, an intolerable state of affairs."

"That," exclaimed the chairman, "is what we got rid of our last chap for."

I left the Council Chamber a saddened man, but determined to do what was expected of me. I accordingly reduced all fares 25 per cent., but, to my horror, found this merely induced more people to ride, and so popular did our service become, that at the end of my first year there was a surplus for relief of rates of £60,000.

This clearly would not do, so I introduced ½d. fares. Everyone who reads the technical journals knows that these are sure to bring ruination. But so perverse were the Blanktown people, that they now simply swarmed on the cars; we did not even have the usual mid-day slackness, and, to my shame be it said, the result of my second year's management was a surplus of £75,000.

I was called before the Council and given to understand that I was on my last chance, but that I could have one more year to atone in. Curiously enough, I received, the same day, a highly eulogistic letter from the Chairman of the Ratepayers' Association.

I now set about matters at the other end. A circular was issued, intimating a rise of 20 per cent. in wages all round. The senior motorman waited on me, and reeled off a speech that had been carefully written for him and learned by heart. When he came to "And we shall all endeavour, by strictest attention to work, to merit your munificent generosity. We shall practise economy in every detail," I stopped him and warned him that any such behaviour would lead to instant dismissal.

Conductors were granted a bonus of 3d. for every genuine case of overriding discovered and 6d. for every fare completely missed. Motormen using over 1½ units per car-mile were specially rewarded, and they were all taught that the first "nick" of the parallel was the proper one to drive on.

We also had the good fortune during the year to have several big accidents, involving the payment of heavy compensation. This, however, could hardly be attributed to sheer luck, for we encouraged motormen to come on duty in an intoxicated condition.

My efforts were crowned with success, and at the end of the year I was able to show a debit balance of £315. I was called before the Borough Council, warmly thanked, and given a substantial increase in salary. But now the Ratepayers' Association is clamouring for my dismissal. It seems to be impossible to please everybody.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Mutual Protection of Engineers.

Are there any, other than those advertisers who for some reason best known to themselves, wish to withhold their names from the light of publicity—who do not fully endorse the views so well submitted by "Vertebra" in a recent issue?

That one should be obliged to give the fullest details of his career to some unknown advertiser, and to state the salary for which he would undertake the duties of a post, any real and guiding particulars of which are seldom afforded in the majority of advertisements, is not only a waste of time and expense to 70 per cent. of the applicants, but is equally useless to the advertisers.

Will the advertisers who consistently, or even occasionally, hide themselves behind box numbers, take the opportunity of expressing their reasons for so doing to the many who wish for enlightenment in this connection, before organised boycott is entered upon?

P. O. W.

"Light and Illumination: Their Use and Misuse."

I have read with interest the comments in your issue of July 11th, with respect to the booklet reprinted from the *Illuminating Engineer* under the above title.

I am, of course, prepared to admit that finality has not been reached in the reproduction of lighting effects in illustrations. Anyone who has had experience of taking photographs by artificial light will agree that the problem is a very difficult one, and it is only recently that attempts have been made to give a faithful picture of artificial lighting conditions in this way.

Special skill is needed to take photographs by the light of incandescent electric lamps, showing figures of people, on account of the considerable exposure entailed, and this, no doubt, explains the darkness of the surroundings in several of the illustrations from the American publication to which you refer. At the same time, I should like to point out that it is now possible for a skilful photographer to take photographs by artificial light, which show the conditions of illumination quite satisfactorily for all practical purposes.

Another matter to which you refer is the successful use of the non-glossy ink and unglazed paper. The reproduc-

tion of half-tone blocks in these circumstances was somewhat difficult, and some experimenting was necessary before we were able to get what we venture to think a satisfactory result in this new field.

It may sometimes be desirable to accentuate some detail in the photograph in order to make a point absolutely clear. For example, we find that in order to emphasise the concentrating effect of the shadow it is often necessary to work in a cone of light underneath the opaque reflector, which the eye cannot, as a rule, see. People who are unfamiliar with these matters have sometimes not enough imagination to picture the rays of light being directed downwards, unless the rays are actually shown in the illustration.

I appreciate your remark that such work is of national importance, and it may interest you to know that a similar publication, in which the text is substantially the same, but the illustrations are applicable to gas, has lately been issued, and has been widely circulated by the British Commercial Gas Association. We understand that the Electric Publicity Committee also proposes to give publicity to this reproduction. In this way uniformity in recommendations on illumination should be obtained—a matter of considerable importance to the lighting industry.

L. Gaster,
Editor of the "Illuminating Engineer."

London, S.W., *July* 18*th*, 1913.

Are Hertzian Waves Injurious?

In the leaderette in your issue of July 11th you quote the *Elektrotechnische Zeitschrift*, saying that radio-telegraphists are subject to anæmia, a deficiency of red blood corpuscles and their haemoglobin contents.

You go on to state that it is not unlikely that the ozonisation of the air round about high-frequency apparatus has an injurious effect. Now, it is a well-established fact in therapy that pure ozone has quite the contrary effect. Ozonised air is used extensively by medical men, especially on the Continent, for the cure of anæmia, because it has a tonic effect on the red blood corpuscles, increases the appetite and tones up the system generally. It is also employed for relief of asthma, bronchitis and other complaints of the respiratory tracts, as well as for heart weakness, and lately, also, for consumption. It is a *sine quâ non*, however, that the ozone must be pure. This purity cannot be achieved when the ozone is generated by any form of disruptive spark, because the heat of the spark in the air produces oxides of nitrogen; these are the harmful constituents of ordinary manufactured ozone, such as is produced by high-frequency apparatus, and there is no doubt that these are responsible for the malady to which radio-telegraphists are alleged to be subject. All the earlier ozone generators had the defect that the ozone was adulterated with oxides of nitrogen, and most of these machines have disappeared. We believe we were the first to produce an apparatus which generates pure ozone, and this has been established by careful chemical analysis.

Ozonair apparatus are recommended by medical men for the alleviation of the aforementioned complaints, and have been installed in cliniques, &c., in all parts of the world. Not a week passes but we receive a visit or telephone call from a medical man or one of his patients, asking us to send an Ozonair apparatus for a case of illness. This proves conclusively that it is not the ozone which is dangerous, but the conditions under which it is manufactured.

Ozonair, Ltd.,
V. Zingler, *Manager.*

London, S.W., *July* 17*th*, 1913.

Rubber Prices.—Mr. C. Williamson Milne, presiding at the meeting of the Kepitigalla Rubber Estates, said that a great many factors were operating which ought to make for better prices before very long. The Rubber Growers' Association recently made representations to the Admiralty with regard to the specifying of plantation instead of Brazilian product in Government contracts.

PROCEEDINGS OF INSTITUTIONS.

The Use of the Electrostatic System for the Measurement of Power.

By C. C. Paterson, M.I.E.E., E. H. Rayner, M.A., M.I.E.E., and A. Kinnes, B.Sc., A.M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers *May* 1*st* 1913.)

The authors have used the electrostatic system for all their alternating-current measurements at the National Physical Laboratory for upwards of six years. The instruments consist of electrostatic voltmeters and an electrostatic wattmeter, together with supplementary apparatus which enables commercial alternating-current instruments of any range and of the highest precision to be calibrated with ease and certainty. The accuracy attained is considerably better than five parts in 10,000; and the long experience gained in the everyday use of the instruments has convinced the authors of the great value and convenience of the system in the work of a central testing laboratory. There is no suggestion that the electrostatic wattmeter should take the place of any of the existing precision instruments used in station work—for this purpose it would prove troublesome—but where a system is required of the very highest accuracy, combined with a wide range of application and convenience in use, the authors are of opinion that at present there is none to be compared with the electrostatic system.

The primary advantage of the electrostatic system lies in the wideness of ranges of both current and voltage over which a single standard instrument can be used. The authors at present go up to 3,000 amperes in alternating-current power measurements; but if there were a demand for tests involving larger currents, it could readily be met. The voltmeter and the wattmeter require but a minute capacity current, and eddy currents do not arise in the apparatus to affect its accuracy under any circumstances met with in practice. The instruments are independent of changes in frequency or in wave-form, are all of the direct deflection type, and their scales can be read easily and accurately with the naked eye.

The chief disadvantages of the system are the relatively small controlling forces in the electrometers, causing the slow movement which is common to most electrostatic instruments; a pressure drop of 1 or 2 volts is wanted whatever be the current through the series resistance; and the instruments are not portable.

Only two electrostatic instruments are really necessary—a voltmeter and a wattmeter. Current is measured by the voltmeter used in conjunction with non-inductive resistances. The two instruments are set up near the centre of a semi-circular darkened enclosure.

The voltmeter is a 160-volt standard horizontal-type Kelvin and White multicellular instrument, with oil damping. Above the oil damper is fixed a concave mirror 20 mm. in diameter, which must be very accurately made. Its radius of curvature is approximately 3 metres. The beam of light from a Nernst lamp and lens is reflected from it, forming an image of the lens and crosswire on a scale, 4 m. away and 8 m. long, which forms the boundary of the enclosure. The voltmeter is the link which connects the system to the fundamental standard of voltage, and everything therefore depends on the accuracy with which it can be read and relied upon. The great length of scale and the sharp definition of the image of the crosswire on it enable the voltage to be read to an accuracy of 1 part in 10,000; the subdivisions marking each hundredth of a volt are about 1 mm. apart. It is easy to read to less than one-hundredth of a volt.

On account of the elastic fatigue of the suspension, and consequent slow creep of the deflection the instrument has to be capable of being calibrated whenever desirable at the point at which it is being used. The calibration is done on continuous current by a simple potentiometer dividing-box, the instrument being reversed to eliminate the contact difference of potential. The voltmeter has been found very reliable, and in conjunction with a non-inductive resistance it enables the electrostatic wattmeter to be calibrated on alternating instead of on continuous current.

The wattmeter has a similarly extended scale; but as the law of the instrument is linear, an accuracy of 1 part in 10,000 is only possible towards the top of the scale. Its calibration is dependent on that of the voltmeter, and the highest accuracy obtainable must, therefore, be regarded more nearly as 2 parts in 10,000. It requires care to get an alternator to maintain as steady a voltage as this, and it is essential that the power should be supplied to it from a battery.

When the wattmeter has been calibrated in the above manner it is ready to be used on the testing circuit. A potential difference proportional to, and in phase with, the current in the circuit is put across the quadrants, and the pressure of the circuit, or a fraction of it, is applied between the needle and the quadrants. The instrument then correctly indicates the power in the circuit, and is independent of frequency or power factor.

The wattmeter is of the quadrant type, and is quite simple in construction. It is essential that all the parts shall be accurately machined, as it has often been necessary to take the instrument to pieces and to put it together again in such a way that the adjustments are unaffected.

The needle and quadrants are made of a special copper-aluminium alloy; this material has the greatest strength of the alloys of this series, and permits, therefore, of the use of a very thin needle. Each set of four quadrants is fixed on to a rigid brass plate, and is insulated from it by means of amberite pillars—three to each

quadrant. The diameter is 12 cm., and the slots are 0·5 mm. wide.

The moving system consists of a phosphor-bronze strip 20 cm. long, soldered to an upper connection, and at the lower end to the frame carrying the mirror. The frame is extended in the form of a long rod about 1 mm. diameter, which ends in the usual form of right-angled square-section hook. The hook engages with the lower rod, in the centre of which the needle is clamped between flanges. The mirror is concave; it has a radius of curvature of 3 m., and is 20 mm. high × 8 mm. wide.

The making of the needle requires great care. The needles are 50 mm. across and of the shape shown in fig. 1; the thinnest metal foil which could be used for the needle without bending under its own weight was 0·06 mm. The time of swing was reduced and the damping greatly improved by using thinner foil and pressing a fluting round the edge. The natural time of swing was reduced to 8 seconds, and the damping was made so that the moving system came practically to rest in 1½ complete oscillations. Foil 0·015 mm. thick was adopted. In practice the potential difference between the quadrants is about 2 volts, and between the needle and the quadrants 100 volts.

When the quadrants are connected to the terminals of a low resistance, the instrument measures the power which is being dissipated between the point to which the needle is connected and the point which is midway between the terminals of the low resistance (fig. 2). That is to say, the watts in half the main-circuit resistance are included in the power measured, and a correction for this must be made. If, however, the middle point of the resistance is accessible, the voltage-circuit can be connected so that no correction is necessary.



Fig. 1.—Wattmeter Needle.

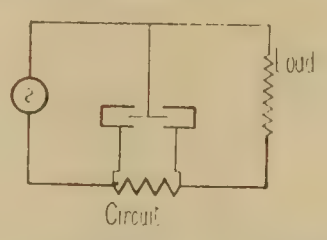


Fig. 2.—Diagram of Wattmeter Quadrants and Needle on Circuit.

The wattmeter has arrangements which permit of a quick determination of its constant at any point of its scale, in the same way that the electrostatic voltmeter is provided with a calibrating circuit which enables the scale error to be determined at any time.

In the larger part of the work with the wattmeter, fictitious loads are used. The current for an instrument is obtained from one source, and the potential difference for its voltage coils from another. The most convenient and usual way is to obtain these from two similar alternators whose armatures are coupled together, but one of whose fields can be rotated in relation to that of the other. In this way any required phase displacement can be

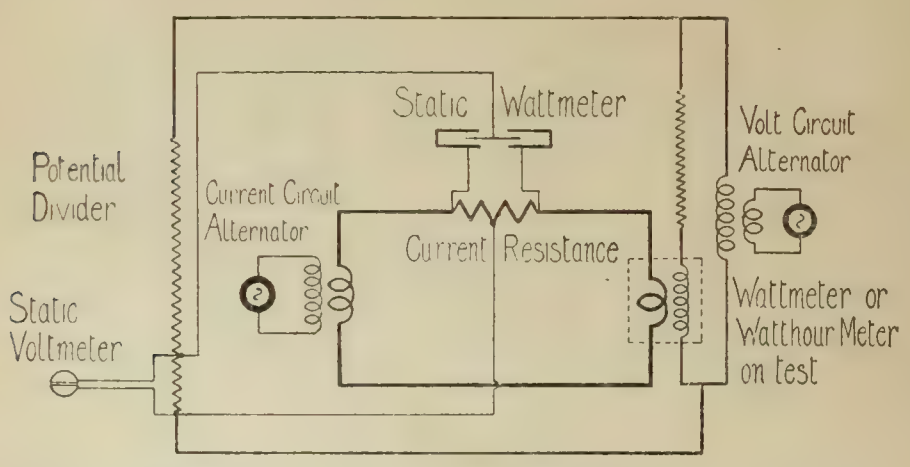


Fig. 3.—Connection of the Static Wattmeter to the Test Circuit for the Calibration of another Wattmeter.

obtained between current and voltage; and separate adjustments for both are secured by means of regulating resistances in the two alternator fields. Fig. 3 gives, in elementary form, the connection of the wattmeter to the ordinary test circuit for the calibration of a wattmeter or a watt-hour meter on a fictitious load. It will be seen that the voltage and current circuits are interconnected at the subdivided end of the potential divider and the middle point of the current resistance. A potential divider is generally used so that the wattmeter can be worked with approximately 100 volts on the needle. The dividing resistances used by the authors consist of two boxes, each containing 100,000 ohms of Duddell-Mather woven resistance subdivided into sections which can be used on circuits up to about 12,000 volts. The resistances are divided into five parts of 20,000 ohms each, one of which is subdivided into 10 parts of 2,000 ohms. This arrangement permits of the choice of a large number of ratios without excessive subdivision of the resistance.

One of the great advantages of the wattmeter is the ease with which it can be used for three-phase measurements by the two-wattmeter method up to any current range.

The various switch arrangements are entirely automatic, the instrument being changed over in a moment from one phase to another without any disturbance of the circuit. In making, for instance, a two-minute test run on a watt-hour meter it is possible to take three wattmeter readings on each phase, changing over the instrument after each reading.

The voltmeter scales are calibrated by applying a known continuous voltage to the instrument by means of a potential divider. The best way of marking off the divisions of the long voltmeter scale, preparatory to the final drawing, is to consider some point at the middle of the scale (say, at 90 volts) as a datum point. After marking this off, the various voltages are marked on either side of 90, taking them alternately above and below so as to eliminate as far as possible the effects of "creep," and returning to the 90-volt point between each reading. The plan of always returning to the instrument zero between deflections was not found satisfactory.

As surface leakage over ebonite, due to the production of acid, has given considerable trouble, and a voltage of 260 was to be the normal pressure on the resistances, special precautions were taken, first to avoid leakage, and, secondly, to detect it easily if it occurred. The principle of breaking the leakage path by a conductor whose insulation from the resistance coil can be checked at any time affords a method of avoiding errors due to leakage. With the ordinary construction of resistances such errors, when they exist, are most difficult to detect.

The accuracy of the whole instrument depends on the proper adjustment of the resistance used for the Weston cell, so that its ratio to the sum of all the resistances of the box shall have the correct value. This can be done by using 16 equal 10-ohm resistances connected as shown in fig. 4. Their resulting value is 1·018518; which is the nominal value of the Weston cell at about

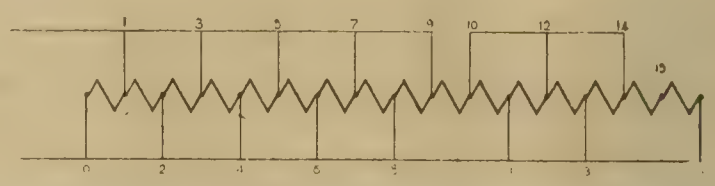


Fig. 4.—Method of Connecting the Dividing Box Resistances for the Accurate Adjustment of the Resistance Used to Balance the Voltage of a Weston Cell.

16·5° C. instead of at 17° C. These connections being made, the combination is arranged as the unknown resistance in a Wheatstone bridge of suitable sensitivity; and balance is then obtained. The "cell" resistance is then substituted for the combination, and is adjusted until the bridge is balanced at the same value. By this means the cell resistance has automatically the correct ratio to the main resistances without any dependence whatever on the accuracy of any of the bridge coils.

The method of measurement of current described below is due to Campbell, and is mainly intended for the measurement of large alternating currents above 500 amperes.

A step-up transformer with a ratio of 1 to 100, or 1 to 200, has its low-voltage primary circuit connected across the terminals of the standard resistance which carries the current to be measured. The potential difference across this resistance is from 1 to 2 volts. The electrostatic voltmeter is connected across the secondary of this transformer, and its indications are proportional to the current in the standard resistance. The fact that the electrostatic voltmeter absorbs no energy ensures that the magnetising current of the transformer is very small. Used with an open-circuited secondary in this way the magnetising current is of the order of 0·02 ampere, and, being nearly at right angles to the impressed voltage, its shunting effect is negligible for resistances having a drop of 2 volts with a current of 50 amperes.

Unfortunately, the authors have found that when a transformer is used in this way, its ratio, instead of tending towards a constant value as the frequency is increased, continues to rise; it follows from this that its ratio will be dependent on the wave-form. The reason for this is mainly the self-capacity of the secondary winding. A way was found of neutralising the effect of this capacity by putting a very small load on the secondary winding.

The important factor in the transformer to be determined to a high degree of accuracy is the ratio between primary and secondary volts at the different frequencies at which the transformer is to be used.

The characteristics of the transformer have been determined when connected up as used in practice, *i.e.*, with the primary connected to a resistance giving a drop of 2 volts, and with the small secondary load compensating for the capacity, using a wave-form approximating closely to a sine curve. The accuracy of the determinations is much higher than is required, but a knowledge of these characteristics has been found of value when using the instrument for measurements of other kinds; and for these purposes a greater accuracy is often wanted.

The authors have experienced so much trouble with ebonite used in their electrical apparatus that a renewed warning on the subject may not be out of place.

In the use of electrostatic instruments for measurements of the highest precision the greatest care must be taken when ebonite is used as an insulator, particularly when it is exposed to strong diffused light. Deterioration due to light is accompanied by such a large drop in the resistance of the surface of the material that it may at times be regarded rather as a conductor than an insulator. The only way which the authors know to avoid the trouble is systematically to wash all exposed ebonite with soap and water.

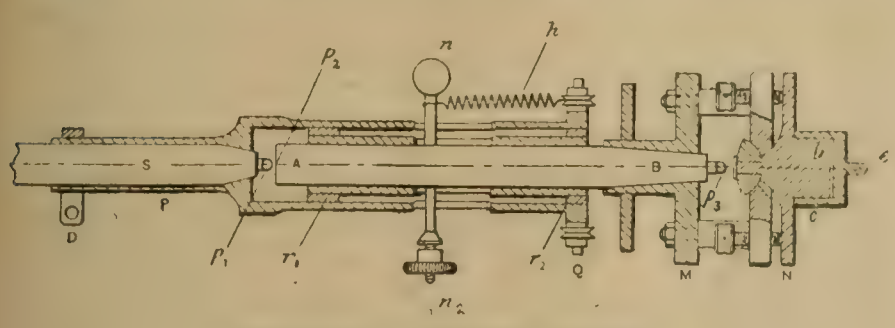
The principle now adopted is that unless the ebonite used in an instrument is well screened from the light it must not be looked upon as an insulator. Wherever possible, terminals passing through exposed ebonite are bushed with amberite.

The correct curve for the scale is horse-shoe shaped, being farthest from the mirror when the deflected and incident beams are in the same vertical plane; it rapidly approaches the mirror when the deflection is considerable.* Satisfactory results depend on the possibility of obtaining mirrors of very great perfection of form and of considerably longer radius of curvature than those usually supplied for instrument work. Such mirrors have been obtained from Mr. H. W. Sullivan, and give excellent definition.

A Nernst lamp forms a most suitable source of light.

An Electrical Measuring Machine.

In a paper read before the Institution of Mechanical Engineers last month, Dr. P. E. Shaw described the latest form of his electrical machine for the accurate measurement of end-gauges of length. The machines hitherto employed for this purpose, while serviceable under ordinary conditions, are unsuitable for use in the standardising work of a metrological laboratory, being incapable of effecting a critical examination of the best modern gauges such as those of Johansson. The author's first machine was made in 1905, and has been used in the National Physical Laboratory since 1909. The new machine has a higher order of reliability than the earlier one, and a wider range of adaptability.



Section of a Measuring End.

The machine consists of a heavy cast-iron bed, on which travel two headstocks and a gauge-holder. The latter provides for the accurate adjustment of the gauge in position with regard to the bed, and for its movement between the measuring ends, so that every part of the ends of the gauge can be measured without risk of introducing error by the displacement. Each head-stock is provided with a "measuring end," a micrometer screw and a reading microscope. The accompanying illustration shows one of the measuring ends. In the older machine direct electrical contact was made between the point p_1 and the gauge; in the present machine, if point contact is to be made, one either uses the extreme point e or the point p_3; in the latter case the end piece M N is pulled off the bar A B. For most purposes p_3 is better than e for point contact. If, on the other hand, we wish to measure with flat ends, the end cap c is pulled off, leaving the lapped flat surface b at the extreme end. The brass tube P Q is coned to fit the screw spindle S, so that when pushed on the latter and the clamp D adjusted the whole forms a rigid system. The invar bar A B is made a true fit in the ebonite bush rings r_1 and r_2 and is prevented from rotating on its axis by the cross pin n n_2, which slides in the slotted brass tube. The end of A B is coned, and the coned end of the fitting M N is pushed tight on A B, the two parts being ground to fit. By means of adjusting screws the end surface b can be brought into a plane perpendicular to the line of the bed. A spring h controls the system and keeps the contact points p_1 and p_2 about $\frac{1}{2}$ mm. apart normally; S is the invar shaft of a micrometer screw. Suppose this screw is advanced to cause the end of the system to meet a gauge surface on the extreme right beyond e. First e meets the gauge, then, as the screw is farther advanced, contacts p_1 and p_2 are brought together. The meeting of p_1 and p_2 completes an electric circuit consisting of a high resistance (say, 5,000 ohms), a cell, switches and telephone. As soon as the telephone sounds, the observer reads the divided head of the micrometer screw. On reversing the micrometer screw the spring h comes into action, breaking contact p_1 p_2, and the telephone again sounds.

It is most important to have clear sounds made in the telephone at "make" and "break." The accuracy of the method rests on this. Any oxide or dust at the contact produces "fuzziness" of sound. Oxide is the principal trouble, and as the surfaces p_1 p_2 are respectively a bead and plate of iridio-platinum, this trouble is reduced to a minimum. It is easy to clean the contacts p_1 and p_2.

It is easy to repeat readings to 0·05 μ ($\mu = \frac{1}{1000}$ mm., or micron). The errors found in the Johansson gauges are exceedingly small, being of the order of $\frac{1}{4}$ micron from point to point of the end surfaces. When the gauge is made up of several smaller gauges "wrung" together, the errors are greater than in the case of a single gauge. In two gauges of English make, the maximum point-to-point errors were 1·2 and 1·15 μ; the gauges agreed at their centres to 0·15 μ.

The machine has been set up at the National Physical Laboratory, and allows comparative readings to be made to within 0·1 μ. The actual length of a solid as compared with a line-standard can also be obtained.

* See E. H. Rayner, "The Shape of Scales Required for Reflecting Instruments with Concave Mirrors," Electrical Review, July 19th, 1912.

CROSSLEY GAS ENGINES AND PRODUCERS.

At the Royal Agricultural Society's Show held at Bristol this month, Messrs. Crossley Brothers, Ltd., had a large exhibit of their new type of engine, and one of their new suction gas producers. We illustrate one of the former, rated at 70 H.P.; similar patterns are made up to 300 B.H.P. The bed-plate in this type is supported throughout its length on the concrete foundation, and is cast with an oil groove round the base; the cylinder is supported, not overhung, and all the valves are arranged vertically, the admission valve forming the cover for the exhaust valve, so that there are no unwatered valve covers (fig. 3). There are no bolts or studs in the water-jacket space. A blow-off valve is provided for cleaning the compression space of oil or other deposit while the engine is running, without removing the piston. The governing gear is very simple and sensitive, and graduates the charges according to the load. Ignition is by low-tension magneto. The gas valve is of the screw-down type, with an index plate to register the amount of opening. The cylinder, piston pin, crank pin and exhaust valve are provided with forced lubrication through sight glasses, and the crankshaft and sideshaft bearings have ring lubrication, while the gear wheels all run in oil baths. Small oil engines of extreme simplicity were also shown.

The Crossley patent open-hearth suction gas plant is designed on quite novel lines. The name "Open Hearth" is given to this plant because the fire is at all times in full view of the operator. The generator A, fig. 2, lined with firebrick, is supported by legs B which also carry the circular plates forming the stepped grate. These plates, of which the patent stepped grate consists, are so disposed as to lie outside the angle of repose of the fuel. This ensures that none of the fuel will of itself fall from the grate. Below the bottom stepped grate the fuel rests on its own bed of ashes. The section of the stepped grate plates is also made suitable for the efficient distribution of water, which is obtained from a small pipe D

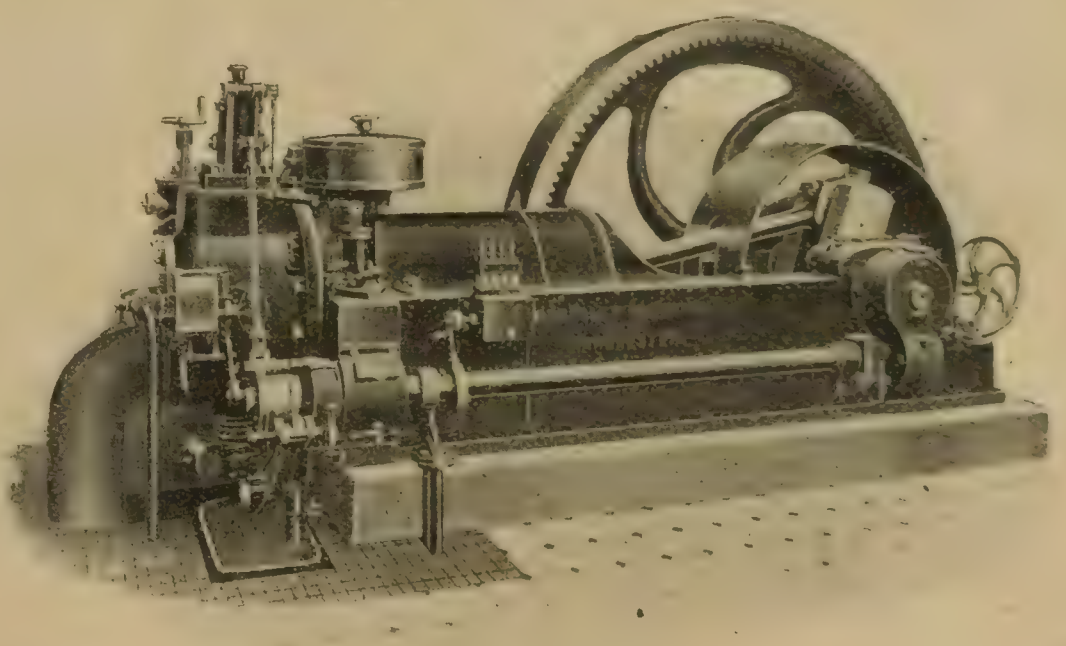


Fig. 1.—Crossley Gas Engine, New Type.

running round the generator case. This water passes in a minute stream into the funnels E, and thence to the grate plates, overflowing from the upper to the lower. By this means the grate is prevented from being burnt out and steam is generated for gas making.

Since there are no vaporisers at the top of the generator, there is nothing to prevent poker holes F being placed adjacent to and parallel with the brick lining. The important feature of this is that when the operator is dealing with badly clinkering fuel, he is able to pass his poker through the generator and free the brick-lining from clinker without damaging the brickwork, as happens in producers where the poke holes are put at an angle from the fuel container. When loosened, the clinker falls, and the operator is then able to see (without opening any doors or otherwise interfering with the quality of the gas) the ash and clinker on the circular plates, whence it may be removed by means of an ordinary rake. If large lumps of clinker have accumulated, they are pushed towards the centre of the grate, and by drawing the ash away from below the centre of the bottom plate, the lumps are easily removed. This type of grate admits of every section of the fire being separately cleaned with ease, and without admitting excess of air. A comparison of this with the ordinary flat grate will at once show its great advantage.

From the generator the gas passes to the external vaporiser G, which forms the communication between the generator and the scrubber. This consists of an outer case, upon the top of which is bolted the box H carrying the gilled tubes J, which have a large

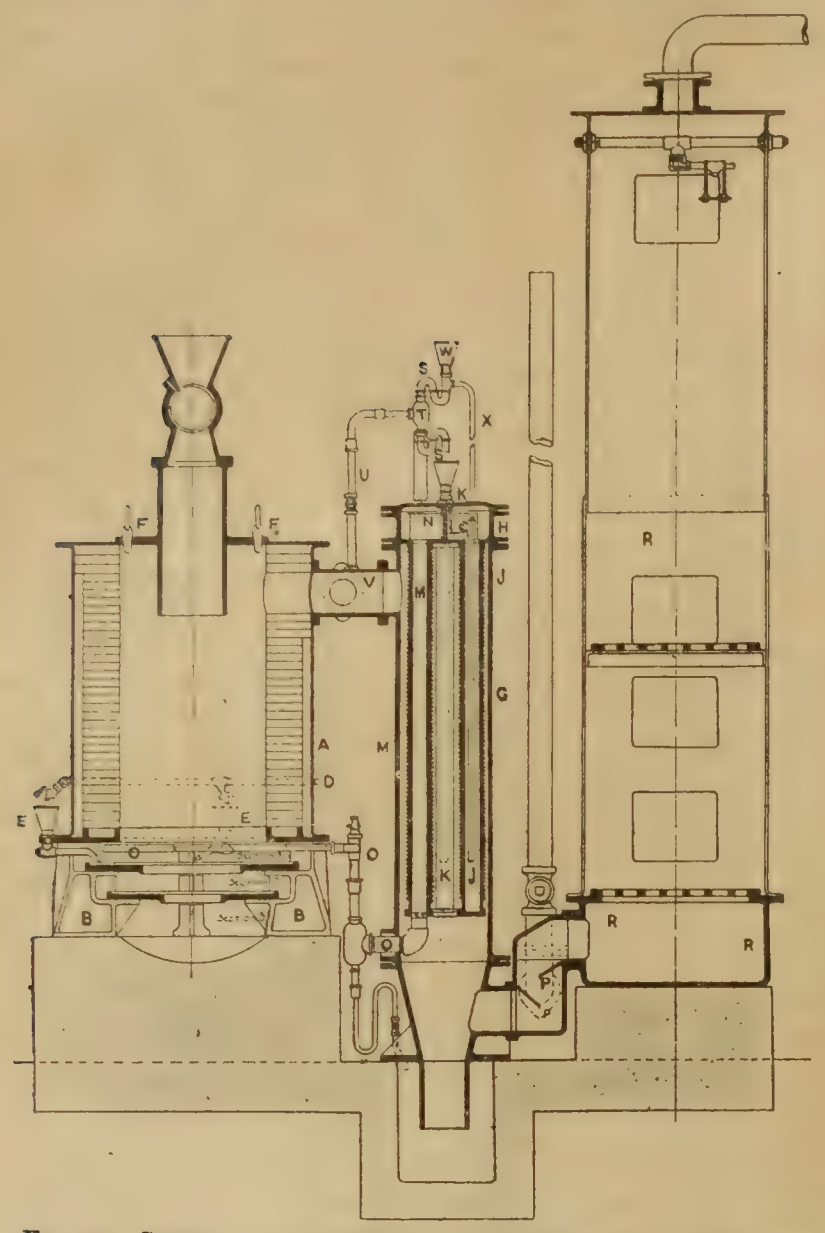


Fig. 2.—Section of Crossley "Open-hearth" Producer.

heating surface, and convey the heat extracted from the gas to the water for vaporisation purposes. The water for the vaporiser is passed first through an automatic water regulator, and flows down the tube K. This tube is open at the bottom, and the water rises in the gilled tube to the overflow L, to which the feed tube of the next gilled tube in series is connected, and so on through the whole of the gilled tubes except the last. This tube M forms the communication between the steam space N of the vaporiser and the steam distribution pipe O to the producer. The

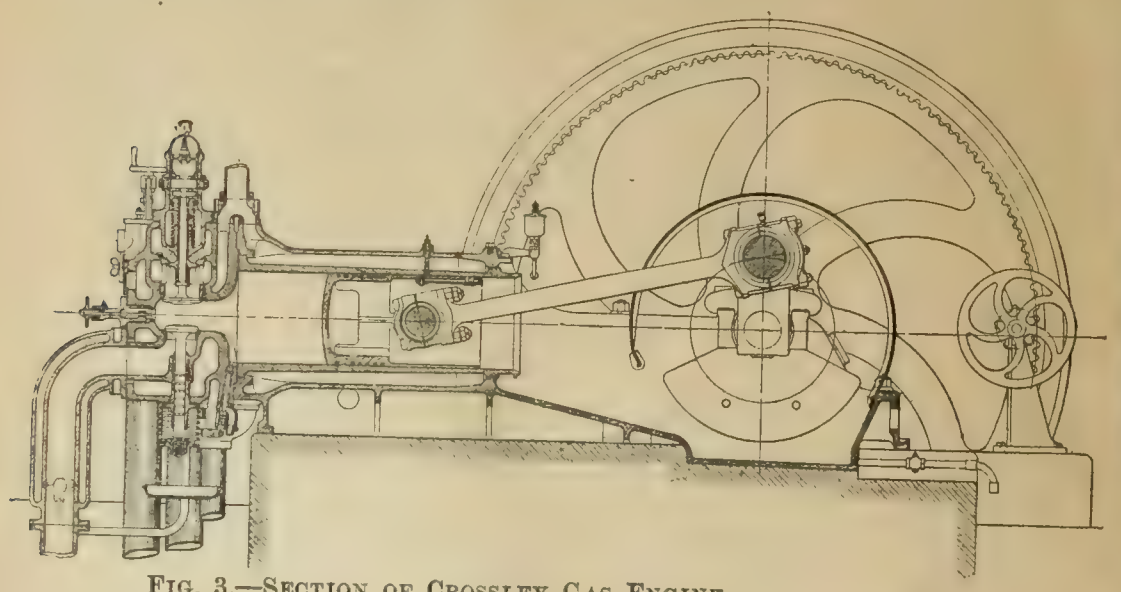


Fig. 3.—Section of Crossley Gas Engine.

water overflow also from the adjacent gilled tube passes down this pipe M, and is flashed into steam.

The distribution pipe O passes round the fire in the producer, and distributes the steam through a number of spaced holes. With this design of vaporiser, the gas which has to be cooled is external to the water which has to be heated, so that the water is continually surrounded by a jacket of hot gas.

Before passing to the scrubber, the gas passes through two cascades of water P formed by the overflow water from the scrubber. The impact of the water on the gas rids it of the heavier impurities, and thus relieves the coke in the coke scrubber, so that it is not necessary to clean and renew the coke as often as with other arrangements.

The scrubber R R contains two trays for supporting the coke, and filling and emptying doors are so arranged that the coke in the bottom portion of the scrubber (which is the first to foul) can be renewed without interfering with the coke in the upper portion of the scrubber. From the scrubber the gas passes to a combined drier and expansion box. Instead of blowing up with a pressure fan, an exhaust fan is used close to the engine, which draws the air and vapour through the fire exactly like the engine.

The automatic water supply to the vaporiser consists of two tubes S coupled to a small vacuum chamber T, which is connected by the pipe U to the gas outlet pipe V from the generator. Water is fed from a tap into the funnel W, and when the engine is not taking a charge of gas, this water overflows at the pipe X, and runs to the seal box. When the engine takes a charge of gas, however, a vacuum is created in the vacuum chamber T, and water is sucked over the upper tubes and runs into the lower funnel, and thus to the vaporiser. The makers claim that this automatic water supply is the simplest as well as the most efficient apparatus extant for its purpose. There are no moving parts whatever with the exception of the water. The supply of water to the vaporiser is, therefore, automatically regulated to suit the load on the engine, thus giving a constant supply of gas of good regular quality.

All parts of the producer which are subject to excessive corrosion are of cast-iron.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Adams Igranic" Arc-Preventing Interlock.

While the arc-preventing interlock device employed by the Adams Manufacturing Co., Ltd., of Balfour House, Finsbury Pavement, E.C., is not new, having been fitted to several types of their motor control panels during recent years, its mode of operation appears to be unfamiliar to electrical engineers; we recently inspected a starter fitted with the device, which is extremely simple and ingenious. In the accompanying illustration showing the firm's "Inching" starter as used by printers—a class of starter in which the interlock is particularly necessary owing to the very frequent starts and stops when inching the press—the interlock is seen at X just below the starting arm, which is actuated by a handle passing through the lid of the box. It consists of a small metal roller running on a brass segment, and completing the circuit through a solenoid which closes the circuit-breaker, which is in the main circuit. The segment above mentioned is divided with a resistance between the two parts, so that while the first contact passes a strong current to operate the circuit-breaker, the

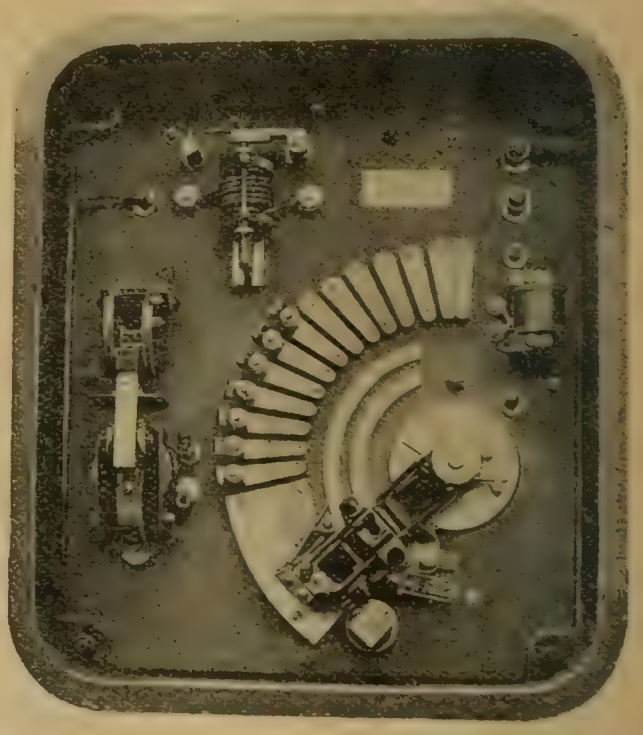


Fig. 1.—"Adams Igranic" Inching Starter (with Door Removed).

subsequent motion of the roller on to the second portion of the segment cuts down the current to a value sufficient only to hold the circuit-breaker in, but not to close it.

The roller, however, does not actually roll, but slides on the segments; and it is provided with two cam-shaped cheeks of insulating material, which provide the essential feature of the device—the arc-preventing interlock. If at *any* portion of its travel the handle is moved back a short distance, the roller turns and the cam-shaped cheeks come into play, lifting the roller out of contact with the segment and thus opening the solenoid circuit, so that the breaker instantly opens. The current broken by the roller being reduced, as mentioned above, causes no sparking worth mentioning, and the main circuit is always made and broken by the circuit-breaker, which has a magnetic blow-out, renewable contact-pieces and carbon tips.

Again, owing to the reduced current, the main circuit cannot be closed again without returning the handle to the "off" position, and thereby reinserting all the starting resistance. The circuit-breaker is provided with an automatic overload release, which is operative at all times, whether the motor is starting or has run up to speed; should the operator start up too quickly, also, the breaker opens. Returning the handle to the "off" position resets the overload release.

While it is not easy to describe the interlock in words, its action is extremely simple and certain, and ensures that all the hard work shall be done by the circuit-breaker, so that the starting switch contacts are completely preserved from burning. The device is fitted to the Adams Igranic "Conspede" and "Varispede" panels, which we have previously illustrated; the latter is provided with a shunt regulating handle in addition to the starting handle, and both panels have double-pole circuit-breakers, so that main switches and fuses are unnecessary. It is impossible to make a mistake when starting a motor with any of these panels, as there is only one starting handle, and any wrong use of it results in cutting off the current.

The "Pelapone" Oil Engine.

A paraffin engine of the vertical four-cycle type, called the "Pelapone" engine, has been introduced by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109-111, New Oxford Street, W.C., and is illustrated herewith, the figure showing the standard four-cylinder electric lighting set. High speed is one of the leading features of the type, which runs at 800-850 R.P.M., and can be started up from the cold by hand without the use of a blow-lamp. Large bearing surface is provided, and the moving parts are

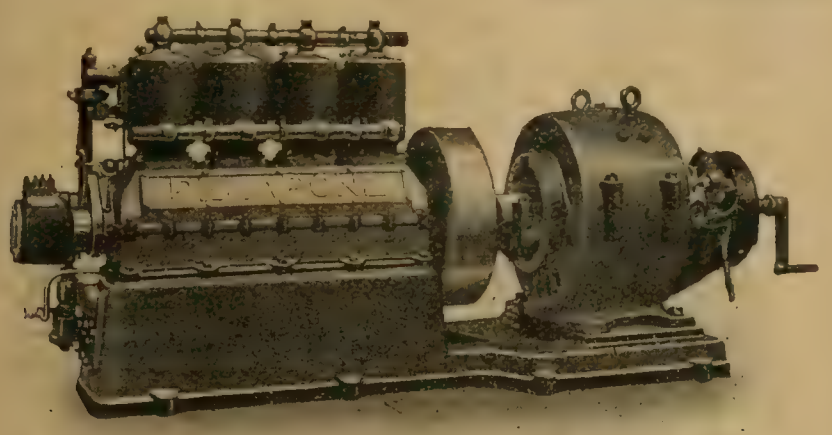


FIG. 2.—"PELAPONE" 12-H.P. ELECTRIC LIGHTING SET.

well balanced. The materials used are of high quality, and forced lubrication is provided.

The vaporiser is designed on a new principle, which enables a fixed gas to be produced, resulting in perfect combustion and clean cylinders and exhaust; both quantity and quality of mixture are automatically adjusted to suit the load, and the speed is controlled by a sensitive shaft governor. An explosion takes place on every firing stroke.

Meter Boards.

The accompanying illustration shows a meter board which has been adopted as standard by an electrical supply company in Burmah. As will be seen, the fuses are of the Zed type throughout. This type has been chosen because the company find them to be particularly suitable for meeting the various difficulties which occur

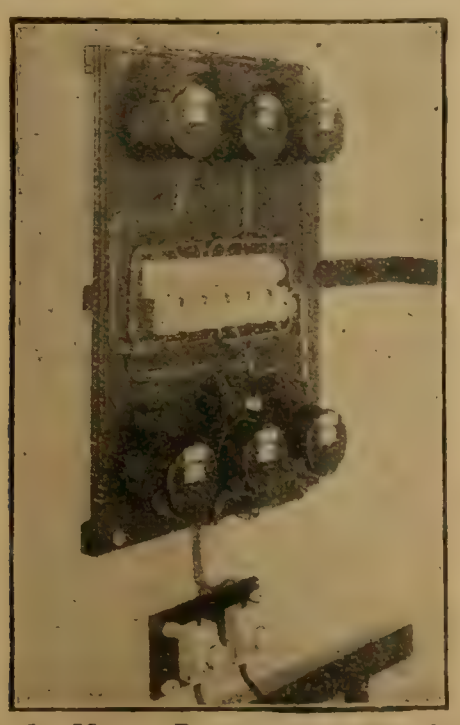


FIG. 3.—METER BOARD WITH ZED FUSES.

where native labour is employed. With the Zed type of fuse, it is an easy matter for a native to replace a blown fuse correctly, without any risk of over-fusing or receiving a shock. The board illustrated represents a type which is in use in large office buildings where a number of suites of offices on one floor have separate meters.

It is difficult for anyone not intimately acquainted with natives to realise to what heights of absurdity they can ascend when connecting up or attending to electrical apparatus, and from this point of view, Zed fuses have been found eminently satisfactory. Many of the large electricity supply companies which have tried the "Z" fuses have been led to adopt them exclusively, owing to their reliability and the control thus obtained over the operations of men sent out to replace blown fuses.

A New Vacuum Gauge.

Mr. Irving Langmuir recently described before the American Physical Society a new vacuum gauge of great sensitiveness.

At very low pressures the viscosity of gases is one of their most marked characteristics. This property is made use of in the new gauge, which consists of a rotating disk above which is suspended, by a quartz fibre, another disk carrying a mirror. The viscosity of the gas causes it to be set in motion by the lower disk, and this motion produces a torque on the upper disk which can be measured in the usual way by a beam of light reflected from the mirror.

The rotating disk is made of thin aluminium, and is attached to a steel or tungsten shaft mounted on jewel bearings and carrying a magnetic needle. The suspended disk is of very thin mica. The lower disk can be rotated easily at a speed of 10,000 R.P.M. by means of a rotating magnetic field produced outside the bulb containing the two disks.

The sensitiveness of the gauge is extremely high. At 1,000 R.P.M., with a scale at about 60 cm. distance, about 400 mm. deflection is obtained for ·001 mm. of air. The deflection is exactly proportional to the pressure below about ·01 mm., proportional to the speed of the revolving disk and practically independent of the distance between the two disks. For different gases at the same pressure the deflections are proportional to the square root of the molecular weights. All these facts are in accord with the kinetic theory. At 10,000 R.P.M., 1 mm. deflection corresponds to ·00000025 mm. There should therefore be no difficulty in detecting pressures as low as 10^{-7} mm.

LEGAL.

L.C.C. TRAMCAR ACCIDENT CLAIMS.

THE turning over of one of the London County Council's electric tramcars at New Cross on the afternoon of September 2nd, 1911, was the subject of an action for compensation for personal injury, heard in the King's Bench Division on July 16th, before MR. JUSTICE BRAY and a special jury. The plaintiff was Mr. Percy Mead Brambleby, a clerk, and he sued on behalf of his three children, aged 7, 5 and 4 years, and he alleged negligence against the driver of one of the Council's cars. Mrs. Brambleby also claimed damages for injuries sustained on the same occasion.

The Council admitted negligence, so that the only question to be determined was that of damages. It was alleged that the cause of the accident was the too rapid pace at which the driver came down the incline to a junction, coupled with the worn state of the rails at the point.

Medical evidence having been given concerning the nature of the injuries, the jury assessed the damages as follows:—Mr. Brambleby, £40 on account of expenses; Mrs. Brambleby, £190; the boy Ernest, £100; the boy John, £600; and the little girl, £30. His Lordship entered judgment for Mrs. Brambleby, the boy John and the girl for the amounts awarded, with costs. In the case of Mr. Brambleby and the boy Ernest, judgment was entered for the County Council, they having paid into Court sums larger than those which the jury awarded.

THE NATIONAL TELEPHONE CO.—DISTRIBUTION OF ASSETS.

(*Concluded from page* 96.)

THE matter having been argued before his Lordship by counsel representing the different classes of holders, his LORDSHIP proceeded to deliver his judgment, giving the whole of the fund to the deferred stockholders. The matter, he said, was one of some complication, but it had been argued before him most carefully and fully, and he did not think that he would better matters by reserving his judgment, especially as he felt very confident that the case would be carried higher, whatever his decision might be. The matter seemed to be governed by Sec. 86 of the Act of Parliament, which provided that unless the articles contained anything to the contrary, any surplus should be distributed amongst the members according to their rights and interests in the company. The effect of that was that the distribution in the first instance was regulated by the provisions in the articles. The first question he had to determine, therefore, was whether on the true construction of the articles there were other provisions which dealt with the distribution of this surplus. If there were such other provisions a number of cases cited were excluded from consideration because they only dealt with the way in which the assets should be divided amongst the members according to their rights and interests, there being no other provision in the articles. If the articles did, in fact, provide that the surplus assets should be divided in some particular way, that particular manner must have precedence over general equity or right. Here there were no less than five sets of claimants—the first second,

and third debenture-holders, and the preferred and deferred ordinary stockholders. This surplus of £200,000 which had to be dealt with was a surplus that might be looked upon as the remains of a very large reserve fund, which was from time to time set aside, and had certainly not been appropriated to capital. He thought nothing was ever done by the company which definitely turned the reserve fund into capital and prevented it being distributed as dividend if the company had been so minded. The rights of the first preference shareholders depended upon Article 83 of the original articles, and under that he came to the conclusion that they were not entitled to more than repayment of their capital, with the interest stipulated for. The second preference were on a somewhat different footing, as they had a share in the profits beyond the fixed per cent. rate that their shares were to bear, but upon the construction of the articles it seemed to him that that was limited to the annual profits made by the company, and there was nothing to show that they were entitled to any return of capital beyond the nominal amount of their shares. It seemed to him that the conclusion any business man would come to was that the second preference were not entitled to more than the return of their capital. With regard to the third preference, their right to be repaid preferentially entirely negatived any right of the holders of those shares to participate to any further extent in a winding up. There was nothing, in his opinion, in the articles that compelled him to come to a different conclusion from that which he had mentioned, that any share that had preference over the ordinary shares was not entitled to anything beyond the amount of the preference dividend. In all the cases to the contrary it had been expressly provided that the rights in the event of a winding up were to be analogous to the rights existing while the company was going on. The fact that the preference shares had express rights attaching to them in the event of a winding up negatived the contention that they were entitled to any further rights in this surplus, and he must hold that the first, second and third preference shareholders took no share in this excess of assets. For the same reasons he must hold that the preferred ordinary were not entitled to anything more than the nominal amount of their shares with the 5 per cent. bonus that had already been paid. The whole surplus, therefore, he held was divisible amongst the deferred shareholders, and the others were not entitled to anything beyond that from December, 1911.

Mr. Danckwerts said that the costs of all parties as between solicitor and client would be paid out of the surplus fund, but he must warn the parties that in the event of an appeal the liquidator would not pay the costs.

Mr. Lawrence said that would be as the Court of Appeal would order.

An order for distribution of the fund was made in accordance with his Lordship's judgment, but its operation was stayed pending an appeal.

Prested Miners' Gas Indicating Electric Lamp Co., Ltd.

In the Companies' Winding-Up Court on Tuesday, Mr. Justice Neville had a petition before him by George Reynolds, Ltd., for the compulsory winding up of this company.

It was stated that it was a judgment creditor's petition for the winding up of the company; there was no opposition. The company was formed in 1903, with a nominal capital of £25,000. The petitioner supplied goods to the amount of £51 in August, 1911, and in October of the same year a Receiver was put in on behalf of the debenture stockholders. The petitioner issued a writ on February 3rd, and judgment was entered in default of appearance.

His Lordship made the usual order.

Hendon Urban Council and the Telephone Service.

In the Railway and Canal Commission Court, on July 17th, Mr. Justice Bankes presiding, an important decision was given in the matter of the application under the Telegraph Acts 1863 to 1911, asking the Court to determine a dispute between H.M.'s Postmaster-General and the Urban District Council of Hendon in regard to the placing of telephone lines along certain roads in the Council's area. In July, 1912, the Postmaster-General, by notice in writing, asked the consent of the Hendon authority to lay the lines along three roads in the district, and the Council declared their inability to give the necessary consent, on the grounds that the roads were not highways, and so not streets or roads within the meaning of the Telegraph Acts, therefore the Council had no concern with them. Further, they contended that if the roads were streets or roads within the meaning of the Acts, they were not repairable at the public expense, and the Council were not the body having control of them within the meaning of the Acts. In accordance with Sec. 7 of the Telegraph Act of 1874, the matter came before the County Court Judge, who gave his decision in favour of the Council. The Postmaster-General, dissatisfied with the award, then brought the matter to the Railway and Canal Commission Court for determination, as he was entitled to do under the provisions of the Acts.

In delivering judgment, Mr. Justice Bankes said the only point the Court had to decide was whether the roads in question were under the control of the District Council, and in determining that point it was necessary to examine the statutes very closely in order to see whether the present case differed from the case which governed the matter, viz., the Redhill Gas Co. and the Reigate Rural District Council. In that case the question turned on whether the Reigate U.D.C. were persons having the control or management of a certain road within the meaning of the Gas Works Clauses Act, 1874. In his Lordship's opinion no distinction could be drawn between that case and the one before him. The two judges who constituted the Court in the Reigate case dealt with a point which was fatal to the contention of the Postmaster-General in the present case. The Lord Chief Justice expressly held that where a road was made up under the powers of the Public Health Act, 1875, and the Private Streets Works Act, 1892, it did not come under the control of the local authority until the work was completed and the road had been taken over. He (Mr. Justice Bankes) was bound by the decision in the Reigate case, and accordingly the Court must determine the difference adversely to the contention of the Postmaster-General.

Sir James Woodhouse concurred, and Mr. Justice Bankes said he had the authority of his other colleague, Mr. Gathorne Hardy, who was not present, to say that he also agreed with his Lordship's judgment.

Baxter & Caunter, Ltd., *v.* Levetus.

The above action was mentioned to Mr. Justice Darling in the King's Bench Division, on Monday, July 21st. The action, it was stated, was for an injunction against the defendant to restrain him from dealing with certain electrical appliances.

Mr. Whateley, who appeared for the plaintiffs, said his clients went before Mr. Justice Channell, and were granted an interlocutory injunction. The Judge also ordered that there should be a speedy trial of the action. He therefore asked that a day should be fixed for the trial.

Mr. Cox Sinclair (for the defendant) said he opposed the application, and argued that the plaintiffs' claim showed nothing which warranted the granting of an injunction, while there was not an atom of reason for expediting the hearing.

Mr. Whateley said the plaintiffs were dealers in electric appliances, and their complaint was that the defendant approached them and bought goods from them pretending that they were for foreign export. By that means they were obtained cheaper. Then, under another name, it was alleged defendant sold the goods to the trade, with the result that the plaintiffs' trade was greatly affected.

The Judge—Are they doing it now?

Counsel—No, because they were found out, and we presumed they stopped it.

His Lordship said in that case there was no need for an injunction. Having regard to the paucity of Judges and the number of cases awaiting trial before the one in question, he could not fix a day for its hearing.

Mygatt *v.* Glyn.

In the King's Bench Division on July 17th, the hearing was commenced of an action brought by Mr. Otis Angelo Mygatt, of Clifford Street, Bond Street, W., against Major Geoffrey Carr Glyn, of Eaton Place, W., and Sharnbrook, Beds. The action arose out of a transaction between the parties consequent to the formation of Holophane, Ltd., a company registered in England in July, 1911.

Mr. Mygatt claimed to recover £4,254 on a bill of exchange dated April, 1911, drawn by the plaintiff and accepted by the defendant and payable on demand and to the order of the plaintiff, and which, plaintiff said, on being duly endorsed and presented by him was dishonoured. It was stated that the defendant and plaintiff were associated in the promotion of Holophane, Ltd. In his defence, and in support of his counterclaim, Major Glyn said that in consideration of his agreement to act as managing director of the company in question for a period of five years from the date of his appointment, and assisting in the building up of the business in England and Europe, it was agreed that the plaintiff should transfer to him certain preference and ordinary shares in the company on the terms that the said shares should become the defendant's property if he continued to act as managing director for the term specified. Meanwhile, the defendant said, he was to hand to the plaintiff a bill of exchange, the condition being that it should not be made payable in the event of his so acting. He continued to act as the managing director of Holophane, Ltd., down to April, 1912, and he, therefore, denied that he was liable on the bill. Defendant counterclaimed for 10 per cent. commission on the stock transferred to the plaintiff as vendor, and 10 per cent. of the plaintiff's profits from the company, which, he said, it was agreed to allow him in consideration of his relieving the plaintiff of the routine business connected with the company, and which he had not been paid. Plaintiff's reply to the counterclaim was a denial of the agreement.

Mr. McCall, K.C., opened the defendant's case first, and said that Major Glyn had an honourable business and military record behind him. Mr. Mygatt was an American citizen, and had a considerable interest in a company registered in America called the Holophane Glass Co., formed for the purpose of obtaining the maximum amount of light from electric globes by the use of a patent called Holophane. Mr. Mygatt wanted the assistance of a gentleman with a reputation for business and good character, who would form an English company or otherwise secure an amalgamation of the English and American concerns. Major Glyn accepted the post, and he was promised a salary of £600 a year payable by the plaintiff until the company was formed and by the company afterwards. Major Glyn set to work. He used his influence and secured capital from his friends, and the company was promoted. He went to America and settled up difficulties there and received a promise of

substantial compensation for his trouble from the plaintiff. He also secured a contract while in America with the General Electric Co., by which that company agreed to take over the business of the Holophane Glass Co. and pay the Holophane Co. a considerable amount of money. Plaintiff promised the defendant 10 per cent. of the shares he should receive from the new English company as vendor, and 10 per cent. of his profits from the company on the understanding that the defendant should relieve him of all routine work. Major Glyn, in return, gave the bill on which the plaintiff now sued, on the understanding that it should not be made payable if he occupied the position of managing director of the company for five years. When the company was formed Major Glyn was appointed managing director. Shortly afterwards friction arose between the company and Mr. Mygatt over the assets of the old business, the company demanding that Mr. Mygatt should hand over to them certain shares and property which, they alleged, he held. Mr. Mygatt refused, on the ground that he owed the company nothing. Following that, for some reason or other, Mr. Mygatt decided to get rid of Major Glyn, and at a board meeting a resolution was passed, in April, 1912, which amounted to a dismissal of the defendant from his position. Allegations were made against the defendant that he had perpetrated a fraud on the trade by selling a shade called Dilux as Holophane, and, said counsel, an action had recently been heard, which was brought by Major Glyn, in which that gentleman was awarded damages against the company for wrongful dismissal. That, contended counsel, amounted to a decision by the jury that the plaintiff had no right to deprive the defendant of his office, and could not, therefore, demand payment on the bill in this action.

On Friday, July 18th, when the hearing of the case was further continued, Mr. McCall, K.C., said that the bill was presented on October 29th, 1912, and dishonoured, and on November 5th the writ was issued. During the proceedings on this day the services of the jury were dispensed with by consent.

Major Glyn gave evidence, and on Monday he continued to do so.

On Tuesday the hearing was further continued before Mr. Justice Bankes, and after additional formal evidence, the case for the defendant concluded.

Mr. Gore Browne, K.C., then opened the plaintiffs' case, and ultimately called Mr. Mygatt, who, in the course of his evidence, said that he had been connected with the working of the Holophane patents for 20 years, and did all the work in America, legal and otherwise. He spent about $100,000 when the American company was formed. Having detailed the arrangements for the formation of a company to work the European business and traced the history of the project to promote the English company, witness spoke to the arrangements made with Major Glyn, and said:—In regard to the two separate commissions of 10 per cent. claimed by Major Glyn in this action, he told the defendant that he could not make any definite arrangement. From November 5th, down to the time that the counterclaim was put in, Major Glyn never claimed that he was entitled to the 10 per cent. on his (Mr. Mygatt) profits, as distinguished from the shares. As to the services rendered for him by the defendant, those rendered prior to the formation of the company were those of a friend, and he in no way represented witness's interests, either in England or America. As far as England was concerned, the defendant largely took the commercial and routine business into his hands. In regard to signing the shares transfer, so far as he could recollect he said he would sign it if his solicitor so advised, but he had never consciously agreed to sign the transfer to Major Glyn.

Cross-examined, Mr. Mygatt said he paid the defendant £600 a year for his services in relieving witness of the routine work, &c., pending the formation of the new company, and the 10 per cent. agreement did not apply till the company was formed. He was to have 10 per cent. upon the income of witness if the flotation was successful, and if he (Major Glynn) got £40,000. The 10 per cent. was to date from the time that the syndicate was formed. He was to work up to the time that the syndicate was formed without receiving any commission on his (witness's) income.

Ultimately the evidence concluded, and counsel on both sides proceeded to address the Judge.

Eventually Mr. Justice Bankes reserved judgment.

Colliery Manager Summoned.

On Saturday last at Chesterfield Mr. Thomas Henry Elliott, manager of the Langwith Colliery, belonging to the Sheepbridge Coal and Iron Co., was summoned on three counts for breaches of electricity special rules, viz. (1) a metallic covering of a lampholder not being earthed; (2) not protecting live parts (switch and fuse); and (3) not having a metallic switch-box earthed. The facts were not contested.

According to the report of the hearing in the *Yorkshire Daily Observer*, Mr. Gichard, appearing on instructions from the Public Prosecutor, said that on March 5th an accident at the Langwith Colliery resulted in the death of a youth. Shortly before the youth fell to the ground he was near a prop used for supporting the roof. To that prop was affixed an electric lamp, and immediately after the boy's death it was noticed that the lamp was hanging down, the inference being that the lad had touched the lamp and received a fatal shock. His Majesty's inspector discovered that the lamp had not been earthed by means of a wire. An inspection of other parts of the mine disclosed two other breaches of the regulations. Had the lamp been earthed the lad would not have met his death. It might be argued that the manager was not responsible, as there was a qualified electrician, but he (Mr. Gichard) would be able to prove that by law the certificated manager was the person responsible for the apparatus, &c.

Mr. Robert Nelson, Home Office Electrical Inspector of Mines spoke as to the lamp in question not being earthed. He also pointed out the dangerous nature of the unprotected live parts. He was aware that the company had adopted a new system of earthing, and that the cable put in passed within a few inches of the lamp.

The defence was that the manager had taken every reasonable means by the appointment of qualified electricians to prevent contravention of the electrical rules

The Bench imposed a fine of £1 and £5 5s. as costs in regard to the "non-earthed lamp" and dismissed the other two cases.

Aldridge v. Hobart Electric Manufacturing Co.

At the Gateshead-on-Tyne County Court on the 15th inst., an action for the recovery of £11 7s. for work done and materials supplied was brought by Henry William Aldridge, electrical engineer, of Coronation Buildings, High Street, Gateshead, against the Hobart Electric Manufacturing Co., of Charterhouse Street, London. Mr. R. S. Holmes was for the plaintiff, and Mr. J. J. McIntyre was for the defendant company. According to the evidence for the plaintiff, it appeared that the defendant company, desiring to hold a demonstration of electrically-driven mincing machines before Gateshead butchers, and being unable to get a suitable shop, had made use of plaintiff's premises. A man named Beck, who gave out that he was acting for the defendants, had charge of the arrangements for installing the machines. Mr. McIntyre said that Beck was no longer in the defendants' service. On the ground that it was a private debt incurred by their agent, the defendants denied their liability to pay the account. Plaintiff, cross-examined, said it was not until he had lost sight of Beck that he applied to the defendants, asking them to pay for the installation. Mr. McIntyre submitted that there was no case for him to answer. The defendants denied that Beck was anything but a sales agent for them. He was not their representative. Plaintiff, re-called, said Beck opened a business office in Grainger Street, Newcastle-on-Tyne, with the company's name on the door.—Mr. McIntyre: What exactly was on the door?—Plaintiff: "Hobart."—Mr. McIntyre: But not the full title of the company. It was not their branch office at all.—His Honour gave judgment for the defendants with costs.

BUSINESS NOTES.

American Lamp Sales.—A report by the Lamp Committee of the National Electric Light Association, of America, shows that the total sales of glow lamps for domestic use in 1912 aggregated about 90 millions, of which carbon lamps represented 25·47 per cent. (a drop from 52·9 in 1911), Gem lamps 33·59 per cent. (19 in 1911), tantalum 1 per cent. (2·74 in 1911), and Mazda lamps 39 94 per cent. (25 3 in 1911). This year it is expected that carbon lamps sales will be less than 10 per cent. of the total. It is noteworthy that the sales of Gem (metallised filament) lamps are increasing steadily at the same rate as of Mazda lamps.

The Balkan War and Austria's Electrical Trade.—On the position of the electrical industry in Austria during the past year, the *Neue Freie Presse* makes the following observations:—Up to the outbreak of the Balkan war, Austria's trade in general, and that of the electrical industry in particular, was marked by a noteworthy expansion. The sales of high-pressure machines, both constant and rotary-current generators and motors, as well as of transformers, were heavier, in connection with the more active tendency shown in the construction of light and power installations, bulk supply stations, and electric tramways. The mining and iron industries likewise furnished good business. On the other hand, main line traction demand still maintained a halting attitude, while for abroad calls were numerous. Low-pressure manufactories were also well employed, as, on one hand, the newly-established, or enlarged, telephone systems yielded a considerable number of orders, and, on the other, the enormous world-demand induced a steady expansion of the glow-lamp section. Prices in the high-pressure industry, nevertheless, on account of causes frequently alluded to, did not keep pace with the sales. Sharp competition, unfavourable conditions of production, the high prices of raw materials and important finished articles, with which the high-pressure industry had to contend, have continued, and even show signs of increasing. On this account, an active development of the profit-earning capacity of the high-pressure industry is not to be too hastily forecasted, although the situation for light and power suppliers and the low-pressure branch may be more favourably judged. The Balkan war has adversely influenced every branch of the electrical industry. Consumers in the country districts withheld orders and investment, while the dearness of money prevailed, and the political uncertainties paralysed every kind of business operation. Austria supplies the greater part of the electrical requirements of the Balkan lands, and political interruption of business was naturally productive of the greatest prejudice. By the geographical position of the Monarchy, and the fact that the Austrian electrical industry in all its branches stands on a level equal with that of foreign countries, foreign competition in most equal with that of foreign countries, foreign competition in most of the Balkan States during the year was successfully opposed;

nevertheless, the prices of raw material, high wages, heavy tax burdens, unfortunate commercial treaties, and many other oft-cited drawbacks, hindered a sound export trade. The immediate prospects of the electrical industry depend upon whether the political uncertainties will be shortly terminated. A powerful economic improvement would give the electrical industries a desirable stimulus, which would be enhanced by a more active giving out of State orders.

Book Notices.—*Car Troubles.* By H. W. Slauson, M.E. London: Harper & Bros. Price 1s. net.—This little book is printed on stout paper, obviously to stand hard wear; the contents relate to the symptoms of the various motor troubles, and set forth the remedies to be applied in the briefest possible manner. Care has been taken to organise the matter so as to facilitate reference in emergency, and the book will no doubt be found a valuable aid by motorists.

We recently received copies of the *Transactions* of the New York Electrical Society, of which five issues have now appeared. The printing of the *Transactions* is a new departure, marking an important stage in the development of the Society, which was founded in 1881 to present in popular form the latest advances in the electrical and allied sciences. Mr. H. H. Barnes, jun., is president, and Mr. George H. Guy (29, West 39th Street), secretary. Some excellent papers are printed in the *Transactions*.

The Syndics of the *Cambridge University Press* announce that they have undertaken the publication of a new and important series of books on technical subjects. The first list of books in preparation includes "Electro-Technical Measurements," by A. E. Moore; "Alternating Currents," by W. H. N. James; and "Electrical Engineering," by T. C. Baillie.

"Switches and Switchgear." By Prof. R. Elder and Ph. Laubach. Price 15s. net. "High and Low-Tension Switchgear Design." By A. G. Collis. Price 10s. 6d. net. 1913. London: Constable & Co., Ltd.

"The Post Office Electrical Engineers' Journal." Vol. VI, Part 2. July, 1913. London: H. Alabaster, Gatehouse & Co. Price 2s. net.

"Regulations for Technical Schools, Schools of Art, and other Forms of Provision of Further Education in England and Wales." 1913. London: Wyman & Sons, Ltd. Price 2d.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 2. April-June, 1913. London: John Murray. Price 2s. 6d. net.

"*Journal* of the Municipal School of Technology, Manchester." Vol. VI. With Prospectus for 1913-14. Manchester: The Education Committee.

"*Transactions* of the Toronto Engineering Society." Vol. VIII, No. 1. May, 1913. Toronto: The University.

"*Proceedings* of the Forty-Sixth Annual Convention," and "Annuary for 1913 of the American Institute of Architects." Washington: The Institute.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 1. July, 1913. Philadelphia: The Institute. Price 50 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 13. July 15th, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

G.E.C. Electrical Novelties.—A pocket flash lamp called the "Defiance" has been placed on the market by the G.E.C. LTD., which resembles an automatic pistol. There is a two-cell battery within the stock of the pistol, and the lamp is an Osram drawn-wire battery lamp fitted in the muzzle. The action of the switch is controlled by the trigger, and a locking pin enables the light to be kept on for several minutes if desired.

Another electrical novelty is a model water turbine, coupled to a magneto generator giving 8-10 volts and about 12 watts. It can be coupled to a main water tap.

Cable Manufacture in Germany.—The copper works of the J. Wahlen Co., of Cologne, have been acquired by the BROWN-BOVERI group at a price of from £25,000 to £37,000, and have been transferred to a special concern bearing the title of the Rhenish Wire and Cable Works Co. Most of the shares in the latter are held by the Swiss Brown-Boveri Co., whilst a further portion is in the possession of the latter's subsidiary company at Mannheim. It is now intended to extend the copper works with special reference to undertaking the manufacture of cables, so that the Swiss-German group in question may render itself independent of the German cable syndicate as far as possible.

Trade Prospects in the Balkan States.—When the war in the East is satisfactorily concluded, the former Turkish vassel States should afford additional outlets for trade in electrical manufactures, for a due share in which preparations should be made in advance. On the methods of securing business, our contemporary, *Elektrotechnik und Maschinenbau*, tenders the following observations:—No manufacturer capable of doing an export business should shun the task, either personally or by means of responsible technically-equipped agents, of collecting the needful information as to local requirements in his branch in the important places of trade in the several countries. This course will most quickly conduce to success. In Bulgaria, in particular, the engagement of a capable technical representative is absolutely needful. A great mistake is made by those exporting firms who engage an agent at Bucharest, and also entrust to him the representation for the country districts, the plan usually involving the disadvantages of extension of credit, postponement of payments, reduction in prices, and reduced purchasing power. An exporting firm having engaged a capable traveller with the recommendation of a local Consul, may scrupulously follow his advice as regards samples, dates of delivery, and conditions of payment. The forwarding of the goods to destinations is matter for consideration, and it is best to follow exactly the instructions given. Where none are given, or merely "by the shortest route," regard must be had to time, as delay on the passage may involve expense exceeding the value of the invoice. In this matter the instructions of the agent should be studiously followed. The character of the package should also be arranged to suit the circumstances. When goods are forwarded by post, the weight and size of the parcel must be considered. The registration of parcels should not be overlooked, and an understanding come to beforehand with the customer as to who shall bear the cost. Laws governing travellers have been in existence some years in Bulgaria, neglect of which involves many difficulties. Foreign agents and travellers, equipped with vouchers from home Chambers of Commerce, are required to take out trade licences at the Custom House at the port of entry, and to make a money payment according to the volume of business, ranging from 50, 100 and 150 fr. per year, besides a stamp tax of 5 fr. These amounts are, however, only exacted from those firms having no resident agent in direct connection with customers. Resident agents are required to keep an order book wherein each order must be entered on the spot when taken, and stamped with a 10-centime stamp. Before entering into trade relations it is also advisable to seek such information regarding local firms as the local Consul may be able to afford, but in this direction English Consuls lend less assistance to the export trade than do foreign Consuls. To this information a German correspondent of the *Berliner Börsen Courier* adds the following:—The great advance now observable in Bulgarian trade owes its origin to the steps taken by the Government in the nineties to foster trade by various politico-fiscal measures and industrial laws. These efforts have not remained fruitless, the more so as valuable vegetable and animal products, mineral wealth, and water-power provide conditions which ensure a prosperous future. Here and there also foreign capital has been invested in the developments of Bulgarian industries. In 1909 the number of industries receiving subsidies from the State totalled 266. In 1911 the number had risen to 293, comprising food and provisions, 103; textile, 67; chemical and related industries, 43; leather, 22; metal, 22; timber and wood, 18; porcelain, 9; paper, 3, &c. In 1911 about 50 new industrial undertakings were started, with an aggregate capital of £1,000,000. Among the new concessions granted were 4 for beet sugar manufacture, 2 for chemical manures, and 2 for cement and hydraulic lime. Electric motive power is coming into use in many of these industries and notably in that of timber which has its chief seat at Rustschuk, where are establishments equipped in the most modern style. The iron and metal industries have also made great strides, but in the opinion of this German correspondent Bulgaria will remain for many long years dependent on oversea manufactories for iron and metal goods and machinery. The textile industries are also developing rapidly, aided by the abundant native supplies of wool.

A Hospital Carnival.—On Saturday, July 12th, at the annual Ilford Hospital Carnival, in the section for best decorated trade vans, THE GENERAL ELECTRIC CO., LTD., secured a first-class certificate for an elaborately decorated Osram motor van. The scheme for the decoration included a tableau of "Aladdin and the Wonderful Osram Lamp." The artistic effect was enhanced by a careful arrangement around the vehicle of Osram battery and automobile lamps, current for which was supplied from portable accumulators within the van. Naturally, the illumination showed up to best advantage in the evening. A powerful "Rushmore" searchlight was fitted to the canopy over the driver's seat.

The decorated Osram motor van also secured the first prize for decorated vehicles at Willesden on Thursday last week. Later, the Rushmore searchlight, which is part of the equipment, provided the necessary illumination for both band and dancers.

Auction Sale.—Particulars will be found in our advertisement pages of an auction sale of electrical apparatus to be conducted by MESSRS. PERCY HUDDLESTON & CO., at Hammersmith, on Tuesday next, July 29th.

The Holidays.—The works of the LONDON ELECTRIC FIRM, George Street, Croydon, will be closed from Saturday, August 2nd, to Monday, August 11th, for the annual holidays.

THE LANGDON-DAVIES MOTOR CO. announce that their works will be closed during August Bank Holiday week.

The works of the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., at Trafford Park, will be closed from this evening (Friday, July 25th) until the morning of Tuesday, August 5th, for the annual holidays.

The works of MESSRS. T. W. BROADBENT, LTD., Huddersfield, will be closed from Friday, July 25th, to Tuesday, August 5th, for the annual holidays.

THE RECORD ELECTRICAL CO., LTD, notify that their works at Broadheath, Altrincham, will be closed from Friday, August 1st, until Monday, August 11th, for the annual holidays.

The offices and works of the BRITISH PROMETHEUS CO., LTD., will be closed from July 31st to the morning of Monday, August 11th, for the holidays.

The works of the WALSALL ELECTRICAL CO., LTD., will be closed from July 31st to August 11th for stock-taking and the annual holidays.

MESSRS. CRYSELCO, LTD., of Kempston Works, Bedford, announce that their works will be closed from Saturday August 2nd, until Monday, August 11th.

The works of MESSRS. HIGGS BROS., of Balsall Heath, Birmingham, will be closed from Friday evening, August 1st, until the morning of August 10th.

In all the above cases a small staff will, as usual, be in attendance to attend to urgent matters.

Catalogues and Lists.—The D.P. Battery Co., Ltd., Lumford Mills, Bakewell, Derbyshire.—Catalogue (26 sheets) containing illustrations and tabulated particulars respecting capacities, dimensions, weights, prices, &c., of various types of D. P. batteries—FX, TX, LX, LSX, F, T, L, and LS—for central station, country house, yacht, traction, telegraph, and telephone and portable service. Lists of important users, dimensioned diagrams of plates and drawings of stands, also details of renewals, accessories, &c., are given.

Messrs. D. H. Bonnella & Son, Ltd., 58 and 60, Mortimer Street, London, W.—48-page catalogue (new edition), of motor-car electrical installation accessories, illustrations, descriptive notes, and prices being given of a large variety of roof lights, steering column and dashboard lamps, switches for interior lighting, motor telephones, accumulators, measuring instruments, Osram lamps, side, head, step and hand lamps, as well as various general carriage fittings and equipments, tool kits, &c.]

Messrs. A. Reyrolle & Co., Ltd., Hebburn on-Tyne.—Illustrated list, No. 60, describing and stating prices and dimensions of single and three-phase potential transformers; also list, No. 48, relating to, and illustrating and pricing, their watertight wall plugs and sockets.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Catalogue No. 20C (20 pages) giving a full description, with half-tone pictures and special diagrams of connections, of their Peebles motor converters. One of the views shows the interior of one of the sub-stations of the Calcutta Electric Supply Corporation, Ltd., with six out of the 19 475-kw. three-bearing sets that have been supplied to this company. Names of other important users are also tabulated. During the past 18 months orders have been received for over 60 sets in sizes ranging from 1,500 kw. down to 100 kw.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Catalogue No. 505 (20 pages) contains excellently illustrated descriptions of their distance thermometers and hygrometers, their principles and practical applications, together with tabulated prices, temperature conversion table and a telegraphic code.

The Westinghouse Cooper-Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—List No. 56 particularising and giving prices and a light distribution curve of their silica lamps for d.c. for foundry, workshop, railway siding and other such lighting. A guarantee is given of a minimum life of 1,000 hours. Another size of lamp, viz., 2,500-c.p. unit for 110 volts, has been added.

Messrs. Wright & Wood, Ltd., Century Works, Pellon Lane, Halifax.—Catalogue consisting of a number of lists in expanding binder, containing brief specification matter, together with illustrations, tabulated sizes, prices, shipping and other particulars, of d.c. and a.c. motors, d.c. and a.c. starting gear, motor-generators, converters, electric saw benches, and polishing machines.

Messrs. Arnold & Large, Ltd., Wolverhampton.—Mail card giving illustrated particulars and prices of their "Arno" power punching press.

The General Electric Co., Ltd, London.—Leaflet O 1,701 dealing with battery fans, and an ingenious electrical novelty for shop-window advertising.

Messrs. Krupka & Jacoby, Ltd., 26-36, Chapter Street, Westminster, S.W.—New leaflet illustrating and pricing their single light weatherproof lanterns for round metal-filament lamps of from 100 to 1,000 c.p.

Messrs. Sandycroft, Ltd., Sandycroft, near Chester.—Twenty-page illustrated catalogue, giving particulars and tabulated data respecting their storage batteries. The types shown include the B.N. lighting cells, A.N. central station type, and Sandycroft car lighting cells. Prices and dimensions, &c., are given. The Sandycroft connecting bolt for battery lugs is shown, as also are views of Planté type positive and box type negative plates.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—36-page catalogue containing an admirably illustrated account of the various departments of the business of this well-known company. General notes respecting the progress of the company, and of Silvertown itself, are followed by information respecting the india-rubber department, the ebonite department, the gutta-percha department, submarine cable department (with brief notes concerning cable-laying achievements of the company), the electrical department, also the mechanical and testing departments. We are sure that many of our readers at home and abroad will be interested in a perusal of this brochure.

Trade Announcements.—Messrs. Credenda Conduits Co., Ltd., of Birmingham, ask us to contradict the rumour which is in circulation in London to the effect that Messrs. Baxter and Caunter, Ltd., have ceased to represent them as their sole agents, as there is no truth whatever in the statement.

The London Electrical Trading Co., Ltd., notify that their new address is 185, Wardour Street, W., and their telephone number "2830 Regent."

Liquidation.—H. A. Harvey & Co., Ltd., London.—The first meeting of creditors will be held at Carey Street, W.C., on July 30th, at 11.30 o'clock.

Bankruptcy Proceedings.—Wm. Wadsworth, 16, John Dalton Street, Manchester, engineer's agent and dealer in electrical accessories.—First meeting, July 28th, public examination, August 15th, both at Manchester.

Joseph Perkins, electrical engineer, Plymouth.—Release of trustee, dated March 6th, 1913.

LIGHTING and POWER NOTES.

Aberdare.—L.G.B. Inquiry.—Last week Mr. Hooper held an inquiry into the application of the Council to borrow £2,453 for electricity purposes.

Acton.—Street Lighting.—The minutes of the Highways Committee, submitted to the U.D.C. last Tuesday, contained a report by the surveyor on the clauses referring to the engineering part of the new scheme for main street lighting, which he had provisionally agreed with Mr. Prangnell, of the Metropolitan Electric Supply Co., providing for the installation of 450-c.p. lamps specifying a minimum luminosity, and penalties if it fell below. From the amended clauses of the company, it appeared that the company was prepared to install lanterns similar to those in the Hanwell district, but with lamps of 400 c.p., and would only agree to penalty clauses for diminished luminosity in consideration of increased payment. The Committee had instructed the clerk to forward a copy of the clauses provisionally agreed between the two engineers, and inform them that the Council adhered to the stipulation that 450-c.p. lamps be installed with a minimum luminosity of 90 per cent., and required the inclusion in the agreement of a clause providing for a penalty should the luminosity upon a specified test be found to be below such minimum.

Alloa.—From the annual balance-sheet of the electricity department of the T.C., it appears that the profit realised was £933, as compared with £588 in the previous year.

Australia.—The Melbourne City Council recently proposed to supply power free of charge to a leading city club for cooking, on condition that the Council's officers were given the opportunity to obtain data and information on the subject for comparison with gas.

According to *Tenders*, the North Sydney Municipal Council has again discussed the proposal to allow a company to supply electricity for street and private lighting. Opinions of counsel were read to the effect that the municipality had no power to enter into the proposed agreement. Our contemporary adds, "This seems to be the death-blow to the scheme."

The Federal Government is reported to have definitely decided upon a site on the Shoalhaven River, N.S.W., between Warri and Bombay, for the construction of a reservoir in connection with the supply of electricity for the Federal capital. The site is about 40 miles from the capital.—*Tenders*.

Ayr.—Supply to Adjoining Areas.—Negotiations have been concluded between the Corporation and the burgh of Prestwick, whereby the former's electric lighting system will be extended to Prestwick, the latter having agreed to support a prov. order authorising the extension. Arrangements have also been made with the County Council District Committee for extending the system to Burns Cottage and Alloway. The communities in each district are to be supplied at the same price as the consumers in the burgh of Ayr.

Blairgowrie.—Prov. Order.—Messrs. Foote & Milne have intimated to the T.C. that they intend applying to the B. of T. on or before December 31st for a provisional order to supply electricity within the T.C.'s area.

Bolton.—Loan Sanction.—The Electricity Committee has received the sanction of the L.G.B. to the borrowing of money for the new generating station at Back-of-th'-Bank. The amount is divided up as follows:—Buildings, £2,583; reservoirs, £8,999; pipes and valves, £2,450; chimneys, £5,670; sub-station gear and transformer, £2,737; machinery and cables, £1,828; travelling crane, £1,110; electric light wiring and fittings, £522; motors and cables, £530; storage battery, £475.

Bristol.—L.G.B. Inquiry.—A L.G.B. inquiry was held on July 15th into the application of the Corporation for sanction to borrow £25,000 for mains, sub-stations, house services, &c., for the next three years. The local Ratepayers' Association opposed the application, urging that the undertaking was "extravagantly managed," &c., and pointing out that the Corporation was proposing to supply 1,100 street lamps free of charge, from which the Association assumed that excessive plant had been provided.

Buckhurst Hill (Essex).—Prov. Order.—The Council has been notified of the intention of the County of London Electric Supply Co. to apply for a prov. order for electric light.

Carlisle.—The net profit on the electricity undertaking last year was £1,509, but abnormal expenditure of a capital nature, increased coal charges and rates, were met during the year.

Chadderton.—The Oldham T.C. has applied for power to supply current in the Chadderton district.

Clitheroe.—Prov. Order.—On July 17th a letter was read in Council from Mr. J. W. Speight, stating that he intended on behalf of a company, to be called "The Clitheroe Electric Supply Co.," to apply to the B. of T. for a prov. order. Mr. Speight has given similar notice to Rishton Council.

Continental Notes.—Germany.—The new electricity generating station of the Rhenische-Hessischen Electricitätswerk, at Osthofer (Hessen), has just been put in operation; it is supplying the necessary current for lighting purposes in no fewer than 131 small towns and villages in the district.

Norway.—The Bistavarre Copper Mines Co. has secured a concession from the Norwegian Government to utilise the water-power of the Goulasjoure and Goulaschok waterfalls at Lyngen, Norway. It is stated that between 14,000 H.P. and 15,000 H.P. will be available.

Poland.—La Station d'Electricité de Sosnowice is the name of a new company which is being formed at Sosnowice, Poland, with a capital of 4,000,000 roubles, to acquire and carry on the electricity supply station which has been established in conjunction with the Count Renard Collieries.

Spain.—La Sociedad des Fuerzas Hidraulicas del alto Pirines is the name of a new company which has just been formed in Barcelona, with a capital of £40,000, to utilise certain available water-power in the Upper Pyrenees. The Compagnia Energia Electrica de Cataluna, of Barcelona, is interested in the new undertaking.

Cromer.—B. of T. Inquiry.—On July 15th an inquiry was held relative to the proposed transfer of the electric lighting undertaking of the U.D.C. to Edmundson's Electricity Corporation, Ltd. What opposition there was, was not against the transfer, but with regard to the terms.

Deal.—Prov. Order.—Messrs. Foote & Milne have informed the T.C. that they intend applying for a prov order for electric lighting.

Doncaster.—L.G.B. Inquiry.—An inquiry was held on July 22nd into the application of the Corporation for powers to borrow £12,500 for the provision of further plant in connection with the electricity undertaking.

Dungarvan.—The scheme which the Council is considering for the electric lighting of the town is likely to cost about £2,600. A Cork expert has been called in to pronounce on the scheme.

Dunstable.—Prov. Order.—The T.C. on Friday received notice that Messrs. Foote & Milne, of London, intended to apply for a prov. order for electric lighting. The Council decided to oppose the application, it being intimated that any electricity scheme for the town would be carried out by the Council.

Easingwold.—Prov. Order.—The York T.C. has informed the R.D.C., that it intends applying to the B. of T. for a prov. order for electric lighting within the Council's area. It is understood that there will be no objection on the part of the R.D.C.

Galashiels.—Prov. Order.—At a meeting of the T.C., the Galashiels and District Electric Supply Co. intimated its intention within the year to apply for a provisional order.

Greenock.—The Caledonian Railway Co. proposes introducing electric light at the Greenock central station, Ladyburn engine-shed and Port Glasgow, and 30,000 units per annum will be required.

Isleworth.—Workhouse Lighting.—Respecting the question of lighting the Union workhouse buildings at Isleworth by electricity, the Brentford Guardians have adopted a recommendation by their Engineering Committee to engage an expert, at a fee not exceeding 25 guineas, to advise as to the best means of obtaining the current required.

Jersey.—Proposed Electricity Scheme.—St. Helier, the capital town of Jersey, is one of the few holiday resorts which does not possess a public electricity service. The question has received attention at different times, and in the early part of this year the Gas Co. retained the services of Messrs. May & Hawes, consulting engineers, who have prepared a complete scheme for the establishment of an electric supply undertaking for the town. Upon the strength of this scheme, application has been made by the Gas Co. to the States for the necessary powers, and to the Parochial Assembly for the usual facilities for undertaking the various works to carry the scheme into effect.

In submitting their proposals to the Parochial Assembly, the Gas Co. point out that the British Parliament and the B. of T. are showing themselves favourable to a dual control, by the number of Acts and Electric Supply Orders which have been granted to English gas companies. The company have offered to submit the scheme to the Board of Trade for examination and approval, and undertake to commence constructional operations immediately the powers are granted, and to start the supply of electricity within two years at latest upon a scale of charges not exceeding the rates of 5d. per unit for residential lighting, 4½d. per unit for business lighting, 1½d. per unit for power and heat, with special rates for large and high load-factor supplies. Slot meters will be available for the smaller classes of property, and public lighting will be undertaken if required by the parochial authority, as is likely to be the case for a few of the principal streets.

The town of St. Helier has a population of over 20,000, but like most similar holiday resorts, it suffers from a very short "season." It is proposed to establish the undertaking on the direct-current, three-wire system, with a pressure of 240 volts for lighting, and 480 volts for power purposes. The generating station will be erected on the site of the old gas works. For the initial equipment two generating sets will be provided, each of 200 KW. capacity, and there will be a large battery capable of dealing with the entire supply for a prolonged period, while provision is to be made both as regards accommodation and the design of the principal auxiliary plant for the introduction of a third generating set of 200 KW. capacity as soon as the demand necessitates it. Underground mains will be used throughout. As part of the compulsory works, the company have undertaken to lay down at the commencement 1½ miles of feeder mains, and 4½ miles of distributing mains in the principal streets of the town.

It is almost unnecessary to add that the electric light is likely to be a valuable asset to the town, in view of the numerous visitors, and under modern conditions there is no reason why it should not be the cheapest form of lighting in most cases.

Keynsham.—Street Lighting.—The P.C. has accepted the tender of the Keynsham Electric Light and Power Co. for public lighting from August 10th to May 10th at £274 5s.

Kimberley.—Prov. Order.—A prov. order for electric lighting is being applied for by the Notts. and Derbyshire Electric Power Co.

Kingston-on-Thames.—The last completed year's working of the electricity undertaking shows a net loss of £1,255. The abnormal price of coal accounted for £1,093 of this; the department will shortly have more efficient plant in use, and may ultimately make a better showing.

London.—St. Pancras.—Annual Accounts.—The gross income of the electricity undertaking during the year ended March 31st last amounted to £90,539, which is an increase of £5,324 over 1912. After paying all working expenses, repayment of loans, interest, &c., and providing for accrued charges, a profit remains on the year's working of £10,685, this being a decrease of £1,751 on 1912. To this profit the balance of £6,307 from last year is added, increasing the balance to credit of net revenue account to £16,992, of which £4,000 is to be retained as a working balance. The balance in hand at the commencement of the year was £41,465 to which is added £1,197 for interest on investments during the year, which makes a total credit of £42,662 in the fund at March 31st, 1913. This balance is represented by cash at the Council's bankers, and £32,509 the balance of loan advanced to the electricity capital account. The capital expenditure out of loan to March 31st, 1913, is £563,582, and the expenditure provided out of revenue and reserve, including £1,040 spent during the year, is £8,154. The total number of units generated during the year amounted to 11,674,023; 10,214,668 of which were sold. The lighting of Euston Road is to be improved by the introduction of 18 modern flame arcs, and the erection of an additional lamp at King's Cross Circus. The question of improving the lighting of the main roads of the borough is under consideration.

Hammersmith.—The B.C. electricity undertaking shows a surplus profit on last year's working, after deducting the equivalent of a penny rate already allocated, of £4,540, and of this sum £2,500 is to be carried to the reserve and invested accordingly. The B.C. has also decided that £250 be set aside from the revenue account as a further allocation of the scheme for supplying on hire wirings and fittings required for external lighting.

Stepney.—The L.C.C. has sanctioned the borrowing by the Borough Council of £25,000 required in connection with the Limehouse station extensions. In anticipation of further extensions at the above-mentioned station, it is proposed to acquire property, including certain mooring rights, at a cost of £4,800. Nottingham Corporation has offered to supply the Council with 198 demand indicators at the rate of 12s. 6d. per instrument, the Council to pay the cost of carriage. It is proposed to accept the offer provided the Corporation reduces the cost of the instruments to 10s. each.

Hackney.—The Council's agreement with L. Berger & Sons, Ltd., to supply between 300,000 and 500,000 units per annum, is to be extended for a period of two years.

Lewisham.—The B. of G. has applied to the L.G.B. for a loan of £1,750 for installing electric light at the workhouse and the infirmary.

Luton.—L.G.B. Inquiry.—On Friday Mr. R. H. Hooper held an inquiry into the application of the T.C. for a loan of £44,296 for electricity purposes. There was no opposition.

Macclesfield.—Electricity Scheme.—A start has been made by the New Electricity Co. of Macclesfield, Ltd., in the matter of providing a supply of electricity for the town. A contract has been accepted for the conversion of a dye house in George Street, Pickford Street, into a generating station, and two Diesel engines are to be installed.

Norwich.—Annual Report.—The Electricity Committee of the T.C. reports that the progress of the undertaking was well maintained during the past year, the increase in the output being 871,627 units. The expenditure of the past year amounted to £20,849, and the balance for the year was £1,688. The interruption to business occasioned by the great Norwich flood in August involved a loss of about £500 in revenue, while £599 was expended in effecting repairs to machinery and mains and generally putting things straight. The cost of the coal consumed last year was £1,727 more, showing an increase of nearly 20 per cent. The number of new consumers was well above the average of previous years. The 2,000-KW. turbo-generator, ordered in the early part of 1912, has not been completed, and it has, accordingly, not been possible to realise the reduction in coal consumption which was anticipated. The re-erection and partial reconstruction of the boiler house adjoining the Wensum has been completed; the work has involved the replacement of five small boilers by two large boilers equipped with mechanical stokers and giving double the evaporative effect. The work has further involved the rearrangement of the economisers and the addition of an induced draught fan to assist the action of the chimney; also the erection of overhead coal bunkers with a conveyor for handling the coal and ashes. No further generating plant will be required this year, but to meet the require-

ments of the winter of 1914-15 the Committee is taking steps to provide a turbine of 3,000-KW. capacity, to be delivered 12 months hence.

Nuneaton.—Works Extensions.—Last week a new 700-H.P. turbo-generator of B.T.H. make was formally started up in the presence of members of the Corporation; the works were thrown open to the public, and subsequently an electrical cooking demonstration was held.

Reigate.—Prov. Order. — Mr. Gilbert Allom has informed the R.D.C. of his intention to apply to the B. of T. for a prov. order for electric lighting within the parishes of Walton-on-the-Hill and Kingswood.

Rickmansworth.—Prov. Order.—The U.D.C. has received notices from Mr. R. E. H. Fisher and the Colne Valley Electric Supply Co. of their intention to apply to the B. of T. for prov. orders for electric light.

St. Anne's-on-Sea.—Annual Accounts.—The municipal electricity undertaking, according to the annual statement, has enjoyed a record year. The gross profit was £5,597, as against £5,180, which is equal to 10·55 per cent. on the capital. There was an increase of 68,651 units sold, and of 150 consumers. Out of the gross profit of £5,597, the sum of £2,066 has been repaid on loans, £1,261 has been paid in interest, £700 has been transferred to district fund, £155 to reserve fund, £275 for meters, &c., and, after certain other allocations, a balance of £490 has been carried forward. The output sold was 939,343 units to 1,281 consumers. The reserve fund amounts to £5,365, being the statutory limit of this fund.

The wardens and officials of St. Thomas' Church have decided to install a clock in the church tower. The cost of the clock and chiming gear is estimated at £202. The clock, which will have three skeleton dials, each 6 ft. in diameter, will be worked by electricity.

Sandiacre (Derbyshire).—Prov. Order.—The P.C. has received notice from the Notts. and Derbyshire Electric Power Co. of the latter's intention to apply for the necessary powers to introduce electricity into Sandiacre and other Derbyshire towns.

Shoeburyness.— The Southend-on-Sea T.C. having applied for consent to supply current to a residence in the town, the U.D.C. has intimated its assent, provided it is paid £4 a year, representing the estimated profit if the residence was supplied with gas. The T.C. has replied that it is not prepared to accept the condition which involved consent for any payment of a monetary consideration, and the U.D.C. has answered that it is not prepared to consent without some consideration. The Southend Council has communicated with the B. of T. on the matter.

Swinton.—Upon the suggestion of Mr. Busbridge, the electrical engineer, the Council has decided to convert 10 gas lamps in Chatsworth Road, Broad Oak Park, to electric lamps, at a cost of £40.

Tyldesley.—The Lancashire Electric Power Co. is engaged in laying cables in the streets, and in the erection of a transformer house. The company, to whom the D.C. transferred its rights of public supply some years ago, intends to take current from the tramway company until such time as it is in a position to give a supply from its own power station at Radcliffe. It is expected that a supply will be available to consumers within a month or so.

West Ham.—Annual Accounts.—There is a net profit of £2,008 on the working of the electricity department during the year ended March 31st last. The total working expenses (including discounts, allowances, bad debts, rates and central administrative charges) amounted during the 12 months to £71,612, as against £64,743 in the previous year, showing an increase this year of £6,868, principally accounted for by the additional business and the increased price of coal over a strike period. The total income for the same period was £110,154, as compared with £102,438 in the present year, showing an increase of £7,716 on the general sale of current, &c., after allowing for the decreased income of £5,804 from traction due to a reduction in the charge per unit to the tramways department. After taking the above items into consideration, there is a gross profit for the year of £38,543, as against £37,695 in 1912, being an increase of £848. The gross profit per unit sold amounted to ·34d., as against ·38d. in the previous year. This difference is not so large when it is considered that for the period under review the maintenance of public lamps has been deducted from income. As compared with 1912, the percentage of total revenue to capital outlay shows ·24 per cent. decrease; and the working, &c., expenses an increase of ·06 per cent; or a decrease of ·30 per cent. in the gross profit on capital outlay. With regard to the sales department there was a trading surplus of £2,008, after charging the proportion of the central administrative expenses, rents, depreciation and interest loans applicable thereto, but the heavy charges for repayment of debt (for very short period loans, now nearly paid off) brought about a net deficit of £985. The total number of units generated during the 12 months amounted to 33,974,343, of which 27,466,098 were sold; 3,020,684 for private lighting; 17,625,343 for private power and heating; 716,187 for public lighting; and 6,103,884 for tramways. In considering the accounts of the undertaking, the Electricity and Tramways Committee reminds the Council that there is no reserve or renewals fund to meet any future demands for replacements of any portion of the assets required before the expiration of the loan periods, and states that it is a matter for serious consideration in view of the fact that the undertaking has not been realising sufficient surplus during the past years to make such provision

Ystradgynlais.—Provisional Order.—At a meeting of the District Council the clerk reported that he had received notice from the Advisory Engineers' Corporation, Ltd., that they intended to apply to Parliament during the next Session for a prov. order for the district. He added that the Council had entered into an agreement with the Glantawe Electric Light Co. to give the supply, and the best thing for the Council to do was to apply for the prov. order itself. It was agreed to communicate with the Council's Parliamentary agents in the matter

TRAMWAY and RAILWAY NOTES.

Australia.—It is suggested that the W.A. Government will arrange for the electrification of the railway between Perth and Northam, at an estimated cost of £70,000, and adopt road tractors as a temporary substitute for feeder railways in county districts.

Baildon (Yorkshire).—It was reported at a meeting of the D.C. last week that the Bradford Corporation Tramways Committee had declined to further consider Clauses 4 and 7 in the draft agreement in regard to the proposed extension of tramways from Shipley to Baildon. Mr. J. W. Whittaker suggested that there was a misunderstanding in regard to the interpretation of the clauses, and asked that the correspondence concerning the clauses be read. Mr. A. J. Greenwood said the Bradford Corporation did not come forward and deal with the matter like business men, because they were disgusted with the way the Baildon Council had acted. A motion to have the correspondence read was defeated.

Birkenhead.—Annual Report.—The report of the traffic manager (Mr. C. Clarke) shows that the past year has created a record as regards passengers carried, traffic receipts and net profit. The traffic receipts amounted to £61,190, advertising receipts £800, miscellaneous receipts £76, bank interest £85, giving a total income of £62,153. Working expenses amounted to £36,358, leaving a gross profit of £25,794. Of this, interest on capital, &c., absorbed £11,808, and instalment to sinking fund, &c., £9,684, leaving a net profit on the year's working of £4,301, which has been placed to renewal fund account. This account has now to its credit £18,069. The passengers carried numbered 13,622,361; the car-mileage was 1,235,277, and the income per car-mile 12·074d., the net profit per car-mile being ·835d.

Continental Notes.—Italy.—It is reported from Milan that the authorities of the province of Alessandria have concluded a provisional agreement with the Italian Westinghouse Co., the Alessi Construction Co., and the Entreprise Générale des Travaux Publics (E. A. Drake), in regard to the construction and working of a large network of tramways in the province. It is proposed in the first place to establish 15 lines of a total length of 233 miles, and application for a concession for these lines has already been made to the Government. The concession is to be for 60 years, and the authorities of the province and the local authorities interested, will grant an annual subsidy of £85 per mile of route for a period of 30 years, and will also guarantee the interest on the loans to be issued. It is subsequently intended to build two further groups of lines of a total length of 186 miles, although the traffic is to be provisionally dealt with by the establishment of a service of automobiles, which will have the benefit of a subsidy of £64 per mile of route served. In return for the subsidies, which are to be raised by the levy of additional taxation in the province, the latter will participate in the receipts from working to the extent of 4 per cent. The power for operating the tramways is to be derived from the waterfalls of the Serivia and the Orba.

Plans are being prepared in respect of a projected electric railway between Aosta and Piè St. Didier.

Switzerland.—A company has just been formed at Sierre with the object of constructing an electric railway from that town to Goppenstein, a distance of about 15½ miles. The line, which will pass through the valley of the Rhone, will commence at an altitude of 1,750 ft., and terminate at 3,920 ft. above sea level. The trains will be hauled by electric locomotives, using single-phase current.

Coventry. — Annual Accounts. — The Corporation Tramway accounts cover two consecutive periods of 3 and 12 months' working respectively, representing the 15 months' working since the undertaking was taken over by the town. The revenue for the 12 months ending March last (9·45d. per car-mile) was just over £39,000; the gross profit was £15,000, and with three months' profit brought down, left £17,984 to net revenue for the 15 months. This provided £10,379 interest; £3,286 sinking fund for 8 months; £2,876 to reserve in lieu of the previous 7 months' sinking fund, and a net balance of £1,443, which was appropriated for various capital expenses. The year's working covered 994,207 car-miles, 7,639,000 passengers being carried. The power station supplied 1,475,211 units at a works cost of ·45d. per unit. The route-miles of track of the system were 13.

Dartford.—Messrs. Balfour, Beatty & Co. have applied to the B. of T. for an extension of time until August 18th, 1915, for the completion of the tramways authorised by the Dartford and District Tramways Order, 1911.

East Kent.—The Light Railway Commissioners on Friday held an inquiry at Dover respecting the application of the East Kent Light Railway Co., for powers to extend new lines from Snowdown Colliery to Woodnesborough, from Mongeham to Deal, connecting up the Betteshanger Colliery area, from Wingham and Wickham to Canterbury, and in the Alkham Valley. The application with respect to Snowdown and Woodnesborough, was adjourned through opposition, the Commissioners deferred their decision respecting the Mongeham to Deal line, in order to view the route; and the other applications were sanctioned.

Edinburgh.—The local tramwaymen have struck work with a view to obtaining ½d. per hour increase in wages; the tramway service has been suspended.

Huddersfield.—The Tramways Committee proposes to purchase five new cars in order that proper and comfortable accommodation may be provided for the residents of Lockwood and Moldgreen.

Japan.—A charter has lately been granted by the Japanese Railway Board to the Onsen Electric Railway Co. for the construction and working of a light electric railway between Kanan, Komatsu, Naya and Dohashi, in the Prefecture of Ishikawa. The line will have a gauge of 3 ft. 6 in., and be about 14 miles long.

Manchester.—A record was made last week when the King and Queen visited the city. No fewer than 825,703 passengers were carried on the tramcars during the day, the previous highest being 698,913, on August Bank Holiday, 1908. The receipts were £4,079, as against £4,144 on August 3rd, 1908. The figures are remarkable, Mr. McElroy, general manager, points out, because no fewer than 110 cars were out of service carrying school children, and the car service was at a standstill part of the day.

Morecambe.—The Tramways Committee has instructed the borough electrical engineer to prepare an estimate for the electrification of the horse tramways.

Northampton.—Parcel Service.—A parcels delivery system has just been inaugurated in connection with the Corporation tramways by the manager, Mr. J. A. Gottschalk. A shop in the centre of the town has been leased for the purposes of a depôt, and the system has been attended with great success. The reconstruction of the South Bridge, Northampton, has been almost completed, and when this and the widening of Bridge Street have been effected, the tramways are to be extended to Far Cotton, a suburb of the town which is at present served by horse 'buses.

Oldham.—Upon the occasion of the King's visit to Oldham, the takings for the day on the tramways were easily a record. The receipts were £727.

Salford.—Annual Report.—The result of the working of the tramways for the year ended March 31st last shows that there is a gross profit of £99,766, which, with the £5,659 for interest on investments, &c., makes a total available balance of £105,426. This sufficed to meet loan and interest charges, to provide £22,000 to the rates, £9,374 for renewals and certain items of capital expenditure. The passengers carried, mileage covered, and receipts are well in excess of previous years. The number of passengers carried was 50,113,120, an increase of 1,392,332. The receipts were £259,704, an increase of £6,389; and the mileage covered was 5,854,830, an increase of 46,461. The Corporation operates over 75 miles of line in eight different areas.

Southend-on-Sea.—Proposed Loan.—The T.C. intends applying to the B. of T. for sanction to borrow a further sum of £16,900 for tramway purposes.

Swansea.—Extensions.—An application was heard by the Light Railways Commissioners, on Tuesday, for a provisional order empowering the Corporation to construct three light railways of a total length of about three miles within the borough, at an estimated cost of £33,000 on construction and equipment and £30,000 on road widenings. The railways, which are to be electrically worked under an agreement with the Swansea Improvements and Tramways Co., are designed to develop the Corporation Town Hill Estate for building purposes, and railway No. 1 is up Mount Pleasant, which, in parts, has a gradient of one in eight. Mr. Stephen Sellon assured the Commissioner that the line could be worked, especially with the "gripper" brake as used on the Highgate system, with absolutely safety. The promoters were represented by the town clerk, and five of the frontagers objected on minor grounds. The Commissioners intimated that the report would be communicated later.

West Ham.—Annual Accounts.—The accounts for the year ended March 31st last show a deficit of £3,388 on the working of the tramway undertaking. This compares with a surplus of £4,082 in 1912 and of £6,923 in 1911. The gross expenditure for the 12 months amounts to £110,049, from which has to be deducted a sum of £1,236 for proportion of costs due from other authorities in connection with through-running, leaving the net expenditure at £108,813, being an increase of £5,115. The total income amounted to £139,298, from which a deduction of £856 has also to be made in respect of proportion of receipts due to other authorities in connection with through running, leaving a net income of £138,441, against a corresponding figure in 1912 of £140,115 or a decrease of £1,673. This leaves a gross profit of £29,628, as against £36,417. The net income per car mile works out at 9·409d. as against 10·228d. in 1912, and the net working costs at 7·368d. as against 7·570d., leaving a gross profit per car-mile of 2·041d. as against 2·658d. The deficit is to be charged against the reserve fund.

The Council is supporting the Croydon Corporation in its application to the Government, urging them to pass such legislation as will place motor-'bus companies on terms of equality, with regard to public obligations, with tramway authorities in the Metropolitan area.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Judicial Committee of the Privy Council has refused the petition of the Commonwealth Government for special leave to appeal against the decision of the High Court, authorising the Marconi Co. to inspect the plant erected by the Government in its wireless stations under Mr. Balsillie's patents.

Imperial Communications.—An Imperial Communications Committee has been formed at the House of Commons, to continue the work carried on by Sir J. Henniker Heaton in Parliament for the improvement of postal and telegraphic communication throughout the Empire.—*Times.*

Imperial Wireless System.—Replying to questions in the House of Commons, Mr. Samuel stated that as the Imperial stations would be State-owned, it was very improbable that licences would be granted to private companies to erect competing stations in the same countries; but where the question of competition did not arise, licences would be granted to British companies of good standing. The delay which had already occurred was an additional reason against further delay in erecting the stations.

A debate took place in the House of Commons last week on a motion for the adjournment of the House, to call attention to the refusal of the Postmaster-General to allow any company other than the Marconi Co. to submit a tender for the erection of the Imperial stations. The mover, Mr. W. Guinness, contended that the Goldschmidt and Poulsen companies should be allowed to compete. Major Archer-Shee, in seconding the motion, stated that the United States Government had chosen the Poulsen system after testing its working over 1,800 nautical miles, and asked for delay to enable the best system to be selected. In his reply, Mr. Samuel referred to the difficulty of maintaining communication over long distances in the daytime, and mentioned that in 1907 the Poulsen Co. assured the Post Office of their ability to establish a thoroughly satisfactory service to America, but nevertheless they had not yet established any trans-Atlantic service. Communication between San Francisco and Honolulu by day was not yet (July 12th) in operation. The official demonstrations of the Goldschmidt system between Hanover and Slough, before Lord Parker's Committee, were failures. Both systems were of considerable promise, but not of proved capacity. It was essential that the stations should be of the highest efficiency and reliability. While other stations were said to be cheaper than the Marconi stations, the latter were to be duplex, and no other company was able to work duplex. In his opinion the situation had not changed since August, 1911, when a Departmental Committee decided not to invite tenders, because the Marconi Co. alone could be depended upon to do the work. He had obtained that day the opinions of the Engineer-in-Chief of the Post Office, the Inspector of Wireless Telegraphy, the President of the Institution of Electrical Engineers, and Lord Parker, who all reported to the effect that it was not advisable to employ either the Poulsen or the Goldschmidt system at the present time. Lord Parker stated that the Committee did not consider that the adoption of any system other than the Marconi system was a practical proposition, having regard to the evidence before them. If the Government intended to act on the report of the Advisory Committee, said Mr. Samuel, it would erect at least the first two stations on the Marconi system, and unless the work was done by the Government, the only alternative appeared to be the employment of the Marconi Co. It was impracticable to proceed with the buildings before the system was decided upon, for the buildings could not be erected unless the sites were chosen, and the contractors naturally would not guarantee success unless they had a voice in the selection of sites. Six months ago the Parliamentary Committee reported that it was a matter of urgency that a chain of Imperial stations should be established, and not a sod had yet been turned. Surely it was time to make an end.

Mr. Austen Chamberlain said that the Government had acted as though the Marconi Co. were their masters, whereas the contrary was the case. He did not like the management of the Marconi Co., and considered their claim for an increased price an impudent one.

On Wednesday last week, Mr. Samuel stated that the Universal Radio Syndicate had proposed, in March, to demonstrate the working of the Poulsen system between the Eiffel Tower and Arlington, U.S.A., and the Foreign Office obtained the permission of the French Government for the trial to be made; but it was found impracticable to install the necessary apparatus at the Tower station. He was not aware that the Poulsen Syndicate in this country could avail itself of the patents used in the American

Poulsen service. The Goldschmidt system was in a purely experimental stage at present. Each Marconi station required 12 masts, costing about £33,000 per station; the Goldschmidt system used one very high mast, about 36 low masts and three brick towers, and the aerial was not directional. Regarding the urgency of the matter, he said that the first comer would have free choice of wave-length and of site without considering questions of interference with contiguous stations, and, above all, would be equipped against the risk of war when other nations were not. A payment outright for the use of patents was evidently less advantageous than an annual royalty, which could be discontinued at any time if the use of the patents was dispensed with.

The admission of any other company's tender would result in delaying the whole matter until next year. Any demonstration must be continued for a sufficient length of time to show that the wireless communication could be maintained during atmospheric disturbances.

Mr. Baxendale, managing director of the Universal Radio-Syndicate, Ltd. (Poulsen system), addressed a long letter to the daily Press last week "to correct a few of the more serious misstatements made by Mr. Samuel" on the 16th inst. Amongst other items, he mentions that the United States Government is paying for the Poulsen station which is to be erected at Panama, and is satisfied that its range will be half as long again as that of any station of the Imperial chain; and that a regular daylight service is being maintained from San Francisco to Honolulu, but not in the opposite direction, owing to the non-completion of the station at Honolulu. Further, Mr. Baxendale states that the English company owns the Poulsen patents for almost the whole world, exclusive of the United States and their dependencies, and is entitled to all improvements made by the American company. A reply from Mr. Samuel was published on the following day, in which he quoted the report of the Advisory Committee, and pointed out that the president of the American company stated on oath that the English company had no such right to the American improvements as was claimed.

On July 23rd a rejoinder appeared from Mr. Baxendale, renewing his statements that a 100-KW. generator had been installed at San Francisco, and was working satisfactorily day and night, and that Dr. Austin had found the arc superior to the spark at distances between 1,400 and 2,100 miles; and pointing out that the president of the American company himself corrected the mistaken statement that the English company was not entitled to the American improvements.

On 22nd inst, Mr. Samuel, in reply to questions, stated that when the Marconi patents expired, the royalties would cease. The cost of the plant covered by the patents would be about 16 per cent. of the total estimated cost of each station, excluding the buildings. The Poulsen plant at the Cullercoats station was purchased at a price that was agreed upon, and approximated to that asked by the vendor.

Mongolia.—A Scotsman named Grant, employed on telegraph duty in Mongolia, was recently murdered by natives; he defied his captors to the last with undaunted courage. The Chinese Government has promised to provide handsomely for his mother.

The War Office and the Poulsen System.—A deputation from the War Office Wireless Committee, comprising Sir Henry Norman, M.P., and Commander Silvertop, accompanied by Captain Lefroy, R.E., who is in charge of the experimental wireless work at Aldershot, has visited Vienna to inspect the manufacture and working of the Poulsen apparatus. Military sets were shown working over a distance of 40 miles, and the Poulsen station at Ober-Laa, near Vienna, which is being erected in order to enable the military authorities to communicate with the military and naval ports of the Monarchy, was visited. On the homeward journey the Goldschmidt station near Hanover, and the station at Laeken, near Brussels, will be inspected.—*Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Alford (Lincs.).—July 28th. Public lighting for the U.D.C. Mr. Thos. N. Loy, clerk.

Australia.—VICTORIA.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 9th.—Common-battery multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

NEW SOUTH WALES.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Austria.—PRAGUE.—July 30th. Installation of the electric light at the railway station at Weinberg, on the basis of unit prices. Forms and conditions, K. K. Staatsbahndirektion, Prague.

July 28th.—Electric lighting and power installation for the railway workshops at Bodenbach. Particulars of Abteilung IV, and tenders to K. k. Staatsbahndirektion, Prague.

TOPOLAY.—July 31st. Tenders for a concession for 50 years to install and work a public and private lighting service. Deposit, 5 per cent. Gemeindeamt, Topolay.

DROHOBYCZ.—July 31st. Installation of a power station in the prison at Drohobycz. Deposit, 5 per cent. K. K. Oberbauleitung der Justizbauten in Lemberg.

Belgium.—BRUSSELS.—July 30th. Supply of electrical material to the State Railways. Salle de la Madeleine, Brussels.

July 30th.—Supply and erection of two cables, with accessories, to connect the telephone exchanges at Brussels and Antwerp; and two cables to connect the two telegraph-telephone lines at Verviers, starting from Ans (Cahier des Charges Special No. 156). Salle de la Madeleine, Brussels.

Blackburn.—August 2nd. Steam coal for the Electricity Committee, for 12 months ending August 31st, 1914. Mr. P. P. Wheelwright, engineer and manager.

Bristol.—Overhead electric travelling gantry, Bathurst Wharf, for the Docks Committee of the T.C. The Engineer.

Chile.—September 13th. (1) An electric generating plant with distributing system; (2) an electric lighting installation—both for the harbour of Valparaiso. Tenders to "Al Sr. Secretario de la Comision, Comision de Puertos, Calle Santo Domingo No. 1,147," Santiago de Chile, where the specifications, &c., may be consulted.

SANTIAGO.—August 9th. The Railway Administration invites tenders for six automobile cars for the 1·68-metre track, and two for the 1-metre track.

France.—July 30th. Supply of high-pressure electrical material for the transformer stations of the railway stations, workshops and warehouses at Rouen and Sotteville. Bureaux du Service Electrique (3e Division), 72, Rue de Rome, Paris.

August 20th. Tenders are invited for the erection of the light and power overhead lines in the stations and workshops at Rennes. Particulars from the Bureaux du Service Electrique (2e Division), Rue de Rome, Paris.

Germany.—July 30th. The Prussian State Railway authorities at Munster, Westphalia, are inviting tenders for four 5-ton electrically-operated travelling cranes.

Greenock.—The Corporation electricity department invites tenders for the supply and delivery of 22,000 tons of steam coal for the year. Mr. J. A. Robertson, burgh electrical engineer.

Heckmondwike.—July 28th. Wiring of new slaughter-house, for the Heckmondwike and District Co-operative Society, Ltd. Mr. H. Stead, architect, Heckmondwike.

Hull.—July 25th. Machinery oils for the Corporation electricity works. Mr. H. Bell, electrical engineer, Sculcoates Lane.

Ilford.—August 11th. Motor tower wagon, for the U.D.C. Tramways Department. Mr. L. E. Harvey, tramways manager.

London.—ROTHERHITHE.—July 31st. Electric light re-wiring and other work at the Infirmary, Lower Road, Rotherhithe, S.E., to the specification of Mr. A. H. Newman, F.R.I.B.A. Forms of tender, &c. (£5 note deposit) from Town Clerk, 283, Tooley Street, London, S.E.

L.C.C.—Tenders are to be invited from selected firms for electric charging apparatus for Waterloo Road fire station, where an electrically-driven motor fire appliance will shortly be placed.

Middleton.—July 28th. Lighting switchboard and renewals to traction switchboard for the Corporation. See "Official Notices" July 18th.

Newport (Mon.).—Re-winding 1,500-KW. three-phase alternator. Mr. A. N. Moore, electrical engineer, Town Hall.

New Zealand.—September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of energy from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Middleton.—July 28th. The Corporation invites tenders for lighting switchboard and renewals to traction switchboard. Mr. S. Pauls, electrical engineer, Townley Street.

Norwich.—August 12th. One 3,000-KW. turbo-alternator and surface condensing plant; rotary converters; E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" to-day.

Servia.—BELGRADE.—Supply of 625 telephone instruments of various kinds to the Servian Telephone Department.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Bloemfontein.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machines, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" to-day.

Shanghai.—August 26th. Two 5,000-kw. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" to-day.

Spain.—August 9th. The municipal authorities of Medina del Campo are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Aldeamayor.—The municipality of Aldeamayor, province of Valladolid, invites tenders for the electric lighting of the city.

Swindon.—July 26th. Steam coal for the electricity works of the Corporation. See "Official Notices" July 11th.

Todmorden.—July 26th. 300-kw. converting plant, H.T. switchboard and cables, mechanical stokers and superheaters, for the B.C. See "Official Notices" July 11th.

Warrington.—August 6th. (1) E.H.T. feeder panel; (2) earthenware conduit for one year, for the Electricity Department. See "Official Notices" July 18th.

CLOSED.

Australia.—According to *Tenders (Mining and Engineering Review)*, the Provincial Electric Development Co., Ltd., of Melbourne, has placed contracts for electric lighting and power equipments for Dandenong and Daylesford (Vic.) in the hands of the I.-R., G.-P. & T. Works Co., Ltd.

The same exchange also reports the following tenders accepted:—

P.M.G., Queensland:—

12,000 copper binders.—I.-R., G.-P. & T. Works Co., Ltd.
12,500 jointing sleeves.—Lawrence & Hanson Electrical Co., Ltd.
74 tons copper wire.—R. Johnson, Clapham & Morris, Ltd.

P.M.G., Western Australia:—

Magneto cordless switchboards.—J. Bartram & Son, Ppty.
10 miles wire, twisted pair.—W. T. Henley's Co.

According to the *Australasian Record*, the following contracts for consumers' meters have been placed:—

Direct current, "Isaria" meters, £824.—Lawrence & Hanson, Ltd.
Alternating current meters, £1,323.—Ferranti, Ltd.

The following orders have been given out for rubber-insulated cable:—

Noyes Bros.	£551
Steffens & Noelle	607
W. T. Henley's, Ltd.	720

The Sydney E.L. Committee has accepted tenders as follows:—

Glazed stoneware bridges.—Bakewell Bros., Ltd.
100 tons bitumen (£695).—W. G. Watson & Co., Ltd.

Argentine.—An order for 15,000 insulator packing pads ("Mascolite," quality P.S.P., ¼ in. thick) has been received by Messrs. Mitchells, Ashworth, Stansfield & Co. Ltd., from the Central Argentine Railway, Ltd. They are to be used under the conductor rail insulators in the electrification of their suburban lines.

Belgium.—Seven concerns—five German, one Belgian and one French—submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cables in the Louvain district, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Ruhr.

Canada.—The Canadian Pacific Railway has awarded the Canadian General Electric Co. the contract for the electrification of the company's line between Castlegar and Rossland. It is intended to use 2,400 volts, direct current trolley system.—*Canadian Engineer.*

Dukinfield.—The installation of electric light at the Technical School and Free Library, and also at the Dukinfield Ward Conservative Club and Old St. George's Church (Stalybridge), is to be carried out by Messrs. C. Benyon & Co., Dukinfield.

Ealing.—The B.C., on the recommendation of the Electricity Committee, has accepted the following tenders for supplies during the ensuing year:—

E. Foster & Co.—500 tons of Bwllfa large coal, and 2,000 tons of Walsall Wood washed nuts.
J. Edge & Co.—3,000 tons of Bwllfa washed nuts.
Young Bros.—Pipes, bends, &c.
Duckham & Co.—Cylinder oil.
Atlas Lubricating Oil Co.—Crank chamber oil and bearing oil.
Bruce, Wallace & Co.—Paraffin.
Nicol & Co.—Waste.

The figures were not disclosed, but Alderman H. W. Peal, J.P., chairman of the Committee, said that the lowest tenders had been accepted in all cases except one, in which instance it was thought undesirable.

East Ham.—The tender of Callender's Cable and Construction Co., Ltd., has been accepted by the T.C., at £55 10s., for a new feeder pillar.

Fleetwood.—The U.D.C. has accepted the tender of Messrs. Thomas Riley, Ltd., for extensions to the boiler house at the electricity works.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

War Office.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Johnson & Phillips, Ltd.
Electric lamps.—Cryselco, Ltd.
Signalling lamps.—Siemens Bros. & Co., Ltd.
Installation of electric lighting, &c., R.M. College, Sandhurst.—V. G. Middleton.

India Office: Store Department.

Accumulators.—Pritchetts & Gold; J. Stone & Co.
Cells.—Pritchetts & Gold.
Insulators.—Bullers, Ltd.

Crown Agents for the Colonies.

Insulators.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Relays, &c.—I.R., G.P. and Telegraph Works Co., Ltd.
Switchboard.—Siemens Bros. & Co., Ltd.
Insulated wire.—Hooper's Telegraph and India-Rubber Works, Ltd.

Post Office.

Telephone exchange equipment and testing positions, Central and City Exchanges, London.—Western Electric Co.
Telephone exchange equipment:—
Doncaster and Runcorn.—Peel-Conner Telephone Works, Ltd.
Central Exchange, Edinburgh; Ealing; North Exchange, London; and Shipley.—Western Electric Co., Ltd.
Museum Exchange, London.—Automatic Telephone Manufacturing Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Wood arms.—A. Bailey; British Australian Timber Co., Ltd.; Millar's Timber and Trading Co., Ltd.
Submarine cable.—W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Telephonic ironwork.—Walls, Ltd.
Telegraphic ironwork.—Bullers, Ltd.; T. W. Lench, Ltd.
Telegraph paper.—Brown & Murray, Ltd.; Waterlow & Sons, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.

Huddersfield.—The Electricity Committee has accepted the following tenders:—

J. Proctor, Ltd.—Coal elevator.
J. Moody, Son & Co.—Hydraulic hoist.

London.—L.C.C.—The Highways Committee received the following tenders for a 50-ton overhead travelling crane for Greenwich generating station, in connection with the first stage of the work of substituting turbines for reciprocating plant:—

Babcock & Wilcox, Ltd.	(accepted)	£2,285
Cowans, Sheldon & Co., Ltd.		2,809
Joseph Booth & Bros., Ltd.		2,970
Carrick & Ritchie, Ltd.		2,989
S. H. Heywood & Co., Ltd.		3,592

Chief officer's estimate, £2,200.

The tenders submitted for charging apparatus for the new Hammersmith fire station were:—

Electric Construction Co., Ltd.	(accepted)	£158
General Electric Co., Ltd.		181

Stepney.—The following tenders have been received by the B.C. for carrying out alterations to the electric light installation at the Whitechapel Library:—

Sweet Bros.	(accepted)	£65
Barlow Bros.		73
Ward Bros.		76
G. Weston & Sons, Ltd.		85
Smeeton & Page		86

For the provision of converting plant the following tenders have also been received:—

	R.P.M.	Price.
Siemens Bros. Dynamo Works, Ltd. (rotary)	750	£4,245
British Westinghouse Co., Ltd. (rotary)	500	4,445*
British Thomson-Houston Co., Ltd. (rotary)	500	4,540
General Electric Co., Ltd. (rotary)	500	4,719
" " " "	375	5,227
" " " "	300	5,794
A.E.G. Electric Co., Ltd. (rotary)	500	5,100
" " " (motor generator)	500	5,400
" " " "	300	7,000
Bruce Peebles & Co., Ltd. (motor converter) (accepted)	375	5,280†
Electric Construction Co., Ltd. (motor generator)	300	6,178
Brown, Boveri & Co. (rotary)	750	4,888
" " "	500	6,770
Dick, Kerr & Co., Ltd. (motor generator)	428	6,840

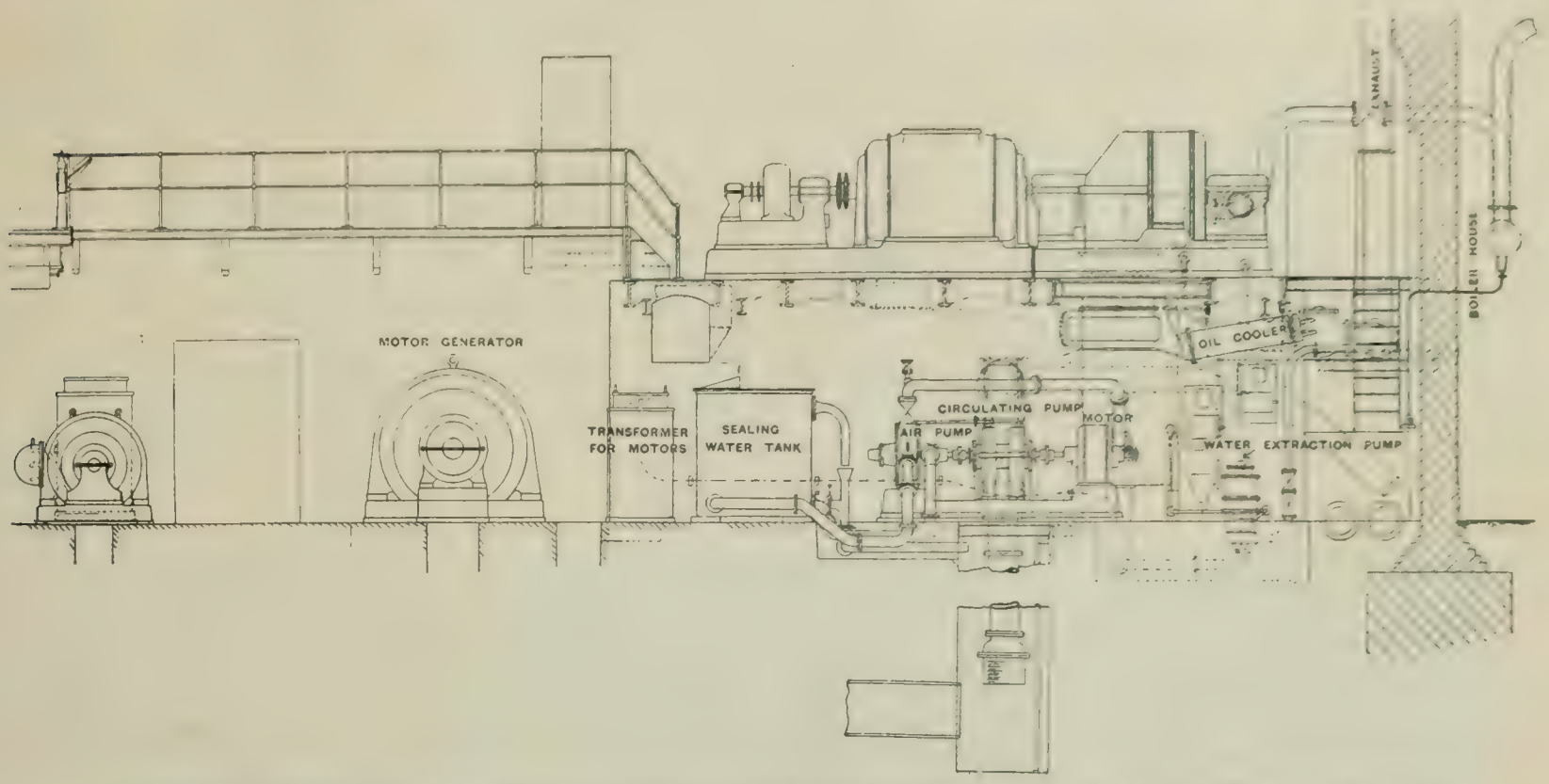
* Without booster; £5,207, with booster. † Without spares.

The tender of Messrs. F. W. Brackett & Co., Ltd., has been accepted, at £720, for the supply of a patent screening apparatus at the electricity works; also that of Messrs. Drew-Bear, Perks & Co., Ltd., at £29,314, for extending the Limehouse generating station. Seven other tenders were received, ranging from £31,831 to £41,633.

(*Continued on page* 143.)

ELECTRICITY EXTENSIONS AT BURTON-UPON-TRENT.

The Corporation electrical undertaking at Burton-upon-Trent was originally started in 1894, the earliest plant consisting of 80-kw. rope-driven alternators, with open-



Drawing Showing Arrangement of New Turbine Set and Condensing Plant, Burton-upon-Trent.

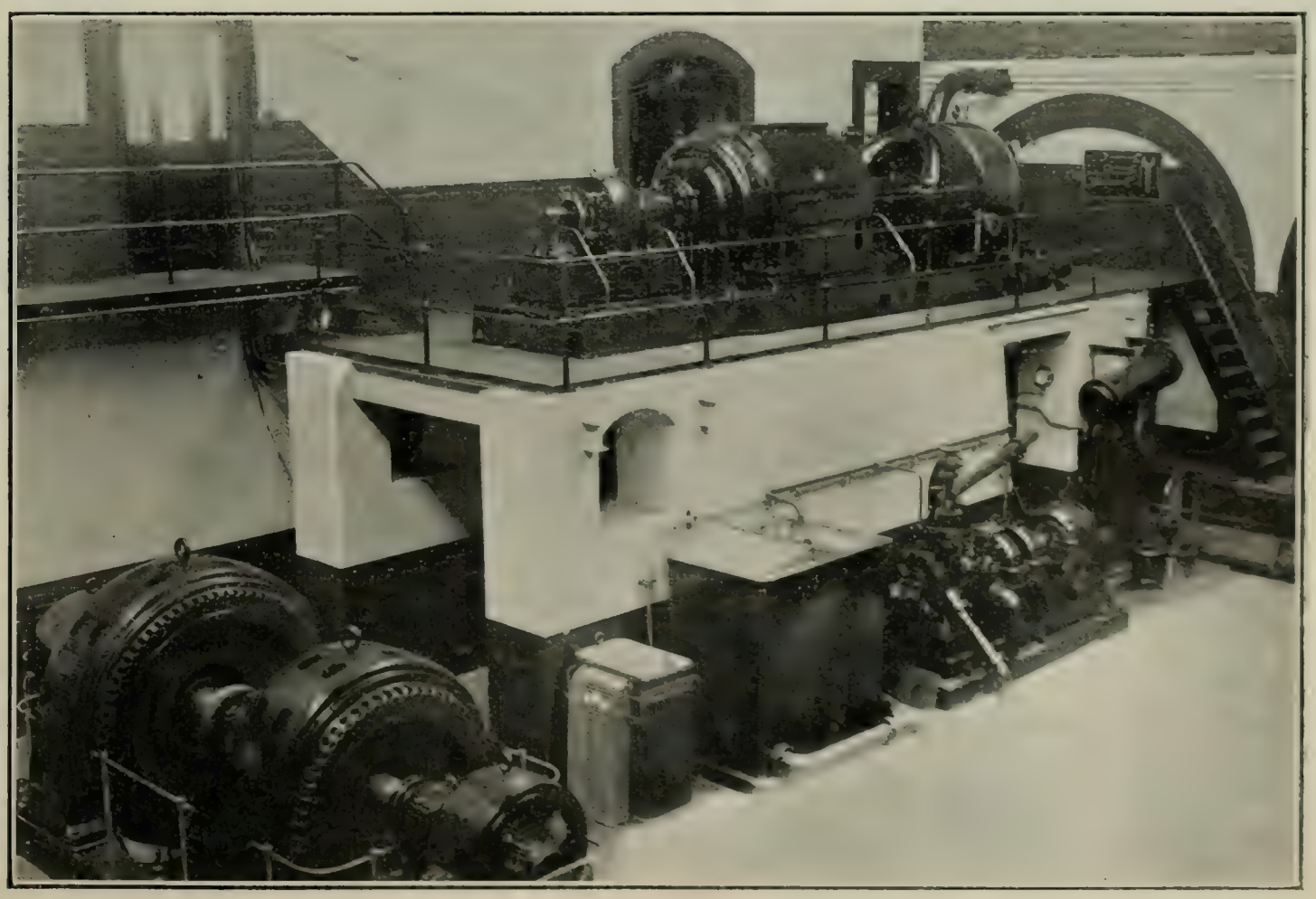
type engines and Lancashire boilers. The 19 years' interval between then and now has seen the introduction of the high-speed engine and its practical supersession by the steam turbine which has been adopted in the recently completed extensions.

The original system of supply for lighting and power was a 75-cycle, 2,000-volt, single-phase alternating one, trans-

ing the traction load, 500-volt direct-current generating plant was necessarily added to the installation.

Towards the end of 1911, when it became evident that additional generating plant would have to be installed, the opportunity was taken to reconsider the whole question of system of supply, and on the advice of the engineer, with a view to more adequately meeting the industrial power load of the town, it was ultimately decided to adopt a three-phase system of supply.

A scheme on these lines was prepared by Mr. Thos. Hall, the borough electrical engineer, and eventually adopted ; it included the provision of turbo-generating plant, and the installation of a motor-generator link with the existing single-phase supply, and a rotary-converter to link up the



General View of Turbo-Alternator, Motor-Generator, and Condenser Auxiliaries

formed down to 100 and 200 volts for consumer's use, and this has continued up to the present time, Burton being one of the very few places in this country where single-phase motors have been largely adopted for industrial driving. During the lengthy interval mentioned above the Corporation tramway undertaking was inaugurated, and for supply-

tramway direct-current supply with the new three-phase generating plant ; new boilers, economisers, switchgear, workshops and three-phase mains were also included in the scheme, borrowing powers for which were sanctioned by the L.G.B. in June, 1912.

Having in mind past experience, the whole of the plant

has been raised two to three feet above flood level; the turbo-alternator has been erected upon pillar foundations, as shown in our view, and provision has been made for putting in a duplicate turbine alongside. This machine is of the Westinghouse-Rateau type, with a normal rating of 1,250 KW.; the generator is totally enclosed, being ventilated by means of a fan at each end of the rotor—the fans drawing clean air through ducts from an air filter, and discharging it through the machine in an axial direction, and into the engine room. The exciter is mounted on an extension of the bedplate, and is shunt wound and fitted with radial commutators.

The turbine exhausts into a surface condenser of 1,980 sq. ft. cooling surface immediately underneath, and this plant is provided with a circulating and Leblanc air-extraction pump set, coupled to a 40-H.P. three-phase motor running at 960 R.P.M. A vertical-spindle 6-H.P. water extraction pump is also provided for returning the condensate to the hot well.

An additional Babcock boiler of 10,000 lb. per hour evaporative capacity, fitted with an Underfeed stoker, has been installed in the boiler house, where previously Lancashire boilers have been used, and in connection with this plant, a new 600-tube Green economiser, and the additional flues, &c., leading to a new chimney have been provided.

The boiler feed plant has also been rearranged, two Weir pumps having been installed in the economiser house, also a water softener and new overhead tank, together with certain auxiliary pumps, most of which plant formerly occupied unsuitable positions in the works.

The new three-phase single-phase motor-generator, which is a Westinghouse machine of 500-KW. rating, is also shown in our views; its capacity is sufficient to cope with the present maximum load of the single-phase supply, and it is available for running in the reverse direction to supply three-phase current if required. The machine is started up by a D.C. motor. The rotary converter, also supplied by the Westinghouse Co., is rated at 300 KW., and is capable of carrying the maximum tramway load; it also is reversible, and can be utilised if desired to supply three-phase current when driven from the existing direct-current tramway generating sets.

This arrangement of plant obviates the necessity of running four or five steam-driven sets, as the new turbine will at present cope with the whole demand of the station through the machines above mentioned.

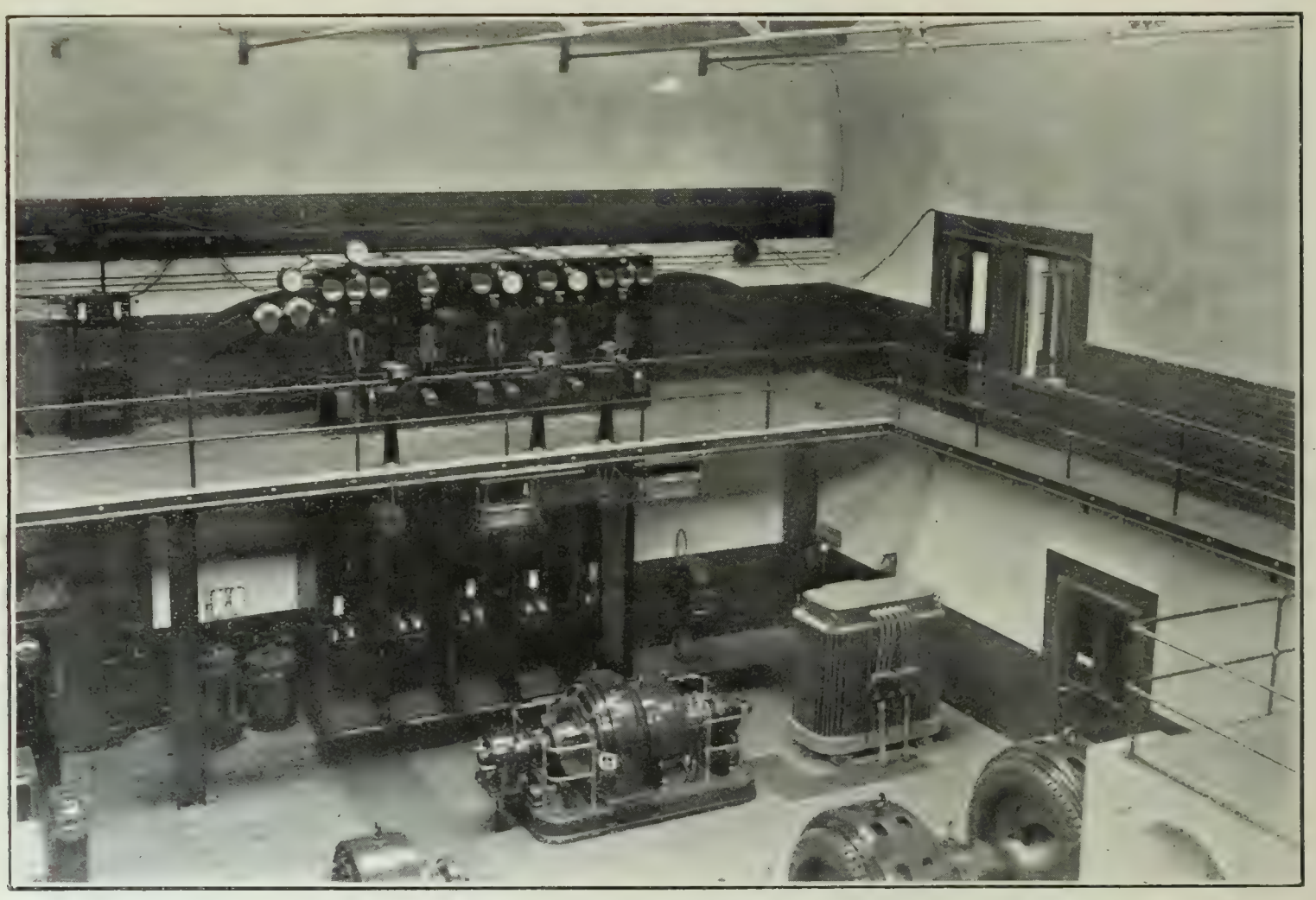
A five-panel Westinghouse switchboard for controlling the new plant has been provided, and is shown in one of our views. The switch cubicles are under the operating gallery on the ground floor, adjoining the present single-phase and direct-current (traction) switchboards.

It is, however, hoped in the future to remove all this switchgear to the gallery.

The laying of three-phase mains has already been commenced, and several large consumers have been connected. It is intended that a trunk ring main shall be installed through the town; a portion of this work has been carried out and the remainder sanctioned.

The staple industry of Burton-upon-Trent is of world-wide reputation, there being no less than 17 different breweries situated within the borough. The bulk of the other industries in the town are connected with the brewing trade, and it is satisfactory to note that up to the present time there is something like 1,800 H.P. of motors connected to the original single-phase system of supply.

Now that the three-phase system is available, the directors of the different breweries are beginning to consider more seriously the question of extending the use of electric power, as with the new system the motors can be coupled direct to the work instead of through loose pulleys as in the case of the single-phase supply.



NEW H.T. SWITCHBOARD, CUBICLES, &C., AND 300-KW. ROTARY FOR TRACTION SUPPLY, BURTON-UPON-TRENT.

Already one of the leading brewers, Messrs. Marston, Thompson & Evershed, Ltd., have decided to take a supply from the Corporation mains for the complete electrification of their brewery.

Another very large consumer is Messrs. Bass, Ratcliff and Gretton, Ltd., who are taking power principally for refrigerating purposes, and it is interesting to note that they are gradually extending it over the whole of their extensive brewery, more especially for the isolated pumping and refrigerating plants.

Other breweries are now realising the adaptability of the three-phase supply, and are commencing by driving their malt mills, which are always situated at the top of the brewery, so that there is every possibility of them extending until the whole brewery is electrically driven.

The local Commercial Development Committee has for some time past been advertising the unique position of Burton-

upon-Trent as an industrial centre, and there is no doubt that the step taken by the Electricity Committee in changing over to the three-phase supply should be of great assistance in securing new industries.

In conclusion, we are indebted to Mr. Hall, the borough electrical engineer, for his assistance in connection with this short article.

A MODEL GAS-ENGINE PLANT IN JAPAN.

The Kawasaki Dockyard Co., one of the two largest and most enterprising shipbuilding companies in Japan, have for a long time adopted electrical methods, direct-current 220-volt motors being used throughout for driving the various machines and tools.

Recently, owing to considerable extensions which have been made to the works, and a consequent increase in the demand for power, it was decided to scrap the existing obsolete generating plant, and replace it with something more up to date, and as a result of careful investigation by the engineers, both in Japan and abroad, it was decided to install a 500-kw. generator, direct-coupled to a four-cylinder scavenger-type producer gas engine, together with the necessary gas plant.

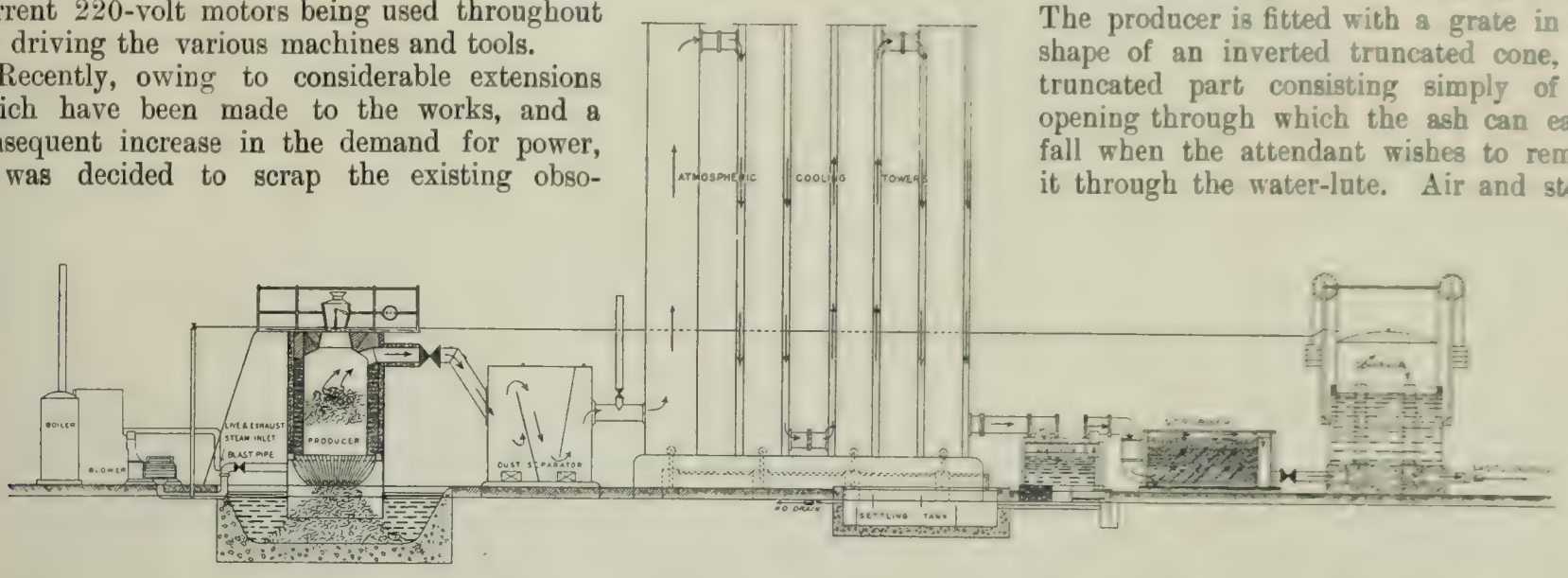


Fig. 1.—Diagram Showing Arrangement of Mond Gas Plant.

Tenders were therefore called for from the local representatives of the various makers of gas engines, both English and Continental, and eventually the contract was placed with Messrs. L. J. Healing & Co., Ltd., one of the oldest and best-known firms in Japan.

The plant is now working, and the results have exceeded expectations. Japanese coal is notoriously poor in quality, but notwithstanding this feature, the consumption is well under 2 lb. per kw.-hour, being about half the consumption of steam turbines installed in another power station of the company.

The gas-producing plant is of the Mond non recovery type, and was manufactured by the Power-Gas Corporation, Ltd. Fig. 1 gives a general idea of the arrangement of this plant. The coal is conveyed to the top of the producer by means of a simple motor-driven elevator. The body of the producer itself is of the ordinary cylindrical type and stands in a water lute, which also acts as a seal. The producer is fitted with a grate in the shape of an inverted truncated cone, the truncated part consisting simply of an opening through which the ash can easily fall when the attendant wishes to remove it through the water-lute. Air and steam under slight pressure are admitted under the grate, the steam being produced either in a separate boiler, as shown in the diagram, or preferably by an exhaust gas-fired boiler, as in the installation under review. About 2 lb. of steam per b.h.p.-hour output of the engine is required by the producer, and it is found in practice that an exhaust boiler will supply this quantity of steam.



Fig. 2.—Mond Gas Plant Installed at the Kawasaki Dockyard, Japan.

The gas from the producer first passes through a regenerator (not shown in the drawing), where part of its heat is given up to the incoming air. After this it passes through a dust separator, a tar extractor, cooling towers, a washer, and duplicate scrubbers, to a gas holder, which at the same time acts as a governor, and thence the gas is drawn on to the engine. It should be mentioned that the temperature in Japan in summer is very high, therefore great pains have to be taken to ensure the efficient cooling of the gas, otherwise tar would be carried through to the engine, and damage to the valves would result.

Two water-cooling towers have been erected, one of which is used for cooling the gas engine circulating water, and the other is used for cooling the water which is used in cleaning the gas. This latter water eventually becomes strongly ammoniacal, and is sold to the local gas company to be treated in their sulphate of ammonia recovery plant.

As a by-product a certain amount of tar is produced, and

as the heat value of tar per unit of weight is several times that of coal, the former is burnt under the steam boilers in another part of the works, and results in a corresponding saving in coal.

Fig. 2 shows the appearance of the gas plant in course of erection.

The gas engine itself is of the single-acting multi-cylinder scavenger type having four cylinders and four cranks, the latter being set at 180°, so that there is one explosion and one impulse every half-revolution. The engine was manufactured by the Premier Gas Engine Co., of Sandiacre; its rated load is 900 B.H.P. at a speed of 200 R.P.M. It was arranged to install a unit of this size in order to enable it to take care of the overload of the dynamo.

The scavenging arrangements deserve special comment. In this engine they consist of an air-pump mounted above the engine cylinders and actuated from the connecting rod. This pump stores air in a receiver at a pressure of a few pounds per square inch only. When the exhaust valve is opened, the scavenging air-admission valve is also opened, with the result that there is a thorough scour through the cylinder. A two-fold advantage is obtained by this: The cylinder and piston surfaces are kept within moderate limits of temperature, thus facilitating lubrication and reducing wear; and at the same time the burnt gases are completely swept from the cylinder, resulting in a purer explosive mixture and consequent increased output for a given size of cylinder.

The engine exhausts through a special boiler which is a modification of the locomotive type. Its function is to extract as much heat as possible from the exhaust. In practice it is found that about 2 lb. of water can be evaporated to steam at 70 lb. pressure for every B.H.P.-hour output of the engine. With a large engine, the quantity of steam obtained is an important item and is more than enough to drive the auxiliary machinery required by the plant and to provide the necessary steam for the gas plant.

The dynamo is a Bruce Peebles standard slow-speed compound-wound machine fitted with inter-poles. Its rated output is 2,225 amperes at 225 volts continuously, with a further overload of 25 per cent. for two hours. The general appearance of dynamo and engine is shown in fig. 3.

The switchboard was manufactured by Messrs. Ferranti, Ltd., and consists of white marble panels fitted with the necessary instruments and switchgear.

The installation was carried out by Japanese workmen under the supervision of the Kawasaki Co.'s engineers, and both the latter company and Messrs. Healings are to be congratulated on the result.

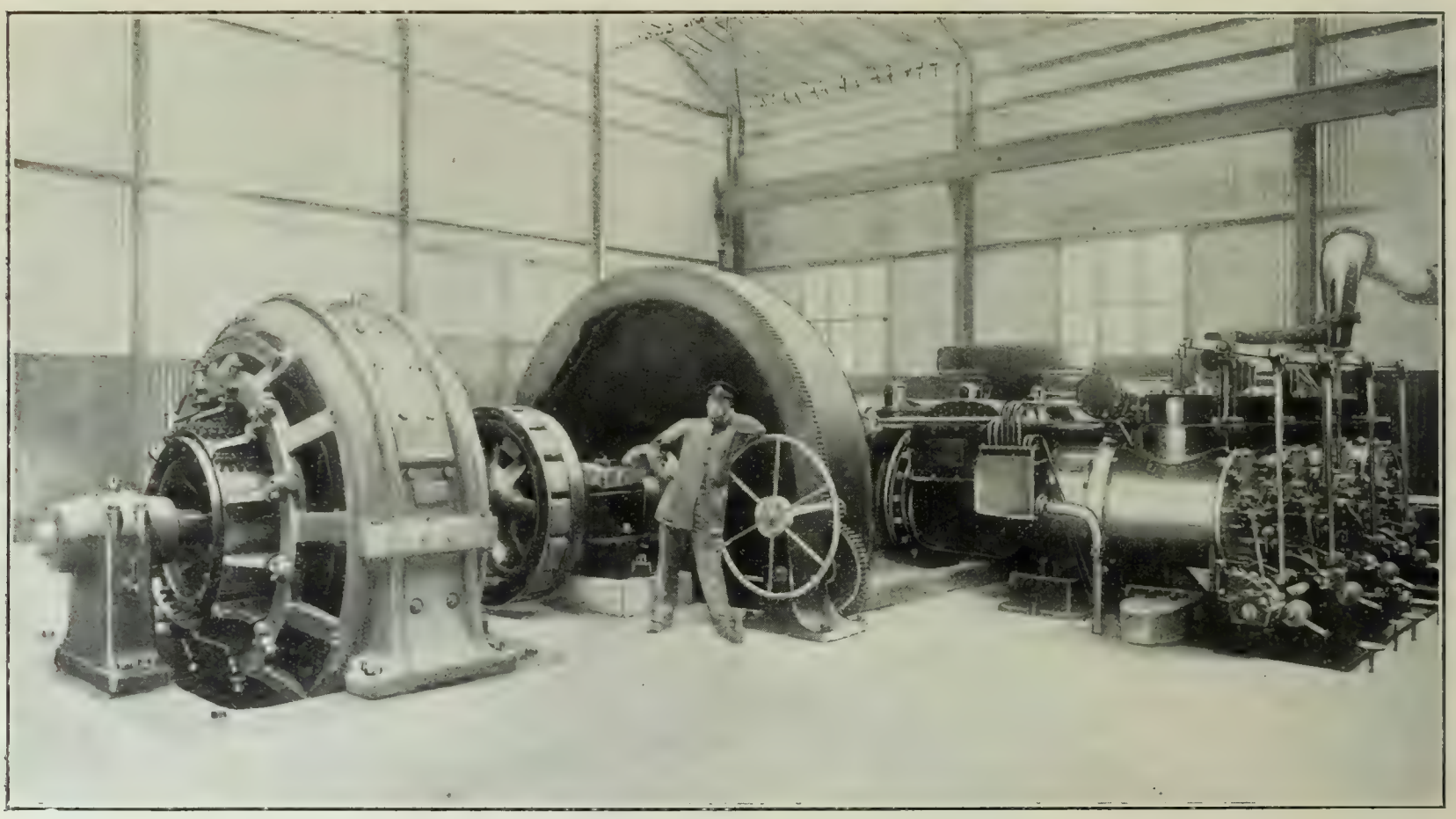


Fig. 3.—Gas-Engine-Driven Generating Set, Kawasaki Dockyard, Japan.

THE GOODS CLEARING-HOUSE SYSTEM.

Last week the New Transport Co., Ltd., gave a demonstration of the system of sorting goods originated by Mr. A. W. Gattie, carried out with machinery invented by him and Mr. A. G. Seaman, and further developed by the engineering staff of the company. Mr. Gattie for some years has assiduously urged the imperative necessity of reform in the methods used for handling and sorting freight at railway terminals and goods yards, pointing out the excessive waste of labour and time incurred under the existing conditions, and the company which has been formed to carry out his ideas proposes to establish a huge goods clearing-house for the railways serving the metropolis, in place of the 74 goods stations which at present exist in London.

The Clearing House would have eight floors, and would provide for the unloading of all goods trains, the dispatch of the goods to the consignees, the receipt of goods outward bound, and the loading of goods trains—all these operations being carried out on an organised system, which reduces to the minimum the handling of goods, the congestion of the platforms and roadways, and the time occupied in transit. The scheme provides for the arrival and dispatch of 240 trains per day, and of 5,000 motor delivery and collecting wagons, each making seven trips a day. The Clearing House would be situated in Clerkenwell, on a site of 30 acres, and would be approached by 10 tube railways. Below street level would run 24 railway berths, from end to end of the Clearing House, each long enough to accommodate a 70-wagon goods train. Over these, on the street level, 12 road bridges would cross at intervals from side to side of the Clearing House. A road vehicle could thus be brought over any desired rail vehicle, and a load could be transferred from the one to the other by an electric overhead crane. Below the rail level would be a "crypt," in which whole wagon loads could be sorted, and, if necessary, temporarily stored until a train was ready to receive them. Above the road-bridge level would be four sorting floors, and above these an eighth floor, with offices and repair shops. In order to save time in loading and unloading, a whole wagon-load would be dealt with at one lift by a crane, by using a "container"—in effect, a removable body which could travel equally well by road or rail. Instead of the 100,000 vehicles which at present block the streets, 5,000 would suffice, and as they would make periodical calls at warehouses, &c., throughout the day, there would be no need for them to stand long anywhere—the most fruitful source of congestion. The machinery employed for sorting the goods is most ingenious; the parcels are placed in trays, which are carried automatically by continually running conveyors to the appropriate places for loading, the trays sliding smoothly from one conveyor to another as required until they reach their destination. It is impossible to describe the methods employed in the space here available, but as the whole of the apparatus would be electrically-driven, consuming 40 million units a year, and the capital outlay on the electric locomotives alone would be £100,000—the total outlay contemplated being 14 millions sterling—it is clear that the adoption of the scheme would be of the first importance to the electrical industry, while, if successful, it would confer immense benefits upon the metropolis. The system is also suitable for other cities and for large stores, &c.

CONTRACTS CLOSED.

(*Concluded from page* 138.)

Keighley.—The Corporation Tramways Committee has accepted the tender of the Cedes Electric Traction Co., Ltd., for a spare pair of hind wheels, with armatures complete, and a spare current collector and flexible wire to the disconnecting socket, for the trackless trolley vehicles, at £123 10s.

Long Ashton.—The Guardians have accepted the quotation of the Portishead Electrical Supply Co. to wire the Portishead Cottage Homes.

New Zealand.—The Dunedin Municipal Council has placed the following contracts:—

Turnbull & Jones.—16 and 22-K.V.A. constant current transformers, lightning arresters, A.C. regulators, S.P. transformers, &c.
Lawrence & Hanson Electrical Co.—Time switches.
National Electrical and Engineering Co.—5 and 10 K.V.A., also ½ to 50 and 150 to 200 K.V.A. transformers.

Nuneaton.—The Electricity Committee of the T.C. has accepted the tender of the Phœnix Dynamo Manufacturing Co. for a line booster, at £321.

Ramsbottom.—The Education Committee has accepted the tender of Mr. Thomas Cornall, of Bury, for the installation of electric light at St. Paul's Church of England School.

Rotherham.—The tender of Mr. Chas. Willis has been accepted by the T.C., at £96, for an electric hoist.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd, for tramway points and crossings, at £295; and that of Messrs. Willans & Robinson, Ltd., for a new engine crankshaft, at £75

Messrs. E. Bennis & Co., Ltd., have received an order for their coal-handling plant, consisting of bucket elevator, chain conveyor, coal-storage bunkers, &c., for the Corporation electrical undertaking.

Torquay.—Messrs. Drury & Chaffe have secured the tender for the electrical illumination of the exterior of the Pavilion and the portion of the Princess Gardens contiguous thereto, at a cost of £260.

Transformer Contracts.—Messrs. Johnson & Phillips, Ltd., of Charlton, have secured the following orders for their standard type oil-cooled transformers during the last few weeks:—

Two 625-K.V.A., 6,600 v., for Dundee Corporation.
Two 150-K.V.A., 6,000 v., for Wigan Corporation.
One 500-K.V.A., 6,600 v., for Oldham Corporation.
Three 100-K.V.A., 2,000 v., for the Admiralty.
Fifty-one 50-K.V.A. and three 300-K.V.A., 13,200 v., for Canada.
Four 400-K.V.A., 10,000 v., for Japan.
Two 350-K.V.A., 6,000 v., for Brazil.

In addition, they have secured contracts for upwards of 5,000 K.V.A. in transformers for English machinery makers in connection with converting plants, &c.

Walthamstow.—The U.D.C. has accepted the tender of the Blasberg Engineering Co., Ltd., at £980, for the erection of a natural-draught cooling tower at the generating station. The tender of Messrs. A. Blackmore & Co. has also been accepted for a supply of coal to the electricity department as follows:—5,500 tons double-screened peas, 14s. 8d. per ton; 5,000 tons Gedling peas, at 14s. 7d.; and Granville nutty slack, at 14s. per ton.

Yarmouth.—The tender of Messrs. C. & J. Webb & Co., Ltd., has been accepted by the T.C. for a supply of overcoats to the tramways department as follows:—For motormen, £1 4s. 10d. per coat; for conductors, £1 3s. 7d.; for inspectors, £1 16s. 9d.; for chief inspector, £1 18s. 3d.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Tuesday and Wednesday, July 29th and 30th. At 10 a.m. At the Senate House of the University. Papers on "A New Method of Cooling Gas Engines," by Prof. Bertram Hopkinson; "Modern Methods of Measuring Temperature," by R. S. Whipple; "Modern Pumping Machinery for the Drainage of the Fens," by R. W. Allen; "A Few Notes on Engineering Research and its Co-ordination," by G. H. Roberts.

Imperial Motor Transport Conference.—Friday, July 25th. At Olympia, London. Conference closes.

Memorial to Sir William White.—There is a movement on foot to establish a memorial to the late Sir W. H. White. The *Times* states that the principal engineering institutions are interested in the matter, and promises of financial support and other communications regarding the matter should be addressed to the secretary of the Institution of Naval Architects (Mr. R. W. Dana), 5, Adelphi Terrace, W.C.

NOTES.

British Trade with Canada.—With reference to our recent articles on the above subject, we have received the following communication from Mr. Percy Joyce, of 295, Bolton Road Walkden, Manchester:—

"I notice a statement in the leading article of the current issue of the ELECTRICAL REVIEW 'British Trade with Canada' and which coincides with our advertisement in the agencies' column, on page 18 of the same number, that a very large number of engineers in Canada are either of American nationality or have been trained on American soil, a fact which naturally influences business in favour of United States firms." There is a considerable amount of truth in the statement, but I know from practical experience that at least one-third of the business could at any time be easily secured by British firms without any, or at least very little, competition, if British firms were alive and conversant with the Canadian methods.

"It is gratifying to know that British goods are continually being asked for, and British engineers are preferred, but they cannot be obtained, as they are all stuck in Britain, afraid of the American underwriters. Canadians have no particular love for Yankees anytime, but there are no Canadian engineers, so that the business must go to the first comer. Mr. Hamilton Wickes can produce very interesting reports on Canadian trade, as he did with the Australian trade, but before waiting for further reports, may I be allowed to state here briefly to those firms interested that the greatest drawback to British firms securing business with Canada, is bad representation, a want of agents on the spot who are good engineers.

"I make this suggestion because much of the work is done for building contractors, hotel and business proprietors, farmers, &c., and other people who have little or no technical knowledge of engineering matters, but who are always keen on obtaining the best advice, and seeking the simplest and clearest explanations. It is because I know this that we are asking to be allowed to represent some British firms there. The ELECTRICAL REVIEW has always left its columns open to Canadian matters; it has repeatedly described to firms on this side of the Atlantic what was required to gain a fair footing in Canada, but what has resulted? Nothing. It cannot be emphasised too strongly the necessity of being well represented in that territory, therefore, in the interests of British manufacturing firms, we shall be pleased to give any information we can, before returning, between now and August 30th. I do not advise firms to proceed to send agents out there who have not had some previous Canadian experience, that would be just as futile.

"It may be of interest to readers to know that some few years ago five small British firms of good standing agreed mutually to speculate a few hundred pounds on opening branches and showrooms and establishing agencies in Montreal, Quebec and Ontario, with a view to securing a portion of the Canadian trade. This proved successful, and judging from the amount of trade they are doing now, I think they have been amply repaid, and it would be wise if other firms would work on the same principle."

The B.A. Meeting.—In its issue of Monday last, the *Times* publishes its usual forecast of the forthcoming meeting of the British Association meeting at Birmingham. It is expected that there will be a large attendance—over 3,000. Among the subjects down for treatment before the Mathematical and Physical Science Section is a paper on "Lightning and Protection Therefrom," by Sir J. Larmor. In the Chemistry Section there will be a discussion on the economical use of fuel. In Section G (Engineering), the sectional president (Prof. Gisbert Kapp) is to deal with the electrification of main line railways; Prof. Marchant is down for a paper on "Some Effects of Atmospheric Conditions on Wireless Signals"; Prof. Howe for one on the "Electromagnetic Rays Employed in Radio-Telegraphy, and the Mode of their Propagation"; Prof. F. W. Lancaster will discuss "The Internal Combustion Engine as Applied to Railway Locomotives"; and Prof. Burstall, "Solid, Liquid and Gaseous Fuel."

The Commercial Motor Vehicle Exhibition at Olympia.—From an electrical point of view, this exhibition is disappointing. No attempt whatever has been made to bring the battery-driven vehicle before the public, either for light or heavy commercial work. Our representative was surprised to find that even the Edison battery people were not there. Four 40-H.P. Tilling-Stevens vehicles are shown by Messrs. W. A. Stevens, Ltd. Great interest appears to be aroused by these cars, and the stand attendants are kept busy. Various improvements have been made in the general design. The makers have found it desirable to mount the electric motor on a sub-frame, so that its centre line lies some inches below the centre line of the engine and dynamo, thus lowering the c.g. of the whole vehicle. On the 40-H.P. type the radiator is placed in front of the engine, and the control boxes are mounted on the dash-board inside the bonnet, instead of being right at the knees of the driver, as in the 30-H.P. type. The leaf spring coupling between the engine and the dynamo has been superseded by a leather ring coupling.

Nine firms are exhibiting dynamo lighting sets, most of which we described at the time of the last International Motor-Car Exhibition. Several well-known makers of electric ignition apparatus have evidently deemed it not worth their while to be present, representation in this section being not very strong.

An electrical change-speed gear is exhibited by the firm of G. A. Claus; Messrs. W. Canning & Co. show electroplating plant; and the E. O. and A. Co. show a selection of "Timken" roller bearings.

The Swansea Strike.—Regarding the strike at Swansea Corporation electricity works, to which we made brief reference recently, our correspondent writes:—"Matters industrially have not been running at all smoothly at the Swansea Corporation electricity station, and the climax was reached by the unskilled workmen to the number of 41, who belong to the Dockers' Union, ceasing work on only 24 hours' notice. The men complained that the system of promotions had not been fairly carried out, but the immediate cause of the stoppage was the dismissal of a fitter's labourer named Wm. Morris on account of slackness of work and the retention of another workman with a shorter period of service to his credit. The general body of workmen adopted a high-handed attitude in ceasing work without the usual week's notice, which would have given the electrical engineer (Mr. C. A. L. Prussman) and his Committee, of which a practical electrician in Ald. A. Sinclair is chairman, an opportunity of arranging an amicable settlement, but even this was eclipsed by the demand made by the Dockers' Union, on behalf of the men, that Morris should be reinstated and the other man stopped. The Council in Committee, realising the gravity of the step taken by the men, at once met to consider the matter and, in the end, a special Committee was appointed to deal with the dispute, one of the conditions being that the Committee should discuss the principle of promotion or retention by seniority, other things being equal. The Committee accepted this principle, and also decided that the engineer should draw up a classification scheme with a view to Morris's case being considered. There was some difficulty at the outset over this, as it was not clear whether the classification should combine inside and outside men, or whether there should be a separate classification for each. This matter was left with the engineer, who is now engaged in preparing the scheme. The strikers, after a day's stoppage, during which the station was kept going by the ordinary staff, returned to work, and it is anticipated that when the classification is arranged, Morris will be reinstated on the ground that he is senior in point of service. Meantime, by arrangement, he is on the funds of the Dockers' Union. Whilst this dispute is in the balance, the Amalgamated Society of Engineers has taken up the wages case of two of its members at the station. The Committee had already made an advance, but the Society wanted the Swansea rate of 45s. per week, or 2s. per week more than the Committee had conceded, notwithstanding that at the docks where the 45s. rate prevails, holidays are not paid for, as is the case at the electricity station. A compromise has been effected, the Committee offering a further 1s. advance, making 44s. per week and payment for holidays. The outcome of the whole matter is likely to be the formation of a Conciliation Committee to deal with disputes of the kind, it being felt that it is a serious thing for the community to be at the mercy of this 'down tools' policy at any moment the men choose to put it into operation."

Later information shows that the dispute is still in the balance. The borough electrical engineer, Mr. Prussman, acting under the instructions of the special committee appointed to deal with the causes of the recent strike at the works, has prepared a classification scheme under the seniority principle accepted by the committee. In effect, this reinstates the workman who had been dismissed because of slackness of work, and a man named Henry, being the junior hand, is to go instead. Both are members of the Dockers' Union, who claim that a workman named Scobell, a member of the Railwaymen's Union, is the one to be dismissed. Another "down tools" is threatened, but before anything is done in this direction, the whole matter is to be laid before the Executive Committee of the Dockers' Union, in London.

Copper. — From the statistics furnished by Messrs. Merton's circular, it appears that the demand for copper during the first half of July has been fairly brisk. Visible supplies, if taken for England and France and afloat thereto from Chile and Australia, show an increase of 1,186 tons, distributed over stocks at Havre, and quantities afloat. English stocks lost 558 tons. Visible supplies for the whole of Europe show a drop of 923 tons for the fortnight, consisting almost entirely of withdrawals from Hamburg, which shows a drop of 1,607 tons out of the 2,109 tons, making up the difference between an increase of 1,186 and a decrease of 923.

In supplies, North America is above average, Spain and Portugal low; Chile shipments are heavy, and Australian also well above the average. Deliveries, at 26,456 tons will, if maintained, show a fairly high figure at the end of the month.

The American Producers' Association give American stocks for the end of June at 23,578 tons, a decrease of 6,544 tons during June. The world's visible supply shows a decrease for June of 8,535 tons, and stands at 61,774 (for end of June), or half what it was in November, 1911.

International Time Signals.—Finding that the time signals issued from Paris and Norddeich since July 1st were not in conformity either with the new or the old scheme, but appeared to be a combination of both, Mr. F. Hope-Jones wrote to Commandant Ferrié, of the Eiffel Tower station, for an authoritative statement on the subject. The following is a translation of part of a letter just received from him, which Mr. Hope-Jones has kindly sent us:—"I have the honour to inform you that the new International Signals established by la Conference de l'Heure in October last, and which were to have been employed commencing from July 1st, could not be inaugurated at the date fixed, for the following reason: The German technical services have announced that certain material difficulties would prevent the time station of Norddeich from being ready before the month of October at the earliest. As the station of Norddeich now sends the time at midnight, and as, according to the new conventions, the Eiffel Tower ought also to send the time at midnight, there would result a jamming of the two emissions. So we have had to delay putting into operation the decisions of the Conference. Nevertheless, we send the new automatic time signals at 10 a.m., according to the new Conventions, in order to give practice to people who take the time. We continue, however, to send the time as formerly at 10.45 a.m. and 11.45 p.m. with the old signals. We were ready to operate on July 1st, as is shown by the fact that we commenced the new morning signals on that date, but it is by courtesy that we have delayed putting into practice the whole of the new international arrangements."

Parliamentary.—Various Bills.—In the House of Lords on July 16th, the Western Valleys (Monmouthshire) Railless Electric Traction Bill and the Dover Harbour Bill were read a second time, and the Rhondda Tramways (Railless Traction) Bill was read a third time and passed.

In the House of Lords on Tuesday, the London County Council (Tramways and Improvements) Bill was read a second time.

In the House of Commons on 15th inst., the Metropolitan District Railway Bill was read a third time.

Electricity Supply Rifle League.—Representatives from the clubs forming the above league had a friendly shoot on Saturday afternoon last with a similar selection from the North-West Middlesex Rifle League. The match took place on the well-equipped range of the Alperton and Wembley Rifle Club, and the North-West Middlesex League won by 25 points. The teams were 14 aside and 12 to count, and the distance was 25 yards. Appended are the scores:—

North-West Middlesex League.—C. W. Barker (Alperton and Wembley), 98; —. Iggulden (Ruislip), 98; W. J. Busby (Alperton and Wembley), 97; H. Gibbons (Hendon), 97; E. F. Moore (Harrow), 97; A. W. Chinn (Alperton and Wembley), 96; C. J. Chinn (Linacre), 95; C. S. Ingram (Harrow), 95; P. J. Gobby (Hendon), 94; W. E. H. Calcoff (Harrow), 94; R. Abercrombie (Ruislip), 93; C. N. Sims (Alperton and Wembley), 93. Total, 1,147. G. Hart (Linacre), 88; J. Gerrard (Neasden), 88. *Electricity Supply League.*—W. J. D. Partridge (Westminster), 97; S. G. Rhodes (Central), 97; A. Brackley (Central), 97; E. Neville (Westminster), 94; H. A. Pearman (Westminster), 94; F. A. Brown (Ilford), 93; R. Tufnell (Ilford), 93; L. Tufnell (Ilford), 92; G. Horley (Westminster), 92; A. E. Beale (Brompton), 91; E. G. Furneaux (Brompton), 91; F. Winchcombe (Westminster), 91. Total, 1,122. H. Mugford (Brompton), 90; A. H. Harvey (Central), 88.

Light refreshments were kindly provided by the lady friends of the Alperton and Wembley Club who had kindly placed their range at the disposal of the leagues for the match, which was thoroughly enjoyed by all concerned. Later in the afternoon an impromptu billiard match was arranged at the Chequers' Inn amongst the members of the Electricity team, and resulted in a win for their captain, Mr. Partridge, of Westminster.

The Microtropometer.—An extremely clever device has been suggested by Mr. G. A. Shakespear, of Birmingham University, in a letter to *Nature*. He proposes to place two instruments physically in series, using the second as a delicate detector and powerful magnifier of the indications of the first. Thus, he adjusts two Boys radio-micrometers in such a way that the luminous image reflected from the mirror of the first is received upon the vane of the second, causing the mirror of the latter to give a scale deflection of 1,000 mm. If, now, the image received by the vane is 1 mm. wide, it is evident that by a movement of 1 mm. it can be brought entirely on or off the vane; thus the movement of the first image causes the second image to be displaced 1,000 times as much, and if the first moves only 0·001 mm., the second gives the readable deflection of 1 mm., the combination resulting in an extraordinary increase of sensitiveness. Mr. Shakespear has tried the method with very satisfactory results, and points out that the first instrument may be any instrument in which a beam of light is used as an indicator, such as a galvanometer, electrometer, or a string-galvanometer, while instead of the radio-micrometer for the second instrument, a thermo-couple, bolometer, or other radiation detector may be employed. He states that by using three instruments on this plan, an initial movement of a millionth of a millimetre may be made to produce a final movement of 1 mm.; this seems to be stretching the process rather far, for we should think it practically impossible to prevent infinitesimal movements of the first mirror through vibration, change of temperature, &c., which would swamp the movements due to the phenomenon under investigation—as, of course, all such chance movements would be equally magnified. The inventor recognises these difficulties, and is continuing his investigations. It is clear that the method may, and probably will, be found of great value in making delicate measurements.

A Belgian Patent Action.—According to information received in Berlin from Brussels, the Belgian Court of Appeal has just decided an action which has been proceeding for years between the A.E.G. Union Electrique, which is the Belgian branch of the Berlin A.E.G., and the Atéliers de Constructions Electriques de Charleroi. The Court of First Instance gave a decision in favour of the former, but the Court of Second Instance held that the plaintiff company was not justified in forbidding the use in Belgium of the Knight and Potter patents (patented in Belgium on July 15th, 1892), and of patents which refer to the Andersen controller (patented in England on December 4th, 1899, but not in Belgium). As a consequence the A.E.G., which is the concessionaire

of the Knight and Potter patents, and which had caused the controllers made by the Atéliers de Constructions Electriques to be seized, was ordered to pay compensation to the latter. The Court of Appeal, however, has refused to accept this interpretation of the Belgian patent law, and has restored the decision of the Court of First Instance in favour of the A.E.G.

London Electric Supply.—The L.C.C. Special Committee on the future of electric supply in London having already gone into the matter in a general sort of way with a number of well-known authorities, now asks the Council to authorise it to spend £2,500 upon obtaining detailed reports on more definite lines. The reports will, *inter alia* :—

1. Deal with the existing means for the supply of electricity in Greater London.
2. Give an outline of a complete ultimate scheme for Greater London, and indicate what modifications would be required in any such scheme if it were limited to the County of London.
3. Include a definite recommendation as to the initial steps to be taken in the direction of a complete scheme, bearing in mind the existing conditions and the general financial position.

An Extraordinary Proposition.—At a recent meeting of the Bridlington Borough Council the following resolution was put forward by one of the Councillors :—"That any official of the Bridlington Corporation receiving a salary of over £120 per annum, including emoluments, when applying for an increase of salary shall at the same time tender his resignation before such increase is considered by this Corporation." Fortunately for the reputation of the Council, the resolution was not carried. It is difficult to conceive what object the mover had in view in proposing so tyrannical a course, unless it were to discourage to the utmost future applications for an advance. One obvious result, however, would be that it would effectually discourage good men from remaining in the employ of the Corporation or from entering it. The incident affords a further indication of the narrow-minded and contemptuous attitude of some municipal representatives towards their officials—an attitude they would not dream of assuming towards the workmen in the Council's employ, whose voting power compels the respect of their representatives. We understand that the author of this iniquitous proposal is a local tradesman ; it would be interesting to know whether he has adopted the system in his own business—we do not think it likely.

Brains count for nothing in comparison with votes.

Electro-Therapeutics.—At the annual gathering of the British Medical Association which is now in progress at Hove, Mr. W. D. Butcher, M.R.C.S., London, is president of the Electro-Therapeutics Section.

Fatalities.—Tom Burrows, a workman in the employ of Burnley Corporation tramways, was engaged working on the "tower" wagon in Manchester Road last week when, through the unaccountable slipping of a binder, a wire was released, and, striking the unfortunate man, knocked him over the hand-rail into the roadway, a distance of about 17 ft., killing him instantly. The Coroner at the inquiry said that while deceased might have been safer on the other side of the wire, he (the Coroner) thought he was doing what he considered best for his employers. The jury returned a verdict of "Accidental Death."

Mr. Tee, on behalf of the Corporation, expressed deep sympathy with the family. They employed a man with 22 years' experience to bind the wires, and, so far as they knew, they had taken every precaution to prevent such a fatality happening.

On Monday an inquest was held into the death of a gantry driver, named Phillips, who was killed at the Melingriffith Tinplate Works, near Whitchurch. According to the *Western Mail*, Frederick James Lloyd, electrical fitter, who was working with Phillips, said they were engaged in putting a new hauling rope on an electrical crane, and witness was guiding a rope while Phillips was inside the "cab" working the controller. The rope jumped out of the groove. Matters were put right, and witness told Phillips to hoist again. As he did not get a reply he went to the "cab," and, to his surprise, he saw Phillips gripping the electric wire, through which a 440-volt current was passing. He switched off the current and endeavoured to save Phillips from falling against a long transverse wire, but was unsuccessful, the deceased man striking the wire with his head, the result of which was that witness also received a shock. Artificial respiration proved of no avail. Dr. Fuller, who examined the body, attributed death to heart failure, due to shock. A verdict of "Accidental Death" was returned, a rider being added that the wires were not sufficiently protected at the time of the accident. Sympathy was expressed with the bereaved relatives.

Accident.—Last week two wiremen employed in the Rochdale Corporation tramway department were repairing wires at Littleborough when a motor wagon ran into the tower wagon on which they were standing. The platform was knocked from under their feet, and the men were left hanging on to the span wire by their hands. A loaded lorry, which was close by, was quickly drawn under the men, who dropped on to it none the worse for their experience.

Institute of Metals.—The programme is issued of the autumn visit of this Institute which takes place on August 28th and 29th to Ghent.

The Production and Consumption of Copper, Lead, Tin and Zinc in 1912.—The well-known statistics which are annually issued by the Metall Gesellschaft, of Frankfort-on-Main, have just been published in relation to the production, consumption and stocks of copper, lead tin, zinc and other metals in 1912. It is mentioned by way of introduction that in consequence of the favourable industrial development last year, the consumption of metals in general experienced such a large increase that it was impossible for the output at times to keep pace with the demand, notwithstanding the considerable augmentation in the production. The tonnage (apparently metric) of the out-turn and consumption of the four leading classes is returned as follows, for the past two years :—

	1912. Metrical tons.	1911. Metrical tons.
Copper production and consumption.		
Production	1,019,800	[illegible]
Consumption	1,040,200	953,700
Tin production and consumption.		
Production	121,500	118,700
Consumption	128,100	120,600
Lead production and consumption.		
Production	1,189,100	1,132,900
Consumption	1,198,900	1,157,700
Zinc production and consumption.		
Production	977,900	902,100
Consumption	987,500	903,200

The average price of copper per long (English) ton is returned at £73 1s. 2d. in 1912, as compared with £56 1s. 9d. in 1911 ; that of tin, £209 8s. 5d., as against £192 7s. 9d. ; lead, £17 15s. 10½d., as contrasted with £13 19s. 2½d. ; and zinc, £26 3s. 4d., as compared with an average of £25 3s. 2d. in 1911. The consumption of the leading countries is set forth as undernoted :—

Consumption of Lead in the Principal Countries.

	1912. Metrical tons.	1911. Metrical tons.
Germany	220,500	229,800
United Kingdom	196,100	198,300
France...	106,500	99,600
United States...	397,800	365,200
Consumption of Copper.		
Germany	232,700	222,100
United Kingdom	144,700	159,200
France...	99,800	95,700
United States...	371,800	321,900
Consumption of Zinc.		
Germany	225,800	219,500
United Kingdom	185,200	175,700
France...	82,000	82,000
United States...	312,400	251,600
Consumption of Tin.		
Germany	21,700	19,500
United Kingdom	21,500	21,900
France...	7,500	7,400
United States...	51,700	48,000

The production of aluminium in 1912 amounted to 61,100 tons, as compared with 45,000 tons in the previous year. The United States were responsible for 18,000 tons of the former quantity, being the same as in 1911 ; France for 13,000 tons, as against 10,000 tons ; and Germany, Austria and Switzerland for 12,000 tons, as contrasted with 8,000 tons in 1911. It is estimated that the world's consumption of aluminium in 1912 reached 61,100 tons, as compared with 46,800 tons in 1911, the United States being credited with 28,000 tons and 20,900 tons in the two years respectively. The average price was 1s. 6d. per kg. (£3 15s. per cwt.), as against 1s. 2½d. per kg. in 1911, 1s. 5½d. in 1910 and 1s. 4¾d. in 1909. Apart from quicksilver and silver, the statistics also show an output of 28,500 tons of nickel in 1912, as compared with 24,500 tons in the previous year, and the major portion of 15,000 was produced in the United States and Canada, as against 12,000 tons in 1911 ; the output in Great Britain was 5,200 tons, as compared with 4,500 tons, whilst the share of Germany in 1912 remained at 5,000 tons without any change.

Appointments Vacant.—The Commissioners for the Port of Calcutta are inviting applications for the post of assistant to the superintendent of machinery with central electric generating experience (Rs. 450 per men., plus free quarters). Apply by August 1st to Mr. J. Angus, consulting engineer and London agent to the Commissioners, 17, Victoria Street, S.W. The Egyptian Ministry of Finance is advertising for an assistant sub-director of the Government Press, Cairo ; civil and mechanical engineering education and experience in electrical power installations. Information from Secretary, Egyptian Government Selection Board, East Alla, Putney, S.W., before August 4th.

Chief clerk and accountant, for the Coventry Corporation Tramways (£180) ; wireless telegraph superintendent, for the Government stations in Somaliland (£400 + quarters) ; assistant electrical engineer, for Port Elizabeth municipality (£500) ; assistant lecturer and demonstrator, for the Borough Polytechnic Electrotechnics Department (£60). See advertisement pages to-day.

Paying Compositions "In Settlement."—In the City of London Court, on Friday, a case of much trade interest was heard before his Honour Judge Lumley Smith, K.C., in which Messrs. S. Lesser & Sons, merchants, 24, Houndsditch, E.C., sued

Mr. E. R. Hicks, 11, Penlee Street, Penzance, for £2 9s. 9d. balance of account for goods supplied in the ordinary way of trade. Defendant wrote to the Court, and said he had had a fire, and after he had received the insurance money there was only sufficient money to pay his creditors a composition of 15s. in the £. A cheque for that amount was sent *pro rata* to each of the creditors, marked "in full settlement," with an intimation that they must accept it in full discharge or return the cheque, when he would file his petition in bankruptcy or apply for an administration order, as the circumstances warranted. Plaintiffs had cashed the cheque, and therefore they had no further claim upon him. They should have returned the cheque or accepted it in full. Mr. Harry Strouts, for the plaintiffs, submitted that the plaintiffs were entitled to sue for the balance notwithstanding the fact that they had kept the cheque. They sent a receipt showing they took it on account. Judge Lumley Smith thought there had been a tendency of late to depart from that rule of law. He was not sure that the plaintiffs ought not to have given the defendant a chance to stop the cheque if he liked. On the whole, judgment would be given for the plaintiffs, with costs.

Annual Outing.—The annual outing of the employés of Electrical Installations, Ltd., took place on Saturday last, 19th inst., at Herne Bay. Although the weather in the morning was not all that could be desired, the afternoon and evening turned out very satisfactory, and, after lunch, the party amused themselves with various pastimes—motor drives, boating, &c.

Institution and Lecture Notes.—The Institute of Marine Engineers.—The site recently purchased on Tower Hill for the purpose of the home of this Institute, is to be cleared, and the construction of the building begun. Tenders for the work have been accepted, and it is hoped that the premises will be ready for occupation in the early part of next year. Of the required sum, £6,000 has been subscribed, and it is hoped that the remaining £6,000 will be forthcoming during the current year. To that end the committee is making its appeal over a wider area than that of the membership of the Institute. Donations for the "City Premises (Building) Fund" may be addressed to Mr. A. H. Mather, Hon. Sec., City Premises Committee, Institute of Marine Engineers, 58, Romford Road, Stratford, E.

Institution of Mechanical Engineers.—The Cambridge meeting takes place on July 29th and 30th, in the Senate House of the University. The Papers include one by Prof. B. Hopkinson on "A New Method of Cooling Gas Engines"; one by Mr. R. S. Whipple on "Modern Methods of Measuring Temperature," and one by Mr. R. W. Allen on "Modern Pumping Machinery for the Drainage ef the Fens."

Electric Smelting of Tin Ore. — The *Revue Industrielle* gives particulars of some experiments carried out by the Groendal-Kjellin Co., of London, in Cornwall for the purpose of investigating the suitability of the electric furnace for the reduction of tin ore. The results were favourable, pure ores giving metal of 98 per cent. purity, while Bolivian ores containing 49·5 per cent. of tin and about 15 per cent. of iron yielded metal of 92 per cent. to 97 per cent. purity, which could be further refined to 99·75 per cent. or more by blowing air through the molten mass. The energy consumed amounted to 1,700 KW.-hours per ton on the average. By working with two furnaces, one to treat the rich slag and the other to produce the metal, the company hopes to reduce this consumption to 1,400 KW.-hours, giving an efficiency of 55 per cent. There is a saving of 25 per cent. of labour. It is stated that at mines where hydroelectric power is available the process will be commercially practicable and economical.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—A number of friends of Mr. and Mrs. Wyld having expressed a wish to celebrate the former's appointment as chief electrical engineer to the borough of Hampstead, and to welcome both Mr. and Mrs. Wyld to London, a Committee has been formed, and it has been decided that a dinner be held on Friday, October 3rd, at the Imperial "Oddenino's" Restaurant, 60-62, Regent Street, W. The number of guests having to be limited, early applications for tickets should be made. As the dinner is to welcome both Mr. and Mrs. Wyld, single tickets will be issued for gentlemen only, and double tickets for lady and gentleman. Applications for tickets should be made to Mr. C. Newton-Russell, 29, Southwood Avenue, Highgate, Chairman of Committee; or to the Hon. Sec. and Treasurer, Mr. E. P. Barfield, "Porlock," Athenæum Road, Whetstone, N.

The Greenock Town Council is granting an advance in salary of £50 to Mr. James A. Robertson, the burgh electrical engineer.

The Aberdare U.D.C. has promoted present members of the electricity staff to the following positions under the electricity and tramways department:—Mr. W. J. Williams, to be works superintendent; Mr. W. T. Hilder, to be outside superintendent; and Mr. G. D. Morgan, to be chief clerk.

Acting under medical advice Mr. Alfred Clough, resident electrical engineer in Liverpool, has intimated to the Tramways and Electric Power and Lighting Committee his desire to retire. The Committee have accepted the resignation as and from October 1st next, and have placed on record their appreciation of the services rendered by Mr. Clough to the Corporation and to the community in connection with the management and development of the electric supply undertaking.

Tramway Officials.—Mr. George Webster, traffic manager, has been appointed by the Rochdale Corporation Tramways Committee to the position of general manager in succession to Mr. J. S. D. Moffet, who has been chosen as general manager of the West Ham Tramways.

General.—The Council of the Royal Society of Arts attended at Buckingham Palace last Friday morning, when His Royal Highness the Duke of Connaught, president of the Society, presented to His Majesty the King, for nine years president and now patron of the Society, the Society's Albert Medal for the present year, "in respectful recognition of His Majesty's untiring efforts to make himself personally acquainted with the social and economical conditions of the various parts of his Dominions, and to promote the progress of Arts, Manufactures and Commerce in the United Kingdom and throughout the British Empire." The following members of the Council were among those present:—Lord Blyth; Mr. Dugald Clerk; Mr. Robert Kaye Gray; Colonel H. C. L. Holden; Sir John Cameron Lamb, C.B., C.M.G.; Sir Philip Magnus, M.P.; Mr. William Henry Maw; Sir Henry A. Miers; Mr. Francis Grant Ogilvie; Hon. Richard Clere Parsons, M.A.; Mr. Alexander Siemens; Mr. Alan A. Campbell Swinton and Sir John Wolfe-Barry.

Messrs. George A. Touche & Co., chartered accountants, London, E.C., have opened offices at Electric Railway Building, Notre Dame Avenue, Winnipeg, Canada, under the management of Mr J. Gilmour Wylie, chartered accountant, and at McKnight Building, Minneapolis, U.S.A., under the management of Mr. Edgar C. Salvesen, chartered accountant.

It is now officially announced that Mr. H. E. Blain, the late general manager of the West Ham Corporation Tramways, has, in consequence of the death of Mr. Joseph Carter, been appointed purchasing agent of the Underground Electric Railways Co. of London, Ltd., and the companies allied therewith.

A financial daily states that Mr. H. C. Walker, managing director of the Waygood Lift Co., has joined the board of the Humphrey Pump Co., Ltd.

Mr. P. S. Hay, A.M.I.E.E., of the Aster Engineering Co., Ltd., Wembley, underwent a severe operation for appendicitis on Thursday last week at the University College Hospital, Gower Street, W.C. We are pleased to learn that he is making favourable progress toward recovery.

Mr. H. E. Ashdown has resigned his official position as managing director of the Birmingham Mica Co., Ltd., to commence on his own account as a manufacturers' agent. His address *pro tem* is 8, Osborne Road, Handsworth, Birmingham.

Obituary.—Prof. Francis Gotch.—We regret to record the death of Prof. Gotch, which occurred in London on 15th inst. at the age of 60 years. He was Waynflete Professor of Physiology at Oxford, but he is brought within the scope of this journal by reason of his researches relating to the electrical changes in living tissue, conducted in co-operation with Sir J. Burdon Sanderson. Some years ago he delivered a most interesting lecture on electric eels to a large popular evening audience at one of the B.A. meetings.

NEW COMPANIES REGISTERED.

Electrical Apparatus Co. (1913), Ltd. (129,845).—Registered June 30th, by Young, Jones & Co., 7, Laurence Pountney Hill, E.C. Capital £90,000 in £1 shares (50,000 7 per cent. cumulative participating preference). Objects: To take over the business of electrical engineers carried on by the Electrical Apparatus Co., Ltd, at Vauxhall Works, South Lambeth Road, S.W. The subscribers (with one preference share each) are:—E. Schattner, 117, Corringham Road, Golder's Green, N.W., electrical engineer; E. A. Godson, 31, Gledhow Gardens, S.W., gentleman; R. Amberton, 9, Evelyn Mansions, Queen's Club Gardens, W., electrical engineer; G. R. Moore, 13, Spencer Road, Croydon, electrical engineer; H. Taylor, Weybourne, Foxley Lane, Purley, incorporated accountant: H. R. C. Partridge, 6, Church Row, Fulham, S.W., engineer; R. H. Barbour, Tiltwood, Crawley Down, Sussex, electrical engineer. Minimum cash subscription, £15,000; the first directors are E. Schattner (chairman), R. Amberton, G. R. Moore, H. R. C. Partridge and R. H. Barbour; H. Taylor and E. A. Godson are "extraordinary directors," and require no qualification; qualification of directors, 1,000 ordinary shares; remuneration, £2,250 per annum, divisible.

Macintosh Cable Co., Ltd. (130,053).—This company was registered on July 10th, with a capital of £25,000 in £1 shares, to carry on the business of manufacturers of and dealers in cables, chains, wires or ropes, contractors, mechanical and electrical engineers, electricians, &c. The subscribers (with one share each) are:—Frederick H. H. Smith, Queen's Lodge, Colwyn Bay, rubber manufacturer; W. Paterson, 5, Cross Street, Manchester, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are Sir Frederick H. Smith, Bart., Frederick H. H. Smith and T. H. M. Harvey. Solicitor: J. Dendy, 5, Cross Street, Manchester. Registered by Jordan & Sons, Ltd., 116 117, Chancery Lane, W.C.

E. M. Ashley, Ltd. (130,168).—This company was registered on July 18th, with a capital of £2,000 in £1 shares, to take over the business of an electrical engineer, carried on by E. M. Ashley, at 2, 16, 18 and 20, Bond Street, Southport. The subscribers (with one share each) are:—E. M. Ashley, 41, Balfour Road, Southport, electrical engineer; E. L. Reynolds, 16, Bond Street, Southport, electrical engineer. Private company. The number of directors is not to be less than three or more than five: the first are E. M. Ashley, E. L. Reynolds and Sarah Ashley; qualification, £50; remuneration as fixed by the company. Solicitor: G. H. Thompson, 6, Lord Street, Liverpool. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

United Salt and Power Co., Ltd. (130,211).—This company was registered on July 19th, with a capital of £250,000 in 235,000 preference shares of £1 each, and 150,000 ordinary shares of 2s. each, to carry on the business of rock salt proprietors, salt miners, brine owners, manufacturers of salt of all kinds, producers, refiners and preparers for market of and dealers in salt, brine, and other substances and liquids producing or produced by or with the aid of salt or brine; owners and workers of salt mines and brine lands in any part of the world, chemical manufacturers, dyers, soap makers, suppliers of electricity, electrical, civil, mechanical and mining engineers, contractors for light, power and heat, &c., and to adopt an agreement with J. L. Brodie. The subscribers (with one preference share each) are:—A. S. Stern, 47, Tabley Road, Tufnell Park, N., clerk; H. H. Walton, 55, Chapter Road, Kennington, S.E., clerk; S. R. Disborough, 8, Denmark Street Park, Tottenham, N., clerk; L. H. Hiscock, 15, Lonsdale Square, Barnsbury, N., clerk; S. Price, 2, Barretts Grove, Stoke Newington, N., clerk; H. E. Williams, 18, Austin Friars, E.C., solicitor; P. J. Hellis, 46, Arthurdon Road, Ladywell, S.E., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are W. T. Holmes, 1, Queen Victoria Street, E.C.; Sir Murland de Grasse Evans, Bart., 27, Old Jewry, E.C.; A. H. Barnard, 148, Fenchurch Street, E.C.; L. Charbonnel, Finsbury Pavement House, E.C.; and C. Gairdner, 13, Fenchurch Avenue, E.C.; qualification, £200; remuneration, £200 each per annum (chairman £300), and 2½ per cent. of the profits, divisible. Registered by Slaughter & May, 18, Austin Friars, E.C.

Hydraulic Power Co., of Scandinavia, Ltd. (130,171).—Registered July 18th, by Ingle, Holmes, Sons & Pott, Capel House, E.C. Capital £425,000 in 10s. shares. Objects: To carry on the business of a water and general power company, to manufacture, generate, sell and supply electricity for power or other purposes and machinery for the generation of electricity, to acquire rights and concessions in respect of the use of waterfalls, rivers and waterways, &c., and to adopt an agreement with the Hydraulic Power and Smelting Co., Ltd. The signatories (with one share each) are:—H. V. Young, 41, Bismarck Road, Highgate, N., clerk; F. T. Linell, Lowood, The Beeches, Carshalton, solicitor; H. Jacques, Elstree Cottage, Victoria Road, Mill Hill, N.W., clerk; E. V. Staff, 18, St. Swithin's Lane, E.C., secretary; W. V. Pooley, 60, Farleigh Road, Stoke Newington, N., clerk; J. Nash, 145, Shernhall Street, Walthamstow, clerk; E. J. Hayman, 18, St. Swithin's Lane, E.C., secretary. Minimum cash subscription upon the first allotment of shares, seven shares; if at any time shares be offered to the public the minimum subscription shall be 10 per cent. of the shares offered; the first directors (to number not less than two or more than five) are R. Blakstad, S. Huldt, A. List, E. Rarel and J. A. Stirling; remuneration, £100 each per annum.

Teleradio Electric Co., Ltd. (130,183).—This company was registered on July 18th, with a capital of £8,000 in 7,900 ordinary shares of £1 each and 2,000 deferred shares of 1s. each, to acquire from the Société Française Radio-Electrique licences and powers to use patent rights, to enter into an agreement with the said Société and Emile Girardeau, to construct, establish, install, erect and work wireless, electric or other systems of telegraphy, radio-telegraphy, radiophony or telephony, to acquire any inventions for the production of light, heat, sound waves, electromagnetic waves, power or other effects by electricity or other power or agency, &c. The subscribers (with one share each) are:—A. E. Hutton, 55, Kimberley Road, Stockwell, S.W., clerk; J. Hylaud, 99, Eton Road, Ilford, cashier. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration, £50 each per annum. No notice of registered office was filed with the original documents. Registered by Roney & Co., 42, New Broad Street, E.C.

Burnham and District Electric Supply Co., Ltd. (130,139).—This company was registered on July 17th, with a capital of £8,000 in £1 shares, to carry on the business of electrical engineers and contractors, electricians, manufacturers of electrical apparatus, suppliers of electricity, &c. The subscribers are:—J. A. Purvis, 6, Pennsylvania Park, Exeter, engineer, 100 shares; Wm. L. Chown, Kyrtonia, Lympstone, engineer, 1 share; Wm. T. Purvis, 13, Albany Street, Edinburgh, consulting engineer, 1 share; T. Cox, Victoria Street, Burnham, auctioneer, 25 shares; W. J. Pople, Woodlands, Burnham, builder, 5 shares; W. Barrons, 4, Redlands, Tiverton, retired surveyor, 50 shares; Wm. Lawrence, 31, College Street, Burnham, butcher, 50 shares. Minimum cash subscription, £2,500. The number of directors is not to be less than three or more than five; the first are T. Cox, Wm. Barrons and Wm. Lawrence; qualification, £25; remuneration as fixed by the company; solicitor, G. A. Morgan, 1, Woodbury Lane, Clifton, Bristol. Registered by Waterlow Brothers & Layton, Ltd., Birchin Lane, E.C.

Percy G. Green & Co, Ltd. (130,003).—This company was registered on July 8th, with a capital of £8,000 in £1 shares (4,000 preferred), to take over the business of an electric wire coverer, cable manufacturer, and dealer in ropes, yarn, woven wire and wire goods carried on by P. G. Green, of the Paragon Wire Mills, 10 and 12, Norman's Buildings, St. Luke's, E.C. The subscribers are:—A. Sissons, Hillside, Horsell, Surrey, accountant, 100 shares; P. G. Green, Lacksley, Chingford, manufacturer, 1 share. Private company. The number of directors is not to be less than two or more than five; the first are A. Sissons and P. G. Green; qualification, 100 shares. Registered office, 10 and 12, Norman's Buildings, St. Luke's, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dacolight Engineering Co., Ltd.—Particulars of £1,500 debentures, created July 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Lea, Son & Co., Ltd.—Particulars of £2,000 debentures, created June 18th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount now being issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction in full on June 27th, 1913, of debentures dated October 26th, 1912, securing £500, has also been notified.

City of Las Palmas Water and Power Co., Ltd.—Trust deed dated June 12th, 1913, to secure £237,000 first mortgage debenture stock, at 5 per cent. interest, charged on a concession for works and services for the supply of water and utilisation of water for providing electricity granted by the Municipality of Las Palmas to Bernardo de la Torre y Comminges, and all lands, works, buildings and fixed plant in connection therewith capable of being specifically mortgaged, together with all income derived from or received in respect of the said concession, and company's undertaking and other assets, present and future, including uncalled capital. Trustees: The Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, Old Broad Street, E.C. The company assigns to the trustees all amounts by way of penalty it may become entitled to under a contract dated November 15th, 1912.

Thompson Bros. (Blackburn), Ltd.—Particulars of £1,000 debs., created June 24th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Helsby Wireless Telegraph Co., Ltd.—Particulars of £2,510 debs., created June 19th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Naylorgraph, Ltd.—Second debenture dated June 25th, 1913, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to prior debenture for £1,000). Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Lamplough & Son, Ltd.—Mortgage on the company's undertaking and property, present and future, including uncalled capital, dated June 17th, 1913, created by the receiver and manager, to secure £700. Holders: A. H. P. Strickland and H. Horne, 37, Fleet Street, E.C.

Bridgwater and District Electric Supply and Traction Co., Ltd. (75,429).—Return dated May 14th, 1913. Capital, £20,000 in £1 shares (5,000 pref.); 12,999 ord. and 525 pref. shares taken up; £1 per share called up on 4,017 ord. and 525 pref.; £4,552 paid, including £1 on 16 forfeited shares; £8,882 considered as paid on the remainder ord. shares. Mortgages and charges: £12,000.

British Insulated and Helsby Cables, Ltd. (72,251).—Return dated March 31st, 1913. Capital, £1,000,000 in £5 shares (100,000 pref. and 100,000 ord.); all shares taken up; £572,675 paid on 74,470 pref. and 40,065 ord.; £427,325 considered as paid on the remainder. Mortgages and charges: £700,000.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Return dated June 4th, 1913. Capital stated in return as £750,000 in £5 shares (75,000 pref. and 90,000 ord.). Balance-sheet says £825,000, which appears to be correct. £825 considered as paid. Mortgages and charges: £450,000.

Brook, Hirst & Co., Ltd. (95,264).—Return dated January 7th, 1913. Capital, £20,000 in £1 shares; £12,500 shares taken up; £12,500 paid. Mortgages and charges: £7,000.

Egham and Staines Electricity Co., Ltd.—Issue on June 26th, 1913, of £400 debentures, part of a series of which particulars have already been filed.

Woodbridge and District Electric Light Co., Ltd.—Particulars of £2,000 debentures, created February 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—Issue on July 10th, 1913, of £129 debentures, part of a series of which particulars have already been filed.

Samuel Greatrix, jun., and Brother, Ltd.—Particulars of £30,000 second debentures, created May 13th, 1898, and having the benefit of a trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £4,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and Alport Works, Quay Street, Manchester. Trustee: G. W. Fox.

I. Frankenburg & Co., Ltd.—Notice is given that a mortgage debt of £15,000 existing on property purchased and advised as outstanding pursuant to Sec. 12 of the 1907 Act, was satisfied to the full extent on June 1st, 1913.

CITY NOTES.

Paignton Electric Light Co., Ltd.

AT the annual meeting the directors reported that the whole of the machinery and plant, including the refuse destructor, was working in a very satisfactory manner, and the supply of current had been given uninterruptedly throughout the year. Additional traction plant was found necessary in order to give the maximum of 250 KW. to the Torquay and Paignton tramways, and this had been erected at a cost of £1,500. Since December 31st a supplemental agreement had been entered into between the two companies for the additional energy required by the tramway company. The amount expended on capital works during the year was £3,064. Ordinary shares had been issued to the extent of £1,255, and a further 500 second mortgage debentures had been issued. Trading showed a profit of £787, and from this £427 was taken for depreciation and £27 10s. towards reduction of the debenture suspense account, leaving a gross profit of £332. The sale of electricity for the past year had increased from £1,667 to £2,694. The directors congratulated the shareholders on the rapid development of the business, and had little doubt that in the near future a remunerative dividend would be payable.

MR. W. J. HAM, C.C., the chairman, said they were doing much better than they expected in five years, but they had been, unfortunately, obliged to spend more in capital than was raised by shares. Had the balance of shares (£3,420) been taken up, the income would have been £150 a year better for the last two years, while the coal strike cost them £800 in extra price and carriage.

The report was adopted.

In reply to questions, the CHAIRMAN said that if the shares were all taken up, the company could start with about a 3 per cent. dividend.

Metropolitan District Railway Co.—A distribution at the rate of 2½ per cent. on the second preference stock, as compared with 2 per cent. a year ago, is announced.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital stock.

Liverpool Overhead Railway Co.—The directors have declared interim dividends at the rate of 5 per cent. per annum on the preference shares and 2½ per cent. per annum on the ordinary shares, for the half-year, against 2 per cent. per annum for the corresponding period last year.

Yorkshire Electric Power Co.

The directors in reporting on the progress of the company say that there has been a considerable increase in the revenue from the sale of current for the past half-year, but the gross profit has been adversely affected by the high price of coal. The gross profit on the revenue account for the three corresponding half-yearly periods ending June 30th is :—

To June 30th, 1913, £10,240.
To June 30th, 1912, £5,805.
To June 30th, 1911, £6,633.

The net profit after payment of mortgage interest for the same periods is :—£6,972, £3,349 and £4,137. The balance available, including £645 brought forward from 1912, is £7,616. The directors recommend a dividend for the half-year ending June 30th, 1913, at the rate of 6 per cent. per annum on the cumulative preference shares amounting to £3,308, carrying forward £4,309. In addition to the current supplied to new customers during the half-year, there has been a steady increase in the amount required by existing consumers, who have continued to add to the machinery already driven from the company's mains. The station for generating current from waste heat at Barugh will shortly be at work, and will, when completed, add a further 5,000 KW. to the generating plant, with considerable increase to the security and efficiency of the company's supply. At the date of this report (July 15th) one-half of the recent issue of £50,000 of 6 per cent. cumulative preference shares of this company, and £17,450 of the issue of £25,000 of 5½ per cent. first mortgage debenture stock of Yorkshire Waste Heat Co., Ltd., had been applied for. Applications continue to be received, and the directors anticipate that the whole of both issues will shortly be taken up. Mr. Frederick James Kitson, of Leeds, has accepted a seat on the board. As a result of the company's increasing business new head office accommodation has been provided at Wellington Road, Dewsbury, to which address all communications should now be sent.

Consolidated Electrical Co., Ltd.

The directors' report for the year ending March 31st, 1913, states that the ordinary income for the period under review amounted to £6,004, in comparison with £5,605 for the previous financial year. In addition a profit of £12,545 was made on the sale of 70,000 shares in the Anglo-Portuguese Telephone Co., Ltd. The general charges for the year amounted to £1,252, in comparison with £1,286 for the preceding 12 months. Out of the profits of the year the directors have written off capital suspense account £542, realisation of assets account £635, and off investments £7,500, the last-named sum representing the company's holding of debentures in the Consolidated Supply Co., Ltd., which—as the shareholders had already been informed—had long ceased to have more than a nominal value. Of the balance of £9,700 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1913, absorbed £450, leaving a disposable balance of £9,250. The final dividend of 3 per cent. paid on the preference shares on the 1st inst. absorbed a further £450, and the directors now recommend the payment of a dividend on the ordinary shares of 3¾ per cent. for the year ending March 31st, 1913. This will require £4,125 and leave a balance of £4,675 to be carried forward. The directors are satisfied that the valuation placed upon the company's investments in the balance-sheet is within their intrinsic and realisable worth. These and the cash balances represent the liquid assets of the company. "The directors intend, at the forthcoming general meeting, to consult with the shareholders as to the future of the company."

The eleventh ordinary general meeting was held at the Institute of Chartered Accountants, Moorgate Place, E.C., on Monday, Mr. H. Allen presiding.

The CHAIRMAN, in moving the adoption of the above report, said it would be remembered that they turned over the manufacturing business to the Consolidated Supply Co., but that company did not manage to make the works pay, and as that asset was not of any tangible value they thought it better to write it off. A year ago they paid a dividend of 3½ per cent. on the ordinary shares, free of income-tax, and they now recommended a dividend of 3¾ per cent., less income-tax, which was practically the same thing as 3½ per cent., free of income-tax. Personally, he thought it was a great mistake to pay dividends free of income-tax. In the report the directors stated that they were satisfied that the valuation placed upon the company's investments in the balance-sheet was within their intrinsic and realisable worth, and these and the cash balances represented the liquid assets of the company. In regard to their investments, the whole of them were readily realisable, and they could realise them to-day at a profit. At the present time they realised a fair amount of interest. The Chairman reverted to the sale of the shares in the Anglo-Portuguese Telephone Co., and said they were quite satisfied with the price they got from the shares. In the report they referred to the future of the company, and they invited the shareholders' opinions on that question.

MR. C. WOOLLEY seconded the motion.

MR. WETHERALL said he was sorry that the directors had sold the shares in the Anglo-Portuguese Telephone Co., and he thought it would have been better if they had had the value of the shares in kind rather than in cash. He thought if that had been done a higher price would have been obtained for the shares. He felt that the company should be wound up; for, whilst he had very great respect for the chairman and directors, he preferred to invest his own money, and he did not like to go into trust corporations. They should get whatever they could in cash, and he would urge the liquidation of the company.

MR. DAVIES asked what they would get per share in the event of winding up.

DR. OWEN agreed with Mr. Wetherall in the views he had expressed as to winding up.

Further discussion ensued, and the CHAIRMAN, replying, said their control of the Anglo-Portuguese Co. had been a successful control, but there was nothing to hold the shares for any longer. The state of Portugal was anything but satisfactory, and none of them could see what course events would take there in the next few years. The directors sold the shares with the best intentions and with the best results, and he did not think that any other board could have got the price they did. They got 25s. per share, and Mr. Wetherall must remember that if he had the shares in kind, he would not have had 25s. a share but £1 shares. The Consolidated Supply Co. was in liquidation, and they had done with that company. If they decided to wind up, the shareholders would get a little over 10s. per share after the expenses of liquidation were met. The chairman stated that Mr. Michall had sent in a series of questions, and having dealt with them, he went on to refer to the proposed winding up of the company, and said they had a large body of shareholders to whom it would be a very great source of regret if they should have to do so. But the directors felt that the time had come when the company should be wound up, and they thought that they might have been able to prepare some scheme to put before them that day. That they had not been able to do, but probably there would be an early winding up of the company with a distribution of the assets in cash.

The report was then adopted.

In the course of further discussion, several shareholders were anxious to submit a resolution in favour of winding up, but this, it was pointed out, could not be submitted that day, and Mr. Kingsbury said that in view of the record of the company they would hardly be justified in passing such a resolution, and the chairman said that probably within a few weeks proposals would be submitted for the almost immediate winding up of the company and the realisation of the assets.

A vote of thanks to the chairman terminated the proceedings.

Chatham and District Light Railways Co.—The directors' report for the half-year ended June 30th, 1913, shows that the revenue was £23,070 and the expenses were £13,068, leaving £10,002, less rent of Rochester Corporation lines £1,872, interest on debentures £1,058, interest account £338, leaving £6,734, plus £562 brought forward. Out of the balance of £7,296, £2,940 is required for dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital, £1,590 for dividend at the rate of 3 per cent. per annum for the half-year on the ordinary share capital, and £2,766 is to be carried to revenue new account. The traffic receipts show an increase of £1,143, and the expenses an increase of £657, as compared with the receipts and expenses for the corresponding half-year of 1912, the increase in expenses being mainly due to the enhanced price of coal. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Minas Geraes Electric Light and Tramways Co. (Companhia de Electricidade e Viacao Urbana de Minas Geraes).—£120,000 5 per cent. first mortgage bonds (Nos. A 1 to 1,000 of £20, and B 1 to 1,000 of £100 each).

United River Plate Telephone Co., Ltd.—Further issue of 54,000 ordinary shares of £5 each, fully and partly (£3) paid.

And to allow the following securities to be quoted in the Official List :—

La Plata Electric Tramways Co., Ltd.—30,000 additional 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 170,001 to 200,000).

Central London Railway Co.—The Underground Electric Railways Co. announce that the Central London Railway holders of non-assenting stocks will receive a dividend in respect of the undivided ordinary stock at the rate of 3 per cent. per annum, and on the preferred ordinary stock at the rate of 4 per cent. per annum. The dividend on the deferred ordinary stock is not payable until the results of the working for the year to December 31st have been ascertained. Those shareholders who are registered holders of the guaranteed assented ordinary, guaranteed assented preferred ordinary, and guaranteed assented deferred ordinary stocks, will receive a dividend at the rate of 4 per cent. per annum on September 1st.

London and Suburban Traction Co., Ltd.—The directors have declared the full dividend on the 5 per cent. cumulative preference shares for the half-year ended June 30th.

London Electric Railway Co.—An interim dividend is announced on the 4 per cent. preference stock at the rate of 4 per cent. per annum, and on the £10 ordinary shares at the rate of 1 per cent. per annum.

Kaministiquia Power Co. — The directors have declared a dividend of 1¼ per cent., or at the rate of 5 per cent. per annum, on the common shares for the quarter ending 31st inst.

South American Light and Power Co., Ltd.

Mr. T. Penn Gaskell, M.Inst.,C.E., chairman, presided on Tuesday at Dashwood House, E.C., over the tenth annual general meeting of the above company.

In moving the adoption of the report, the Chairman said they were able to pay a dividend of 5 per cent. on the shares this year, against 4 per cent. last year, and that was after writing off £912 against the expenses of the debenture issue. Since the close of the financial year, they had received a return from April, which was the first month of the current year, and this showed a profit of about £600 over the corresponding month of last year, or about 15 per cent. If that went on, and from all accounts Blanca was in a much more prosperous condition than it was last year, they might expect an increase in the dividend next year. Probably it would be an increase of 1 per cent., or something of that kind, for they had quite a large deficiency against the debenture issue, and they would like to pay off some of that deficit. He did not know that there was anything special to call attention to, for the business of the company seemed to be progressing very satisfactorily.

Mr. E. Charrington, in seconding the motion, said the most satisfactory feature of the year was that they had increased the number of their consumers from 1,381 to 1,706. The company was going ahead now. The capital expenditure was very moderate last year, and they had now only to go on increasing the cables and connecting consumers. That was their chief source of expenditure, and was bound to increase. They had got into smooth water and were bound to go ahead.

The report was adopted.

Ceara Tramway Light and Power Co., Ltd.

The report to June 30th last, states that the company was registered on December 11th, 1911, but did not commence active operations until June, 1912, when it definitely took over from the vendors the mule tramway and concession for electrification. A contract was entered into about the same time with the South American Railway Construction Co., Ltd., for the complete electrification of the tramway system and the establishment of a lighting and power installation. Under the construction contract the contractors undertake, until the final handing over of the completed electric system, to work the existing mule system and to bear and pay all the expenses of this company (including the interest on the debenture stock). The contractors report that the receipts of the mule tramways are very satisfactory, notwithstanding the disorganisation caused by the electrification work. There have been considerable delays in the prosecution of the electrification work, but from the latest reports from the company's resident engineer satisfactory progress is now being made, and the starting up of the first section of the tramway may be expected shortly.

Mr. Charles Hunt presided at the offices, 42, New Broad Street, E.C., on Monday, over the first annual meeting of the company. In moving the adoption of the above report, he said that the accounts were of very little interest to them as shareholders, and, were it not for the provisions of the law which provided that a general meeting must be held about this time, it might have been deemed convenient to have deferred calling them together until a later time, when information and figures of a more vital character could be placed before them. They were a company which, at the moment, was not in working possession of its property, but was simply waiting the time when its contractors should have completed the works which they had contracted to carry out, when they would be handed over to them in a complete working state. It was anticipated that that time would have arrived ere this, but delays, unavoidable for the most part, had occurred in the construction work, which would have the effect of deferring for a short time the taking over by the company of the working of the new installation, but the consulting engineers estimated that the power installation would be sufficiently advanced to allow the starting up of the first section of the new system about the end of August. The consequences of these delays, however, did not fall upon the company, as, until the handing over took place, the contractors were liable to defray all the expenses of the company, including the interest upon its issued debenture stock. Through their consulting engineers, the board were keeping closely in touch with the work being carried out by the contractors, and felt confident that the company's interests were being well watched. The selection of a competent staff was also a matter to which the board were directing their attention. It would be obvious that the company must be quite ready in this respect when the time arrived to take over the working of its property. The board had conferred on this matter with the contractors with a view to preserving, as far as possible, some continuity in the technical and business management of the tramways, and it had already been arranged that the gentlemen selected by the company for the chief direction of its local affairs should be employed by the contractors in connection with the construction works and management of the existing tramways, so that, when the time came for the company to assume responsibility for working, its chief employés would already have had a fair acquaintance with the property which it would be their business to direct. In accordance with this arrangement, the gentleman who had been selected by the board as their general manager, Mr. E. M. O. Scott, was now in Ceará acting as the manager of the existing mule system for the contractors. The secretary, who was at present in Ceará, would during his stay there, confer with Mr. Scott upon the various matters which would require attention before the company was ready to take over. Although not directly concerned, the board obtained from time to time information respecting the traffic movements on the existing mule tramway, and he was glad to say that, in spite of the certain amount of disorganisation necessarily attendant upon the electrification work, the figures indcated progressive movement. Reports which had also been received from the consulting engineers and others indicated that the prospects of the electrified system were even more favourable than was originally considered. The track would be extended 47 per cent., and the car service trebled, and, judging from the present receipts from the disorganised mule tramway, the receipts from the electrified tramway system, when completed, should largely exceed the original estimate. He, therefore, looked forward with confidence to meeting them at subsequent gatherings, feeling that they were interested in a property which had a solid prospect of a prosperous future, and that the results of working an electric tramway, light and power business in Ceará would prove as favourable as had been the case with other concerns of a like nature in South America.

Mr. A. A. Campbell Swinton seconded the resolution, which was carried without discussion.

Prospectuses.—*The United Salt and Power Co., Ltd.*—The list is to close to-day in an issue of 235,000 6 per cent. cumulative participating preference shares of £1 each in this company, which is formed to acquire Patent No. 28,171 of 1911, relating to the Brodie process for the manufacture of salt and electrical power, to purchase 14 acres of proved brine land at Middlewich, Cheshire, together with preliminary plant erected there by Mr. Brodie for the purpose of demonstrating the working of the process under ordinary conditions. It is estimated that with a plant capable of manufacturing 400,000 tons of salt per annum, the steam available would suffice to produce 2,000 KW. of electrical power, which would be treated as a by-product, and "if sold at the extremely low price of ¼d. per unit, would produce an additional £10,000 per annum net profit for the company." No difficulty is anticipated in selling the surplus power. Tenders received from Messrs. Mirrlees, Watson, Messrs. Manlove, Alliott & Co., and Messrs. Babcock & Wilcox, show that the complete plant of the company can be put down for £120,000. Reports have been prepared by Mr. J. Swinburne and Messrs. Baillie & Dobrée, and their estimates of profits show £82,083 profit available before allowing for management and administration expenses, or for preference dividend.

Bristol Tramways and Carriage Co., Ltd.—The list was to close on Wednesday in an issue of a further £250,000 4½ per cent. mortgage debenture stock at 92½ per cent. The money is to be used to meet outlays made, or to be made, in connection with the development of the motor and motor-omnibus services.

R. Waygood & Co., Ltd.—We read in the financial Press that the recent share issue was largely over-subscribed.

Lanarkshire Tramways Co.—The directors' report for the half-year ended June 30th, 1913, states that the revenue was £43,450, and the expenses were £24,655, leaving £18,794, less contributions payable to local authorities £1,433, interest on debentures £911, and interest account £644, leaving £15,806, plus £1,577 brought forward, making the balance £17,383. £10,290 is to be absorbed by a dividend at the rate of 6 per cent. per annum for the half-year on the share capital, £7,093 being carried to revenue new account. The traffic receipts for the half-year show an increase of £6,314, and the expenses an increase of £3,182, as compared with the receipts and expenses for the corresponding half-year of 1912. A service of motor-'buses was inaugurated during the half-year, and commenced running in April between Newarthill and Cleekhimin, but the result so far, from the company's point of view, has not been satisfactory. The Lanark County Council are proceeding with the construction of tramways from Uddingston to Bellshill, Mossend and New Stevenston. It is anticipated that part of the tramways will be in operation by the end of August and the remainder by the end of October. These tramways will be leased to the company under the agreement with the Lanark County Council. Twelve cars have been ordered to meet the additional traffic, and the car-shed is being extended. The directors will, as usual, provide for depreciation in the accounts to December 31st next.

Bulawayo Waterworks Co., Ltd.—In their report for the year ended December 31st, the directors say that the total demand for electric supply during the year from all sources amounted to 260,961 units as compared with 140,500 for 1911, the gross profit being £8,651, as compared with £6,840. Included in the above total are 61,599 units required for pumping water and 41,921 units for electric power. It is expected that the demand for power purposes will steadily increase.

City and South London Railway Co.—Interim dividend for the first half of the year ending December 31st next on the 5 per cent. preference stocks, 1891, 1896, 1901, and 1903, at the rate of 5 per cent. per annum: on the consolidated ordinary stock at the rate of ¼ per cent. per annum.

St. James's and Pall Mall Electric Light Co., Ltd.—Interim dividend for the June half-year at the rate of 10 per cent per annum as last year.

Chili Telephone Co., Ltd.

Mr. Geo. Keith (chairman) presided on July 17th, at the offices, 42, Old Broad Street, E.C., over the meeting of the above company.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 69), said that the business had made excellent progress during the year under review. The gross revenue in Chile had increased during the year about 23 per cent., which improvement was partly due to the adjustment of the rates to meet the lower value of the currency and partly to the general expansion of business throughout the company's system, especially in the large centres of population, Santiago, Valparaiso and Concepcion. The working expenses in Chile amounted to 48 per cent. of the revenue or a decrease of 1 per cent., which had added considerably to the net currency revenue, but, on the other hand, the sterling value had suffered somewhat from the lower average rate of exchange which came out at about ⅛d. less than it did the year before. As to the revenue account, the net income from Chile showed an increase for the year of £10,413. Interest brought in £748 less due to the sale of some of their securities during the year. The London office expenses showed an increase of £34, and income-tax was £109 more. The result of the year's business was a credit balance of £58,388, of which £17,565 was expended in Chile on replacing and improving plant, and £13,904 had been carried to reserve. The reserve account now stood at £76,000, whilst the capital expenditure account was increased by £17,874, expended during the year on extending the property and plant in Chile. The investments remained the same as last year. He congratulated the shareholders on the result of the year's operations. A large amount of constructive work had been carried out during the year to meet the growing requirements of the business. The placing of the lines underground in the City of Santiago had been satisfactorily proceeding; the trunk and junction lines at various centres had been largely increased and extended, and 17 new provincial offices had been opened for service throughout the central and southern districts. For some years past the company had acted in an advisory capacity for the Ecuador Telephone Co., and lately an opportunity presented itself for acquiring the undertaking for a nominal sum. The directors, thinking that with care and perseverance they would be able to improve it, took over the concern, and it was now being worked as a subsidiary company. The prosperous condition of Chile was steadily improving, and the nitrate and other industries were doing well. The longitudinal railway was now open for traffic between Santiago and Serena, and it was expected the whole line would be completed this year. Great progress was also being made in port and other public works, all of which would contribute to the general prosperity in which their company would participate. He thought they might be well satisfied with the position of the company. Its relations with the Government and the authorities in Chile were very cordial and the business was being most ably managed by the staff.

The Hon. H. F. Allsopp seconded the motion, and it was carried.

Mr. Keith was re-elected a director, and the meeting closed with a vote of thanks to the board.

Japan.—A proposal to amalgamate the business of the Tokio Electric Light Co. and the Nippon Electric Light Co. is just now attracting considerable attention, and is the cause of great discussion in the Japanese capital. In connection with the matter, the following summary of the different electric lighting undertakings in Tokio may be of interest:—

	Authorised capital.	Capital paid up.
Tokio Electric Light Co.	£5,000,000	£3,440,000
Nippon Electric Light Co	1,200,000	300,000
Katsuragawa Hydro-Electric Co. ...	800,000	400,000
Kinugawa Hydro-Electric Co.... ...	1,350,000	993,000
City Electric Bureau	950,000	950,000
	£9,300,000	£6,083,000

The amount of capital raised in connection with the organisation of new electrical companies and the extension of old concerns in Japan during the first half of the current year amounted to £3,499,700, an increase of £2,194,200 over the corresponding six months of 1912.

The Keisei Electric Railway Co. is paying a dividend of 5 per cent., out of a net profit of £3,222.

Continental.—France.—A new company has just been formed in Paris (23, Rue de Rome) with a capital of £50,000 and the title La Société des Acièries Electriques de Paris et de la Seine.

Switzerland.—La Société Electro-Metallurgique des Procédés Paul Girod, of Neuchatel, is being reorganised. The present capital of £480,000 is being written down to £288,000, and new shares issued to bring it back to the original amount.

The Gesellschaft Brown-Boveri Co., of Baden, reports a gross profit of £298,000 for the last financial year, as compared with only £225,730 in the preceding 12 months. The dividend is being increased from 7 to 8 per cent. It is also proposed to increase the capital of the company from £1,120,000 to £1,280,000.

Crompton & Co., Ltd.—Mr. E. Reeves, the liquidator, announces that the company having gone into voluntary liquidation for the purpose of reconstruction, the short term notes of the old company are now repayable. Bearers will be entitled, on presentation of their notes (before July 31st), to receive payment of the principal sums due, with interest from May 1st.

Blackpool and Fleetwood Tramroad Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

The markets of the Stock Exchange have regained a certain amount of buoyancy by reason of the renewed expectations of peace "breaking out" in the Balkans. Bears began to buy stock, and, on the strength of this, the House, as a whole, assumed a more cheerful complexion. Business on behalf of the general public was not, however, greatly stimulated, and, in view of past experience, a good many people elected to wait for further developments before believing the Balkans war to be really over.

Money Market conditions remain easier, but the best-informed quarters look for no fall in the Bank Rate. The idea is that the current minimum will remain in force until the usual autumn drain for gold sets in, when it may become necessary to raise the rate.

Home Railway dividend declarations opened with the announcement by the District Company of 2½ per cent. on the Second Preference, against 2 per cent. this time last year. The market regarded this as somewhat colourless, and the price of Districts did not move. The Second Preference stock has not yet been issued to the public; it is all held by the Underground Electric Railways, and the full rate to which it is entitled is 5 per cent. In Central London Ordinary the usual 3 per cent. has been declared; the only changes here are rises of 1 apiece in the Ordinary and Preferred Guaranteed Assented stocks. City and South London Ordinary gets ¼ per cent., as against 1¼ per cent. a year ago, but this, of course, is no longer quoted separately. The London Electric Ordinary shares will receive 1 per cent.; the 4 per cent. Debenture stock remains at 92.

Metropolitan Consolidated is ½ lower, but Great Northern and City Preferred shares have risen 5s. to 2¼, which is supposed to represent, roughly, the equivalent of Metropolitan Railway stock, to which holders will be entitled when it is exchanged for the shares. London and Suburban Traction 4½ per cent. Debenture stock dropped back to 70, holders being apparently frightened by the recently-advertised misfortunes that have befallen tramway enterprise in London. London United Tramways Debenture is a point lower at 58 for a similar reason. The London General Omnibus Company announces a dividend of 8 per cent. actual, but Underground Electric Railways "A" shares eased off a little. The £10 shares remained at 3½, while the 4½ per cent. bonds, on publication of the 'Bus Company's figures, rose 2 to 99. A new comer, Greater Omnibus Services, Ltd., has appeared this week, with a prospectus that aroused a good deal of criticism. The appeal to the public was based in no small measure upon the success of the London General Omnibus Company.

Changes amongst London Electricity Supply shares take the form of two small falls in Preference issues, and ⅛ rise in Westminster Preference. City 5 per cent. Debenture rose 1. Edmundson's Debenture is a point lower. Hove shares are up 5s. The market, as a whole, lacks interest, and business has fallen away to retail proportions. Electric Construction Preference are ⅛ higher, at 2 middle. British Westinghouse 4 per cent. Debenture shed 1, which was gained by the company's prior lien Debenture. Babcock & Wilcox shares are 1/32 easier. Shareholders are inquiring in what way the Admiralty's change of fuel is likely to affect, if at all, the Babcock Company. It may be observed, as a matter of curiosity, that proprietors in some of the colliery concerns are somewhat perturbed by Mr. Winston Churchill's speech in favour of oil.

Callender's, ⅛ up at 11, may be said to have recovered from the slight pressure to liquidate the deceased account, brief reference to which was made here last week. India-Rubber shares are ¼ higher at 11⅞.

There has been some recovery in Mexican issues, after their long and severe drop. News from the country is the reverse of reassuring, but it is contended that prices have had such a slump as discounts to a large extent the risks that remain. Mexican Tramways Sixes are again 2 points down, but in Mexican Light and Power Preferred there is a rally of similar amount, and the slant in the price of the Common shares has been stayed. Rio Tramway bonds, too, are firmer, the Firsts and Seconds both going up ½. British Columbia Railway stocks show advances. Shawinigan Water Capital stock fell 1, but the 4½ per cent. Debenture is 1½ to the good.

Further offering of Anglo-Argentine Tramways Second Preference reduced the price at one time to 4 3/16, from which there was a recovery to 4 5/16, leaving the shares 1/16 down on the week. The 5 per cent. Debenture at 97 is ½ better. Manila Bonds have hardened. Rangoon Preference fell ¼. Brazilian Traction remain at 88.

The revolution in China caused Eastern Extensions to lose ⅛, the group, however, being hard as a whole. Eastern 4 per cent. Debenture rose 1½. Globe Preference and Western Telegraphs are both ⅛ down. New York Telephones continue to be bought with persistency; another point advance has been scored. Telephone of Egypt Debenture has risen ½. National Telephone Deferred, after fluctuating with freedom, settled to 28½. Reuter's remain a weak market. The shares have gone back to 9¼ middle.

Pending the declaration of the dividend, Marconis kept very close to 3 1/16, at which they were 1/16 better on the week. The terms proposed for the new contract with the British Government are being studied with lively interest in the market. American Marconi's went up a little, to 17s., but soon reverted to 16s. 3d., and in Canadians the movements have been equally slight, the price at the moment being 9s. 6d. buyers.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9½ — 10½	..	5 14 8
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅜	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅝ — 9½	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8½	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅛ — 4⅜	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4	..	5 12 6
Do. Do. 4 % Deb. ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	+ ½	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	98 —100	..	4 10 0
County of London, Ord.	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	11¼ — 11¾	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅛ xd	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1¾ — 2⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	—1	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 8	+ ¼	5 12 6
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 8
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	7¼ — 7⅝ xd	..	5 15 5
London Electric, Ord.	8	2½	2½	1½ — 1¾	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	— ⅛	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8½ — 8⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4⅞	— ⅛	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	78½ — 81½	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	5 18 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	6	2⅜ — 8½	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/16 — 1 1/8	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4†	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	3	2½ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5½	+ ⅛	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	5	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	108 —112	..	6 5 0
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	⅝ — 1 3/16	..	6 3 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	5	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 5 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 3/16	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —101	..	4 19 0
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	57 — 61 xd	..	6 11 2
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	+2	7 4 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	123 —127	—1	4 6 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	+1½	4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅜d.	1 1/16 — 1 3/16	..	.
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93⅛ — 95⅛	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 —132	..	6 1 3
Do. Collat. Trust	$1000	4	4	90 — 92	+1	4 7 0
Anglo-American Telegraph ..	Stock	8	8	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	107½ —108½ xd	+ ½	5 10 6
Do. Def.	Do.	30/-	30/-	28¾ — 29¼	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 11
Chili Telephone	5	7	8	7 1/16 — 7 1/8	..	5 2 5
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83 — 85	..	4 13 7
Cuba Telegraph	10	6	6	8½ — 9⅛	..	6 6 4
Do. 10 % Pref.	10	10	10	15⅝ — 16⅜	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7⅛	..	6 18 0
Direct United States Cable ..	10	5	4	6⅛ — 6⅜	+ ⅛	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	124⅛ —127½ xd	..	5 9 10
Do. 8½ % Pref. Stock	Do.	8½	8½	73⅛ — 76½ xd	+ ⅛	4 12 9
Do. 4 % Mort. Deb.	Do.	4	4	92 — 94	+1⅛	4 5 1
Eastern Extension	10	7	7	11⅞ — 12⅛ xd	— ⅛	5 18 2
Do. 4 % Deb.	Stock	4	4	91 — 95	..	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	+ ½	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11⅛	..	5 8 9
Do. 6 % Pref.	10	6	6	11⅛ — 12⅜	— ¼	4 14 1
Great Northern Telegraph ..	10	18	20	30 — 32	..	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3¾	+ 1/16	5 6 8
Do. 7% Cum. Partic. Pref.	1	17	..	2⅞ — 3⅛	..	5 8 9
Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98⅜ — 99⅝	+ 1	4 10 6
Oriental Telep. and Elec. ..	1	8	10	15⅜ — 16⅜	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	+ 1	4 1 8
Reuter's	10	10	10	8⅞ — 9⅜	— ⅛	10 5 2
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	+ ½	4 12 9
United River Plate Telephone	5	5	8†	6⅜ — 7	..	5 14 4
Do. 5 % Cum. Pref. .. .	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 1/8	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	..	4 15 8
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	99 —100	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12⅜ — 12⅝	— ⅛	5 8 9
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 22nd.	Rise + or Fall —	Present Yield £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	5/16 — 7/16	..	Nil
Do. 5 % Pref.	1	5	5	33/64 — 35/64	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	..	..
Do. Do. Deferred	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	..	7 6 4
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	75 — 77	..	3 18 0
Do. Gtd. Assented	100	..	..	80 — 82	+1	4 18 9
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Gtd. Assented	100	..	..	82 — 84	+1	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1898	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1903	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	+ ¼	Nil
Hastings Trams, 6 % Pref.	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	9/16 — 13/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	15/32 — 23/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	—2½	6 0 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 22nd.	Rise + or Fall —	Present Yield £ s. d.
	*					
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	—1	6 13 4
Metropolitan Railway Consol.	100	17/8	1⅞	45¾ — 46¼	— ⅛	3 10 3
Do. Surplus Lands	100	2⅛	2⅛	61 — 63	..	4 7 4
Do. 8½ % Deb.	100	8½	8½	83 — 85 xd	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Con. Pref.	100	8½	8½	78 — 80	..	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32¾ — 33¼	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 6 11
Do. 8½ % Gtd.	100	8½	8½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91¼ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	9/32 — 13/32	..	..
Do. 5 % Pref.	1	6	5	11/16 — 13/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3⅜ — 3⅝	..	Nil
Do. "A"	1/-	4½	..	3/8 — 1/2	—1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	5	108 —110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	98 —100	+2	4 10 0
Do. 6 % Income	100	3	6 †	89½ — 90½	..	6 12 7
Yorkshire (West Riding), Ord.	5	..	..	1/2 — 9/16	..	Nil
Do. 6 % Pref.	5	..	3†	3 5/16 — 3 13/16	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¾ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 13/16 — 4 15/16	— 1/16	6 3 11
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	96 — 98	+ ½	5 2 0
Auckland Trams, 5 % Deb.	100	5	5	99 —101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	87 —89	..	6 14 10
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅜ — 5⅜	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	123 —128	+2	6 5 0
Do. Pref. Ord.	100	6	6	111 —116	+1	5 3 5
Do. 5 % Pref.	100	5	5	102½ —105½ xd	+1½	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 8
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 1/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	6	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	29/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 1/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87½ — 90½	..	5 10 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 — 101	+ ½	4 19 0
Mexico Trams Com.	$100	7	7†	89 — 92 xd	..	7 12 2
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 92	..	5 8 8
Do. 6 % Bonds	100	6	6	87 — 90	—2	6 13 4
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4¾ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ —105½	..	4 14 9
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	— ½	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	+1	5 1 0
Do. 5 % Mort. Bonds	100	5	5	91½ — 93½	+ ½	5 7 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	£500	5	5	99 — 101	..	4 19 9
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4½ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	+ ½	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	9/16 — 13/16 xd	..	7 7 8
Do. 6 % Pref.	1	6	6	25/32 — 27/32 xd	..	7 2 6
Babcock & Wilcox	1	28	16	2 25/32 — 8 1/32	—1/32	5 5 7
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 8
British Aluminium, Ord.	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	5	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	2	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb.	100	4	4	64 — 68	—1	5 17 8
Do. 6 % Prior Lien	100	6	6	100 —103	+1	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅝ — 11⅜	+ ⅛	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3⅝ — 3¾	..	5 6 8
Do. Deb.	100	4½	4½	108 —106	..	4 4 11

Crompton & Co.	..	..	..	..	.. — ..	..	..
Do. Deb.	100	5	5	64½ — 69½	..	8 8 0
Dick, Kerr	1	5	Nil	5/16 — 9/16	..	..
Do. Pref.	1	6	5	13/16 — 15/16	..	7 18 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1½ — 1⅝	..	7 5 6
Do. Pref.	2	7	7	1⅞ — 2⅛	+ ⅛	6 11 9
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9¾ — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11½ — 12½	+ ½	6 2 5
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	84½ — 86½ xd	..	6 11 7
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1913.

ALTHOUGH the export total for the month of June—amounting to practically half a million pounds—was considerably lower than the figure recorded in the previous month, viz., £638,271, yet the general business of June (excluding telegraphic exports), reached a somewhat higher level.

Electrical machinery and battery exports improved, but cable exports fell away considerably, as also to a small extent did the telephonic and certain other sections.

The imports for the month, valued at £211,256, also show some falling off as compared with the May figures. In this case, decreases were fairly generally distributed, but most marked in the case of the machinery sections; exceptions to the rule, however, were telegraphic and telephonic imports, which added some £14,000 to the May total.

The re-exports reached £26,304, a figure which compares somewhat badly with the £34,569 recorded in the previous month.

India was our most prominent customer during the month, with Canada not far behind; South America, Australia, China and Japan were also well represented. Germany, as usual, was the leading importer into this country, and, amongst the others, Canada was represented for a considerable value.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,016	144	468	154	2,912	151	8,196	140	15	22	10	2,724	16,952
Germany	2,971	979	41	27	619	9	3,000	...	53	88	...	338	8,125
Netherlands, Java and Dutch Indies ...	778	1,229	93	11	...	24	834	...	12	52	121	827	3,981
Belgium	377	426	201	...	154	2	2,330	25	4	8	765	382	4,674
France	214	...	3,638	...	...	...	7,239	1,680	58	95	529	5,000	18,453
Portugal	257	249	...	...	...	...	203	15	78	13	428	56	1,299
Spain, Canary Isles and Spanish N. Africa...	2,412	2,426	140	82	275	290	7,313	34	29	171	90	7,047	20,309
Switzerland, Italy and Austria-Hungary ...	1,358	40	324	22	32	19	1,541	6	...	291	18	8,087	11,738
Greece, Roumania and Turkey	177	42	20	150	...	...	257	...	31	11	1,253	3,385	5,326
Channel Isles, Gibraltar, Malta and Cyprus...	61	457	33	224	...	115	215	...	32	22	75	377	1,611
U.S.A., Philippines, Cuba, &c.	504	...	153	...	35	22	861	...	25	...	...	37	1,637
Canada and Newfoundland	996	10,555	347	461	10	3,402	11,691	...	12,679	15	2,335	3,766	46,257
British West Indies and British Guiana ...	130	...	26	36	...	180	244	...	22	...	11	...	649
Mexico and Central America	2	38	11	...	...	...	4,770	...	...	...	42	256	5,119
Uruguay and Paraguay	131	128	5	163	...	18	48	...	195	120	61	111	980
Chile	152	...	...	65	...	208	3,570	2,620	184	22	855	9,326	17,002
Brazil	459	1,346	2,290	40	173	187	4,875	2,711	1,129	30	2,915	5,251	21,406
Argentina	3,808	2,941	673	1,034	615	584	17,048	5,266	1,732	119	7,417	235	41,472
Colombia, Venezuela, Ecuador and Bolivia...	294	157	74	69	38	...	1,080	5	50	...	129	...	1,896
Egypt, North Africa and Persia	1,837	144	173	99	801	70	2,602	50	96	38	207	503	6,614
British West Africa	20	518	75	27	58	...	49	...	203	...	179	76	1,205
Rhodesia, O.R.C. and Transvaal	2,148	60	398	938	...	556	6,251	...	192	...	5	104	10,652
Cape of Good Hope	2,372	1,091	322	1,631	18	1,477	2,647	69	1,749	5	3,613	2,335	17,329
Natal	786	5,170	611	388	203	214	1,164	57	107	...	148	94	8,942
Zanzibar, Brit. E. Africa, Mauritius & Aden	246	31	67	66	...	148	852	1,074	...	...	218	367	3,069
Azores, Madeira and Portuguese Africa ...	99	921	70	...	26	103	1,648	163	673	...	921	1,291	5,915
China and Siam	1,518	8,397	1,130	293	...	1,571	1,532	7	73	...	1,131	9,548	25,200
Japan and Korea	350	66	1,081	22	...	1,980	18,856	519	499	...	...	...	23,373
India	5,549	7,135	2,064	2,388	343	1,383	24,183	2,573	3,216	243	1,078	3,400	53,555
Ceylon	758	178	321	40	...	56	641	204	80	...	196	134	2,608
Straits Settlements, Fed. Malay States, Brit. Borneo and Sarawak	620	699	784	227	86	837	6,455	27	121	101	2,863	2,794	15,614
Hong Kong	814	1,216	37	...	...	431	541	...	22	...	204	10	3,275
West Australia	97	397	126	562	...	73	941	...	445	...	51	321	3,013
South Australia	501	942	623	343	...	109	714	1,440	44	...	342	...	5,058
Victoria	1,515	4,699	349	1,261	76	175	4,870	763	787	...	946	90	15,531
New South Wales	903	16,208	704	999	119	1,873	8,860	2,146	579	...	1,290	6,398	40,079
Queensland	549	137	44	38	...	209	6,091	98	5	...	6	200	7,377
Tasmania	36	38	...	...	...	...	...	...	...	...	9	...	83
New Zealand and Fiji Islands	994	3,950	801	966	42	732	4,230	678	427	...	9,364	433	22,617
Total, £	38,809	73,154	18,317	12,826	6,635	17,208	168,442	22,370	25,640	1,466	39,825	75,303	499,995

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	125	...	8	14	...	...	4,516	...	758	...	8,074	13,495
Germany	2,432	19,953	3,232	8,983	7,097	2,354	38,208	4,069	2,695	7,055	8,567	104,645
Holland	...	...	...	513	397	...	...	180	...	...	...	1,090
Belgium	1,723	6,187	152	131	21	2	3,559	185	297	276	5,033	17,566
France	188	800	1,270	362	199	722	2,514	250	166	3,755	1,338	11,564
Switzerland	649	198	36	5	2	433	2,518	251	...	64	124	4,281
Italy	88	3,160	10	...	4	...	940	...	...	...	141	4,343
Austria-Hungary	...	379	...	450	164	...	68	...	62	198	324	1,645
United States	4,411	787	1,394	3	186	46	7,611	21,582	309	338	8,554	45,221
Canada	180	...	...	...	...	8	...	...	...	...	6,622	6,810
Total, £	9,796	31,464	6,102	10,461	8,070	3,565	59,935	26,517	4,287	11,686	38,777	210,660

Additional imports: Spain, carbons, £596.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	12,823	2,203	...	1,660	230	...	8,343	...	75	698	272	26,304

TOTAL EXPORTS: £499,995. TOTAL RE-EXPORTS: £26,304. TOTAL IMPORTS: £211,256.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRIC STEEL FURNACES IN SHEFFIELD.

With Special Reference to Messrs. Darwin and Milner's Tool Steel Furnace.

The electric steel furnace appears at last to be emerging from the experimental stage in this country. In Scandinavia large furnaces of this type have been in operation for years past, but there the availability of cheap hydro-electric power has facilitated experiments on a large scale. As to the advantages of electric steel furnaces, *per se*, there can be no doubt. The crucial factor determining their use is purely commercial, and is the price at which electrical energy is available. In Norway hydro-electric power is available at 0·05d. per unit (£1·75 per KW.-year), but the largest power distribution companies in this country cannot supply energy at less than 0·33d. per unit (£12 per KW.-year), and even this tariff is only available to consumers offering a very large demand of exceptionally high load factor.

In Sheffield, the city to which we at present confine our attention, energy is supplied to electric steel furnaces at 0·6d. per unit, or alternatively at £4 per annum per K.V.A. demand + 0·25d. per unit consumed. The latter tariff enables a minimum price of 0·38d. per unit to be reached for demands of 100 per cent. load factor, but at 50 per cent. load factor—a figure which can hardly be exceeded as an annual average in steel furnaces operation—current costs 0·5d. per unit on the "demand" tariff. Unless the load factor exceeds 30 per cent. or 35 per cent., the flat rate is the more economical. These tariffs compare unfavourably with those operative in Scandinavia and other countries blessed with powerful waterfalls but, owing to their inherent merits, electric steel furnaces have made steady progress in Sheffield during the past three or four years, and the experience gained with them has been such that their use is now likely to extend rapidly.

At the present time, there are three steel furnaces supplied from the Corporation mains and a fourth equipment is in course of installation. In addition to these, there are electric steel furnaces owned by Messrs. Vicers and supplied from their own generating plant. Single-phase furnaces have been installed by Messrs. Edgar Allen and Messrs. Thos. Firth, and a two-phase furnace is about to be installed by Messrs. Keyser, Ellison & Co., of a type similar to that which has been in successful use by Messrs. Darwin and Milner for several years past and which is described in detail below.

From the description of the Sheffield electricity supply undertaking which recently appeared in these columns,* readers will remember that energy for power applications in this district was, until recently, supplied at 2,000 volts, 50 cycles, two-phase, but that 11,200-volt, 50-cycle, three-phase generation and distribution is now practised and will be continued in all extensions. The first electric steel furnaces in Sheffield were supplied through two-phase—one-phase motor-generators, the low-tension supply being at 28 cycles in Messrs. Allen's installation, and at even lower frequency in Messrs. Firth's plant. The demand of a steel furnace is too heavy to be carried unbalanced across one-phase of a two or three-phase system, hence motor-generators will, of necessity, continue to be used for single-phase furnaces in Sheffield. Messrs. Darwin & Milner's furnace, and that about to be installed by Messrs. Kayser, Ellison, are of a two-phase type, and are supplied in the first case by direct static transformation from the two-phase mains, and in the second case through Scott T-transformers from three-phase mains. In both cases, the furnaces are operated at 50 cycles; it is only in induction furnaces that this frequency is objectionably high and in the present cases, the only advantage of lower frequency would be slightly reduced transformer iron losses.

Messrs. Edgar Allen's electric furnace is chiefly used to prepare steel for casting and is never charged with cold metal. Messrs. Firth's furnace is frequently used to melt from scrap but its chief application is to the refining of metal previously melted in a Siemens furnace. The work which has been carried out in Messrs. Allen's and Firth's furnaces has been chiefly of an experimental and very varying nature—leading to the accumulation of a large mass of data not easily reducible to a form suitable for publication, but Messrs. Darwin & Milner have specialised in the electric-furnace manufacture of titanium and vanadium tool steels, and, by their courtesy, we are now able to publish the following particulars of their equipment, method of working and results obtained. In the latter connection, it must be emphasised that the data quoted below are actual average working results, as distinct from the unreliable figures obtained in preliminary experimental work such as the extraordinary "snap" data frequently advanced by furnace makers as capable of realisation under continuous working conditions.

The two-phase electric steel furnace used by Messrs. Darwin & Milner is the joint invention of Grönwall, Lindblad and Stalhaue, and is exploited in this country by Messrs. Electro-Metals, Ltd. The external appearance of the furnace in use is shown in fig. 1. Referring to fig. 2,



Fig. 1.—Electric Steel Furnace at Messrs. Darwin and Milner's Works, Sheffield.

which shows the furnace in side and front sectional elevation, it will be seen that the A and B phase arcs are struck in parallel, between the charge and adjustable vertical carbon electrodes. The neutral electrode, to which current flows through the charge, consists of a massive carbon block protected from the molten metal by the basic (dolomite and magnesite) lining of the furnace and attached to the neutral terminal casting by a special conducting cement.

The fact that two-phase current is used in the furnace enables supply to be taken from two-phase or three-phase networks (such as are now almost exclusively used for power distribution), through static transformers—without the intervention of motor-generators, which inevitably give trouble when supplying the irregular and heavy current demand of steel furnaces. During the melting of scrap metal, it is practically impossible to prevent frequent extinction of the arc due to falling about and subsidence of pieces of metal. The arcs being in parallel in the present furnace, the extinction of one arc merely reduces the instantaneous demand by 50 per cent., but, in a furnace with series arcs, the extinction of either throws the whole demand off the mains until both arcs are re-struck. This point is of great importance from the electricity supply point of view, and it is interesting to note that the present furnace alone, among those now connected to the Corporation mains in Sheffield, is permitted to start melting cold scrap during the evening peak load hours. From the furnace user's standpoint, parallel arcs offer the advantage of more rapid and economical melting.

A further advantage of the electrode arrangement shown in fig. 2 is that a vertical, as well as a horizontal, circulation of the molten metal is set up electromagnetically. Not only does this circulation ensure even and efficient heating of the

* Electrical Review, August 30th, 1912, pp. 324 *et seq.*

charge and prevent excessive local heating of the furnace lining, but it also expedites the desired chemical actions by bringing the whole of the charge successively into intimate contact with the refining slag. The basic lining covering the bottom electrode of the furnace is a secondary or electrolytic conductor (but possesses sufficient conductivity when cold to enable the furnace to be started up without difficulty), and the heat generated by the passage of current through it prevents solidification of more or less unrefined

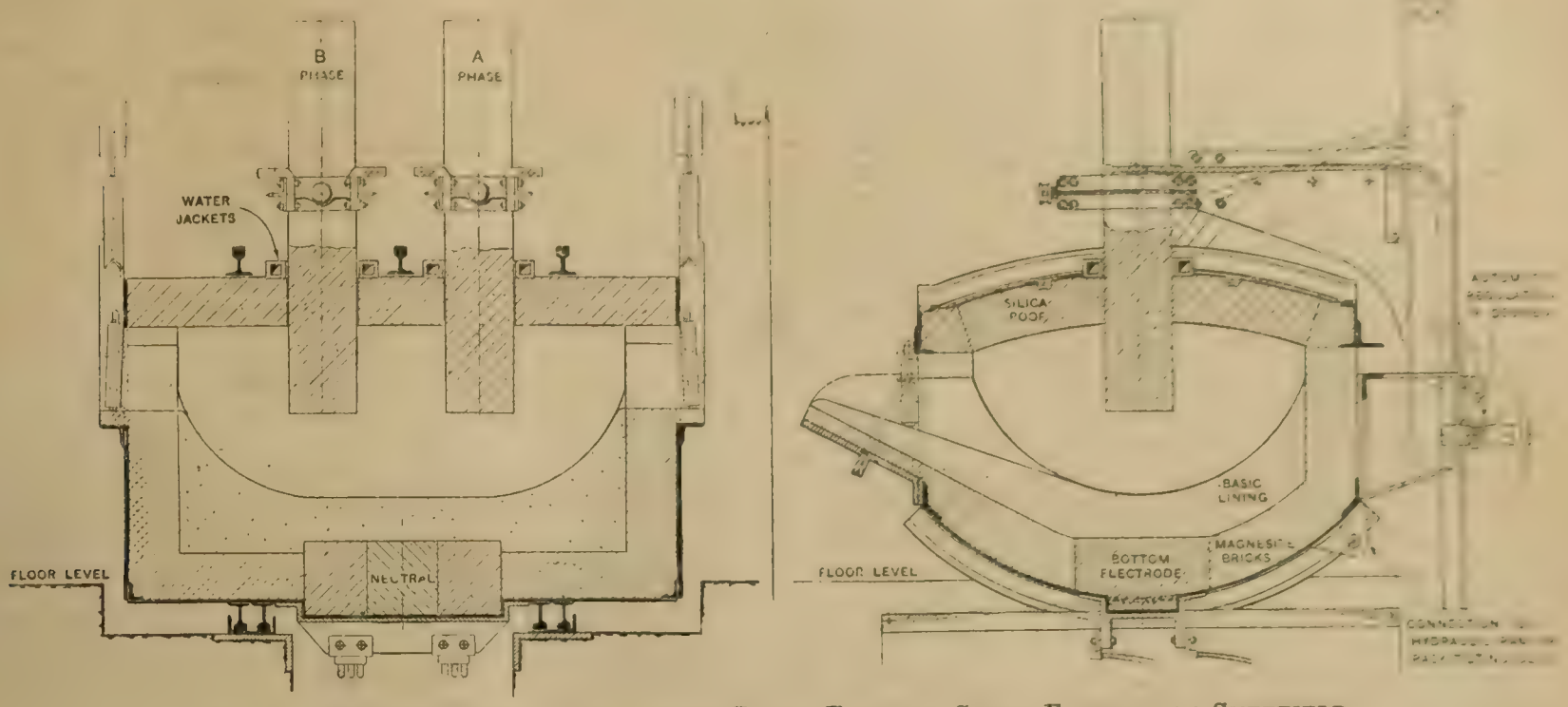


Fig. 2.—Sectional Elevations of Two-Phase Electric Steel Furnace at Sheffield.

metal at the bottom of the bath, and thus enables the whole charge to be "teemed" in a chemically and physically uniform condition.

In the present installation, two single-phase transformers are connected to the 2,000-volt, 50-cycle, two-phase power mains through a main oil switch which is provided with overload trip gear. Owing to exigencies of space, the transformers are placed in an underground pit, through which air is blown for cooling purposes; in a new installation, now under design, the transformers will be erected in a ventilated housing above the furnace level. Low-tension current at 55 volts (the transformer secondary voltage on open circuit is 62 volts) is carried through a flexible copper cable to four 3 in. $\times \frac{3}{16}$ in. copper strips on the furnace. These strips are clasped round the electrodes by a chain band with bolt clips as clearly shown in fig. 2, and a special feature is that connection is made low down on the electrodes, thus reducing to a minimum C^2R loss in the latter. From the transformer terminals to the electrodes is about 10 ft.

The electrodes used are amorphous carbon rods 12 in. in diameter and of 1·57 sp. gr.; each is 5 ft. long (longer carbons would be used but for the limited headroom below the crane in the present foundry), weighs about 400 lb. and is provided with a screwed recess. Screwed carbon plugs are used to connect each new electrode to the stump of its predecessor; wastage is thus avoided and the screwed joint, being packed with a paste of graphite and tar, offers little contact resistance and runs quite cool in service.

As shown by fig. 2, each electrode is carried by an overhanging arm mounted on a vertical column provided with rack feed. In the present installation, the electrodes are adjusted by hand-operated worm and pinion gears (above which are mounted ammeters operated by series transformers in the respective phases of the furnace supply leads), but automatic motor regulation can be easily arranged.

In a new 3½-ton furnace, soon to be installed by Messrs. Darwin & Milner, the essential features of the above furnace will be retained, but various mechanical improvements will be incorporated and the external appearance of the furnace will be somewhat changed. The exact

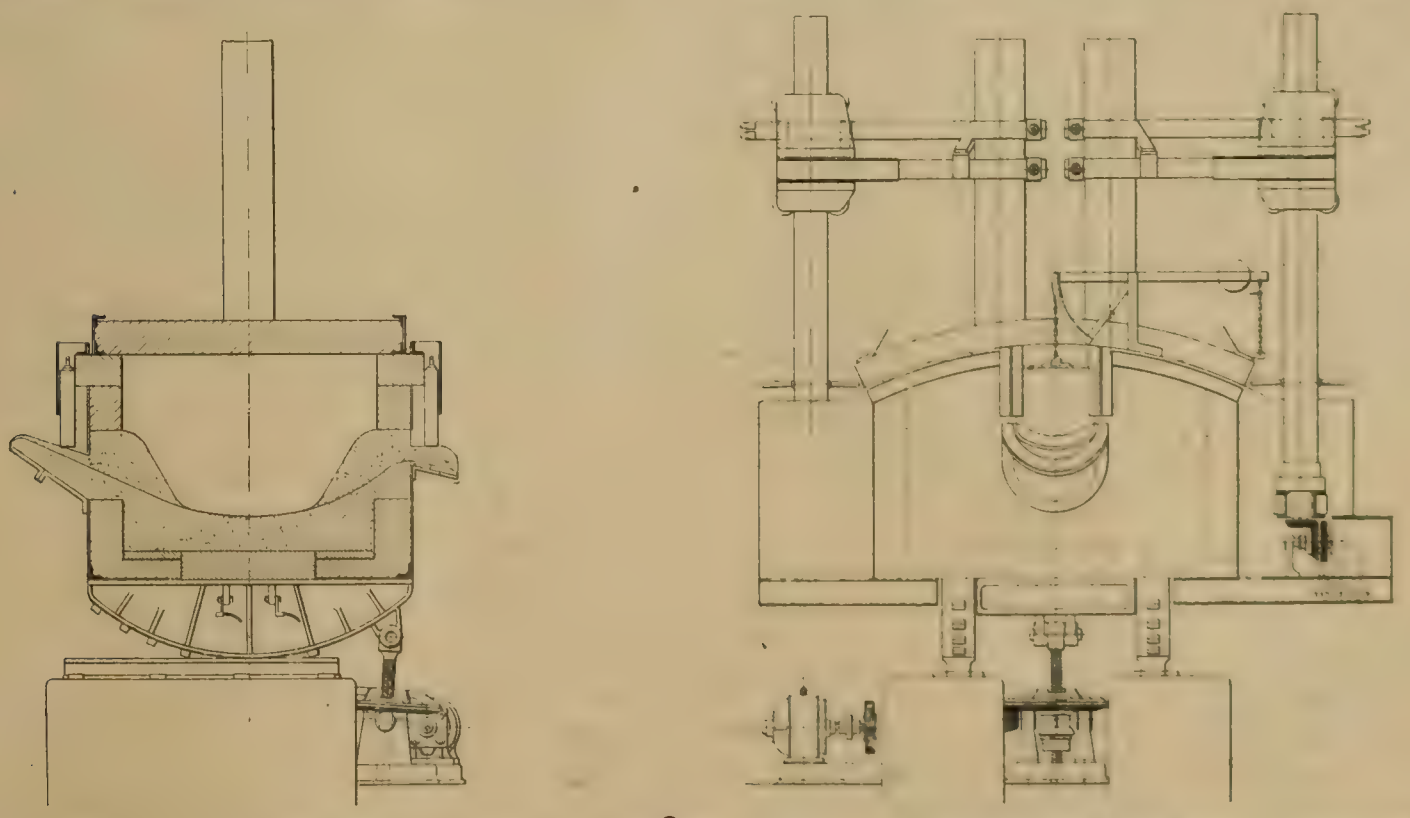


Fig. 3.—Views of New Two-Phase Steel Furnace with Automatic Regulation and Motor Tilting Gear.

nature of the alterations in design may be seen by comparing figs. 2 and 3. Automatic is to be substituted for hand-regulation of the electrodes, and motor-tilting for the present hand-tilting gear.

Manipulation and Performance of Furnace.—The present furnace—the first of its kind installed in this country—has been in use during the past 2½ years in the preparation of high grade alloy and carbon tool steels from rail end and similar scrap. The charging of the furnace with scrap and

a preliminary slag occupies about 30 minutes. Current is then switched on and maintained at from 4,000 to 4,500 amperes per phase for two or three hours, by which time the charge is completely melted. The oxidising or dephosphurising slag (containing scale, lime and fluorspar), which is added, removes carbon, silicon, manganese and phosphorus; a supplementary amount of the same material is added later if required. By the time the action of this slag is complete, the iron contains a large percentage of oxides, and could not be cast. To remove these oxides, together with sulphur and occluded gases, a deoxidising slag is introduced (lime, sand and fluorspar, with additions of powdered anthracite coal from time to time).

During the refining stage of the treatment, a current of 2,500 to 3,000 amperes per phase is used, and two or three hours after melting is complete, the impure scrap metal has been reduced to a steel containing not more than 0·025 per cent. phosphorus. At this stage a sample is cast, broken, examined for blowholes, and subjected to a rapid chemical analysis, the results of which enable carbon, ferro-vanadium and ferro-titanium, or other alloys, to be added to the furnace charge to bring it to the desired composition. As already explained, the electromagnetic circulation of the fluid metal ensures rapid and uniform absorption of the materials added.

During the preliminary stages of melting, the electrodes are under continual adjustment to compensate for the ever-varying level of the mixture of solid and molten iron below them, but as melting proceeds, the arcs become steady and quiet, and during the final de-oxidising stage of the refinement, heavy soot deposits collect round the electrode holes in the roof, and it is not easy to determine whether the furnace is working or idle.

The composition and temperature of the charge being correct, current is cut off and the furnace emptied into a ladle, which is then lifted over a trumpet feeding four 10-cwt. ingot moulds (see fig. 4). About 1 cwt. of metal remains in the trumpet and this is subsequently returned to the furnace

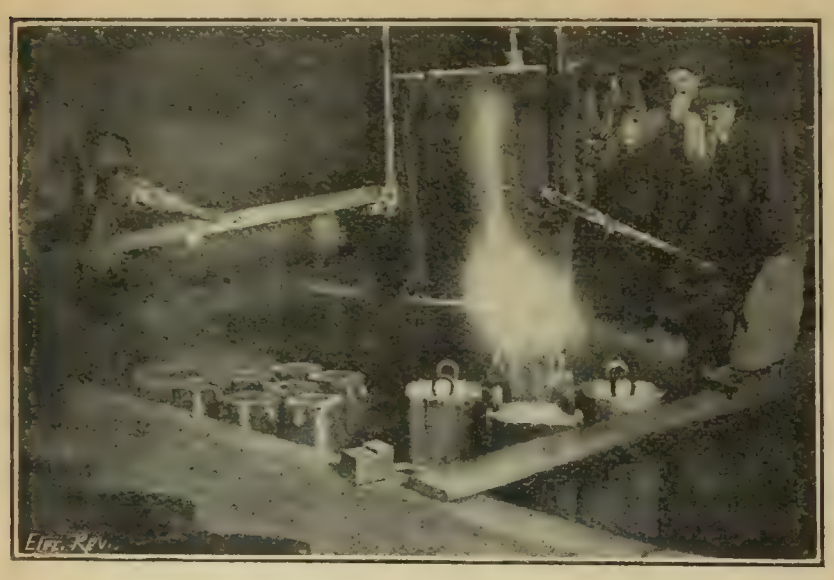


FIG. 4.—FILLING ½ TON INGOT MOULDS.

along with other scrap. The molten metal in the moulds is covered with a special composition powder, the effect of which is to prevent the formation of contraction "pipes" down the centres of the ingots during cooling.

Particulars relating to the melting and refining of a typical charge are as follows :—

Charge.—2 tons 2 cwt. 2 qrs. rail-end scrap containing C. 0·38 per cent.; S. 0·06 per cent.; P. 0·09 per cent. Charging commenced 1 p.m.; current on 1·25 p.m.; melted 3.30 p.m.; current off 5.50 p.m.; total time 4 hr. 50 min.

Yield—Ingots	... 2 tons 0 cwt. 0 qrs.	: alloy steel containing S. 0·01%; P. 0·02%.
Scrap	... — 1 cwt. 0 qrs.	;
Furnace loss	— 1 cwt. 2 qrs.	

Energy Used—

Melting	... 880 KW.-hrs.	= 415 KW.-hrs.	per ton of charge.		
Dephosphurising	280 ,,	= 132	,,	,,	,,
Deoxidising	... 580 ,,	= 273	,,	,,	,,
Total	... 1,740 KW.-hrs.	= 820 KW.-hrs.	per ton of charge.		
		= 870 KW.-hrs.	per ton of steel ingot.		

Cost of electrical energy per ton of ingot (at 0·6d. per KW.-hr.) = £2 3s. 6d.

In another instance, 2 tons 1 cwt. of high-speed steel scrap was melted and deoxidised in three hours, by an energy expenditure of 520 units per ton of scrap.

As typical energy consumption for a 2½-ton furnace of this type may be taken :—

	Kw.-hrs. per ton of scrap.
Melting and first dephosphurising slag ...	525 to 545
Second dephosphurising slag	40 to 50
Desulphurising, deoxidising and (if necessary) re-carbonising	235 to 255
Total	800 to 850

The power factor of the furnace is about 89 or 90 per cent.

It will be seen that roughly 65 per cent. of the total energy consumption is required to melt scrap metal, (the duration of the melting period being as long as or longer than the refining period, and the current flowing being roughly twice as great in the former case). Under English conditions as to energy supply, melting can be more cheaply effected in open-hearth furnaces.

The minimum time interval from teem to teem is from 5½ to 6½ hours, distributed as follows :—

Fettling and recharging	0·5 hour
Melting (at 4,000-4,500 amperes per phase)...	2·0 to 3·0 hours
Slagging and skimming, &c.	0·5 hour
Refining (at 2,500-3,000 amperes per phase)...	2·5 hours

The staff required to operate such a furnace includes (apart from the supervising engineer and analyst), a melter and second hand, two men to operate electrode wheels (if these be hand regulated), and two ladle and pit men to assist in teeming and making up the ingot moulds, &c. It is imperative that the melter should be a first-class man; he must have had experience with open-hearth furnaces, and must be a better man than is required by the latter. The mistake has been made in the past of placing men who were simply electrical engineers in charge of electric steel furnaces. Actually, of course, the electrical features of the latter are very simple, and their manipulation calls for no particular electrical training. The electric steel furnace simply offers better facilities for the exercise of the steel maker's art.

The maintenance required by the present type of furnace includes: Electrode renewal, fettling, re-roofing and re-bottoming. The last two operations need only be carried out at considerable intervals, and their execution necessitates a temporary shut-down of the furnace and removal of its roof. The roof lining, which is the part most subject to wear in arc furnaces, is of acid silica bricks (basic material, though desirable, is unable to withstand the conditions encountered at the roof). The side walls are of magnesite brick and the bottom is a rammed mixture of dolomite and magnesite. The roof needs relining about once in 30 charges at a cost of £5, *i.e.*, roughly, 1s. 6d. per ton of yield. About 150 charges can be melted and refined before a new bottom is required; re-bottoming, which occupies about five days, is therefore necessary about once in two months if the furnace be worked double shift. The electrode consumption is about 25 lb. (costing 4s.) per ton of steel produced.

The total costs of production, excluding capital charges and the cost of scrap and alloys, may therefore be taken as :—

	Per ton of steel.
Electrodes	4s. 0d.
Lining, roof, fettling	6s. 0d.
Slag materials	2s. 6d.
Labour (assuming automatic electrode regulation)	6s. 0d.
Tools	1s. 0d.
Total—Materials and labour	19s. 6d.
Electrical energy, 825 KW.-hours at 6d. =	£2 1 3
Total—Materials, labour and energy	3 0 9

The prime cost of a 3½-ton furnace installed complete is about £2,200 (the greater part of this amount being on account of the necessary transformers and switchgear, &c.). The capital charges to be debited to the furnace when in service are practically limited to the interest on the initial outlay; there being no running machinery, the allowance to be made for depreciation is very low. The furnace represents but a small fraction of the total outlay and is kept in good condition by the regular maintenance charged for

above. Even allowing 10 per cent. for standing charges on £2,000, the total cost of production in a 2½-ton furnace averaging 2,200 tons output per annum is £3 2s. 6d. per ton, assuming current at 0·6d. per unit; or £2 15s. 8d., assuming current at 0·5d. per unit. This is a very favourable result considering the uniformity and high grade of the steel produced.

From the data given above, it will be seen that there is no difficulty in melting and refining an average of 18 or 20 charges per week (shut down from Saturday noon to Sunday night and working day and night for the rest of the week). Assuming 19 charges per week, there would be consumed per annum (19 × 52 × 2 × 825) = 1,630,000 KW.-hours. Taking the maximum demand to be 5,000 amperes per phase at 55 volts, or, say, 550 KW. from the supply mains, the above annual consumption would correspond to a load factor of about (1,630,000/550 × 8,760) = 34 per cent. The maximum possible load factor which can be realised with this type of furnace—assuming equal melting and refining periods and double current consumption during the former—is obviously 75 per cent., and it is anticipated that the load factor of the new furnace to be installed by Messrs. Darwin & Milner will approach 70 per cent. during each run and will average (on 20 charges per week), 70 × 20/28 = 50 per cent., in which case electrical energy will be available at 0·5d. per unit and the current cost per ton will be reduced to about 33s. per ton of steel (800 units at 0·5d.), and the total cost of production to about 44s. per ton.

So far as we know, the furnace illustrated in fig. 1 is the only one in this country used exclusively for tool steel manufacture, and 2½ years' experience with it has led to the conclusion that the best grades of steel can be prepared more easily and certainly by this than by any other process. Much experimental work has been carried out with this furnace, and the results obtained show that in it, inferior scrap can be converted to a tool steel or alloy steel of any desired composition, or the furnace may simply be used to prepare very hot and fluid metal, free from occluded gases, for use in making high-grade castings. Messrs. Darwin and Milner are now building a new electric steel foundry, in the equipment of which will be incorporated the results of the experience gained on their present equipment. In this new plant, even more favourable results are likely to be secured, and these we hope to report in due course. In conclusion, our thanks are due to Mr. P. R. Kuehnrich and to Mr. T. D. Robertson for their courteous assistance in compiling the above notes and data.

REVIEWS.

Electrical Engineering for Mechanical and Mining Engineers. By N. J. S. Heather, B.A. London: *Electrician* Printing and Publishing Co., Ltd. Price 9s. net.

This is really a work on electrical engineering designed for the purpose of explaining the elements of electricity to mechanical or mining engineers who, though fairly conversant with steam engineering, have little or no knowledge of electricity or its practical application for the transmission of power.

The work consists of 20 lectures, which were written for a special class of men in the South African gold mines, namely, the resident mechanical engineers, who, owing to the decision of the mine owners to abandon the direct production of power by steam, and to purchase electrical power, found it necessary to acquire an adequate knowledge of electrical engineering to enable them to retain their posts. A similar state of things is fast arising in our own country, and for this reason we think the work will be valuable to colliery engineers who may find themselves in a similar position. In the South African mines, as here, prior to the change from steam to electricity, the latter had only been used to a small extent, and the "electrician" occupied a comparatively unimportant position, being responsible to the resident mechanical engineer on each mine. As a consequence, the capabilities of some of the electricians were not of a high order, and the limitations in their responsibilities resulted in their being, as a class, somewhat deficient in the power of handling men, the very quality to which many of the mechanical engineers owed their positions. It appeared likely, therefore, that the gold-mining industry would find itself short of men capable of taking charge of the engineering department unless the mechanical engineers could adapt themselves to the new conditions. Hence the lectures.

No attempt is made in the work to deal with general electrical engineering, mechanical construction of apparatus or switchgear, or transmission and distribution systems, and in this respect it is, perhaps, a little disappointing; but we feel quite sure that when once the mining or mechanical engineer has mastered the intricacies of the "electric circuit," "resistance," "continuous and alternating currents," and those stumbling blocks so very difficult to get over, "three-phase currents," "periodicity," "wattless currents," "power factor," &c., he will have no difficulty in understanding the mechanical construction of the apparatus when it is before him. Everything is simply and clearly explained, often with arithmetical examples where calculations are involved, with the aid of numerous diagrams; mechanical analogies are frequently given the better to explain some law, and a number of questions to be answered are given at the end of each chapter. Dynamos, motors, transformers, polyphase systems, polyphase transformations, induction motors, and the effects of running under abnormal conditions are all dealt with in turn; and probably the only fault to be found with the work—and this only because it is designed for mining men—is that nothing is said about "earthing," which is becoming such an important factor in mining installations, at any rate in this country, and which we are convinced is very little understood. As it is, we have no hesitation in recommending the work as an introductory text-book to mechanical engineers who would like to know the ins and outs of electrical phenomena.

The Repayment of Local and Other Loans. Sinking Funds. By E. H. Turner. London: Sherratt & Hughes. Price 21s. net.

This is a valuable though a somewhat unnecessarily ponderous work, with copious examples dealing with a variety of detail with the following aspects of the subject:—(1) Mathematical principles; (2) Methods of repayment of loan debt; (3) Sinking-fund problems—annual instalment, annual increment, date of borrowing and the redemption period; (4) Life of the asset, and its relation to the redemption period, and incidence of taxation; (5) the Equation of the period of repayment; and (6) the Equation of the incidence of taxation; the author's stated object being to render the work practically useful to those engaged in connection with the loan debt of public authorities and privately-owned undertakings.

The section on mathematical principles occupies over 80 pages, and is divided into "logarithms," "simple and compound interest," "compound interest as applied to a sum of money," "compound interest as applied to an annual or other periodic payment," "Thoman's logarithmic tables of compound interest and annuities," and "Standard calculation forms."

So far as the mathematical side of the subject is concerned, the reader who has already mastered the elements of interest and annuities certain will, of course, experience no difficulty in following the tenor of the author's way; but there are many to whom mathematical formulæ offer no attraction, and who do not exert themselves to obtain a passing knowledge of the science, which, though eternal, is comprehensible. For our part, we should have preferred the recognised notation. For instance, instead of $P = A/R^N$, we should use v^n, which represents the present value of 1 due in n years, or $(1 + i)^{-n}$. Again, we should express the present value of an annuity certain for n years by A_n, which is the result of $\frac{1 - v^n}{i}$ in preference to $P = A_y \left(\frac{R^N - 1}{R^N r}\right)$, but these are small matters, which do not detract from the value of the book.

Section II deals thoroughly with the repayment of loan debt from the usual points of view, viz., instalment method,

annuity method, the relation between the equal annual instalments of principal and interest combined and the sinking-fund instalment, the sinking-fund method, and the accumulative and non-accumulative sinking fund.

Adequately discussed, though we do not recognise any new feature, the sinking-fund problems section is full of interest.

The equation of the period of repayment of loans repayable at various dates which are required to be redeemed on one uniform date is treated from two standpoints : where the loans are authorised in respect of outlays of varying character, each having a different life in period of continuing utility and consequent repayment ; and where the necessity to find the equated period of repayment arises on the consolidation of existing loans.

In Chapter 33, the author discusses a comparison of the total annual loan charges to revenue or rate, before and after the equation of the period of repayment, showing the unequal incidence of taxation if the annual instalment and interest upon the total loan be spread equally over the equated period.

One of the most striking chapters in the book is that treating of the life or duration of the continuing utility of the asset created out of the loan, its relation to the redemption period, and the incidence of taxation. The difficult problem herein arises out of the periods allowed by Parliament (or other Government department concerned) for the repayment of loans authorised for different classes of outlay having longer or shorter lives, or periods of duration, and this variation in the life of the asset may in its turn react upon the period over which the loan is borrowed, or is repayable. This factor gives rise to the necessity to equate the period during which loans shall be repayable depending upon the life of the asset, and the consequent period of repayment, the date or dates of borrowing, whether in one year or spread over a period of years, and a combination of both periods, viz., of borrowing or repayment.

The Baudot Printing Telegraph System. By H. W. Pendry. 1913. London : Whittaker & Co. Price 2s. 6d. net.

Until comparatively recently, the Baudot system was only employed in the British telegraphic service for communication with Paris. Within the last few years, however, its use has been extended to the inland circuits of this country, and the number of lines worked in this manner is rapidly increasing. The small book under review has been written to meet the requirements of telegraphists and others who, in consequence of this development, have been brought into contact with the new system, and desire to gain some knowledge of its method of working.

Owing to limitations of space, the descriptions of the different portions of the system are perforce somewhat brief. A reader who is in touch with the actual working of the instruments should not, however, have much difficulty in obtaining from the book a good general knowledge of the fundamental principles of the Baudot system.

The whole subject is covered, from a brief introductory sketch of the evolution of the Baudot to the latest developments. The final chapter contains some useful instructions on the adjustments of the different parts of the system, and the tracing of faults. There are, however, a few points which the author would be well advised to modify in a subsequent edition.

The mechanical action of the system is first described, and afterwards the electrical arrangements are dealt with. It would be much better for the student if detailed descriptions of the complicated mechanical devices were postponed till the broad outlines of the system had been given.

The description of the action of the distributor governor is by no means clear ; the mechanical terms introduced are very loosely employed. For instance :—

"It should be remembered also that the tendency towards an increase in the speed of rotation of the weight is restrained by the fact that the amount of centrifugal force required varies not in proportion to the increased speed, but as the square of that speed." And also—

"In order that the distributor speed shall remain constant, it is essential that the resistance shall uniformly balance the energy."

In the account of the motor-driven receiver the author says :—"Before proceeding further, it is considered advisable to furnish a brief outline of the principles upon which the motors are constructed and operate." This appears to be somewhat out of place in a book dealing specifically with a telegraphic system—the theory of the electric motor being much better studied in works specially devoted to electrical engineering. But the author proceeds to discuss, in a very scrappy manner and without any diagrams, the theory of the dynamo, and then remarks that continuous-current motors are constructed precisely on the plan of continuous-current dynamos, but by them electrical energy is converted into mechanical energy, the armature being urged to rotate by the mutual action of the magnetic field and the current in the armature coils. It is to be feared that the reader, having no preliminary knowledge of the subject, will not gain very much from this description.

The following sentence from the same section is rather curious :—"When the permanent magnets of the earlier electric machines (*sic*) gave place to electromagnets, and arranged to become self-exciting, the machines were termed dynamos." We are acquainted with live wires, but we should have liked to have seen these magnets in conference !

The section dealing with the distortion of the signals is also susceptible of considerable improvement. In this section the author says :—

"The impulses may be considered as transmitted by undulations of electromagnetic waves. When passing through a non-inductive resistance, such as that of an ordinary resistance box, the deteriorating influence experienced by an impulse is simply a falling-away of its magnitude, or attenuation, due to the ohmic resistance. But on all except very short lines the transmission waves suffer from the effects of capacity and inductance, the one producing a 'lead' and the other a 'lag' in the wave."

The writer is apparently unaware that a non-inductive resistance produces no attenuation in a varying current flowing through it. Attenuation is the action in a circuit which causes the current at the receiving end to be less than that at the sending end, and in a non-inductive resistance the strength of the current is the same at all parts of the circuit. Also, the effects of inductance in a telegraph line, and the capacity of the line to earth, are similar, each tending to retard the beginning of a signal, and to prolong its termination. The writer is apparently confusing these effects with those produced on the relations between the current and voltage in an alternating-current circuit by inductance and capacity in series with the line.

An account of the Post Office standard relay is given, and also, in the chapter on repeaters, a short description, with diagram, of an ordinary relay with a sounder in its local circuit ! In a book on the Baudot written for telegraphists in the British Post Office, these portions seem quite superfluous. The student of telegraphy, without any doubt, will know all about the standard relay and the simpler circuits in which it is used, before he ventures to attempt to study the theory of the Baudot system.

The foregoing criticisms are not intended to disparage the book, but to show how it could be made better and more useful than at present.

The points indicated are, however, mostly theoretical, and for practical men, in daily touch with the instruments themselves, the book should prove very useful. It is well printed on good paper, and the diagrams and illustrations are very clear.

Electric Massage.—After considering communications from the Commissioner of Police for the Metropolis, and representations from a number of societies, the Public Control Committee of the L.C.C. recommends that "establishments where massage, manicure, or electric treatment is carried on should be properly regulated." The Council asks Parliament to empower it to license or register and inspect such establishments.

L.C.C. Electrical Employés.—Following upon the objection raised by the Electrical Trades Union, last February, respecting the grading and pay of controller-repairers and light and power attendants, the Highways Committee now recommends the Council to refer the matter to the Rolling Stock Conciliation Board.

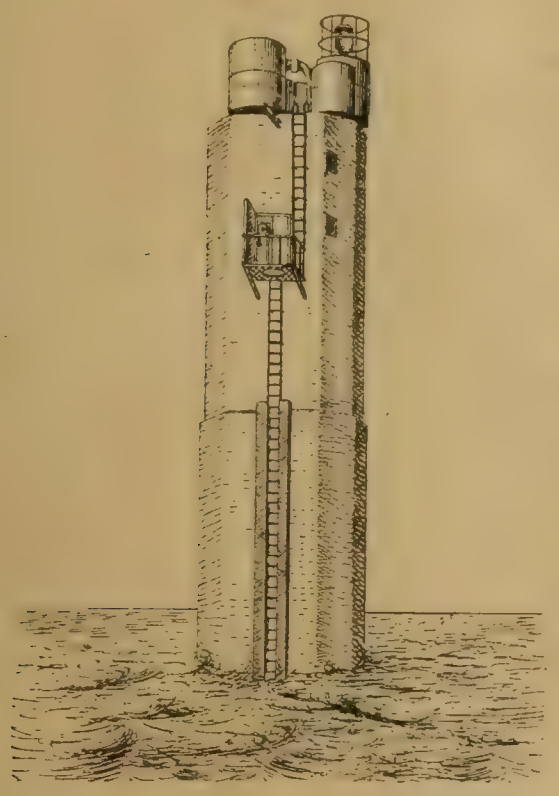
A TELEPHONE CALL OFFICE OUT AT SEA.

With a view to obtaining news of approaching mail boats during fog, a telephone has been fitted by the Guernsey Telephone Department on an unattended lighthouse on the Platte Fougère rock, 1¼ miles to the N.E. of the island of Guernsey. As described in our issue of October 14th, 1910, the fog signal on this lighthouse, operated electrically from the shore by means of a submarine cable, guides ships to the lighthouse, where they drop anchor until the lifting of the fog enables them to take the narrow channel leading to the harbours at St. Sampsons and St. Peter Port.

Few of the mail boats are fitted for wireless telegraphy, and it is believed the new telephone will prove a useful link and may prove invaluable in unforeseen emergencies at sea.

A mail-boat captain held up by fog could send off an officer to report his arrival at Platte Fougère, and thus allay anxiety in Guernsey as to his whereabouts. In many cases fogs are more or less local, and should the Channel be reported clear, the captain might find it possible to push forward.

Often the captain of a mail boat would not care to send off a boat to the lighthouse, owing to the delay should the fog suddenly lift. In such a case any local pilot in the vicinity would be expected to telephone news of the arrival of the mail boat. In return for this service, the pilots are given the free use of the telephone for their own purposes throughout the year.



Platte Fougere Lighthouse.

The telephone is reached by climbing the lighthouse ladder of 42 rungs to the platform outside the doors. Before leaving the ladder a trap door has to be pushed open, and the pilot can then step on to the platform. Before the lighthouse door can be opened the trap door must be closed down. On opening the door an inner door, kept locked, is seen, and to the outside of this the telephone—an ordinary walnut-wood magneto call instrument (well paraffin-waxed)—is seen.

On ringing up, the light-keepers on the mainland are called, and can plug through to the Guernsey exchange system.

Besides three power cores of 19/17 copper, the submarine cable contains two 7/23 conductors, only one of which is available for telephone use. An earth return is, therefore, used with a transformer on shore to link up with the metallic-circuit system of Guernsey.

Even the single wire is not exclusively available for the telephone, and an automatic door switch ensures that when the telephone is not in use various lighthouse devices are connected in its place. It is, therefore, essential that after use the lighthouse door shall be properly closed, and to guard against forgetfulness, it is arranged so that the pilot using the telephone cannot lift the trap door to reach the ladder until the light-house door is first completely closed.

Speaking is good, even when during fog 18 E.H.P. is being transmitted by the power cores of the same cable (three-phase alternating, neutral point not earthed).

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NICARAGUA.—The Government has passed a decree providing that every Customs entry and Consular invoice required therewith must give particulars of the contents of each parcel, and must indicate the gross weight, the net weight, and the value of the various articles. From the date of this decree, a copy of the invoice must be presented with the entry. For the purposes of the decree, gross weight is understood to mean the weight of the goods with all containers, packing, coverings, receptacles, wrappings, &c., interior, exterior or immediate, in which the goods are contained or packed on shipment. The net weight does not include any *exterior* packing, covering, receptacle, &c.; but it does include all interior or immediate receptacles, including cardboard, paper, wood or other materials to which the articles may be attached. Straw and other similar materials placed for protective purposes between the outer container and the immediate receptacles of the goods are not included in the net weight. Weights must be expressed in kilogrammes or fractions thereof. The value of the goods to be declared in the entry and in the Consular invoice is their wholesale price in the principal markets of the country from which they are exported, when packed and ready for shipment (including the value of all boxes, crates, sacks, packing and containers of all kinds, and other costs and expenses incidental to the preparation of the goods for shipment); maritime freight, insurance, export duties, Consular fees and buyers' commissions are not included. The value of the goods is to be expressed in the currency of the exporting country.

SWITZERLAND.—The Customs authorities have decided that insulating tubes of paper or paper pulp, with sheath of common metal, are to be dutiable at the rate of 12 fr. per 100 kilogs.

HONDURAS.—The Government has passed a decree imposing a surtax of 5 per cent. on all imports into the country. The decree is to come into force on August 1st.

NEW ZEALAND.—The Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods; the rates given are in every case those under the preferential tariff for British goods:—

Insulator bolts, swan-necked	... Free
Contact makers	... 20 % ad val.

PERU.—The Board of Trade has received a copy of a decree of the Peruvian Government which, in view of the early opening of the Panama Canal, lays down certain provisions designed to encourage the use of the ports of Paita, Callao and Mollendo for the warehousing of goods destined for re-exportation from those ports to other countries.

In the case of goods shipped to the three ports in question, Peruvian Consuls are to legalise, free of charge, the four copies of the Consular invoice which are required under the Peruvian Consular Regulations in respect of all goods shipped to Peruvian ports when the shipper declares that the goods are to be re-exported from the port of destination to another country. If the shipper does not make such declaration, the consignees of the goods shall be entitled to receive a refund of the Consular fees paid for the legalisation of the invoices if the goods, after being warehoused in the Customs house of one of the three ports, are subsequently re-exported to a foreign country. The charge for the warehousing of goods in transit for foreign countries at these three ports is to be at the rate of ½ per cent. per month, as against 1 per cent. otherwise for the first month, and ⅛ per cent. for each succeeding month.

As regards goods imported at Paita, Callao and Mollendo, and deposited in Customs warehouse under re-export declaration, the Consular fee for the legalisation of the invoices, as also warehousing charges at the full rate, will be payable if the consignee subsequently decides to clear them for consumption in Peru.

Educational Notes.—The new buildings for the School of Architecture at University College are approaching completion, and will be ready for the opening of the new session in October. They provide accommodation for one hundred students.

Northampton Institute.—The arrangements of the courses for next session are announced in our advertisement pages to-day.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,585. "Dynamo-electric machines." BROLT, LTD., B. BROOKS and W. HOLT. July 7th. (Complete.)

15,587. "Sparking plugs." J. H. RUNBAKEN. July 7th.

15,607. "Adjustable telephone arms." M. J. D. CARTER. July 7th.

15,636. "Magnetos." H. FORD. July 7th.

15,642. "Electric switches mechanically controlled from a distance." F. HODGSON. July 7th.

15,643. "Electric lighting control systems." F. HODGSON. July 7th.

15,644. "Incandescent electric lamps and their fittings." F. HODGSON. July 7th.

15,648. "Electrical devices for operating door sashes of automobiles and other carriages." J. F. P. DE LA RIBOISIERE. (Convention date, July 9th, 1912, France.) July 7th. (Complete.)

15,658. "Electric railways." C. M. WHITE. (M. E. Sturgess, United States.) July 7th. (Complete.)

15,673. "Wireless telegraph transmitter." J. G. BALSILLIE. (Convention date, September 23rd, 1912, Australia.) July 7th. (Complete.)

15,674. "Wireless telegraph receivers." J. G. BALSILLIE. (Convention date, September 23rd, 1912, Australia.) July 7th. (Complete.)

15,675. "Apparatus for checking any suitable predetermined excess number of calls at a telephone call-box or other place." J. PINTER. (Convention date, July 13th, 1912, Hungary.) July 7th. (Complete.)

15,682. "Electric control of electric motors." OTIS ELEVATOR Co., LTD. (Otis Elevator Co. Incorporated United States.) (Addition to 3,249/13.) July 7th. (Complete.)

15,686. "Variable-speed dynamo-electric machines." B. BROOKS and W. HOLT. July 8th.

15,696. "Method for aerial signalling and intercommunication with wireless telegraphy." G. H. JONES and L. V. HARBOR. July 8th.

15,697. "Dynamo-electric machines." B. BROOKS and W. HOLT. July 8th.

15,698. "Battery lamps." A. F. HAWDON. July 8th.

15,719. "Storage battery grids." E. F. WACKWITZ. (Convention date, July 8th, 1912, United States.) July 8th. (Complete.)

15,729. "Means for and methods of changing the frequency of alternating electric currents." A. M. TAYLOR. (Addition to 8,853, 1911.) July 8th.

15,733. "Electrically-operated piano-players." C. YOULDON and C. A. YOULDON. July 8th.

15,739. "Transformation and distribution of electric currents for lighting and other purposes." D. SUCHOSTAWER and J. O. OXLEY. July 8th.

15,748. "Telephone systems." W. D. DERRIMAN. (J. B. Russel.) July 8th. (Complete.)

15,760. "Electrical fuses of the plug type." H. T. PAISTE. July 8th. (Complete.)

15,769. "Systems for supplying from high-pressure mains continuous current at a lower pressure." E. A. GRAHAM and W. J. RICKETS. July 8th. (Complete.)

15,783. "Sounding transmitting apparatus." W. H. DERRIMAN. (Automatic Enunciator Co., United States.) July 8th. (Complete.)

15,797. "Telephone systems." L. W. BANNEHR. July 9th.

15,811. "Base-plate for electrical measuring instruments." LANDIS AND GYR, G.M.B.H. (Convention date, July 12th, 1912, Germany.) July 9th. (Complete.)

15,818. "Reversible variable-speed electric motors." L. SATCHWELL, C. WALLBRIDGE and J. ROSS, JUN. July 9th.

15,824. "Manufacture of electric glow lamps." WOLFRAM LAMPEN AKT.-GES. (Convention date, July 17th, 1912, Germany.) July 9th. (Complete.)

15,826. "Safety lifeguards for attaching to motor-omnibuses, electric tramcars, taxicabs, and other like vehicles." E. W. EVANS. July 9th.

15,828. "Telephony." S. G. BROWN. July 9th.

15,869. "Method of indirect excitation for oscillatory circuits." E. GIRARDEAU. (Divided application on 11,703, 1912, May 16th.) (Convention date May 17th, 1911, Germany.) July 9th. (Complete.)

15,870. "Electric fans." B. FAZAN. July 9th.

15,875. "Arrangement for starting groups of electrical machines consisting of a synchronous machine and an asynchronous machine connected in cascade with it." ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI SOC. ANON. (Convention date, March 21st, 1913, Belgium). July 9th. (Complete.)

15,879. "Heating by electricity." P. R. WILDE. July 9th.

15,891. "Devices for cleaning the globes of electric arc lamps and the like." R. L. IRELAND. July 10th.

15,900. "Electric igniting device." E. V. JONES. July 10th.

15,909. "Dry batteries." SAKIZO YAI. July 10th. (Complete.)

15,929. "Manufacture of drawn tungsten and the like wire." C. GLADITZ. July 10th.

15,950. "Automatic breakers for electric circuits." A. POLLAK. (Convention date, July 18th, 1912, United States.) July 10th. (Complete.)

15,951. "Safety devices for electric conductors." G. GILES. (Addition to 4,997/09; Convention date, July 20th, 1912, Switzerland.) July 10th. (Complete.)

15,968. "Contact devices for electrical testing purposes." EVERSHED AND VIGNOLES, LTD., W. CLARK and G. SENIOR. July 10th.

15,974. "Sparking plugs for internal-combustion engines." ELECTRIC IGNITION Co. (1913), LTD., and A. COX. July 11th.

15,975. "Insulating or the like slabs." J. A. TORPEY. July 11th.

15,980. "Thermo-electric batteries and the like." C. D. MCCOUAT. July 11th.

16,011. "Electric transformer furnace." J. BALLY. (Convention date, July 12th, 1912, France.) July 11th. (Complete.)

16,015. "Dynamo-electric machines." H. LUCAS and H. E. MOORE. July 11th. (Complete.)

16,027. "Alkaline electric accumulators." E. FOSS, F. HARRIS and B. W. PARKER. July 11th.

16,034. "Electromagnetic balances." SOC. DES ETABLISSEMENTS GAUMONT. (Convention date, July 29th, 1912, France.) July 11th. (Complete.)

16,040. "Electric heating." A. F. BERRY. July 11th.

16,048. "Electrolytic diaphragms." H. A. WAGNER. July 11th. (Complete.)

16,058. "Incandescent bulbs in electric safety." F. FAERBER. July 11th. (Complete.)

16,066. "Process of producing filaments or wire wolfram and wolfram alloy." E. A. KRUGER. July 11th. (Complete.)

16,078. "Sparking plugs." F. A. L. JOHNSON. July 12th.

16,081. "Expanding pendant for gas or electric light fittings." E. PHILLIPS. July 12th.

16,092. "Thermostatic control of electric currents." E. G. BYNG and C. H. ARCHER. July 12th.

16,103. "Antiseptic telephone receiver." F. Robinson. July 12th.

16,113. "Electric motors suitable for display advertising devices and the like." A. C. HARRIS. (Addition to 19,268/11). July 12th.

16,123. "Means for completing an electric circuit when a predetermined temperature is reached, applicable for actuating fire alarms and for other purposes." J. MATLEY and C. RUSSEL. July 12th.

16,126. "Electro-magnetic receivers." T. C. COYKENDALL. July 12th. (Complete.)

16,128. "Money boxes for apparatus such as prepayment telephones, coin-freed gas meters or the like." H. G. C. FAIRWEATHER. (Ges. für Elektrische Industrie Akt.-Ges., Austria.) July 12th. (Complete.)

16,150. "Automatic telephone register." A. W. CRAWFORD. July 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

MACHINE FOR ELECTRIC BRAZING, SOLDERING OR WELDING FOR UNITING BRAKE STRIPS TO WHEEL RIMS OR BEADS TO THEIR RIMS. C. H. Apsey. 29,120. December 27th. (June 27th, 1912.)

1912.

APPARATUS FOR ACTUATING CONDUIT COVERS AND COLLECTOR PLOUGHS OF ELECTRIC RAILWAYS. D. Samaia. 9,637. April 23rd. (Patent of Addition not granted.)

IGNITION SYSTEMS. C. F. Kettering. 12,047. May 21st. (May 23nd, 1911.)

TELEPHONE EXCHANGE SYSTEMS. W. Aitken. (Automatic Electric Co. partly.) 14,318. June 19th.

ELECTRICALLY-CONTROLLED POINT OR SWITCH OPERATING MECHANISM FOR RAILWAYS AND THE LIKE. R. V. Cheatham. 14,739. June 24th. (June 22nd, 1911.)

RECEIVERS FOR PRINTING TELEGRAPH SYSTEMS. G. S. Hiltz. 14,837. June 25th.

CALL-DISTRIBUTING TELEPHONE SYSTEMS. H. P. Clausen. 14,945. June 26th. (June 26th, 1911.)

ELECTRIC OVENS. H. T. Harrison. 15,065. June 27th.

TELEPHONE SYSTEMS. A. E. Keith. 15,072. June 27th. (June 28th, 1911.)

ELECTRIC LAMPS USING INCANDESCENCE FILAMENTS OF THE SECOND CLASS. A. Clarke. 15,127. June 28th.

STORAGE BATTERIES. E. Sokal. 15,404. July 2nd.

SUPPORTING DEVICES FOR FILAMENTS OR WIRES IN INCANDESCENT METAL-FILAMENT LAMPS. Julius Pintsch Akt.-Ges. 15,485. July 2nd. (November 18th, 1911.)

ELECTRIC AERIAL RAIL OR ROPE WAYS. Elektro Motoren Werke Hermann Gradenwitz. 15,920. July 8th. (July 8th, 1911. Addition to and divided application on No. 12,833 of 1912, May 31st.)

APPLIANCES OR MEANS FOR MOUNTING INCANDESCENCE ELECTRIC LAMPS AND THE MANUFACTURE THEREOF. A. W. Beuttell. 16,307. July 12th.

INSULATING AND TENSIONING DEVICE FOR ELECTRIC CABLES. I. Porak. 16,671. July 17th. (April 4th, 1912.)

HOLDERS FOR INVERTED GLOBES OR SHADES OF GAS AND OTHER LIGHTS. A. Rose, W. Bellamy and J. Dolphin. 17,102. July 23rd.

ELECTRIC FLOOR LAMPS. G. Maurice and L. G. Byng. 17,247. July 24th.

AUTOMATIC TELEPHONE EXCHANGE SWITCHES AND CONTROLLING CIRCUITS THEREFOR. Western Electric Co. (Western Electric Co.) 17,858. August 1st.

ELECTRIC COUPLINGS OR CONNECTORS. J. Wilkie. 18,060. August 6th. (Patent of Addition not granted.)

COMBINED PLUG AND SWITCH FOR ELECTRIC CIRCUITS. W. R. Lambert. 18,275. August 8th.

ELECTRIC RECTIFYING APPARATUS. British Thomson-Houston Co. (General Electric Co.) 18,747. August 15th.

HOLDERS FOR TELEPHONES. G. B. Stern. 21,725. September 24th.

COMBINED ELECTRIC INDICATORS AND STEAM FLOW METERS. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,262. September 30th.

MINE EXPLODERS. Sterling Telephone and Electric Co, Ltd. (Schaffler & Co.) 22,450. October 2nd. (Addition to No. 27,318A of 1906.)

SWITCHES FOR ELECTRO-MAGNETIC CLUTCHES IN MACHINES WITH REVERSAL OF MOTION. E. C. R. Marks. ("Vulkan" Maschinen Fabriks Akt.-Ges.) 23,150. October 10th.

BRUSH-RAISING MECHANISM FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co., Ltd., and F. P. Whitaker. 25,704. November 8th.

FILAMENT CARRIERS FOR ELECTRIC INCANDESCENT LAMPS. Westinghouse Metallfaden Gluhlampenfabrik Ges. 26,288. November 15th. (November 20th, 1911.)

"Switching" Certificates.—The energy displayed by Messrs. A. P. Lundberg & Sons in advancing the cause of improved controls for lighting circuits is remarkable. The latest efforts of the firm in this direction consist in instituting periodical examinations in "Electric Light Switching." A series of questions is based on the subject as dealt with in the firm's booklet "Lektrik Lighting Connections"; these may be worked out at home by anyone who cares to do so, and may then be submitted to Messrs. Lundberg for examination without charge. Though reference to the above (or any other) book is not barred, the questions are of such a nature that they cannot be answered directly from the book. In other words, they are a test that the examinee can see between and beyond the actual published examples of controls; and practically every answer involves the sketching of a more or less original connection diagram. Certificates and money prizes will be awarded to the senders of satisfactory papers, and those who wish to test their knowledge of the subject of lighting controls should apply to the firm at 477-489, Liverpool Road, London, N., for one of their "Electric Light Switching-Competition Circulars." We have one of these in front of us, and a glance through the questions conclusively proves that there is much more in switching than meets the eye. We note, for example, questions relating to the control of lights on warships and in railway trains. The idea is a good one, and should effectively stimulate study of this important branch of wiring work.

THE

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(J. A. Berly's).

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THE MARCONI CONTRACT.

LAST week the Prime Minister announced the forthcoming publication of the new contract with the Marconi Co., and provisionally fixed a day for the discussion of its terms; but the matter still remains in suspense, and in the meantime the daily Press has been deluged with communications on the subject from amateur "experts" and party politicians.

Prominent amongst these is a long letter from Sir Henry Norman, Associate I.E.E., who is a member of the War Office Wireless Committee and has recently "visited, minutely examined, and taken copious notes of every type of high-power long-distance wireless station in Europe"! So far as he knows, no other person has done this. Sir Henry is to be congratulated upon his remarkable achievement, on the strength of which he imperatively demands the abandonment of the royalty and the formation of a State Department for Imperial Communications. But as a member of a Departmental Committee, would he not show better taste by refraining from polemics in the public Press?

Brushing aside all questions as to the *bona fides* of the parties to the contract—though in passing we may express our unshaken confidence in the integrity and single-minded patriotism of Mr. Samuel—the chief points around which the battle has raged are these: Is the provision of Imperial wireless communication a matter of extreme urgency?—Is it essential that the work should be placed in the hands of the Marconi Co.?—Are the terms of the contract reasonable and just?—Will the contract prove detrimental to the progress of wireless telegraphy and to the national interests?

As regards the first of these questions, we have already expressed the view that we must accept the reiterated statements of the men to whom we have entrusted the duty of safeguarding the defences of the Empire. The British public is notoriously distrustful of the expert, but it cannot afford to ignore his deliberate judgment in a matter of such transcendent importance. Let it be granted, then, that the erection of the Imperial chain is a matter of pressing necessity—how can it be effected with the least delay? The Post Office admittedly cannot undertake the work; the Admiralty will not, even if it can, for its staff is fully occupied with its normal duties, which must not be neglected. It has been proved by the investigations of the Scientific Advisory Committee that of all the possible competitors for the contract, the Marconi Co. is the only concern which has done similar work on a commercial scale, and is in a position to carry out the undertaking at once with a certainty of success—and certainty is a *sine qua non*. There is, to our mind, no alternative.

The third is perhaps the most vulnerable point of the policy of the Government, for it is urged that the royalty is excessive, that it will become a perpetual burden upon the wireless service, that it will enable the company to throttle all competition, and that the payment of the full royalty irrespective of the number or value of the patents in use is a preposterous condition. We need not discuss the pros and cons of the matter, however, for the Postmaster-General on Monday stated that the royalty conditions had been radically changed; the royalty has been split up into

four sections in such a way as to remove its most objectionable features and to enable the Government to reduce the payment on discarding any section, whilst retaining some of the company's patents in use. As the hostility of the opposition to the contract has mainly centred on this question, we may now hope that the contract will be ratified in the course of next week, and that the work of construction will be put in hand without further delay.

As regards the possible effect of the contract upon future progress, there is room for a great deal to be said on either side, but little is to be gained by the discussion. No man can tell what to-morrow may bring forth. There is one factor, however, to which we may direct attention. It is sometimes pointed out that the company, enriched by an extortionate royalty, will be in a position to purchase all rival patents and to establish a virtual monopoly in wireless telegraphy. But is the Imperial service likely to prove as lucrative as is suggested? We doubt very much whether the receipts will assume the magnitude assigned to them. The cable is not yet obsolete, and it is significant that the cable companies are not perturbed at the prospect of the competition of the wireless chain. The Government has sedulously avoided giving any estimate whatever of the probable amount of the gross receipts. It must be borne in mind that the wireless service is devoid of that most important quality—secrecy—and, therefore, that all messages of such a nature as to necessitate secret transmission will have to be sent by cable. No cipher, we are told, is undecipherable, and only by means of a private code can absolute secrecy be secured in wireless transmission. Speed also is an important consideration, and as the wireless messages must be repeated manually at every station, both speed and accuracy will necessarily suffer in comparison with the cable service, which now has at its command automatic repeaters of the highest efficiency. The automatic records of the wireless service will be photographic, and will, therefore, have to be read and transcribed by human agency, which is prone to error.

We believe that the bulk of the public traffic on the wireless system will be of a domestic nature, a class which the cable companies until recently did not trouble to cater for; it must necessarily be cheap, and its development will be of slow growth. During the first years, therefore, the royalty payments cannot assume large proportions, and the company will not possess those boundless resources that are necessary to establish and maintain a monopoly. Moreover, the British Empire does not comprise the whole world, and there is plenty of scope for other concerns to develop their systems beyond the control of the British company. We see no valid reason for the fears which have been expressed on this score, and we sincerely hope that a start will shortly be made with the work.

We are glad to record the fact that the Government has taken steps to form a technical Advisory Committee, somewhat on the lines suggested by Sir Joseph Larmor, and that Mr. W. Duddell has been invited to preside over its deliberations. The choice was no doubt inevitable, but is none the less gratifying on that score. The President of the Institution of Electrical Engineers is probably the most eminent independent expert in wireless telegraphy that we possess, and we congratulate Mr. Samuel on having retained his services on behalf of the nation for a period of years.

Ghent Exhibition.

Our readers probably need no reminder that an International Exhibition is now in progress in Ghent, one of the most interesting cities in the "Lowlands," and one which is particularly easy of access from this country at a trifling cost. The exhibition is a large one, occupying an area of 250 acres, and includes a wonderful representation of a village in "Old Flanders," to mention only one of its varied attractions. We are here concerned, however, not with æsthetics or antiquities, but with the modernities which appeal to the professional sympathies of our readers, and from this restricted point of view we are compelled to state that the list of exhibits presenting noteworthy features is but a very short one. The British Section, as a whole, is a very fine one, well worthy of its origin, and we are informed that the "arts and crafts" section is one of the best collections ever brought together; but the most striking and important exhibits in the Machinery Hall are devoted to the textile industries, which afford examples of electric driving, but are not otherwise of electrical interest. In the International Machinery Hall also there is little for us to comment on, but an annexe to this building, called the Palais d'Electricité, is prettily illuminated, and contains a variety of small electrical apparatus for domestic applications, as well as motors, accumulators, &c.

In the French section a room is set aside for electrical exhibits, which are well set out, though perhaps rather crowded, and there are a few items in the German section.

While the Board of Trade Exhibitions Branch has, undoubtedly, afforded very valuable assistance to exhibitors, it is, we think, very questionable whether the holding of two exhibitions in the same country within a period of two years is not overdoing the thing. We understand that many of the British exhibitors were anxious to be represented at Ghent, no doubt remembering the successes they recorded at Brussels, but we suggest that, while under similar circumstances such firms should be amply supported by the Branch, the question whether British manufacturers should receive a general and pressing invitation to exhibit and thus to form a large British Section should receive very careful consideration. We are not in possession of all the facts that led the Branch to adopt this course, and it is too soon yet to take stock of the results; but we think we shall voice the opinion of manufacturers in general in propounding the view that at least five years should elapse before one of its international exhibitions follows another in any one country, and preferably a longer interval should be allowed.

The First Municipal Waste Heat Station.

Elsewhere in this issue we illustrate and describe the new exhaust-steam generating station of the West Hartlepool Corporation. The scheme is the first of its kind to be carried out by municipal enterprise, and its novelty in this connection led to very close scrutiny of the proposals by the L.G.B. at the official inquiry, which was concluded in July, 1911.

Under an agreement which lasts for a period of 30 years, the Seaton Carew Iron Co. provides exhaust steam from its blowing engines, or, if none is available, live steam from its boilers, to mixed-pressure turbines provided by the Corporation, as well as the circulating water required by this plant, in exchange for electrical energy to meet its requirements. Various guarantees in the agreement safeguard the Corporation, which also has sufficient adjoining land to build a coal-fired boiler plant in the event of its being necessary to do this.

The immediate effect on the Corporation's electricity supply will be roughly the loss of a large consumer—the Seaton Carew Co.—and the gain of others requiring more than double the lost supply; on the operating side, coal and water costs will practically disappear, but the saving in this direction will necessarily go towards the capital charges on the new plant. Thus it is not probable, and, indeed, Mr. Friederichs, the borough electrical engineer, does not anticipate, that the full benefit of the new plant will be felt for a year or two.

The expected practical disappearance of coal costs, at a time when coal prices promise to remain at a high level, leaves little doubt as to the ultimately profitable character of the scheme, which is welcome, if only on account of the enterprise displayed by the Corporation and its engineer in facing modern electrical requirements in a business-like manner.

Salaries in Public Service.

We find ourselves entirely in agreement with the Chancellor of the Exchequer when he argues for large salaries to be paid to men qualified to hold important positions in the public service. There was a time when not every member of the present Cabinet used to think that way. But the times change and we change with them,

so there is nothing incongruous in thinking when you are young that no man is worth more than £500 a year, and when you get to years of maturity drawing an annual salary of ten times the amount. Yes, we quite agree with Mr. Lloyd George, that when, as in the case of the Road Board, men of exceptional standing and ability in matters of organisation and control are called from private occupation to the service of the State, they should be compensated with the hand that is not niggardly. "It was very desirable that they should get the best men available for these positions, and he did not think there was a greater mistake than to underpay them" (*Times* report).

There are, as most people will admit, many things calling loudly for redress in connection with the Civil Service. We have sympathy with the agitation which occasionally arises for less of privilege and more of merit to decide who shall *enter*, but the Chancellor's trouble at the moment concerns the later doings of those who after having proved their fitness are weaned from the service of the State by the attractions of the world. He says: "One of the most serious facts they had to face was that their really good men passed from the Civil Service," for "the moment a man developed first-rate business abilities, it paid big businesses to offer him a large salary, even as much as £10,000." Now, if we were to read much more of this sort of thing we should feel prompted to call for a speech from the Postmaster-General, and inquire into the health of the Telephone Service. It is, no doubt, a crying shame that the business world should attract our State servants by dangling princely salaries before them.

But let us consider another case. Imagine a huge business built up by private enterprise and then bought over by the State for many millions sterling of purchase money. We will decide not to take over any official whose salary exceeds £700 per annum. Efficiency, brains, powers of organisation, expert knowledge of a most intricate business—these shall all be subordinated to that policy of the fixed salary limit. What would the Chancellor of the Exchequer say to that? What *does* the Postmaster-General think of it, in the midst of the bombardment of complaints respecting the telephone service of this year of grace 1913? Perhaps we had better not ask what do the Post Office Engineering Department staff think of it.

Applying the Chancellor's own words in this connection, may we not say that "One of the most serious facts that we have to face is that really good men" of high technical qualifications are not yet appreciated at their proper value, that the status of the Post Office engineer leaves much to be desired? For the Road Board we will have the best men we can get; the telephone—upon which we are going to spend 10 millions sterling more—must take care of itself.

Cooling Gas Engines.

The paper read by Prof. Bertram Hopkinson this week before the Institution of Mechanical Engineers heralds a new era in the history of the gas engine; the novel system of cooling the cylinder and piston, which he describes, will undoubtedly prove of fundamental importance to the internal-combustion engine, especially in the larger sizes, and will very materially modify the relationship between the large gas engine and the electricity supply industry.

Briefly, Prof. Hopkinson has found a way of cooling the parts exposed to the hot gases which will completely do away with the necessity of installing costly cooling towers, pumps, &c., and at the same time greatly simplifies the construction of the engine, as water-jacketed cylinders and pistons will no longer be required. The cylinder will become more simple even than that of a steam engine, for it will need no jacket at all; and with simplicity and the removal of high temperature stresses will come a freedom from cracked cylinders and pistons, which must greatly increase the reliability of the large gas engine. The use of internal cooling also has the rather paradoxical advantage that its absence through the accidental failure of the water supply, instead of wrecking the engine, merely results in a temporary stoppage without any damage—and not even a stoppage, if the mishap is discovered within ten minutes or so of its occurrence. Moreover, the speed of the engine and its output can be increased by a considerable percentage, and possibly its present inability to carry an overload for long may be removed (though the author does not make this claim).

We do not wish to suggest that startling consequences will follow this new and interesting development; but there is no doubt that, assuming the author's claims to be fully realised, it will place the gas-electric power plant in a much more favourable position than it has hitherto occupied in this country. Already the large gas plant challenges the supremacy of the steam plant, and if the cost of the former can be reduced by, say, 20 per cent., and the output increased by a like percentage, it is clear that the balance of economic advantage will be radically altered. The question whether steam or gas power shall be employed in a new generating station will assume an entirely new aspect.

So far as the competition between the electric motor and the small gas engine is concerned, no change need be anticipated, for the cooling of the latter is not surrounded with the difficulties met with in the case of large engines, and the benefit derivable from the new system will be proportionally far less.

An Arbitrary Specification.

A specification recently issued in connection with the electric wiring of the new Mining and Pottery Schools at Stoke-on-Trent, contains clauses which are, in our opinion, both arbitrary and retrograde. In one clause it accepts the model general conditions recommended for use in connection with contracts for electrical work by the Institution of Electrical Engineers, but modifies this acceptance by the phrase "when such conditions are applicable and *not at variance with the provisions herein*."

Amongst these provisions we note that no payments are to be made to the contractor until one month after the completion of the work to the satisfaction of the architect and the engineer, when an amount equal to 80 per cent. of the contract price is to be paid. The work is to be carried out to the entire satisfaction of both architect and engineer, but no plea as to their acts or orders is to be put forward to excuse any error of construction or fitting. If any part of the work fail on test, it is apparently open to the architect totally to reject such work, and to deduct from the contract price the architect's estimated cost of the rejected work being redone by another contractor. According to the letter of the specification, no opportunity is to be given the contractors to put the matter right.

Any claim for extras is to be made in detail by the end of the month in which the work is done, or it will be considered that the claim has been waived.

If the contractor die during the course of the contract, it is open to the architect to proceed as if the firm became bankrupt, getting the work done by other parties, and charging the cost against the estate of the deceased contractor. In our opinion the representatives of the deceased should have the option of completing the contract.

Coming to the work to be done, the descriptions given are very vague, so vague indeed that a meeting was arranged between the contractors and the engineer to elucidate many of the most elementary points. No plan of circuits is given, nor is there a clear definition of the class of cable to be used, while, in some cases, parts of the work are to be done by the builders at the contractor's charge, such charge forming part of the contract sum. It would be possible to give many instances where the specification is too vague for close tendering. Our object is, however, simply to enter a protest against the relapse which this specification illustrates into what we had hoped were the methods of bygone days, when unduly vague specifications coupled with unjustly stringent general clauses made electrical contracting a gamble rather than a business.

D

WATER SUPPLY FOR INTERNAL-COMBUSTION ENGINES.

By A. N. RYE.

The supply of cooling water to the cylinder jackets, cylinder covers, exhaust valves, &c., of gas and Diesel engines is a matter which in many cases does not appear to have received sufficient attention. It is, however, one of the most important details, particularly if the engines installed are of considerable power, and it is rather astonishing that many of the makers of this class of plant appear to treat the matter almost with indifference. Possibly under the existing conditions of keen competition they do not consider it advisable to call the attention of buyers to the necessity for installing elaborate and costly water supplies.

Most engineers with steam plant experience are naturally inclined to deal with the cooling water for internal-combustion engines in the same way as they would deal with the circulating water for a surface condenser, but further consideration of the subject will show that the two problems are not similar to one another, and it will also show that a water supply which is quite suitable for surface condensers may be totally unsuitable for internal-combustion engines.

The importance of a reliable supply of cooling water for internal-combustion engines cannot be over-rated; any failure of the circulation may cause a most serious breakdown if not noticed at once. Particularly on Diesel engines, with their fine clearances, it does not require a very great increase of cylinder temperature to cause either a cracked piston-head, cracked cylinder cover, or a seized piston—all of these are expensive accidents, and the latter may cause a complete wreck of the engine. Of course gas engines are subject to the same risks, but for various reasons they appear to be rather less susceptible to ill treatment. Even if the failure of the water supply is noticed in time, it means that the engines involved must be shut down at once, and if overheated they must be allowed to cool down before again turning on the cold water; it is possible to crack an expensive casting by restoring the water supply too quickly. A delay of this nature may cause a serious interruption to the supply. It is, therefore, evident that a reasonable outlay on securing a reliable water supply is a good investment.

It is surprising to see the totally inadequate provision for water supply made by many manufacturers of internal-combustion engines, which are frequently sent out with a small belt-driven pump for this purpose. It is disconcerting to know that the safety of the engine and the reliability of the supply depends on such an arrangement.

In other cases an electrically-driven pump is employed; if a duplicate pumping set is available, this arrangement is preferable to a pump driven from the engine, because in the latter case the engine may have to be shut down for hours due to a trifling defect in the pump, but even with duplicate electrically-driven pumps, a fuse may blow, and the plant may be disabled before the attendant notices that anything has gone wrong.

In a generating station containing 500 H.P. of Diesel engines, and 960 H.P. of gas engines, with which the writer is connected, both the above methods have been tried and found unsatisfactory, and when the plant was extended the following system was decided upon; it is not suggested that it is the one and only way to do the work, but it has worked well, and may be of interest to other engineers.

A pump room has been built at right angles to the engine room, and entirely open to it, so that everything is under the eye of the attendant. Above the pump room tanks have been erected at a sufficient height to supply water to all the engines by gravity; these tanks hold a supply sufficient for the whole of the engines for 20 minutes' running. The water flows from the various engine jackets, &c., into receivers arranged in the usual way, so that the flow in every water circuit may be seen without difficulty, and the temperature tested at intervals. These receivers connect to a hot water main, which takes the water by gravity to two of Heenan & Froude's rotary water coolers; the cooled water is discharged into an underground tank of large capacity, which is also fed by a ball valve from the town water supply. The floor of the pump room is sunk below the ground level to such a depth that all the circulating pumps are below the water level in the underground tank; this avoids the necessity for priming arrangements, and makes it certain that a spare pump can be set to work with the minimum of delay. Three motor-driven centrifugal pumps are installed in the pump room, two of which can deal with the whole supply; normally one pump runs continuously, the second is controlled by an automatic starter operated by a float, and the third is held in reserve. Duplicate electrical circuits are run direct from the main switchboard to the pump room.

It will be seen that the pumps deliver from the underground to the overhead tanks, and that the remainder of the water circuit is by gravity, and that, if the whole of the pumps are stopped for any reason, there is still 20 minutes' water supply for the engines contained in the overhead tanks.

This arrangement has important advantages, in addition to a reasonable certainty of supply. It enables the water to be turned on to an engine a few minutes before starting, thus making certain that the jackets are full and everything is in order, and it also allows the water to be left running after stopping the engine; if this is not done, there is no doubt that the cylinder jackets attain a very high temperature due to the heat stored in the cylinder walls, &c.; in fact, the comparatively small amount of water left in the water spaces quickly reaches boiling point unless the water circulation is maintained, and when the water attains a high temperature it deposits any scale-forming impurities which it may contain; this scale is most difficult to deal with, and causes troubles which will be referred to later.

There is an additional reason for maintaining the flow of water for some time after the engine is stopped. As soon as the engine is at rest the cylinder lubrication ceases, and the cylinder is left with a thin film of oil on its surface; unless the temperature of the metal on which this oil is lying is reduced quickly, it seems reasonable to expect that this thin film of oil will evaporate and leave the cylinder in a dry condition for the next time the engine is started.

Some engineers encourage the practice of leaving the cylinders hot in the case of gas engines, to prevent the deposit of moisture on the sparking plugs, but no difficulty has been found in this particular installation, possibly because Lodge ignition is used.

In addition to an ample and reliable supply of water, the quality of the water is of great importance. A very large number of cases of cracked cylinders, pistons, &c., on internal-combustion engines have been due to no other cause than the use of unsuitable water.

The water spaces in cylinder jackets, and particularly in cylinder covers, are generally intricate, and it is nearly impossible to clean them; if a bad water is used a scale will be deposited in these water spaces which will prevent the passage of heat from the interior of the cylinder to the cooling water, and the result will be the same as a failure of the water supply, that is, seized pistons, cracked pistons, cracked cylinder covers, burned exhaust valves, &c. Within the last year there have been many cases of failure in widely different localities due to deposit of scale; in some cases practically the whole of the water space has been filled up, leaving only a small channel through which the water flowed, of course doing practically nothing towards cooling the cylinder or cover.

The same effect has been brought about by drawing water from a stream which carries down mud in wet weather, the mud filling up the water spaces very rapidly.

To avoid these troubles it seems advisable to use the best water available, and to use a sufficient quantity to keep the temperature down to such a low figure that there is little risk of deposit. When it is considered that the cost of replacing a cylinder cover or piston may amount to as much as £60, it is obvious that the use of anything but the best water available should not be considered. It has been proved many times that a water which is good enough for boilers is frequently not good enough for internal-combustion engines because of the difficulty of removing deposit.

The cooling of the water is a matter of considerable importance.

The makers of internal-combustion engines generally state the quantity of cooling water required, and they usually

assume a temperature of 60° F. Now, in all except the smallest installations, the water must be cooled in some form of cooler, and if this is done the temperature of the cooled water will be at times as high as 80° to 90°. The temperature at which the water leaves the engine is limited to a certain maximum figure, partly because of the necessity of keeping the cylinder temperature down, and partly to avoid scale; this figure may be taken at about 120°—130°; it is possible to go higher with safety if it is necessary, but it does not appear to be advisable to do so.

If, therefore, the maker of the engines specifies a quantity of water on a temperature range of 60°—120°, and owing to any reason the temperature range at certain times can only be 90°—120°, then approximately twice the quantity of water must be used and the water plant must be designed accordingly.

It is also important to see that the water does not become concentrated. The evaporation at the cooler is taking away a proportion of the water all the time and leaving the solids in solution in the remainder; consequently, a water which at the start was good will in time become unsuitable, and require renewing; in districts where the air is clean the drainage of the roofs may be led into the water tanks, so that in rainy weather they may be flushed out with soft water, and the water renewed without expense.

A consideration of the points mentioned in this article will show that, although there is no difficulty in providing an efficient supply of water for internal-combustion engines, the details require careful consideration, and the matter is of some importance, because on details of this description the success of an installation largely depends.

ELECTRIC INCUBATION.

The electricity supply companies of America are nothing if not practical. They believe that in order to promote the sale of electricity it is necessary to inspire a customer with a reason for the faith that is in him with regard to the advantages of electricity applied to the everyday needs of the community. As a large proportion of the customers of electric light and power companies throughout America are situated in rural districts, the attention both of electrical apparatus manufacturers and of electric supply companies has been directed very especially to the problems attending the application of electric power and heating to the needs of farm life. Bearing this point in mind, it is interesting to refer to a demonstration which has recently been given by the Kentucky Electric Co., of Louisville, for the purpose of demonstrating to the public generally the advantages of electric heating for incubators. In order to effect this, a show window was set apart for the demonstration, and it naturally attracted a very considerable degree of attention, as it was situated in a position easily available to the general public. A "Cyphers" electric incubator with a capacity of 120 eggs was used. The incubator was set on February 27th, with its full complement of eggs, and on the seventh day of incubation the first test was made and 11 imperfect eggs were discarded. The demonstrations were carried out by Mr. Eugene Strauss, proprietor of a well-known American poultry farm, and white Wyandotte eggs were used. Mr. Strauss devised a rather ingenious appliance, by means of which he obtained satisfactory tests on the eggs with the results indicated. Three of the 11 eggs displayed dead germs, while the remainder showed up as unfertile eggs.

The second test was made on the 12th day of incubation, when again 11 eggs were discarded. The test revealed that each egg contained a dead embryo, showing that the eggs in this case were originally fertile. It was easy to find an explanation for this catastrophe, however, as a section of the incubator was for a few hours on the preceding day subjected to the direct rays of the sun through a heavy plate glass window. As a result of this increased temperature, the 11 eggs were literally cooked. This left 98 eggs in the incubator at the hatching period, which began on the 20th day.

A rather remarkable record of 86 chickens emerged from the shells during the two days of the period. Unfortunately this success in itself proved the cause of another disaster, as owing to a failure to relieve properly the congestion in the hatching drawer of the incubator, 21 of the chickens were smothered before they dropped into the warming chamber at the bottom of the incubator. This left 65 chicks, which were placed in the brooder and kept in the window for four or five days as an exhibit of the success of the undertaking. Only two chickens died in the brooding pen.

The temperature within the incubator was started at 101° F., and increased on the second day to 103°. The purpose was to keep the temperature as close as possible to the latter figure, and only for a few hours did it vary from this point. The minimum was 101½°, and the maximum 105° in these fluctuations. The hygrometer varied during the period of incubation from 52 to 67, and the outside temperature ranged from 56° to 74°. The total energy consumption of the whole period was 14 KW.-hours. From an advertising standpoint, the demonstration proved to be a great success. The results were shown day by day on a blackboard giving the temperature readings and the amount of energy consumed. When the chicks began to pick the shells, interest increased until there were hundreds of persons around the window for hours at a time. It is on this account that we hesitate to recommend the same demonstration to British electricity supply companies, at any rate in the more congested thoroughfares of our cities, as we do not wish to incite our readers to perpetrate any acts which may lead them into collision with the police. Nevertheless, the value of ocular demonstration of this description is undoubted, and at the present time, when poultry farming appears in many quarters to be receiving new and scientific attention, it might be advisable for electricity supply companies to make a feature of this in order to draw attention to some of the useful applications of electricity supply on the farm and homestead.

WORKING UNDER A NON-TECHNICAL GENERAL MANAGER.

By AXON.

In many businesses of a purely engineering character, or of a nature which makes them dependent for successful working on the proper and efficient management of an engineering plant, it is often found that the general manager at the head of the whole concern is a purely commercial man, having no knowledge whatever of engineering matters save that which he has picked up in the course of every day contact with the members of his staff who are responsible for the engineering department, or, in the case of a manufacturing firm, the men who actually design and superintend the manufacture of the firm's products.

Now seeing that the business could not go on without the help of skilful designers and superintendents, and that it is an engineering business when all is said and done, it may appear terribly unjust to the engineering staff that they are under the direction of a commercial man without any engineering training, and that the salary of this commercial man should be much greater than their own. Especially does this feeling become keen when the engineers reflect that the training of the general manager has not cost him in either time or money, study or worry, one half the expenditure and self-denial that the engineer's training has cost him. No engineer to-day can be said to have even a chance of competing for the higher appointments in the profession unless he has an education which will take him more than half way towards a B.Sc. degree, in addition to a long and fairly wide practical experience. It is the above feeling of injustice which is the cause of the want of co-operation so often found in engineering works which are controlled by a commercial man as general manager. This want of co-opera-

tion is altogether wrong, both as regards the welfare of the engineering staff and also in the light of their clearly defined duty towards the firm which employs them.

The sole reason why any person risks capital in establishing a business is that he hopes for a good return on his money; therefore the real object of the business is to make money. This fact is so very often forgotten by engineers when placed at the head of a business and allowed to control its destinies, that investors and boards of directors have by painful experience learnt that a first class engineer is necessary, but also that in the majority of cases, especially if the engineer is also an inventive genius, it is absolutely necessary to have a commercial man to direct the general policy of the concern if it is to remain a paying business. In many cases where this arrangement is in force there is a studied hostility on the part of the engineering staff towards their commercial colleagues, this being rendered possible by the fact that the directors or committee wisely insist that the engaging or dismissal of any member of the engineering staff shall be left absolutely with the chief of the engineering department. From some experiences which the writer has recently undergone, he is convinced that this attitude is not only wrong on the grounds of interfering with the career of the firm or department, but that it is also very wrong in regard to the best interests of the engineering staff.

In a case in which the writer has been recently a spectator from the inside, the policy of the head of the engineering department was to keep the general manager as much as possible in the dark with regard to every detail of the engineering side; the general manager did not take the matter up with the directors simply because he did not intend to acknowledge that he felt for the time being inconvenienced, and the engineering department almost to a man thought that this state of things could be always maintained, forgetting that the general manager had been previously manager of a similar business, and was by no means wanting in resource, brain power, or determination. What happened might easily have been foreseen, and was in fact pointed out by the writer as the line which the manager would take. After taking a month or two to attend to matters which were ready to his hand and which were of a purely commercial nature, the manager suddenly surprised everyone by stopping the manufacture of a certain article which he said did not pay. The chief of the engineering staff tried in vain to refute this idea; there were the figures in black and white to prove the matter, which figures the manager showed could have been obtained any time during the last couple of years by anyone having even a moderate amount of the commercial instinct. As the previous general manager had been an engineer, and as the board of directors had thought that a more commercial manager would be advisable when he left to go to a better appointment, this little matter was exceptionally nasty for the engineering staff to digest. The directors did not altogether like the stopping of this line as it was of old standing with the firm and somewhat a pet idea of the late manager's, but the figures were undeniable, and at the end of a further six months' working the accounts proved the absolute soundness of the manager's policy.

By this time the manager was able to progress a trifle faster and officially complained to the chief engineer that a certain department was costing a heavy sum to run. To this the engineer replied that the department could not be run for less, forgetting, as so many engineers in a similar position forget, that a man who has been managing a similar business elsewhere must have records and statistics of what was done and of how much it cost, or that if he has not the exact statistics for that particular job he will have friends in the old place and in similar businesses elsewhere who will help him out of the difficulty. At the end of another three months the manager again told the engineer that there had been no improvement and that he considered one easily possible; he was again met with the same answer from the chief engineer. The reply to this was very quiet, but extremely effective. The manager appointed an additional departmental head, placed him at the head of the disputed department, and removed the department from the control of the official who had previously managed it alone, with another department, giving as his reason for the appointment, the fact that the work of both departments had so much increased that this additional official was necessary. The chief engineer seeing that he was playing a losing game in this case did not fight the matter. The new official was brought from the works which the manager had previously controlled.

To cut a long story short, it will suffice to say that the new official put all he knew into the work of the department, and in six months reduced the cost of that department by 15 per cent. Instead of taking the lesson to heart, the chief engineer simply pursued his old policy of attempted concealment and evasion, and then woke up one fine morning to find that a project for very large extensions had been talked over between the board and the manager, and that an outside engineer had been called in to advise on the matter. The engineer then realised that only his long connection with the firm had saved him from being asked to resign some time previously, and seeing a chance of a move to another firm he took it, being helped into it by the manager whom he had tried to trip up.

What then, it may be asked, is the correct policy for an engineer to adopt who is under a commercial man? The only policy is that of absolute straightforwardness; and this policy is not only ethically right, but it also produces the best working results for the engineer and the whole of his staff. The idea of an engineer so placed should be to implant the firm conviction in the mind of the manager that he has only to turn to the engineer in any of his difficulties in order to be helped out of them in the best possible manner, and with willingness and promptitude. Let the manager feel convinced that the engineering department is being carried on in a proper and trustworthy manner, and there will be no interference with matters which are in themselves purely engineering matters. The majority of managers are only too glad to feel that this part of the business is in reliable hands, whilst in case the engineer has to complain of undue interference, the fact that he has always supplied all information asked for promptly and correctly, and that this information has been found to be sound, will put the engineer in a very strong position when he approaches the board.

The object of an engineer so placed should be to make the manager feel that he cannot afford to lose the services of his engineer, and that he is his right hand. The engineer should not wait for the manager to approach him previous to a discussion on the policy of the firm, but should make a point of regularly talking over matters with the manager, and suggesting improvements where he thinks they are necessary. This may seem a platitude, but the fact is that the writer knows more than one capable engineer who deliberately adopts the attitude of waiting for the manager to come to him seeking information, cap in hand, as if any man with a man's spirit would put up with so humiliating a position. One engineer personally known to the writer adopted this attitude for some years, and then expressed great surprise one day to find that the manager had gone elsewhere for his information, and that, as a consequence, the manufacture of a certain line of goods in his department was stopped and given to an outside firm, thus taking away from the engineer a large part of his responsibility, and the opportunity for further advancement.

Engineering is so fascinating a profession that, in spite of its poor pay and exacting demands in the way of study and time, many engineers would not care to leave it for a position in which the engineering side took a distinctly secondary place, and to such engineers the only policy which will bring progress, peace of mind, and respect, is the policy outlined above of serving the manager, and through him the firm, to the best of one's ability. Even with a manager who seeks to take all the credit to himself this is the only sound policy—to serve him well until one can get away.

An engineer who seeks a managerial position should first obtain a good engineering training, and then, after some short practical experience, get into the commercial side; he will then be so valuable a man after a few years spent commercially, that he is almost bound to obtain a position with comfortable hours and a first-class salary.

In conclusion, remember that people go into business to make money, not to carry out marvellous engineering feats which spend money and do not make it; and that, although

the engineering works could not be run without an engineer, yet the possession of commercial acumen and skill is absolutely necessary if money is not to be lost, and that if the shareholders could not get an engineer to run their works, and had, therefore, to give up the idea of engineering, the skilful commercial man could still get them 4 per cent. or 5 per cent. on their money fairly safely, without the risks run in manufacturing. And it is money that shareholders are after.

THE CARELS-DIESEL ENGINE WORKS.

Last week, on the invitation of The Consolidated Diesel Engine Manufacturers, Ltd., we paid a visit to the works of the well-known firm of Messrs. Carels Frères, at Ghent, who are associated in the above-named concern with the Diesel Engine Co., Ltd. The Consolidated Co. is building a new works at Ipswich, which will be put in operation in two or three months, and as, we believe, by far the greater part of the output of Carels-Diesel engines is already disposed of in this country, it is clear that the works will start with an assured market for its products.

The firm of Carels long ago acquired a world-wide reputation for the manufacture of the steam locomotive, and later of the stationary steam engine; but its attention was early attracted to the principles put forward by Dr. Diesel, and 20 years ago it obtained the right to manufacture under his patents.

But the evolution of the Diesel engine was not a matter of months; not until 1900 was its development so far advanced that the regular manufacture of the engine on a commercial basis could be commenced. Since that year constant progress has been made, the engine being built in continually larger sizes, and during the past five years Messrs. Carels Frères have been building reversible engines for the propulsion of ships, in addition to the types they had been constructing for driving dynamos and workshops. Three years ago they proved their ability to obtain 1,000 B.H.P. from a single-cylinder engine, and their successes speedily rendered it necessary to extend their own works, doubling their power of production, and to grant manufacturing licences to a number of foreign firms, mostly in this country.

The Carels-Diesel engine for land installations is usually built on the four-cycle principle, with vertical cylinders; the two-cycle design is adopted for powers above 700 H.P., while small engines are made of the horizontal type. One of the most notable achievements of the firm was the development of a successful system of reversing gear, in 1908, rendering the engine suitable for the propulsion of ships; a four-cylinder reversible engine of 1,000 B.H.P. was completed in that year, and was followed two years later by the development of 1,000 B.H.P. in a single cylinder, forming part of a six-cylinder reversible 6,000-B.H.P. engine. The principal feature of the firm's large exhibit at the Ghent Exhibition this year is a very fine six-cylinder engine of this type, built to the order of the British Admiralty, and developing 2,200 I.H.P. This engine, with the propeller revolving in air, was repeatedly reversed in our presence from full speed ahead to full speed astern, and *vice versâ*, the operation of reversal being completed in less than seven seconds.

The manufacture of the Diesel engine is not a task to be lightly undertaken. An exceptionally high degree of accuracy in workmanship is indispensable, and there are many special problems to be solved which are not met with in ordinary engine building. A knowledge of the proper qualities of castings to be employed is essential, and long experience is necessary to ensure successful results. All these requirements are fulfilled in the works of Messrs. Carels Frères, who have made a special study of the subject for 20 years, and stand in the foremost rank of Diesel engine builders.

The works at Ghent are largely of modern construction, and are well laid out for the economical manufacture of the engines; they are provided with an ample equipment of modern machine tools, derived from various countries, the principle followed being that only the best should be installed, no matter whence obtained. The foundry is an exceptionally important department in this branch of engineering, the castings being much more complicated than in steam engine practice, and Messrs. Carels Frères accordingly have devoted a large space to this purpose; their special facilities enable them to make very big castings for other purposes, one shop being set apart for the casting of enormous flywheels, of which a large number were in progress at the time of our visit.

An elaborate and highly organised system of passing orders through the shops has recently been introduced, and is in course of development with a view to ensuring that, as far as possible, every man and every machine shall be kept employed in the most economical and efficient manner; the manager is enabled to see at a glance the position of every job, what machines are available, and whether time is being gained or lost on the estimated time allowed for the completion of each stage. The scheme is worked in conjunction with a bonus system, and a cardinal principle of the method is to see that at least two days' work is always planned ahead for every man or machine, so that the foremen are relieved of the necessity of allocating jobs and can devote their whole attention to the maintenance of high quality of workmanship. Special attention is given to the physical welfare of the workmen, ample facilities for washing and feeding being provided; cooks and cooking apparatus are supplied at the firm's cost, and the commissariat is managed by a committee of the men, to enable them to obtain meals at the minimum cost. Moreover, the large messroom which is now being completed will be furnished with periodicals, &c., and will be kept open to a late hour in the evening, in order that the men may use it as a recreation room. The physical and psychological needs and propensities of the men are far too seldom adequately cared for, and in this respect, as in others, the example set by Messrs. Carels is worthy of imitation.

It is hardly necessary to add that the new works at Ipswich will have the benefit of Messrs. Carels' experience and skill, and will thus be enabled to start right away under the most favourable conditions. At a later date we shall have an opportunity of placing particulars of the works before our readers; for the moment we conclude by expressing our appreciation of the enterprise of the Diesel Engine Co. and Messrs. Carels Frères in embarking upon the manufacture of their engine in this country, and our hope that they will never have occasion to regret that step.

PLANT EXTENSIONS AT BRADFORD.

In a lengthy report to his committee, Mr. Thomas Roles, the city electrical engineer, discusses the future of the Corporation's generating station in Valley Road.

The present capacity of these works is 15,800 KW., but this includes 2,800 KW. in 12 direct-current high-speed engine sets in the No. 2 works, which would ere this have been disposed of, had not recent winter loads compelled their retention. Generally, he considers that in future extensions on this site three-phase turbo-generating plant should be adopted and installed in the No. 3 works, the No. 2 works being retained as a town sub-station, and equipped with the necessary transforming and converting machinery for supplying the direct-current lighting and tramway networks.

His immediate recommendations, then, to provide for the winter of 1914-15, are that a 3,000-KW. turbo-alternator be installed to replace the obsolete high-speed engine plant in the No. 2 works, where two 1,500-KW. rotary converters will be installed; in place of a third similar stand-by plant, Mr. Roles proposes to provide a battery capable of discharging at the rate of 2,000 KW. for one hour. Various other additions are outlined, including induced-draught plant, suction ash-handling plant, cooling towers, &c., and the scheme is estimated to cost in all £86,250, which expenditure has been approved by the Corporation Finance and General Purposes Committee.

Probably the most interesting part of this report deals with the distant future of the Valley Road works. Mr.

Roles, looking some ten years ahead, comes to the conclusion that while the position of these works will always be an excellent one as a direct-current distributing centre for the city, yet, with the increase of load and the necessity of installing still larger sets than those at present contemplated, as well as the lack of adequate condensing water, and of land to accommodate any very large extensions to plant, it will be necessary to equip an entirely new generating station on a new site possessing adequate facilities for both coal and water supply.

This drastic proposal would, if accepted, involve the ultimate shutting down of the comparatively modern No. 3 station, and its use for some other purpose if necessary; but prior to this development, it is suggested that one, or perhaps two, of the 1,000-KW. low-speed engine sets shall be replaced by one or more turbo-generators, each of a capacity of 6,000 or 10,000 KW. capacity—the No. 3 engine room being capable of housing as much turbine plant as the boilers and cooling towers which can be accommodated on the site can deal with.

The report which we have outlined carries us very much into the future—in fact, to a time when, in all probability, the economic limits of individual generating station capacity will have been definitely settled; and this brings us to the question, which has, no doubt, received serious consideration by Mr. Roles—whether, after all, the future saving in cost with a brand-new power station will be such as to outweigh the undoubted additional security which would result from retaining the existing turbine station when the full complement of, say, up to 30,000 KW. of plant is installed, and building a new station to carry the additional load.

This question has been discussed by prominent American authorities, who have apparently decided against putting all one's eggs into the same basket, largely in view of the increased security of operation which is possible, and, one may add, imperative where local industry is dependent on the supply, but also because where stations of reasonable size are interlinked, efficient operation does not suffer to any extent.

No doubt, before the future Bradford scheme is carried into effect, intervening developments and experience will materially assist in solving the problems which are bound to arise in connection with it.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The British Engineering Position in China.

The keen interest you display in the furtherance of British engineering affairs is my excuse for seeking the hospitality of your columns to express my views on an undertaking which at the moment is being largely advertised. The British Engineers' Association has been called into being for the purpose of supplying—to use a homely phrase—a long-felt want. While the promoters do not altogether ignore the existence of a Government Department, presided over by an able officer in Peking, whose objects are presumably identical with their own, they make it pretty clear that they do not think much of its efficiency, and equally clear that they condemn the apathy and want of enterprise of the British manufacturing engineer; they are, they say, the people to make up for all shortcomings. There is a fine air of patriotism, too, about their pronouncements, a sort of "shoulder to shoulder" "Rule Britannia" sentiment, which appeals to audiences at friendly dinners and local gatherings, but does not "cut much ice" with the people amongst whom they intend to operate. While not doubting the sincerity of the Association's belief in itself and its objects, one is tempted to ask why they do not begin at home, where engineering manufacturers are driven frantic by foreign competition, and compelled to witness the spectacle every day of both public bodies and private firms placing orders for machinery with foreign countries, on terms which they cannot equal. Considerations of pocket easily override those of patriotism at home, and how does the Association propose by its intervention in China to bring about a different result?

Two principal factors influence the Chinese in placing machinery contracts, irrespective of the country of origin, or the nationality of the seller; first, the price to be paid; and, second, the length of credit to be obtained. Not Great Britain alone, but all the manufacturing nations on earth are here in the fiercest competition, and that country, Germany or another, offering the lowest prices, and the best terms, gets the business; the time is past when "British made" was a title to preference. Does the Association then, acting as *amicus curiæ* between its members and the Chinese, propose to induce these members, *i.e.*, manufacturing engineers, to reduce their prices to a competitive level, and loosen their purse strings? If they can do this they will have accomplished something practical, but much cannot be augured for their success. It is all very well to boast of a number of members whose capital aggregates £60,000,000; it would be much more to the point to know that even a trifling part of this enormous sum will be available for financing the contracts the Association hopes to influence in British favour.

Again, each member of the Association pays a sum of 10 guineas in consideration of a dozen enumerated privileges. It is my purpose for the moment to deal with only one, the first of these, which is stated to be worth all the money. Members are to receive reports at frequent intervals on matters which affect their business interests in China. I do not think the Association could even attempt to rival the Chinese in their methods of obtaining and circulating information. To be of any practical value, information as to a pending job or contract, must be instantly available, and not the subject of a general report, however frequent; that agent or representative would be but poorly equipped for his business, who was compelled to wait on these, and, moreover, the contracting and merchant firms with whom he deals, and who, by the way, must remain outside the fold of the Association, are splendidly served in this way.

I now come to the condition of affairs on the spot, and how these are likely to be affected by the activities of the Association, which starts its career with the avowed intention of fighting German predominance and counteracting German influence. The makers of machinery at home, those presumably who expect to benefit by their membership, have hitherto steadily declined to act as main contractors, for reasons of policy, the principal of which undoubtedly was that they would be called upon to abandon the sweet simplicity of "Cash against documents," for the risk involved in giving credit in a distant country. This means, as any thoughtful man familiar with the situation can see at a glance, that their agents or representatives are cut off from direct negotiation with the Chinese, by the fear of prejudicing or offending the merchant and contracting houses who are their principal, if not their sole, customers. It is only fair to make honourable mention, in passing, of one British firm—the General Electric Co., of China, of which the General Electric Co., Ltd., Witton, is the parent concern—who, under able management here and strong backing from home, have successfully established themselves as main contractors; their name does not appear as members of the Association.

And now comes the crux of the position; the contracting houses are nearly all German—such as the representatives of the A.E.G., Berlin, and the allied Siemens concerns, who, with their splendid organisation, tireless energy in travelling, lavish expenditure, and liberal terms to the point of rashness, have practically obtained possession of the field. Certainly 75 per cent. of the contracts made fall into their hands. Fortunately for the British manufacturer, this is where his representative comes in, and, owing largely to his efforts and the close and friendly relations he maintains with the German firms, British machinery largely preponderates as prime mover. His success in this direction is now likely to be most seriously threatened. How does the Association's commissioner propose to deal with this, in the face of the bold challenge thrown down to Germany?

The facts must be confronted; if he is out for a fight

let him look to it that he is prepared for the consequences, the first of which will be retaliation and the loss of our present principal customers. The issue is clear: either British merchants and engineers must combine both in brains and money to push the business along the lines so wisely and successfully pursued by their rivals, to a point even beyond that which they have reached, or better the British Engineers' Association had never been born.

An Old China Hand.

Shanghai, *July 11th*, 1913.

Air Filtration, Cooling and Ventilation of Electrical Machinery.

In view of the interesting paper on the above subject read by Mr. J. Christie, of Brighton, at the I.M.E.A. Convention of 1913, I wish to state the experience of the manufacturers of dry-air filters whom I represent in this country. Our experience extends over the whole period since turbo-generators were first provided with air filters, and we have several thousands of dry-air filters of different types now in use in practically every climate.

As manufacturers we turn out what is required, and if time should prove that the wet-air filter will do continuously what it has done at Brighton since last year, we should immediately manufacture this type.

Two instances may here be cited which cause us to hesitate. First:—The United States of America, the home of the wet-air filter, seem to be wavering in allegiance, as American orders have been placed for dry-air filters.

Secondly, the largest European constructors of turbo-generators are not favourably inclined to wet-air filters, although not themselves interested in the matter, apart from the effect on their machinery.

Taking seriatim the advantages claimed for the water-screen filter over the dry air or cloth filter by Mr. Christie, our past experience is as follows:—

1. The air must pass through a wet-air filter at slow speed if the apparatus is to work satisfactorily.

Judging from the illustration published on page 1088 of the Electrical Review, of June 27th, 1913, which is all I have in front of me, the wet filter takes hardly less floor space than a single-pocket cloth filter.

The size of a wet filter will always be in proportion to the quantity of air required by the generators, and will mean a proportion between the size of the air filter and the quantity of air to be provided, the speed remaining constant. Thus, a wet filter for dealing with 10 cb. ft. of dusty air per second will take double the floor space wanted for a filter of this type to deal with 5 cb. ft. The same applies to cloth filters.

We cannot, therefore, see why the size of a wet filter should increase in a lesser proportion than that of a cloth filter.

2. With regard to the risk of fire, I have before me data referring to about 3,000 or 4,000 generators provided with cloth filters. We have heard of three fires where the cause of fire has not been ascertained, so that cloth filters need not necessarily be responsible. The filters were in these instances not impregnated against fire; we now impregnate the whole of our filters to make them flame proof.

We further deliver, when required, our automatic system of shutters. These act at the least danger of fire and cut out the filter, while opening simultaneously another air duct, thus admitting air to the machine without the use of the filter.

3, 4 and 5: Without going closely into the question of the cost of maintenance of wet filters, about which we have no details, we know from our experience in other branches of our industry that the nozzles easily and frequently choke, and that for their cleaning complicated automatic appliances have to be used to prevent this. Without such appliances, sooner or later there must be a stoppage. The circulating pump and its motor require constant attendance, and the same remark applies to the renewal of the water. The least defect of the pump, the bearings, the nozzles, &c., means a complete stoppage.

A single-pocket cloth filter normally works six to eight weeks without any attention; then the pockets can be renewed and cleaned in one day, or even in a few hours, by employing sufficient labour. A stoppage at the period mentioned will not matter, because other parts of the generator will then also require inspection.

As a rule, spare cloths are supplied with our filters, and are used to replace the cloths while they are being cleaned.

By using the best cotton cloth obtainable, we have found that the cloths do not wear out quickly. We have filters in use which have been working for over 10 years; many have been working for five years, and in all these cases the cloths have not yet had to be renewed.

The expenditure stated to be £75 to £100 per annum for cleaning and upkeep of a cloth filter for a 3,000-kw. turbo-generator does not tally with our experience. I notice that Mr. D. Bennett states the cost of cleaning to be about £8 per annum. The figures we should give would err on the right side and would be eight cleanings per year by two men, taking each time two days. We should estimate the cleaning to cost £2 each time, or £16 per annum. Add to this the wear and tear of the cloths and take instead of 10 years a period of only two years: the cloths for this plant, which on the single-pocket system cost about £20, would mean £10 per annum, or £26 as the total cost of cleaning and upkeep.

In practice this is quite an outside figure. The cleaning does not require to be done so often, and can be finished by skilled men working at top speed in a few hours.

The water screen filter installed by Mr. Christie takes about 2 h.p., and a unit of this size generally requires about 15,000 cb. ft. of air per minute.

A single-pocket cloth filter, when thoroughly soiled, and then showing a resistance of ¼-in. water column, takes for this unit 0·6 h.p.

6. The well-known construction of the single-pocket air filter prevents the choking of the pockets, which certainly was troublesome when a single cloth filter was used.

H. R. Witting.

London, W., *July 22nd*, 1913.

The Mutual Protection of Engineers.

The writer is pleased to see from your columns that there are others besides himself who object to the present methods of advertising vacant posts. Some years ago I had the painful occupation of replying to a number of advertisements in the Review, and out of over 30 applications had four replies, three of which were from firms who had given their names instead of a box number. If the proposed Association did nothing else than alter this method of advertising, I should think that it had been of use. I may say that I intend to join, although I am employed by a firm second to none in their treatment of staff men, and while I have no fault to find with my present position, I remember that I may not always hold it, and also that there are others who are worse off than myself. So far as I can see the existing Associations of various kinds do not meet the situation, and therefore I beg to sign myself

Prospective Member.

Slag Action in Electric Steel Refining Furnaces.

In your account of my recent informal talk before the Faraday Society on a new type of furnace, reported in your issue of July 11th, page 79, you state: "It is, however, a little difficult to understand how 'chemical' impurities are going to be removed by slag-action, seeing that the heating takes place from below the slag, and that the latter will always be at a lower temperature than the steel."

This is a point which has been frequently raised by the advocates of arc furnaces, in which the slag necessarily has a higher temperature because it receives the heat from the arcs and transmits it down into the metal. They have made a virtue of that which necessarily exists. I think it will not be denied, however, that the only chemical action which exists between the slag and the steel is along their surface of contact. The really active layers of slag and steel between which there can be any action, are, therefore, only of molecular thickness, hence almost infinitely thin. It seems unreasonable to suppose that there can exist any great

differences of temperature between these two thin layers, especially as the slag presumably "wets" the surface of the iron, if such a term may be used; between two substances which are in such close contact that one "wets" the other, there cannot, in my opinion, be any great differences of temperature, for, if there were, it would flow very quickly from one to the other until both were practically at the same temperature, or at least very nearly so. Hence even if the top layers of the blanket of slag were at a higher temperature than the metal, it is difficult to understand how that could materially affect that thin layer of slag which is in direct contact with the metal, and it seems to me that it is only that contact layer which can be chemically active.

Hence whether the heat flows from a hotter slag down into the metal, or from a hotter metal up into the slag, it cannot, it seems to me, make any material difference at the active surface of contact. While, of course, there would necessarily be a slight difference of temperature between the two molecular layers at their surface of contact, for the fact that heat is flowing from one to the other means that a difference of temperature must exist—yet it is difficult to see how that can be more than a very small amount, hence it cannot make much difference.

The facts concerning the furnace in question in which the heat flows from the metal to the slag, are that the sulphur is very easily eliminated; in one test, even under very unfavourable conditions, it was very quickly reduced from ·077 to ·006.

There may, of course, be some virtue in having an extremely hot slag, in that it is therefore more liquid, hence the exhausted molecular layers of contact with the iron are more easily replaced; but this may, perhaps, be accomplished more quickly by an active circulation, instead of by such extremely high temperatures as will injure the roof, and cause appreciable losses of heat through it.

In my opinion, a far more important feature than this possible slight difference of temperature between these two molecular contact layers, is a very rapid mechanical renewal of these contact layers, and rapidly bringing up every molecule of steel from the bottom of the bath to the blanket of slag, instead of waiting for the slow process of diffusion. It will, I think, be admitted by all those who saw the furnace in operation that there is no question that this repeated renewal of the surfaces of contact takes place very actively in this furnace. By continually and rapidly bringing fresh metal into contact with a fresh slag surface, it is reasonable to suppose that the rapidity of refining would be increased, and if this time of refining were thereby reduced to one-half or one-quarter, or even less, it would mean that the so-called radiation losses through the walls of the furnace would be reduced in the same proportion, and for refining furnaces in which there is no melting or increase of temperature, these wall losses constitute practically the total energy put into the furnace.

In a furnace with a very thick roof, which latter becomes possible when no electrodes have to pass through it, it is not unreasonable to suppose that the top of the slag will have nearly the same temperature as the metal below it, especially if there is a very active circulation. As long as the contact surfaces between slag and steel have practically the same temperature, and I hardly see how it can be otherwise in any furnace, it seems to me to be even an advantage not to have the slag excessively hot, for it would seem that the hotter it is the more it cuts the lining and the greater the losses of heat from the top. The cooler the top of the slag, the less will be the heat loss from the top and the less will be the destructive heat action on the roof.

Carl Hering.

Philadelphia, Pa, U.S.A.
July 22nd, 1913.

The 1914 Rubber Exhibition.—We have received a pamphlet giving particulars of the various competitions that are to be arranged on the occasion of the International Rubber and Allied Industries Exhibition in London next June and July. Copies can be obtained from the offices, 75, Chancery Lane, W.C. The purpose of the competitions is stated to be to encourage the better production of rubber, and suggestions by inventors and others of new uses thereof

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Large Impregnating Chamber.

THE accompanying illustrations show a large impregnating chamber made by MESSRS. DRYERS, LTD., 53, Victoria Buildings, Manchester, and installed at the Carville power station of the Newcastle Electric Supply Co. to the order, and under the instructions of Messrs. Merz & McLellan. The vacuum chamber is 13 ft. 6 in. in diameter inside, and is made to withstand a vacuum of 28 in.-29½ in., and a working pressure of 60 lb. per sq. in.

A removable varnish tank is provided to go on the platform car shown, for impregnation purposes. This tank is connected by a

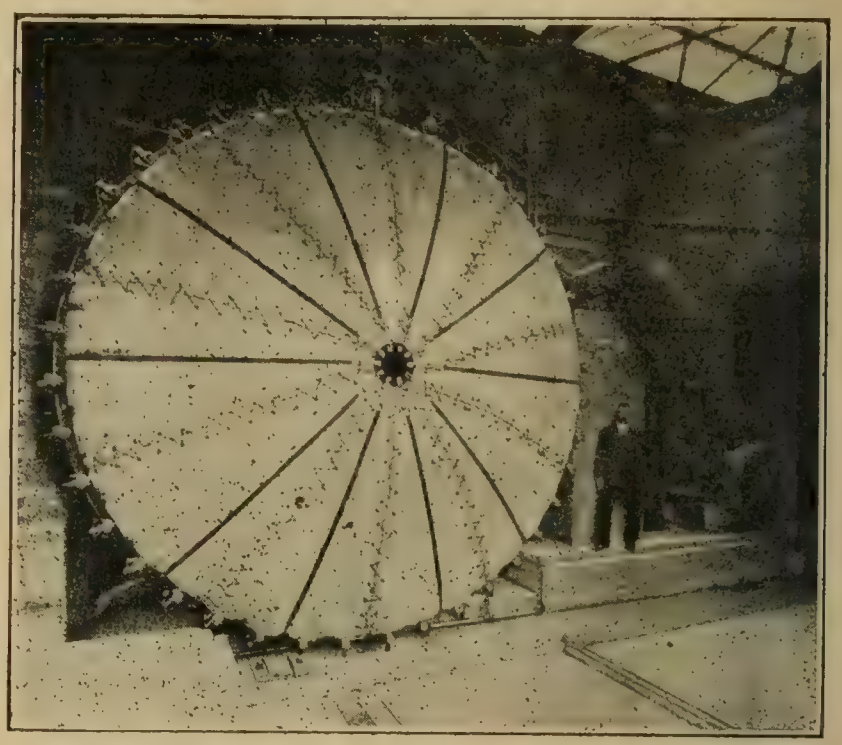


FIG. 1.—IMPREGNATING CHAMBER, CLOSED.

swivel joint, shown in the interior view, fig. 2, to the varnish pipes outside, so that after being dried under vacuum the articles flooded with insulating material and impregnated under pressure in the usual way.

The tank is large enough to accommodate a complete stator for a 10,000-KW. dynamo, weighing about 50 tons. The stator is placed in the tank when the latter is on the truck, and is then run into the

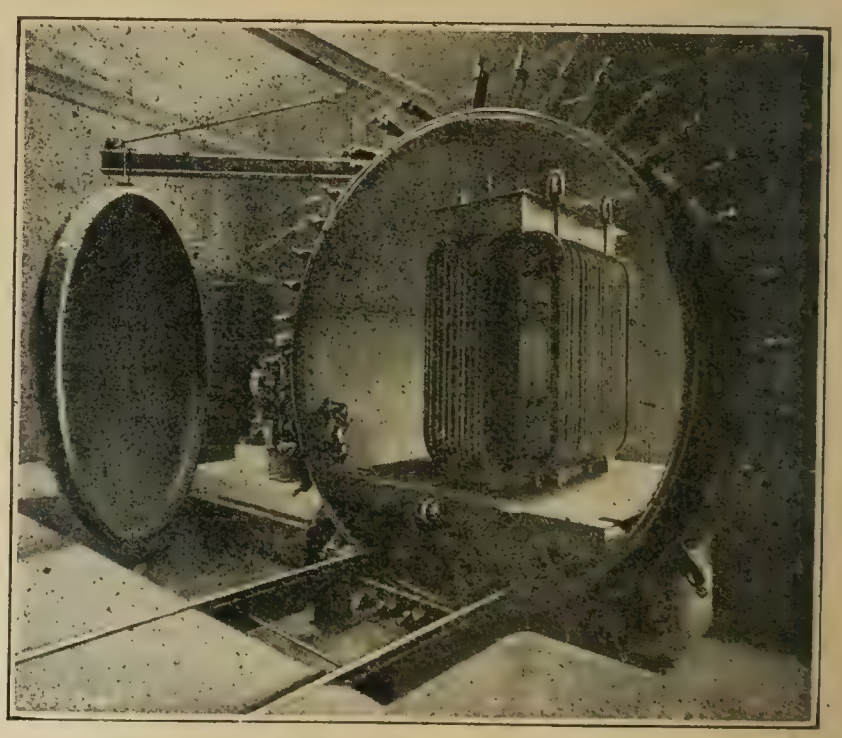


FIG. 2.—TRANSFORMER IN CHAMBER.

vacuum chamber shown, dried thoroughly under a vacuum of about 29-29½ in., then flooded with insulating material, and a pressure formed inside, which forces the material all through and into every portion of the stator. The storage tanks for the insulating material are shown in the background, and are connected by means of overhead pipes to the tanks. All the connections are made at the top of these tanks to prevent any chance of leakage.

This plant is also used for drying transformers, and impregnating them with transformer oil. A special cooler for the air, which also acts as a condenser for any vapour which comes over, is installed close to the air compressor. A two-stage air compressor is provided for giving the necessary vacuum, and also for producing a pressure in the tank. There is also a special high-pressure boiler

which works at any pressure required up to about 250 lb. per sq. in., for supplying the necessary heat to the apparatus. The boiler was tested to 500 lb. pressure both before and after being installed. Electric temperature gauges for thermometers are installed so as to give the temperature at different points in the tank. These indicate on a board at the front of the engine room, on which a steam gauge, vacuum gauge, air-pressure gauge, and depth gauge for the insulating material are placed, so that all indications can be obtained at the same spot.

Conduit Spacing Saddles.

Messrs. Simplex Conduits, Ltd., of Birmingham, are introducing some new forms of "spacing saddles" for use where the conduit is installed on the surface, as in damp situations, &c. These are so constructed that the conduit is installed with a

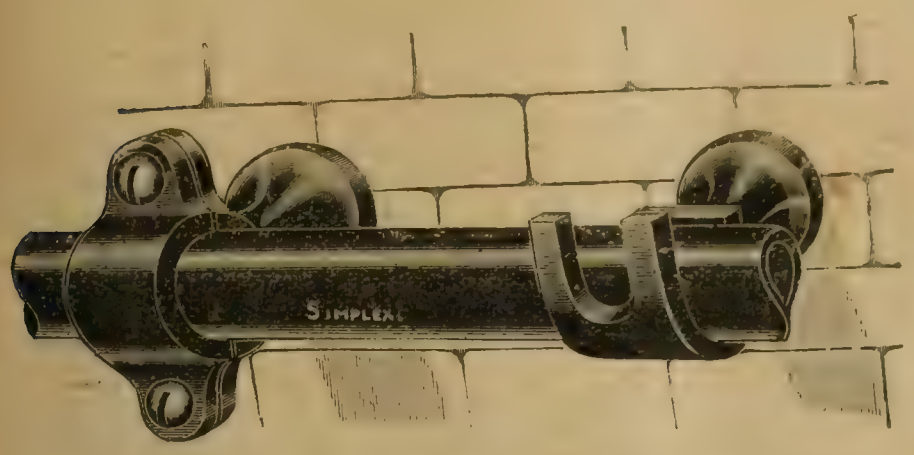


Fig. 3.—Two Simplex Spacing Saddles.

clearance from the wall, thereby guarding the conduit against the effect of surface moisture or sweating.

They are made in two forms; Type "A" is so constructed that the tube is simply dropped in position, the holdfast being made in two sizes, to take exactly the size of tube which is being used. Type "B" is an improved pattern, in which the conduit is firmly held, the fitting being made in two pieces, which are held together by means of two brass screws. The ordinary wood screws may be used, and considerable saving in labour is effected by screwing direct between the bricks, although the wall should preferably be first plugged. Both types are illustrated in fig. 3.

New Motor.

Messrs. Newtons, Ltd., of Taunton, inform us that they are placing on the market a commutating-pole motor of special construction. The magnet system, with the exception of the commutating poles, is of cast-iron and in one piece; the frame is ventilated so as to provide better ventilation in a vertical direction than hitherto. It is claimed that the use of cast-iron, combined with the particular position of the main field coils, gives a better torque curve in motors having series or compound field coils. Owing, too, to the poles being solid and of special shape, the machine is absolutely silent in running. A further claim is that the magnet system is the most economical at present known; the no-load losses are a minimum, and the efficiency curve is a particularly good one. In a 10-B.H.P. continuous rated motor running at 850 R.P.M., the constant losses at full load equal 550 watts, and the variable losses 700 watts, giving an overall efficiency of 85·4 per cent. at full load, 85 per cent. at three-quarter load and 83 per cent. at half load. The weight of these machines is about the same as that of the usual steel construction. A number of them have been supplied for quick-rated reversible lift motors, &c., as well as for continuous-rated machines.

The temperature rise is within the standard specified by the British Engineering Standards Committee.

A St. Helens Rubber Tire Exhibit.

Amongst the exhibits at the Commercial Motor Exhibition was one by the St. Helens Cable and Rubber Co., Warrington, of a new kind of solid rubber tire, which is worth mentioning in our columns, in view of its possible adoption on the electric battery vehicle, although, of course, it is suitable for use on any heavy motor vehicle.

The tire is of ordinary semi-circular section, and its special feature is the insertion between the hard tread rubber and steel band of a layer of specially pure, resilient Para rubber, which absorbs all road shocks, and relieves the tread rubber of their destructive effects.

The tire, which is known as the "Super-resilient" (Seymour patent) band tire, is the invention of Mr. E. Seymour, the St. Helens Co.'s works manager; it is claimed to have nearly 70 per cent. greater resilience than the ordinary solid tire.

The Lighting of Cinema House, Sheffield.

The lighting of this theatre is interesting, because it represents a harmonious combination of a number of different lighting systems. The installation scheme was prepared by the B.T.H. Co., of 77, Upper Thames Street, E.C., along lines suggested by Mr. Ravenscroft, the managing director of the theatre. The B.T.H. Co. also supplied the lamps, fittings and other lighting equipment.

The auditorium is lighted by B.T.H. trough reflectors, containing Mazdalite tubular lamps, concealed in the cornice. The light is projected on to the curved ceiling, and from there reflected downwards into the auditorium.



Fig. 4.—B.T.H. Lighting at Cinema House, Sheff

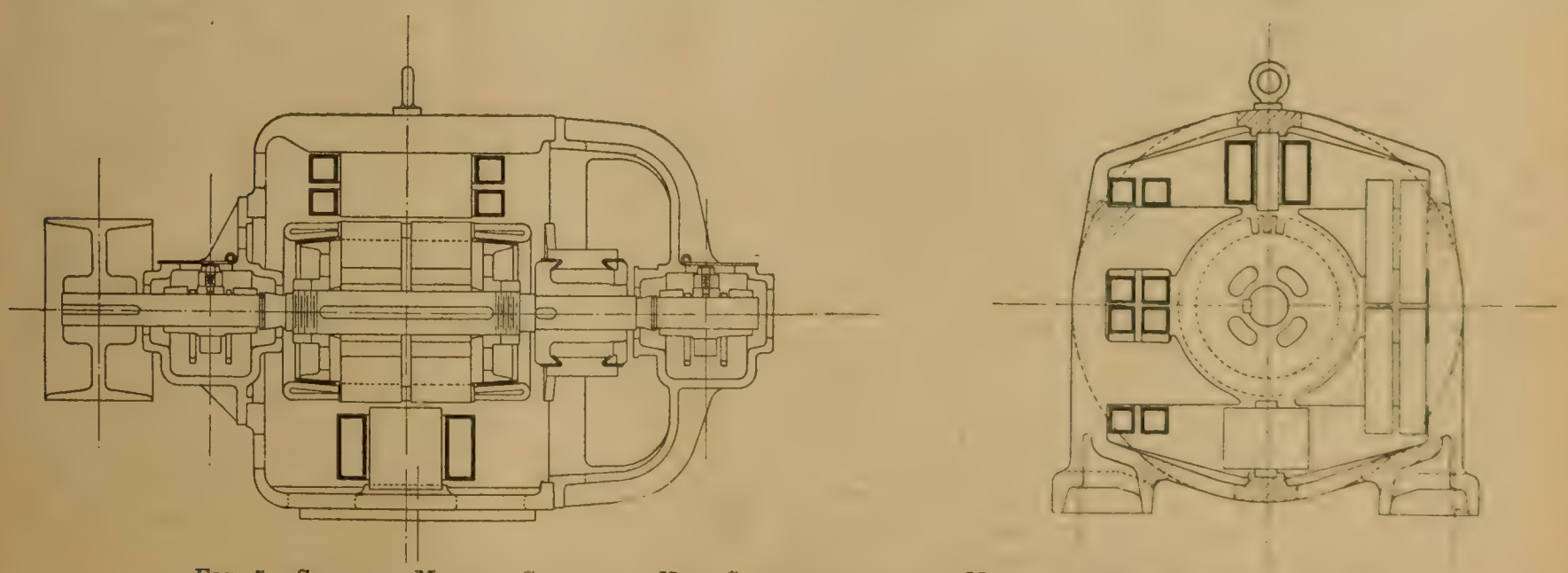


Fig. 5.—Showing Magnet System of New Commutating-pole Motor, by Messrs. Newtons, Ltd.

This cornice lighting is supplemented in a rather novel way. There are six domes in the roof of the auditorium, and each of these domes is covered on the under side by beautifully-tinted amber glass. Above the glass, around the bottom edge of each dome, is arranged a row of upturned Mazdalux reflectors, containing Mazda drawn-wire lamps, and the light is first projected on to the white dome, and then thrown downwards into the auditorium *viâ* the stained glass, giving, we understand, a delightful effect.

The foyer and entrance are illuminated by indirect and semi-indirect lighting fittings, while in the tea-room B.T.H. Holophane reflector bowls, supplemented by wall brackets, are used.

E

Some New Westinghouse Starters.

The British Westinghouse Co., of Trafford Park, Manchester, have recently introduced a new design of multiple-lever starter, which embodies many improvements on their older pattern.

We illustrate the new switch in fig. 6. It is a "loose handle" starting device, and the brushes open automatically should an overload or no-load occur at starting or subsequently, quite independently of the operating handles. Thus it is impossible to start up too rapidly; the levers can only be closed in correct sequence, and they come out in the opposite order, and are ready for starting up again without further adjustment.

The overload coil in operation opens the circuit of the no-volt coil, which method possesses a great advantage over the usual

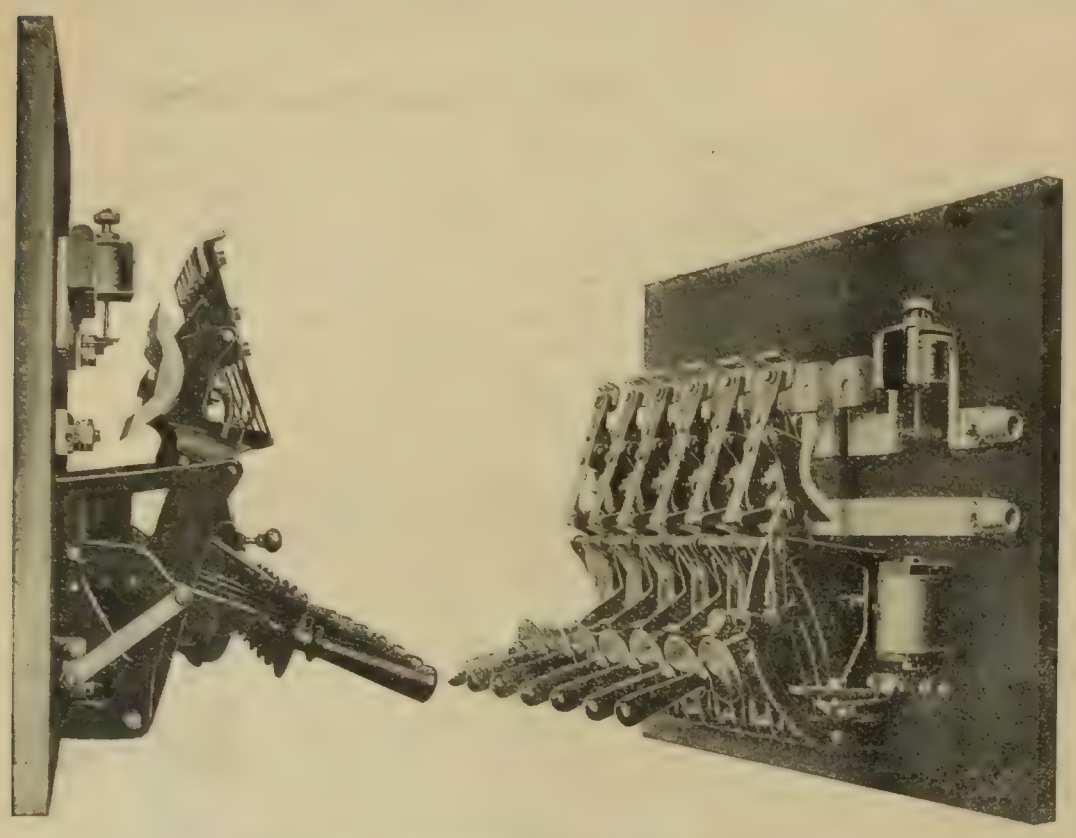


Fig. 6.—Views of New Westinghouse Multiple-Lever Starter.

practice of shorting the no-volt coil, in that the overload attachment breaks the no-volt coil circuit under all circumstances. In starters where a short-circuiting device is employed, the contacts are liable to become oxidised when not used for a considerable time, causing them to fail to operate at the critical moment.

Regulation over any number of steps can be obtained if desired, whilst all the automatic features can be retained. Thus, if it is desired to eliminate a separate rheostat for speed regulation, additional levers over and above those required for starting only can be fitted in order to obtain the necessary rheostatic effect.

The overload devices can be fitted to much larger sizes than hitherto, and can be fitted with time-limit devices if desired. A



Fig. 7.—Westinghouse Star-Delta Starter.

push-button trip is provided. Other features are laminated brushes with a large break, handle shields and grid-type resistances, mica insulated.

This type of switch is particularly suited for the larger sizes of direct-current motors, where the usual radial switch starter cannot be employed.

The Westinghouse Co. have also introduced a new design of star-delta starter, embodying some interesting features, and designated type "O.R.S."

The internal parts are mounted in a cast-iron frame, with a cover having a suitable vent for gases. The oil tank is below, forming the lower half of the starter, and can easily be lowered away when necessary. The contact drum is made on the metal and mica principle, and consists of a mica-insulated square steel shaft, on which are securely clamped spider castings carrying renewable segmental copper contact strips, working with standard contact fingers.

The no-volt and overload releases are fitted in the starter above the oil tank. The no-volt coil is connected across one phase, and is so arranged that the circuit to the motor can only be closed when there is voltage on the line. This release is worked by gravity, and acts quite independently of the overload release.

The overload coil is connected in two phases, and is cut out in the star position, and can be set between approximately full-load and 100 per cent. overload.

The operating handle is of the "loose" crank handle type, and the mechanical operation from the off to the star position, and thence to the delta position, is so designed with interlocks that the starter can be operated in no other way. A device is fitted making a slight pause necessary at the star position before it is possible to move the handle through to the delta position. The handle cannot be left in the star position, since when it is released it flies back to the off. The contact drum is returned to the off position (thus stopping the motor) in the event of an overload or no-volt occurring.

Ammeters can be mounted on these starters when desired, the instruments being of the moving iron type, and are not in circuit when the drum is in the star position.

Trifurcating boxes can be fitted if required, in which case the starter fully conforms with the new mining rules.

A Safety Device for Lifts.

In view of the recent discussion in our pages on safety devices for lifts and elevators, a reference to a form of safety device which is extensively used in the United States may be not without interest. This is made by the Altizer Elevator Co., of Chicago, and consists briefly in a friction governor which is of very simple construction, and, at the same time, very substantial and effective in operation. There are four important features in this safety device, the first being that there is no limit to the power, as the car becomes its own power as soon as the governor is thrown into operation, and the vice-like jaws continue to pinch tighter, until the car stops. The action, which is produced by a screw and wedge working together, is very powerful, yet the motion is gradual, bringing the car to an easy stop without jar. The shaft on which the governor is mounted is self-adjusting, making the pressure equal on each end, and thereby holding the car perfectly level. Moreover, the releasing of the safety device after it has been thrown into operation, and is holding the car, can be easily accomplished without danger to the operator by first adjusting the lifting cables so as to hold the weight of the car, after which the governor is turned in the opposite direction to that in which it originally operated in setting the jaws, leaving the rope on sheave and clutch-in until the wedges are in their proper place. The clutch is then released, and the car is again ready for service. This safety device is placed under the bottom of the car, and in view of the length of lift operated, and the high speeds which are sometimes attained by the cars, it is probable that the device has been sufficiently tested in American practice to warrant consideration.

PROCEEDINGS OF INSTITUTIONS.

A New Method of Cooling Gas Engines.

By Prof. Bertram Hopkinson, F.R.S.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *July 29th*, 1913.)

External water-cooling is the ultimate cause of most of the disadvantages under which the gas engine has hitherto laboured and which have retarded its development in large sizes. The provision of a jacket, and of the elaborate appliances necessary for the circulation of water in the moving piston and exhaust valve, must be largely responsible for the great weight and cost of large engines of this type.

The inequalities of temperature set up in the metal cause stresses, which are very liable to crack a casting already (by reason of the double wall required to form the jacket) difficult enough to design and manufacture. Secondly, the overheating of certain parts of the inner surface, whose temperature is much above that of the water, is apt to cause pre-ignition of the charge, especially if deposits of carbon or tar are formed. In consequence of the dangers of overheating, it has been found impossible to work gas engines, especially of large size, continuously at the maximum power which they can develop. If it were possible, the cost per horse-power would be reduced by from 20 to 40 per cent.

If water can be injected internally against the sufaces to be cooled, the heat is removed on that side of the metal on which it is generated, and, therefore, there is no heat-flow through the metal, and no difference of temperature between the inner and outer surfaces. A simple single-walled casting can be used for the

cylinder, resulting in a great saving in weight and cost and in improved reliability on account of the elimination of casting stresses. The arrangements for cooling the piston, which are necessary in large engines, can be dispensed with—a point of great importance, because these arrangements, besides being costly, frequently give trouble, and their failure may easily result in wrecking the engine. Finally, pre-ignitions are entirely prevented.

In the method of internal injection described in this paper, cold water is injected through a hollow casting projecting into the combustion-chamber, and provided with a number of holes or small nozzles about $\frac{1}{32}$ in. in diameter. The jets so formed are comparatively coarse, so that even when projected into the flame the water reaches the part of the wall against which it is directed with but little evaporation on the way. The jets are directed to all parts of the surface of the combustion-chamber and against the face of the piston.

Most producer-gas contains a certain proportion of sulphur dioxide. This dissolves very readily in cold water, forming sulphurous acid, which rapidly corrodes any metal surface with which it may be in contact. Even when the gas does not contain sulphur dioxide, liquid water spoils the working of the engine by washing away the lubricant.

The author has overcome these difficulties by the simple device of regulating the amount of water injected in such a way that the temperature of the whole of the engine is kept well above 100° C. Under such conditions (which are only rendered possible by the absence of all external water-cooling) every drop of injected water is boiled when it reaches the walls, and no liquid can accumulate. That corrosion may be completely prevented in this way has been proved by actual trials.

The rate of heat-flow from the gas into the metal is far more rapid at, and soon after, the moment of ignition than at any other time. Hence it is sufficient to inject water on to the surface of the combustion-chamber and the head of the piston only, the whole of the cooling of the barrel being effected by conduction into the piston, which is itself kept cool by the projection of water on to the head when it is near the in-centre.

In order to put the author's ideas to a practical test, a Crossley gas engine, rated at 40 B.H.P., with coal-gas, at 180 R.P.M., was fitted with a new cylinder, consisting of a plain barrel without any water-jacket; no other change was made.

A section of the new cylinder is shown in fig. 1. The injection-rose is a hollow casting projecting into the combustion chamber. There are about 25 holes in the rose, each $\frac{1}{40}$ in. in diameter, and the jets proceeding from these are directed as shown against all

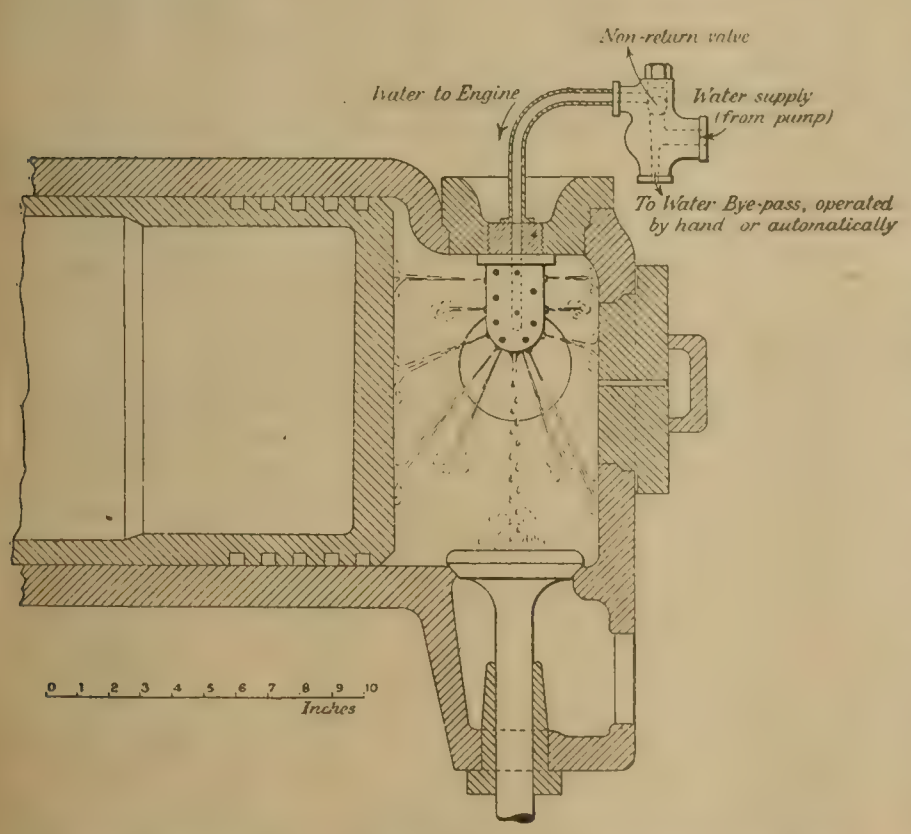


Fig. 1.—Section of Cylinder with Water-Injection Rose.

parts of the combustion chamber and piston-head. There is no jet on the exhaust valve, as it has been found that the drip from the rose is sufficient to keep this cool. The water is injected by a simple plunger pump, driven by a cam on the valve shaft, whereby a charge of water is injected once in a cycle. The pump stroke commences about 30° before, and finishes about 30° after, the point of ignition, so that water only goes in at a time when practically the whole of the sliding surface of the barrel is covered by the piston.

Immediately after erection with the new cylinder, the engine was run continuously for 120 hours on an electrical load, with coal-gas; it developed during this period 43 B.H.P. on the average, and ran very smoothly and steadily. The average mean effective pressure was 101 lb. per sq. in. When jacketed, the engine would not develop more than 40 B.H.P. continuously without overheating. The formation of the steam does not involve any thermodynamic loss, such as occurs when water is sprayed into the cylinder in an atomised condition and evaporated before reaching the walls, since the heat used is that which would otherwise be wasted in the jacket-water.

The quantity of water used on this trial was on the average 102 lb. per hour, equivalent to 2·4 lb. per B.H.P.-hour. The temperature of the engine varied from 150° to 180° C. When the engine was stopped at the end of the trial the inside of the combustion chamber was found to be perfectly dry.

The engine consumed in this trial 15 cb. ft. of Cambridge coal-gas per B.H.P.-hour reckoned at atmospheric temperature and pressure, approximately the same as it burnt when developing the same power for short periods when jacketed. On the average it may be said that the economy is unaffected by the use of this method of cooling; the reduction in maximum pressure is counter-balanced by a slightly raised expansion line.

After the trial just described, the engine was put to drive a dynamo in a factory engine room. Its speed was increased from 180 to 195 R.P.M. It was left in the hands of the ordinary engine room staff for several weeks, and was worked continuously for long periods of time at excessive loads. During this time it developed at times 50 B.H.P. with coal-gas for several hours together—an increase of 25 per cent. on the maximum continuous load which it could safely carry when jacketed. The engine is now at Cambridge in regular service with a suction-producer, driving the workshops and producing electric current for the engineering laboratory. It is left to itself like an ordinary gas engine, giving no trouble at all, and has now been in regular work for two years, the total time of running being 5,000 hours.

Anthracite coal is used in the producer, and this coal contains a considerable proportion of sulphur. Yet there has been no trace of corrosion in the engine. The combined wear (on cylinder and piston together) in the course of 4,000 hours has nowhere exceeded one-hundredth of an inch.

The ordinary working temperature of the cylinder is about 160° C., but the engine will run satisfactorily at any temperature between 120° C. and 200° C. Regulation of the water supply in accordance with the load is effected by coupling the pump to the hit-and-miss governor, so that the pump only makes a stroke when the engine takes gas. With a throttle governor it is easy to connect the gas supply and the water supply in such a way that the correct amount of water is delivered at all loads.

A simple form of thermostat has been designed, which opens a by-pass valve if the temperature falls too low; it has been in use for some months, and is quite satisfactory. Once adjusted, it need never be touched, and the engine can be started up in the morning day after day, and left to itself, no attention whatever being paid to the water supply. Failure of the water supply entails nothing worse than a temporary shut-down. The engine heats up quite slowly, and if unattended it stops by the occurrence of pre-ignitions arising usually from the injection-rose. Even in a 36-in. cylinder it has been found that no serious harm is done by such an event.

In order to guard against any danger, however, the engine is provided with a fusile plug, screwed into the wall of the combustion-chamber. Should the temperature rise above about 200° C. the plug melts, and the noise of the escaping gases warns the attendant. This simple device has been thoroughly tested and has been found absolutely reliable.

The method has been applied to the cooling of larger engines—one an engine of 18½ in. bore giving 105 B.H.P., the other a 1,000-H.P. Oechelhauser engine of 36 in. bore. In each case the water was simply run out of the jackets, the injection-rose fitted, and the engine put again to its ordinary work.

With no water in the jackets or pistons of the large engine, the temperature of every part of the engine when on full load could be kept between 100° and 200° C. The engine was taking full load within a few hours of fitting the apparatus, and ran for 30 hours without a stop.

The trials of this large engine, which continued for a considerable time, proved beyond any question that the largest cylinders now built can be cooled entirely by water-injection, if applied in accordance with the principles here enunciated.

The whole injection apparatus was made and put together in Cambridge; it cost about £20, and within a few hours of fitting it on the engine it was doing all the work of the complicated and costly plant—cooling tower, centrifugal pumps, 8-in. water mains, and the like—which is necessary for the cooling service of an engine of this size when jacketed.

The author put in hand an entirely new engine designed *ab initio* with a view to the use of water-injection, which is completed and is now undergoing trials. It is a two-cycle, single-acting engine, 18-in. diameter by 24-in. stroke, with separate gas and air pumps and is cooled entirely by water-injection.

Thunderstorms on the Rand.—In the eighth annual report of the Rand Water Board, the following paragraph appears respecting electrical disturbances:—"The policy adopted in previous years, of closing down the plant during thunderstorms so as to minimise damage by lightning, has been followed during the current season. The total number of stops due to electrical disturbances during the year ending March 31st, 1913, has been 53, and the time involved amounts, in the aggregate, to 123 hours. During the previous year, the plant was only closed down on 24 occasions, and the total stoppage was 61 hours 20 minutes. The comparison referred to above shows that the storms during the last 12 months were exceptionally severe. Storms have not only been numerous, but, in several instances, they have been of unusually long duration. Six of the stops, for instance, were for periods of over seven hours each. It is usually found that the potential is much higher in dry storms than in wet ones, and this is the reason why it has been necessary to close down a greater number of times during the recent drought."

LEGAL.

Tottenham Urban District Council *v.* Metropolitan Electric Tramways, Ltd.

On Thursday (July 24th) judgment was given in the House of Lords, allowing the appeal by the Urban District Council of Tottenham against an order of the Court of Appeal in favour of the respondents, the Metropolitan Electric Tramways, Ltd. The respondents were the owners and occupiers (*inter alia*) of lines of rails of certain tramways running through the streets of Tottenham. The question was whether that portion of the respondents' system, which had originally been constructed under powers given by the Tramway Act, 1870, was a "railway" within Sec. 211 of the Public Health Act, 1875. That section enacts that "land used solely as a railway constructed under any Act of Parliament" should pay rates on one-fourth only of the assessed value. In the present case, the company were for the year ending April 1st, 1910, assessed in respect of their tramway at £495 12s. 6d. They paid one-fourth, £123 18s. 5d., and refused to pay the balance. The action was then brought by the rating authority claiming the balance, £371 14s. 4d. The Court of Appeal, reversing the judgment of the Divisional Court, held that the company were entitled as a "railway" to the partial exemption given by the Act of 1875.

Mr. Macmorran, K.C., Mr. Ryde, K.C., and Mr. Cartwright Sharp appeared in support of the appeal; Mr. Danckwerts, K.C., and Mr. C. C. Hutchinson for the respondents.

The arguments were heard in June and judgment reserved.

Lord Moulton went exhaustively into the various statutes under which the respondents' system of trams was constructed, and into the authorities cited, and said that in the case of Swansea Improvement and Tramway Co. *v.* Swansea Urban Sanitary Authority, it was laid down in 1892 that a tramway laid in streets did not come within the exemption given to a railway by the Act of 1875. That decision remained unchallenged until it was overruled by the House of Lords in the Thornton case. In his opinion, that case and the Wakefield Corporation case in which the same was held, could be distinguished on the facts from the present case, and, therefore, the decision in the Swansea governed this, and the appeal must be allowed. When tramways were started, they were in the hands of private companies, and the Legislature was not disposed to treat them too liberally. On the other hand, under the Light Railways Act, 1886, the Legislature gave many advantages as inducements to promoters. It seemed to him that light railways, running as they did in many cases over land owned by the promoters, could get but very small advantage from municipal expenditure of the rates, such, for instance, as the lighting and sewering of roads, and therefore were justly entitled to contribute to the rates at one-fourth of their assessment. But that was not the case with a tramway running down the main streets, for the pavements might, in a sense, be said to be the platforms and stations for the use of their passengers, and they got full advantage of the lighting and general expenditure on the streets paid for by the rates. The undertakings sanctioned under the Light Railways Act of 1896 had secured irrevocably the Statute and privileges of light railways, however little they merited it. But the lines to which the present case related were constructed under the Tramway Acts, and, therefore, it was only indirectly that this House was concerned with what had been done under the Act of 1896. He thought that the distinction between a light railway and a tramway or tramroad was clearly understood, both by the popular and the legal acceptation of the two terms respectively; and that if the partial exemption to rates conferred on light railways by the Public Health Act, 1875, was intended to extend to "tramways," the Act would have made it clear in terms. Therefore, in public legislation the word railway did not include tramway, unless it was expressly made to do so by the terms of the Act. To hold otherwise would be to put trams under the exclusive jurisdiction of the Railway and Canal Commissioners, and it had never been suggested, during the 40 years of the existence of that Court, and would be obviously contrary to the intention of the Legislature, that that Court should control tramways. For these reasons the judgment of the Divisional Court should be restored, and the respondent tramway company must pay the appellants their costs in that House and in the Courts below. Order accordingly.

Solicitors: Mr. F. Shelton, for the appellants; Messrs. Ashurst, Morris, Crisp & Co., for the respondents.

Mygatt *v.* Glyn.

Mr. Justice Bankes, on Saturday, July 26th, delivered his reserved judgment in the action brought by Mr. Otis Angelo Mygatt, of Clifford Street, Bond Street, W., against Major Geoffrey Carr Glyn, Eaton Place, London, claiming £4,254 on a bill of exchange of April 12th, drawn by the plaintiff and accepted by the defendant, and payable on demand to the order of the plaintiff, and which plaintiff said, on being duly endorsed and presented by him, was disowned. The total claim, with interest, was for £4,660. The defendant denied that the bill was payable on account of certain arrangements that he claimed had been made, and he counterclaimed against the plaintiff upon an alleged agreement by which, he said, he was promised 10 per cent. of what the plaintiff received from the flotation of the English Holophone Co. and 10 per cent. of the plaintiff's income derived from all Holophane business.

Mr. Justice Bankes decided that the defence to the bill could not be sustained, and he gave judgment for Mr. Mygatt on this part of the case. As to Major Glyn's counterclaim for the two 10 per cents. and for 1,193 preference shares in the Holophane Co. transferred to him by Mr. Mygatt, he (the judge) came to the conclusion that Major Glyn had failed to establish any right to the payment of the 10 per cent. of the vendor's interest in the company, but he had succeeded in establishing his right to be paid for the relief services that he had performed between October, 1909, and November, 1910. As to the claim for 1,193 shares that it was said Mr. Mygatt should transfer to the defendant, he could not find that the defendant had proved to his satisfaction that Mr. Mygatt agreed to the transfer. He, therefore, entered judgment for Mr. Mygatt on the bill for £4,254 and interest at 6 per cent. from April, 1911, and costs; judgment for Major Glyn on the counterclaim for £2,000 and costs; and judgment for Mr. Mygatt on the issue as to the 1,193 shares with costs.

Glyn *v.* Mygatt.

Further litigation arising out of the business of the Holophane Co. was before Mr. Justice Bucknill in the King's Bench Division on Friday last, July 25th, when an action was brought by Major Geoffrey Carr Glyn, formerly managing director of the Holophane Co., against Mr. Otis Angelo Mygatt, to recover damages for alleged slander uttered on December 12th by the defendant of the plaintiff at a meeting of the directors of Holophane, Ltd., in regard to his position as managing director of the company. The case was heard on Wednesday, July 23rd, and Thursday, July 24th, the plaintiff giving evidence, and on Friday a settlement was announced.

Mr. McCall, K.C. (for Major Glyn), said that the parties had been able to act upon a suggestion by his Lordship that the case should be settled. He had agreed to accept on behalf of the plaintiff the defendant's withdrawal of the charges that he had made, and also to accept the statement that would be made on the defendant's behalf to the effect that in regard to the charge, having heard Major Glyn's evidence, the defendant was prepared to admit that Major Glyn had acted honestly and fairly, although, as they thought, mistakenly. The plaintiff (added Mr. McCall) had not brought the action to put money into his pocket, but merely for the purpose of vindicating his character as a gentleman engaged in commerce.

Mr. Justice Bucknill said that the invitation to settle the case had come from him. The correspondence showed that these two gentlemen, Major Glyn and Mr. Mygatt, were at one time on the most friendly terms, and when the defendant had heard what the plaintiff had to say, he thought he might venture to suggest the settlement. He was delighted at the result, and it was a result that was satisfactory to all parties.

The record was accordingly withdrawn.

BUSINESS NOTES.

Book Notices.—*The Newspaper.* By G. Binney Dibblee, M.A. London: Williams & Norgate. 1s. net.—This little book, though it contains a good deal of matter which is of interest to the vast army of men and women who gain their livelihood either entirely or in part in the multifarious occupations connected with the production and distribution of newspapers, no doubt has as its main object the informing of the mass of general readers who have their own quite different callings to follow. Even in these days, when it would seem that so much of honour and independence are sacrificed on the altar of commercialism, there is, we hope, still some interest surrounding those who mould—or should it be follow?—the opinion of the public, and we venture to believe that the man in the street, as we call him, is likely to have greater respect for the Press by reading what Mr. Dibblee has put together in this popular account of the newspaper, its function, its power as an organ of opinion, its news-collecting, reporting and business organisations, and its mechanical production and distribution. "Journalism and Journalists," the final chapter, contains some entertaining reading. For those who are in the thick of the newspaper fight, whether on dailies or on trade and technical organs, there are some comments in the chapter on "Business Organisation" which give food for thought; we refer especially to the author's reference to the necessity for resisting the "tendency to a decline and fall into the last stages of commercialism," and his comments on the "puff preparatory or supplementary"—a practice which, while not "in any way immoral," is undignified, and followed by "the weaker half of the Press of the United Kingdom." We are not sure that many of the items that are now circulated by advertisers for editorial use would not add to the interest of the circulator's ordinary advertisement. What is to be more desired, from the advertiser's point of view, than that the reader of a paper shall be got into the habit of regularly turning to see "what So-and-So have to say this week?" Mr. Dibblee has, in this book of 240 small pages, only touched the fringe of a subject which, if covered in detail, would require a work of many volumes. He has, however, told sufficient herein to interest the ordinary reader and to indicate that he knows a vast deal more than he has written. He is quite accurate in his reference to the London electrical Press of to-day when he says that "the two earliest electrical papers are the Electrical Review

(1872) and the *Electrician* (1878)." We should hardly expect him to refer to papers born out of due time and now defunct, for he points out that, "confined as we are to a brief space, our best course is to deal only with living papers." The protest of a contemporary in this connection might be thought amusing enough for it to mark the occasion by awarding itself one of its own hot-plates.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 6. July, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"Collected Researches," Vols. IX and X, 1913, and "Report for the Year 1912" of the National Physical Laboratory. Teddington: The Laboratory.

"*Journal* of the Institution of Electrical Engineers." Vol. LI, No. 221. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for July, 1913, contains the following papers: "Phase Advancing," by Dr. G. Kapp; "Use of the Electrostatic Method for the Measurement of Power," by C. C. Paterson, E. H. Rayner and A. Kinnes; Report of the Council for 1912-13; Accounts for 1912; Application of Telephone Transmission Calculations," by A. J. Aldridge; "Use of the Thury System in Mines."

"Electricity for the Farm and Home," by Frank Koester. New York: Sturges & Walton Co. Price $1.00 net.

Patent Application.—The British Oxygen Co., Ltd., have applied for restoration of patent No. 17,216 of 1909, for "Improvements relating to the liquefaction of air and the separation of it into its constituents," granted to Société l'Air Liquide.

The Black Gang in Turkey.—A British Consul at Constantinople, in a report published in the *Journal* of the British Chamber of Commerce of Turkey, refers to the activities of the Black Gang swindlers. We quote:—

"Notwithstanding all the warnings published in trade reports and Chamber of Commerce journals from Constantinople and Smyrna, the Black Gang has been more active and successful than ever in 1912.

"The following is a list of the Black Gang swindles which have been reported to this Consulate during 1912:—

"A Nottingham firm paid 50 per cent. (about £90) in advance on a consignment of 'scoured white wool,' which upon arrival turned out to be a mixture of cows' hair and lime of a totally different weight.

"A Dublin firm of candle manufacturers ordered 1½ tons of 'genuine beeswax,' and paid 80 per cent., or £140, in advance. The goods, on arrival, weighed only ¾ ton, and consisted of almost valueless 'off-colour' paraffin wax.

"Another Dublin firm lost £170 by precisely the same trick.

"A Birmingham firm paid cash against documents for 'a parcel of hair,' which upon arrival proved to be valueless matter of one-quarter of specified weight.

"Finding that the rubbish which it sent to Europe and America was not appreciated by the buyers, the gang has now gone one better, and has had false bills of lading printed, which it supplies to its clients. The same purpose is served, as the buyer advances his 80 per cent. just as readily on the forged bill of lading, and the gang is spared the expense and trouble of shipping the rubbish.

"The names under which the gang trades have been furnished to the Commercial Intelligence Branch of the Board of Trade, but there is no reason why they should not employ any name. The obvious precaution is to inquire from this Consulate, or from the British Chamber of Commerce, before dealing with strangers on this market."

The Holidays.—The Brimsdown Lamp Works will be closed from to-morrow (Saturday, August 2nd) to Monday, August 11th, for the annual holidays. The staff at the Kingsway offices will attend to urgent business and execute pressing orders.

The Union Electric Co., Ltd., announce that their offices and stores will be closed on Monday and Tuesday next, August 4th and 5th, and the works from Monday, 4th inst., until Saturday, the 9th inst.

The Electrical Power Storage Co, Ltd., announce that their works at Millwall will be closed from to-night (Friday, August 1st) till Monday morning, August, 11th. A small staff will be at the offices to deal with urgent correspondence.

Messrs. Cecil Hodges & Co., Ltd., announce that their works at Hammersmith will be closed from Saturday, August 2nd, until Monday, August 11th, for the annual Volunteer training and stock-taking. A small staff will be available at Balfour House to attend to urgent matters.

The "Omega" Electric Lamp Co., Ltd., of Hammersmith, announce that their factory will be closed from Monday, August 4th, to Saturday, August 9th, both days inclusive, for the annual holidays.

The Midland Electric Manufacturing Co., Ltd., of Rea Street South, Birmingham, announce the closing of their works from noon to-morrow (Saturday) until the morning of Monday, August 11th.

Messrs. Parmiter, Hope & Sugden, of Manchester, will also be closed from August 2nd to 11th.

Messrs. Cox-Walkers, Ltd., Darlington, announce the closing of their works from to-morrow (Saturday, August 2nd) until Monday, August 11th, for the annual holiday.

The Cable Accessories Co., Ltd., Tividale, also remain closed rom to-morrow until Monday, August 11th, for the same reason.

New Steel Works.—It is reported in the *Times* that Messrs. Armstrong, Whitworth & Co. have purchased upwards of 600 acres near the River Ouse and the Selby and Goole railway, to be used for the erection of steel works which are to give employment to 1,000 men.

Electrical Progress in Japan.—The U.S. Consul at Nagasaki, in a recent report, says that work on the Kagoshima-Sendai branch railway, which extends westwards from the city of Kagoshima, the present southern terminus of the Kiushu division, was expected to be in operation by the end of April. The distance is 30 miles. This branch line is to be operated by electricity, the power to be received from a hydroelectric plant on the Sendai River owned by the Nihon Chisso Hiryo Kaisha, arrangements for which have already been made by the Railway Board. This plant has a capacity of 7,000 H.P.

The electric light and power companies in this Consular district had a very good season in 1912, and all indications point to a more prosperous season for 1913. As a consequence many new companies are projected in all parts of the district.

The new plant of the Nagasaki Electric Light Co. was expected to be in a position to furnish current day and night for both light and power in June. In March it was only available for lighting at night. This company had a very prosperous year, and in addition to declaring an 8 per cent. dividend for 1912, carried forward net profits amounting to an additional 7 per cent. The Nagasaki Electric Tramway Co. has not as yet been able to finance its enterprise, and the promoters have asked for an extension of six months in which to begin the construction work, the time limit for beginning the work having been fixed by charter for February 4th, 1913. The principal promoters are Saseho and Kobe men. They were not able to enlist Nagasaki capital to any great extent, and tried to finance the scheme in Kobe. The capital required was about $600,000. The two suburban electric lines, one from Nagasaki to Tokitsu and the other from Nagasaki to Mogi, also were not able to finance their projects and were waiting for the building of the city lines, their lines being intended as extensions or feeders of the city trams. The electric railway from Sonogi, in Nagasaki Prefecture, to Azambara in Saga Prefecture, *viâ* Ureshimo and Takeo, both hot springs health resorts, and known as the Hizen Railway Co., is rapidly nearing completion, and the section between Sonogi and Takeo is expected to be opened to traffic during the present summer. A cargo of fittings and machinery for this road came from the United States last spring. The Kagoshima Electric Tramway (city) was open to traffic December 1st, 1912, and is in successful operation. The machinery is of American make. The hydroelectric power station at Chijiwa, owned by the municipality of Chijiwa, in Nagasaki Prefecture, has been in very successful operation, and the plant will have to be enlarged to supply the demand for electric light on Shimabara Peninsula.

The large power station of the Kiushu Hydroelectric Co., at Hita, on the upper reaches of the Chikugo River, in Northern Kiushu, is now in course of construction, and is expected to be in operation by October 1st, 1913. This plant will be capable of developing 20,000 H.P., and the promoters expect to transmit power to Moji, Kokura, and Wakamatsu, on the Straits of Shimonoseki.

C. and H. Convention.—This is an age of conventions, and the latest to be started is a private one by Messrs. Chamberlain & Hookham, Ltd., who last week held the first of what it is proposed to make an annual event, namely, a meeting of all those engaged in the selling of Chamberlain & Hookham meters. The occasion was the coincidence of the arrival in Birmingham of the managers of the Canadian and German subsidiary companies and the return of a director from a long and successful visit to South America. Besides those actually engaged on the selling side of the business, the heads of the works, testing, and accountancy departments were present, so as to bring them into touch with the problems of the outside staff, while the latter were made aware of the way in which the inside staff try to cope with the demands made upon them. The meeting was under the chairmanship of Mr. John Chamberlain, and a long discussion which took place will, it is believed, be to the advantage of the customers of the firm all over the world. Mention was made of the fact that the business of the company had increased five-fold since 1900, and this year's assured business is 25 per cent. greater than that for 1912—a very fine record for a firm who first started making meters in 1887. At the luncheon given by the firm at the Imperial Hotel, Birmingham, mention was made of the length of service with the company of different members of the staff, one of them having been with the firm from the commencement, before they started making meters, and others for long periods up to as much as 25 years.

Fire at Witton.—As some of the various newspaper reports which have appeared relative to the fire which took place last week at the Witton Works of the General Electric Co., Ltd., may have created an erroneous impression regarding the extent of the fire and its consequences, we are asked to make the following statement:—The company have at Witton separate factories for the manufacture of all electrical plant, carbons, conduits, small motors, switchboards, switchgear, arc lamps, &c. None of these buildings have in any way been injured by the fire, which broke out in one of the various pattern stores adjoining the foundry. These stores were burnt down, but the company's manufacturing arrangements have in no way been interfered with, and all the above-mentioned factories are proceeding with work as usual, and no inconvenience will be caused to customers.

Bankruptcy Proceedings.—Joseph Swainson (J. Swainson & Co.), electrical contractor, Manchester. Receiving order made July 26th, on debtor's petition.

F. T. Johnson, electrical engineer, Cambridge—First meeting August 6th; public examination, September 17th; both at Cambridge.

Gas Progress.—In its very extensive area the Gas Light and Coke Co. during the past six months increased its consumers by 8,959, and the number of gas stoves sold and let on hire by 19,372. The sales of gas advanced by 3¼ per cent., as compared with the corresponding period of 1912.

Dissolutions and Liquidations.—Boiler Scalers, Ltd.—A meeting of creditors is called for August 8th at 37, Temple Row, Birmingham. Liquidator, Mr. R. B. Woodward.

Johnson-Lundell Electric Traction Co., Ltd.—A meeting is called for September 4th at 14, Old Jewry Chambers, E.C., to hear an account of the winding up from the liquidator, Mr. A. E. Messer.

The Miners' Lamp Electric Lighting Co., Ltd.—A meeting of creditors is to be held at 42, Spring Gardens, Manchester, on August 12th. Liquidator: Mr. James Blakey, to whom creditors must send particulars by August 11th.

Trade Announcements.—The telephone number and name of Electric Control, Ltd., Queen Anne's Chambers, Tothill Street, London, S.W., has been inadvertently omitted from the Telephone Directory. Instructions have, however, been given to all exchanges, and the firm's friends have only to ask for them by name.

The British Electric Plant Co., Ltd., have removed their head office from 144, St. Vincent Street, to more commodious premises at 78, St. Vincent Street, Glasgow, where all communications should be addressed.

The Armorduct Manufacturing Co., Ltd, have recently opened another depôt at 37, Moorfields, Liverpool (telephone, Central, Liverpool, 5096), where a large stock of their specialities will be held.

Catalogues and Lists.—Messrs. Balcke & Co., Ltd., Broadway Court, Broadway, Westminster, London, S.W.—Leaflet describing, with diagrams, their Balcke wet-air filters.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Two leaflets, one, No. 34, illustrating and giving tabulated prices and code-words of high tension ironclad switchgear for mining and sub-station work (2,000 to 6,000 v.); the other, No. 49, particularising their Clapper switches for remote control.

The Lazilite Co., 5, Baldwin's Gardens, Gray's Inn Road, London, E.C.—Illustrated folder giving particulars and prices of "Lazilite" extension electric light fittings and extending telephone holders.

Messrs. Electrical Installations, Ltd., of 27 and 28, Martin's Lane, Cannon Street, London, E.C., have sent us one of their desk blotting cases. It is a very neat production, in black and gold. The large memoranda block on the right hand and a telephone number index on the left can be closed over on to the blotting pad when not in use, making a very compact arrangement.

Conditions in Canada.—The *Times* Toronto correspondent quotes Sir Thomas Shaughnessy as stating that the present economic situation in the Dominion does not occasion anxiety. He fully expects conditions to become quite normal late in the autumn. He attributes the falling off in public works under municipal control almost wholly to world-wide rather than to domestic financial conditions.

LIGHTING and POWER NOTES.

Birmingham.—Proposed Loan.—The Electric Supply Committee has recommended that application be made to the L.G.B. for sanction to borrow £6,300, the estimated cost of erecting two more cooling towers at Summer Lane generating station.

Blackpool.—During the past three months 107 new consumers have been obtained, as compared with 54 in the same period of 1912.

In connection with the supply of electricity by the Corporation to the St. Anne's and Lytham Tramways Co., the minimum guaranteed to be taken per year by the company has been reduced from 122,000 to 110,000 units.

Bradford.—Plant Extensions.—The city electrical engineer (Mr. Thos. Roles) has just issued a long report upon the advisability of installing additional plant at the Valley Road Electricity Works, and recommends the provision and erection of the undermentioned plant at the estimated costs set out:—One 3,000-kw. turbo-generator, complete with exciter and condensing plant, £10,000; steam, exhaust, water, and drain piping, £2,320; switchgear and cables for generator, £2,950; air filtration plant for generator, £350; two cooling towers complete, erected on site, £4,331; induced draught plant for 12 boilers, including fans, motors, switchgear, dampers, &c., £3,078; suction ash plant for handling ashes from 12 boilers, £2,075; one rotary feed pump, and two sump pumps, £600; two 1,500-kw. rotary converters and switchgear, £14,110; oil storage and filtration plant, £300; building work, including subway, foundations, pump room, completing switch house, &c., £8,153; switchgear for six extra-high-tension feeders, £2,400; storage battery capable of discharging 5,000 amperes for one hour, £16,756; switchgear and connections for battery, £5,985; battery boosters, £5,565; building for battery and extension of switchboard gallery, £7,267; total, £86,250. There is no doubt, Mr. Roles states, that the power users in the city are now recognising the great advantages to be obtained by the use of electricity for the driving of machinery of all descriptions, and especially the value of alternating-current supply for the driving of textile machinery. In view of the success which has been attained, more especially during the past two years, it is certain that electricity will be used for the driving of a large proportion of the new textile factories which are erected in Bradford. The scheme, which has been approved by the City Council, is referred to on page 167.

The electrical engineer has been instructed to light half-a-dozen main road crossings in the city with 500-watt lanterns, at an annual inclusive charge of £7 each; also to light certain roads in the Thornbury and Tyersal districts at an annual charge of £4 per 200-watt lantern, and to convert certain gas lamps at an inclusive annual cost of £2 12s 6d. per lamp.

Brighton.—Workhouse Lighting.—The B. of G. has decided to have the nurses' quarters at the Workhouse lighted by electricity in place of gas. The initial outlay will be covered in three years by the saving as between the cost of gas, 2s. 10d. per 1,000 cb. ft., and electricity.

Bury.—Generating Station Extensions.—Mr. S. J. Watson (engineer) has reported to the Electricity Committee that in order to deal with the requirements of additional consumers, it would be necessary to provide a third set of generating plant at the Chamber Hall station, and to make provision for further plant by extending the buildings. The Committee has decided to recommend the Council to make application to the L.G.B. for sanction to borrow £55,000 for the purposes mentioned.

Bushey.—The U.D.C. is having prepared an agreement with the Watford U.D.C. for a supply of current under a prov. order being applied for by Watford.

Canada.—According to the *Standard*, the provincial Hydro-Electric Commission has let contracts for the construction of a generating plant at Wasdells Falls. Contracts have also been let for the extension of the Dundas, London, and St. Thomas stations, and the work of building the transmission line to Windsor at the extreme western end of the province is being rapidly pushed forward.

As a result of occasional interruptions to the supply of electricity from Niagara Falls the city of Toronto will erect an auxiliary steam plant to serve in cases of emergency at a cost of £205,000.

Chester.—At a meeting of T.C. it was stated that in connection with the electricity undertaking the number of units sold during the year exceeded that of the previous year by nearly a quarter of a million, that the number of consumers added during the year was far greater than in comparison with any other year, and that in spite of the increased cost of coal, the cost per unit for generating the current was less than ·889d.

Chesterfield.—Application has been made to the B. of T. by the Corporation for consent to overhead transmission from the electricity works in Chatsworth Road to Bryan Donkin Co.'s works and from there to the works of the Chesterfield Tube Co., Ltd., for the transmission of electrical energy at a pressure of 6,600 volts.

Cuba.—Permission has been asked of the Government to establish electric light plants at Madruga, San Nicolas, Catalina de Guines, Jaruco, Carabello, Bainoa, San Antonio, and Rio Blanco del Norte, all in Habana Province. Ramos Valderas has been given authorisation by the Jovellanos municipality to establish an electric plant in that city, situated in Matanzas Province. Manuel P. Cardenas is petitioning for permission to establish an electric plant in Moron, Camaguey Province. Luis Torres has solicited Government permission to establish an electric plant in Los Arabos. Messrs. Mon and Fernandez have received the necessary Government authorisation to install an electric plant at Isabela de Sagua, the north coast port of Sagua la Granda, Santa Clara Province. Sr. Rafael Rodriguez has received authorisation to install an electric plant in Calimete. Light service will include also the towns of Manguito and Amarillas. All places mentioned are in Mantanzas Province.—*The Cuba Review.*

Doncaster.—L.G.B. Inquiry.—At the recent inquiry relative to the application for powers to borrow £12,500 for the extension of the electrical undertaking, the town clerk stated that the Corporation had recently applied for powers to extend the area of supply and had already obtained sanction to include the adjoining urban district of Wheatley. At the present time it was applying for power to extend the area of supply into the urban districts of Balby and Bentley, and the provisional orders had passed the second reading. It had also had applications for current from a number of manufacturers. He further stated that the Corporation had recently applied to the Light Railway Commissioners for powers to extend the tramway system to Brodsworth, a colliery district to the north of the town and to Warmsworth, another colliery district to the westward.

Edinburgh.—The Electric Lighting Committee has decided by a majority that the surplus of £2,169 be used for the reduction of capital account. The minority contended that the surplus should be applied to the relief of the rates. The estimated surplus next year is £1,800.

Exeter.—Electric Cooking.—The T.C. has authorised the electrical engineer to expend £150 on electric cooking appliances for demonstration purposes.

Finchley.—Annual Report.—According to the report of Mr. Syrett, the U.D.C.'s electrical engineer, there was a net profit of £1,421 on the working of the undertaking during the 12 months ended March 31st last. The gross profit was about 11·5 per cent. on the capital outstanding at the end of the year, and approximately 8·65 per cent. of the total capital expended on the undertaking up to March 31st. There was an increase of 133,663 in the number of units sold to consumers, this number being nearly double the increase of the previous year.

Fort William.—Street Lighting.—The T.C. has approved of a proposal of the Electric Lighting Committee to carry the wires for the lighting of the eastern section of the burgh overhead on poles, each pole to carry a 30-c.p. lamp, instead of the present 16-c.p. lamps on the town pillars, which are placed 90 yards apart.

Halifax.—The Borough Treasurer's statement of accounts of the electricity undertaking for the past year, shows that the income from the sale of electricity amounted to £48,025, and the aggregate expenditure incurred was £38,948, leaving a balance to appropriation of £6,886.

Haslingden.—A Sub-Committee has been appointed to go into the question of the applications for electricity in the Helmshore district.

Hastings.—The Borough Education Committee on July 25th, decided to have the electric light installed at Mount Pleasant, Clive Vale, Ore, Priory Road, and West St. Leonards Schools, at an estimated cost of £174.

Hyde.—The Generating Station Committee of the Joint Board has decided to leave the question of the street lighting at Hyde to the engineer.

Ilford.—The U.D.C. has fixed the price for current for the tramways for the coming year at $1\frac{1}{16}$d. per unit.

The Wanstead U.D.C. has arranged with the Ilford Council for a supply of energy for power purposes at the sewage works at 2d. per unit, or 1d. for a minimum consumption of 10,000 units per quarter.

A battery sub-station is to be erected, at a cost of £2,400 (battery, £1,650; booster, switchgear and connections, £550; and diversion of feeder and distributors, £200), to provide for the satisfactory supply of extra load anticipated in the Goodmayes district.

Leyton.—The electrical engineer requires a supply of public lighting lanterns, also three additional arc lamps. The architect of the Goodall Road and Mayville Road handicraft centres has been instructed to obtain quotations for the installation of electric light thereat.

Listowel.—Workhouse Lighting.—At a meeting of the B. of G., it was decided that electric light be installed in the workhouse, and that the Listowel Electric Light and Power Co. be requested to submit an estimate of the probable expenditure connected with the proposed scheme, and that details of the cost of lighting the institution with petroleum for the past three years, be obtained. It was stated that the cost per year for oil alone, exclusive of lamps, &c., would be about £50, whereas the cost of electric light would be about £35.

London.—Marylebone.—Sales Department Report.—Messrs. Price, Waterhouse & Co., in their report on the working of the B.C.'s Sales Department of the electricity undertaking during the year ended March 31st last, state that:—"The difficulties which we experienced last year in accurately separating the accounts relating to this section are substantially unaltered. We have drawn up an approximate profit and loss account, and this is divided into two parts, the first of which covers the proceeds and the direct cost of articles sold and services rendered by the sales section. The turnover shows satisfactory increases in respect of all items except sales and work done. The falling off in this particular, which very nearly counterbalances the other increases, is, in our opinion, accounted for by the change in the method of working, whereby the department no longer undertakes the wiring of new buildings. The turnover of the department was £21,629, and the direct cost £16,384, leaving a gross profit of £5,245. It, therefore, appears that the price charged for supplies and work done includes a gross profit of 24½ per cent., or an addition of 32 per cent. to the direct cost of the work done. The second part of the account includes the apportionment of the general expenses of the department. These expenses amount to £4,714, exclusive of interest on the capital employed, or 21¾ per cent. upon the turnover already referred to. Deducting these expenses from the gross profit shown above, there would remain an estimated net profit of £530, which is equivalent to 2½ per cent. upon the turnover, or 3½ per cent. upon the capital of £15,000, which we estimate to be the amount invested in this department."

In discussing this matter in Council, Mr. Duncan Watson moved as an amendment that the Council disagree with the report as presented, pointing out that the allocation of the charges connected with the department, saddles the electricity undertaking with an unnecessary expense. In the course of his speech, Mr. Watson said that the pretext for introducing the sales department in the first instance was, they were told, because tradesmen in the borough were dishonest, incompetent, and charged exorbitant prices, and their work was unsatisfactory. He added that the sales department was incompetent and did unsatisfactory work, while the price charged was nearly 30 per cent. higher than it ought to have been, therefore the whole case for the existence of the sales department fell to the ground. In no sense had it been proved that any increase in units could be attributed to the work of this department. The resolution disagreeing with the report was carried

The chairman of the Electricity Committee, Colonel Hopkins, announced his resignation.

The following motion by Mr. Duncan Watson was held over as a quorum was not present:—"That a Special Committee be appointed to investigate the position of the electrical undertaking as affected by the latest tariffs and as to the abnormal cost of the sales department in connection with new business and to report to the Council on the future prospects of the undertaking."

The L.C.C. has agreed to advance £20,000 for 15 years on account of the loan of £42,500 sanctioned by it for the extension of the electricity plant. A further application is to be made for a loan of £10,825 required in respect of extensions.

Metropolitan Asylums Board.—The Board is renewing for a further period of seven years its agreement with the County of London Electric Supply Co. for the supply of energy to the Tooting Bec Asylum. The company offers to supply energy for the additional buildings on the existing terms of 2¼d. per unit for lighting and 1d. per unit for power and heating.

The managers are to enter into an agreement with the South Metropolitan Electric Light and Power Co. for the supply of current to the Brook and Park Hospitals upon certain conditions which include a fixed charge of one guinea for each kilo-volt ampere of the maximum demand per quarter, and 1¼d. per unit for the whole of the energy metered. The agreement to be for a period of 21 years terminable at the end of the first seven years or at the end of any subsequent year. The cost involved in connection with the provision of accommodation for the company's transformers and for the change over to low voltage metallic filament lamps, including transformers and alterations to mains and wiring, is put at £550 for the Park Hospital and £700 for the Brook Hospital.

Woolwich.—Proposed Loan.—The L.C.C. is to be asked to advance the following amounts required in connection with the electricity undertaking:—General main extensions, £1,500 (repayable in 25 years); house services, £1,100 (repayable in 12 years); meters, £630 (repayable in 10 years); hire-purchase, £1,000 (repayable in 10 years). Application is also to be made for sanction to borrow a further sum of £15,000 on account of the scheme of extension at the Globe Road generating station, £9,000 being for machinery.

Long Eaton.—L.G.B. Inquiry.—An inquiry was held on July 23rd into the application of the U.D.C. for a loan of £10,000 for extension to the electricity works, by which a 500-kw. engine and condensing plant will be installed. There was no opposition.

Maryport.—Prov. Order.—The U.D.C. has received from Messrs. Foote & Milne, Ltd., an intimation of their intention to apply to the B. of T. for a prov. order for electricity supply in the town.

Paisley.—Year's Working.—The electricity department has closed the year's accounts with a profit of £112, which it is proposed to carry forward. The cost of coal was nearly £1,300 more than in the previous year, and a deficit was looked for, but as there was a big increase in the demand for current the department was enabled to close the account on the right side. The sale of current went up from 2,930,773 units to 3,323,528 units, an increase of 13 per cent. The estimates for the year show a profit of £154, but as these include an expenditure of £500 for the renewal of arc lamps—a charge which might be spread over several years—the statement is better than it looks.

Shipley.—Plant Extensions.—The U.D.C. has decided to install further turbine plant at the electricity works at an estimated cost of £15,300, and to erect a new engine house for the plant. A loan for the expenditure is to be applied for.

Southampton.—The borough engineer and borough electrical engineer have been instructed to submit a joint report upon the system of lighting Shirley High Street, together with an improved scheme of lighting and estimate of cost. The B. of T. has submitted a draft order permitting the Corporation to supply energy to Chilworth. Tenders are required for the supply of a boiler and generator at the electricity works.

Slough.—New Plant.—The U.D.C. has passed plans of extensions at Chalvey by the Slough and Datchet Electric Supply Co., including a new water cooling tower and engine room.

Stoke-on-Trent.—Annual Accounts.—In moving the confirmation of the Electricity Committee's proceedings at the meeting of the T.C., Alderman H. Leese said the total receipts from the undertaking were £46,425, an increase of £4,131 on the previous year. The gross profits at the different works were as follows:—Burslem, £4,596; Hanley, £8,535; Longton, £1,873; and Stoke, £3,198; but after repayments on loans and sinking fund, the net amounts were:—Burslem, £838; Hanley, £222; Stoke, £299; and Longton, £141 (loss). The average price for lighting and power had been lower than for most of the large towns, and he thought the old plant had done very well. When the new works were running he anticipated they would have much better results. Councillor Coates drew attention to the amount of business done compared with the net profits, and to the fact that nothing had been set aside for depreciation on a capital of over £238,000. From £5,000 to £7,000, he urged, ought to be made annually to place the undertaking on a sound basis. Alderman Leese said they were practically providing for depreciation by their substantial reductions of loan charges each year. He anticipated that the new central power station would have the effect of bringing about great economies and increasing the profits.

Sutton (Yorks.).—Prov. Order.—The Hull T.C. has given notice to the local authorities of the intention of the Council to apply for a prov. order for electric light at Sutton.

Welshpool.—Prov. Order.—At a meeting of the T.C. a letter was submitted from Mr. J. H. Edwards, Wrexham, giving notice of his intention to apply for a prov. order to supply electricity within the Council's area.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Annual Report.—The accounts of the Corporation tramways for the year ended May 31st, show that the total revenue for the year was £80,166, being an increase on the previous year of £2,985. The working expenses amounted to £43,206, or an increase of £2,236. Interest, sinking fund, depreciation and renewals absorbed £24,906, a decrease of £510. The profit for the year was £12,524, the largest yet obtained in the history of the undertaking. The car-mileage was 1,738,966, an increase of 95,719 miles, and 19,990,711 passengers were carried on a system of almost 14½ miles. For traction purposes 2,110,964 units were used, an increase of 217,887 units. The cost of electrical energy was £7,138, equal to ·81d. per unit, as against ·86d. for the preceding year. Satisfactory results were obtained from the new pay-as-you-enter cars, 10 of which are in operation.

Bradford.—New Rolling Stock.—Having considered the report of the tramways general manager embodying proposals for expenditure on new equipment, car bodies, trucks, &c., the Tramways Committee intends to incur the following expenditure on rolling stock during the year commencing April, 1914:—Fifty trucks, estimated cost, £4,050; 100 motors, £10,600; 50 resistances, £412; 100 circuit breakers, £215; 100 controllers, £2,400; 50 power brake sets, £2,500; 50 sets power circuits, £875; 10 car bodies rebuilding, £2,250; total, £23,302. From this total is to be deducted, £2,500 representing the value of old equipment.

Bury.—Owing to the demands of the B. of T. in connection with the Heywood Street branch of the tramways, the Tramways Committee has decided to discontinue the service (outward) from the date of the next meeting of the T.C. The suggestions of the board, if acted upon, would involve an expenditure of £1,760. In view of the loss at which the experimental service was previously run the Committee cannot see its way to undertake the work.

Continental Notes.—Russia.—It is announced that the Moscow-Windau-Rybinsk Railway Co. is prepared to proceed with the conversion to electric traction of the suburban line between St. Petersburg and Pawlowsk, at an estimated expenditure of £100,000 on the definite grant of the concession for the St. Petersburg-Orel railway.

Austria.—A further stage has now been reached in connection with the proposed conversion to electric traction of the Vienna City Railway and the construction of underground electric railways in that city, concerning both of which two banking groups have hitherto been in competition. On the one hand, there is a group of Vienna banks and German and Austrian electrical firms, including the Siemens-Schuckert Works; while the other group is composed of the French Omnium Lyonnais and the Banque Centrale de Province. It is now stated that the two syndicates have come to a provisional arrangement to co-operate in the financing of the schemes. The proposal is for each of the groups to subscribe one-half of the share capital of £2,080,000 with which the construction company would be equipped, and the loan capital of £6,000,000 would be raised to the extent of one-fourth by the Austrian group and three-fourths by the French syndicate, which would be allotted for French works 25 per cent. of the orders for the city and underground railways. Apparently, the placing of this percentage of the orders has yet to be agreed to by the German interests, whose share in the contracts for rolling stock and machinery would be reduced by the amount of the work given to French firms. The definite conclusion of the agreement between the two groups is expected to take place when the French group has ascertained whether consent will be given, as is confidently believed, to the admission of the shares and loan capital to quotation on the Paris Stock Exchange; and, in this event, the French Société Générale will join the group. The proposed company will be purely a construction enterprise, as the city railway will presumably continue to be worked by the State, whilst the Vienna Municipal Council will undertake the operation of the underground railways.

Keighley.—The Tramways Committee has granted the request of the men for a week's holiday, with pay, in the year, and it is to commence with the present year. The holiday has been given on the specified condition that the men shall not, in their holiday week, take advantage of the chance of getting double pay by doing similar work elsewhere.

Annual Accounts.—The annual statement of the tramways and motor-'bus undertakings for the year ended March 31st last, submitted last week, shows that the total traffic revenue had decreased by £742, but an increase of £81 in sundry revenue brought the net decrease in total revenue to £680. This drop is stated to have been largely due to the bad summer of last year, and to the cheaper facilities—2½ miles for a penny—given to the public. The total revenue from tramways had been £9,158, the gross profit being £3,187. The number of passengers carried had been 3,099,272.

Railless Traction Experiment.—It was reported that the experimental railless car which had been running since May 3rd last, had created a favourable impression. From that date to July 14th, the car had run 2,126 miles, the revenue having equalled 12·54d. per mile. In congratulating the Committee upon the results of the year's working of the tramways, and the railless experiment, Alderman King urged the authority to proceed carefully with the latter project, and "not to make the blunder which they had made with the motor-'buses." He advocated the entire abolition of the motor-'buses. The reports and accounts were adopted.

Liverpool.—A return, prepared by Mr. C. W. Mallins, the tramway manager, shows that the total revenue for the five days of the King's visit to that part of the country has established a record. The total receipts for the five days amounted to £13,974, and there were 2,856,896 passengers carried.

Leyton.—The Council has accepted the offer of the Postmaster-General to run aerial cable over the Council's trolley wires, where telegraph and telephone cables cross, provided the Council pays half the difference in cost between the provision of the cable and open wires. A modification of the Council's agreement with the L.C.C. for through running on the Lea Bridge Road route has been made, whereby the receipts for cars on the through route are to be pooled and divided according to the mileage run by each authority, for a period of three months from August 1st next. The proportion of mileage run by each authority is to be on the same basis as at present.

London.—L.C.C.—The Council has decided to expend £25,000 (a sum which includes £7,000 for turbo-generator switchgear) on the provision of protective devices with the object of guarding against breakdowns of the tramways generating plant and localising same.

Manchester.—Proposed All-night Cars.—A petition, signed by 3,553 night workers of Manchester, has been presented to the Tramways Committee. The petitioners ask for a night service of tram cars or motor-'buses. The matter is receiving the attention of the Committee.

Preston.—The appointment of a sub-committee of the Corporation is being recommended for the purpose of considering tramway extensions.

Rawtenstall.—Annual Accounts.—Traffic receipts on the Rawtenstall tramway system last year amounted to £25,276, against £23,938 in the previous year, and the total revenue for the year was £26,648, as compared with £25,243. The working expenses were £15,106, as compared with £13,514 for the previous year. The gross profit was £11,542. The loss on the year's working was £517, and to meet this and provide £982 for the renewals fund £1,500 will have to be provided from the rates.

TELEGRAPH and TELEPHONE NOTES.

Australia.—In the early stages of telephone construction in New South Wales, some 300 lines were erected by private users before the Government assumed control of the system, and the owners of these lines were granted the right in perpetuity to retain them on payment of £5 per annum. An Act was passed in 1911 to empower the Government to resume the lines on payment of compensation, to be settled by arbitration, and these powers are now being enforced, greatly to the annoyance of some 250 firms that will be affected.

Poulsen System.—Newcastle (N.B.) is to be the Atlantic Coast station of the Universal Radio Syndicate for the wireless service between the Dominion and Ireland.

"Jamming" in Naval Manœuvres.—In reply to questions in the House of Commons, Mr. Churchill said that it was not the universal custom during manœuvres to attempt to interfere with the opposing fleet's messages, though it might at times have been attempted for short periods. It was not worth the trouble involved and the delay caused to the communication with one's own fleet, and had in practice often been found abortive. It was possible to tap the messages.

St. Kilda.—The *Daily Mirror* wireless station has opened communication with the mainland.

Imperial Communications.—A sub-committee of the British Empire League has been formed, under the name of the Imperial Communications Committee, to keep in touch with the general question of improvement and cheapening of postal and telegraphic communications in the Empire, to collect facts and arguments and to bring them to the notice of the public and of Parliament and Ministers.—*Times.*

(*Continued on page* 183.)

ELECTRICITY DEVELOPMENTS IN WEST HARTLEPOOL.

The Corporation Waste Heat Generating Station.

Electricity supply in West Hartlepool dates back some 12 years, the original generating station of the Corporation in Burn Road having been opened in January, 1901.

Ever since its inception, Mr. H. F. Friederichs, the present borough electrical engineer, has controlled the destinies of the undertaking—indeed, it is not too much to say that it is due to his early appreciation of the necessity for developing the industrial possibilities of the area, which offers comparatively little scope in the matter of electric lighting, that the West Hartlepool electricity department has reached its present satisfactory position.



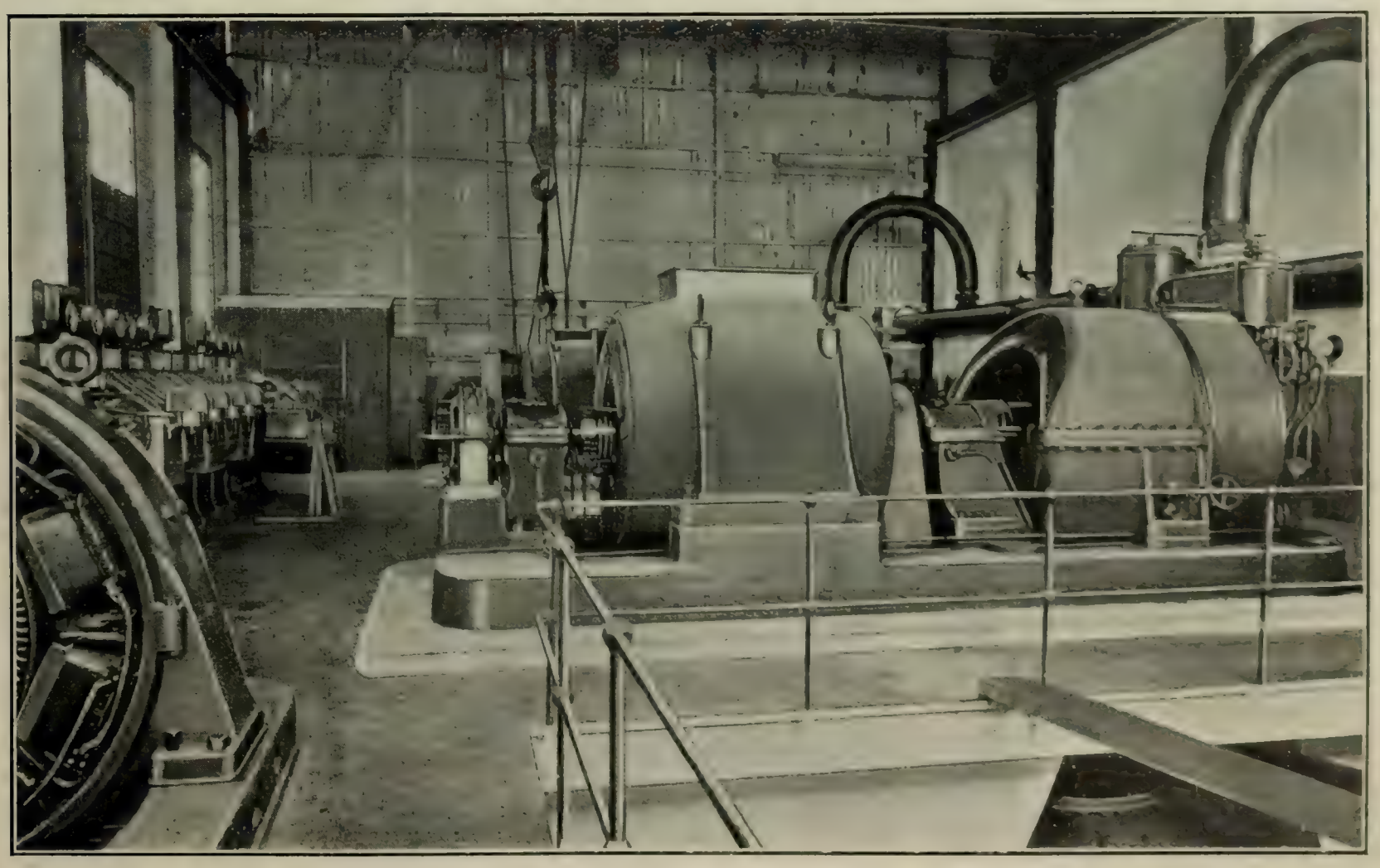
Blowing Engine-House and Exhaust Steam Main Leading to Corporation Power Station (on Left).

Industrially, both West Hartlepool and its smaller sister, Hartlepool, are dependent on the shipping and allied trades, and the local iron and steel works; and it is in connection with one of the latter—the Seaton Carew Iron Co.'s works—that the latest development of the electrical undertaking, viz., the construction of a waste heat power station has taken place.

The Corporation is the first municipal authority to adopt the system of generating electricity from waste steam obtained from outside sources, although the Cleveland and Durham Power Co., which strongly opposed the carrying out of this scheme by the Corporation, has, of course, had several such stations in use for a considerable time.

For the past five or six years the Corporation has supplied the Seaton Carew Iron Co. with some 1½ million units per annum, and under the agreement which has resulted in the erection of the new power station, the company's present electrical requirements will be supplied free in exchange for exhaust steam which was previously blown to atmosphere.

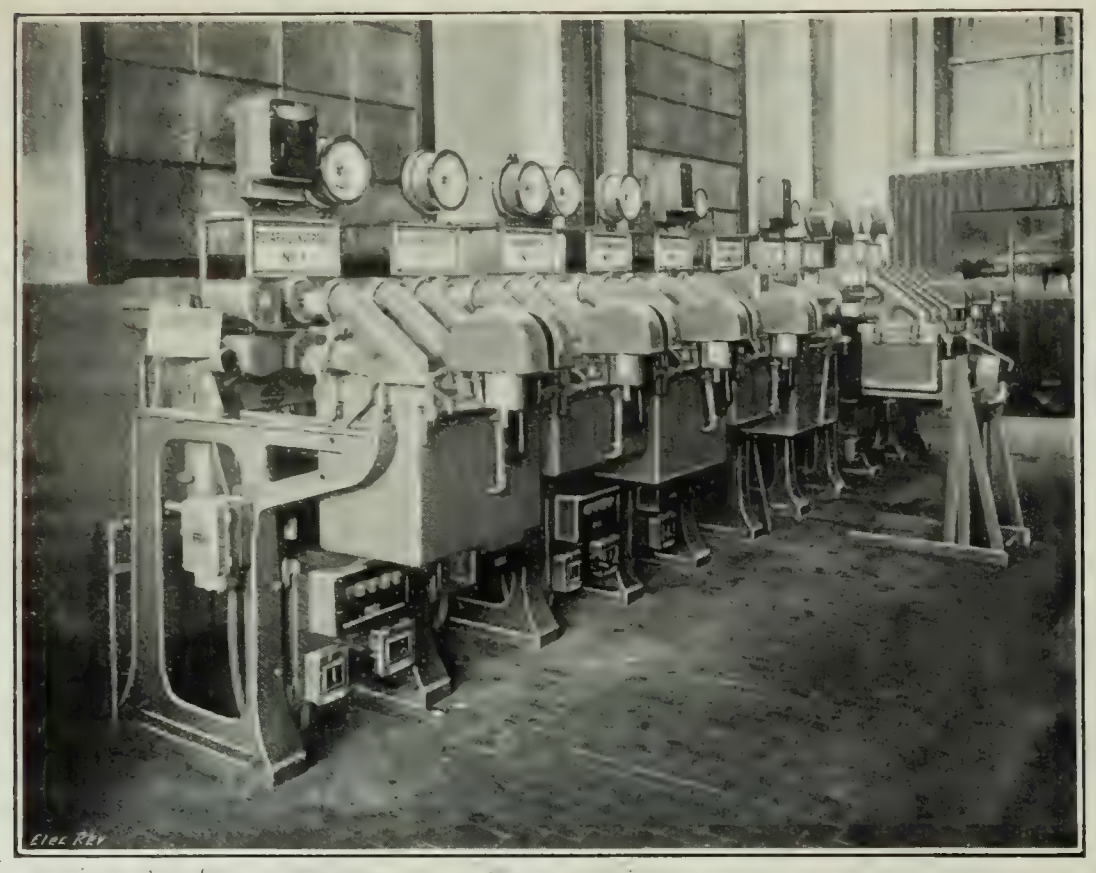
The new power station consists of steel frame turbine house, 40 ft. wide and 70 ft. long, with a temporary end, to allow of extensions: the walls are filled in with 4½ in. concrete reinforced with expanded metal, while the roof, of wood, is covered with Polite tiles. The ground space, how-



Mixed-Pressure Turbine Sets, Ironclad Switchgear, and Rotary Converter (on the Left): West Hartlepool Waste Heat Power Station.

ever, provides for a coal-fired boiler plant adjacent to the engine house, in the event of this being required in the future.

The present steam requirements of the plant, however, are supplied from the exhaust steam from six furnace-blowing engines, which in turn are supplied with steam at 80-100 lb. pressure from a battery of 16 gas-fired boilers, evaporating some 200,000 gallons of water per day. The



Ironclad 6,000-volt Switchgear at the New Power Station.

blowing engine exhausts are led into a 33-in. diameter riveted steel main, fitted with an automatic valve at each end balanced to ½ lb. pressure; the steam, at slightly above atmospheric pressure, passes through a Princeps oil separator prior to entering the turbine house. In the latter are installed two Richardsons, Westgarth mixed-pressure turbines, of the Curtis type, running at 2,400 R.P.M., coupled to 1,250-K.V.A. Siemens three-phase alternators, which have an efficiency of 93 per cent., and are designed for a 25 per cent. overload for two hours.

The turbines are three-stage machines, which normally run on two L.P. stages; owing, however, to the blowing engines being partially shut down at intervals, due to flue-cleaning operations, provision has been made for running the turbines on H.P. steam from the existing boilers, from which a 10-in. solid-drawn steel main runs to the turbine house.

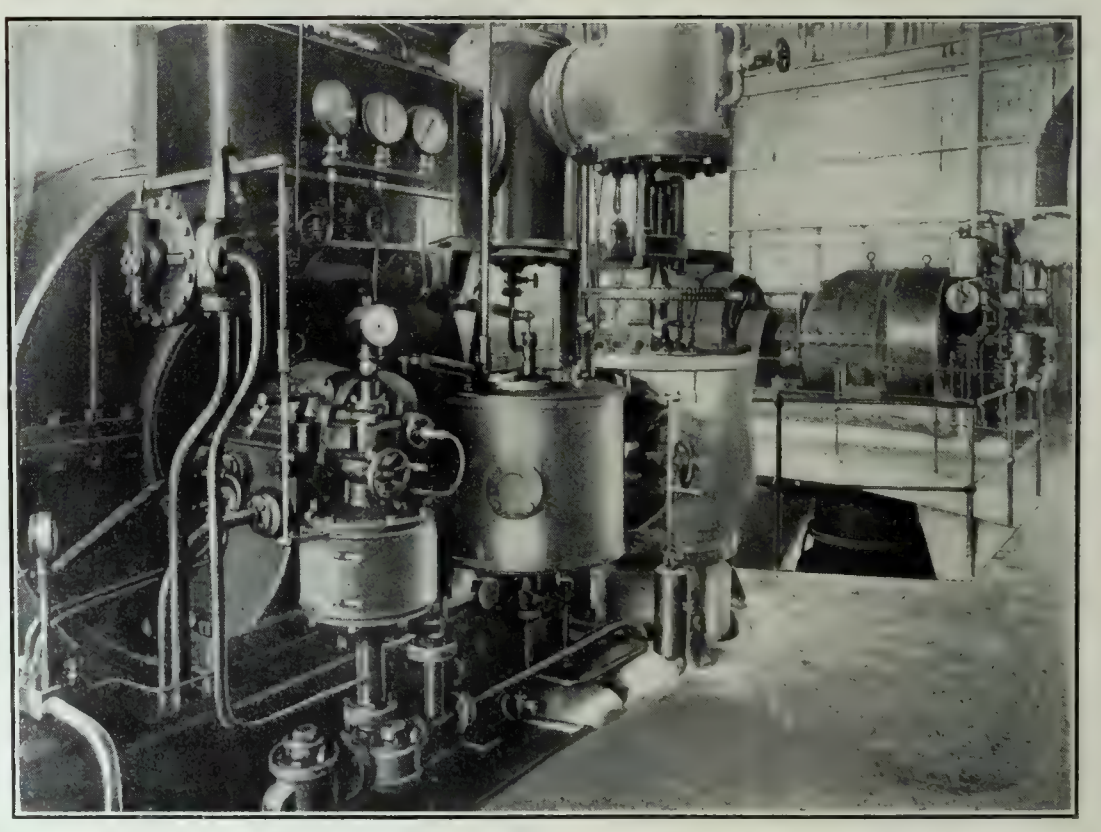
Both L.P. and H.P. governor valves are provided on the turbines, and are interconnected, so that in the event of the L.P. steam giving out, the H.P. valve is opened automatically, passing steam through all the three stages of the machine. The guaranteed steam consumption per KW.-hour of the turbines working on exhaust steam is 31·9 lb. on full load; 37·9 lb. on half load; and 53 lb. on quarter load. On H.P. steam, the expected steam consumption is 23·7 lb. on full load, and 29·3 lb. on half load. The turbines each exhaust direct into a Contraflo condenser of 5,400 sq. ft. cooling surface, which, together with centrifugal circulating and Kinetic air pumps and tanks, are installed in the basement below the turbine floor.

The Kinetic air pump equipment is similar to that which was fully described in our issue of July 4th last, except that in this case the condenser auxiliaries are motor-driven—the Kinetic air pumps being each coupled to a 28-H.P. motor, speed 2,400 R.P.M., and each circulating pump to an 82-H.P. motor running at 600 R.P.M.

The condensate is passed through a Lea recorder, which provides a check both on turbine steam consumption and the steam supply—a minimum supply being guaranteed in compliance with the L.G.B.'s wishes; from the recorder the water discharges into a hot-well underneath and is then, under the agreement, returned (by a small pump coupled to a 4-H.P. motor) to the Seaton Carew Co.'s boilers. The condensing plant is connected through 22-in. diameter suction and delivery pipes to three Morrison Cascade type natural draught cooling towers, each capable of dealing with 115,000 gallons of circulating water per hour—the make-up water being supplied from the company's deep well. The towers, which are of wood, each measure 30 ft. × 60 ft. × 75 ft. high; the internal water distributing system is somewhat novel as the circulating pump discharge is distributed through stout deep troughs, from which it falls through a series of short pipes, on to small specially-shaped spreaders, each of which creates an umbrella-shaped spray. The latter falls on to specially shaped and arranged lats, and is directed by means of baffles into a lower series of troughs, this arrangement being repeated three times before the water reaches the tank underneath. By means of the baffle system the air is circulated through the tower in such a way as to obtain the maximum cooling effect.

It is claimed that the trough construction in these towers ensures even distribution of the water, and is proof against troubles due to warping.

Turning to the electrical equipment, the Siemens alternators are of the totally-enclosed type, fitted with rotor fans, one at each end, for the forced circulation of cooling air; the latter is drawn from the basement through Sturtevant air filters and discharged into the engine room. The alternators supply three-phase current at 6,000 volts, 40 cycles, excitation being provided by 13-KW. shunt-wound interpole 100-volt machines direct-coupled to the alternator shafts. Each alternator has an earthing resistance and switch.



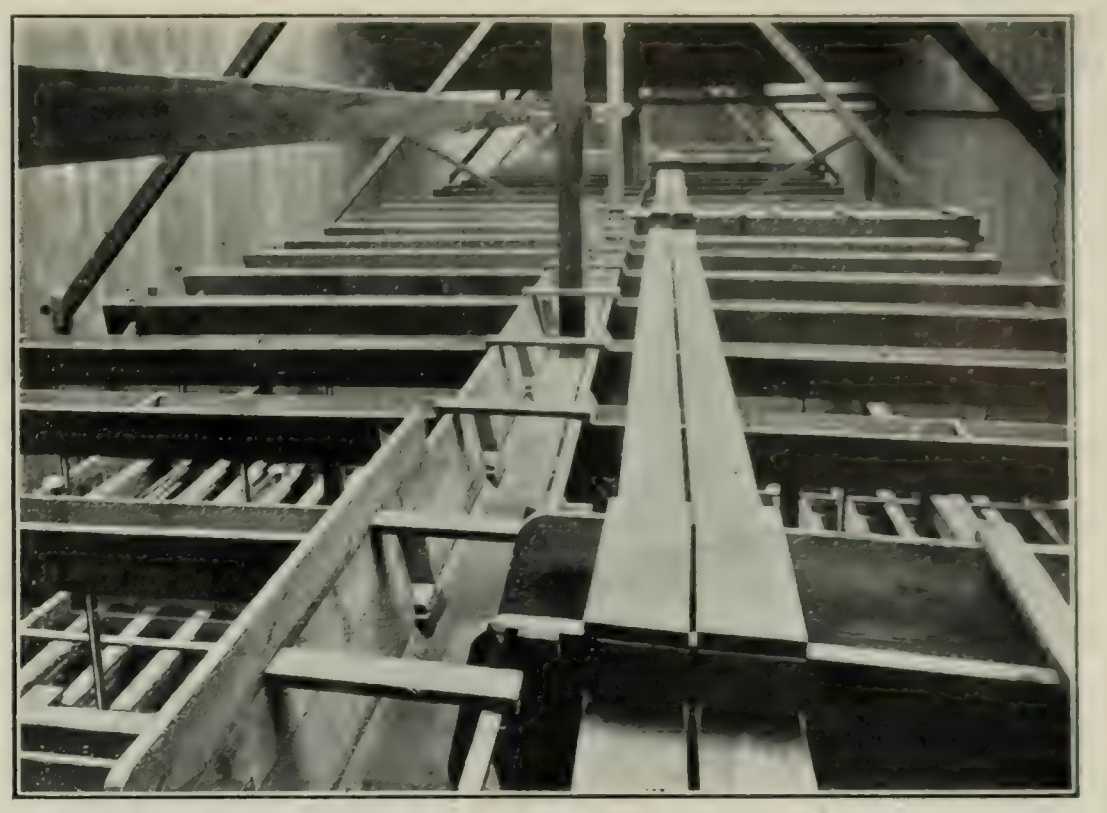
View of Steam End of Mixed Pressure Turbines, Showing the Interconnected Exhaust and High-Pressure Steam Valves.

The H.T. switchboard consists of 10 Reyrolle ironclad direct-operated switch units, the constructional features of which are, or ought to be, familiar to our readers.

Roughly, each turbine unit has its own set of switch panels, consisting in each case of one feeder, one machine, one station transformer and a static discharge panel, with an inter-connecting switch between the sets. An extra panel is provided on one side for a rotary converter, which supplies the Seaton Carew Co.'s works.

The machine panels are fitted with overload trips, and Merz-Price protective gear is applied to the H.T. feeders; a swinging synchronising panel is provided.

The "unit" arrangement is applied to the station auxiliary motors, which in the case of each condenser are supplied through a separate transformer. Two Siemens oil-cooled 150-K.V.A. station transformers are installed for this purpose in the basement, which are coupled to the 6,000-volt bus-bars and each supplies secondary current at 440 volts through a C.I. distribution box fitted with Reyrolle switch fuses to its own section of the plant and for station lighting.



Interior of Morrison Cascade Cooling Tower, Showing Distributing Troughs.

An interconnecting switch is provided between the distribution boxes so that one transformer can, in emergency, supply both of them.

The rotary converter plant, to which reference has been made, is installed in one corner of the engine room and consists of a 500-KW. six-phase machine, speed 600 R.P.M., coupled to a midwire booster and starting motor, and arranged for self synchronising by the Rosenberg method. The machine, together with the oil-cooled transformer in the basement and L.T. switchgear, was supplied by the Westinghouse Co., who have also supplied several similar self-synchronising converter plants which have been installed in connection with the scheme.

The supply to the Seaton Carew Co. is at 460 and 230 volts direct current, by means of overhead wires running to the works sub-station; this is also coupled to the old generating station in Burn Road, and the latter is thus able to supply energy to the new power station, through the rotary, for running the condenser auxiliaries, when starting up the turbines on L.P. steam.

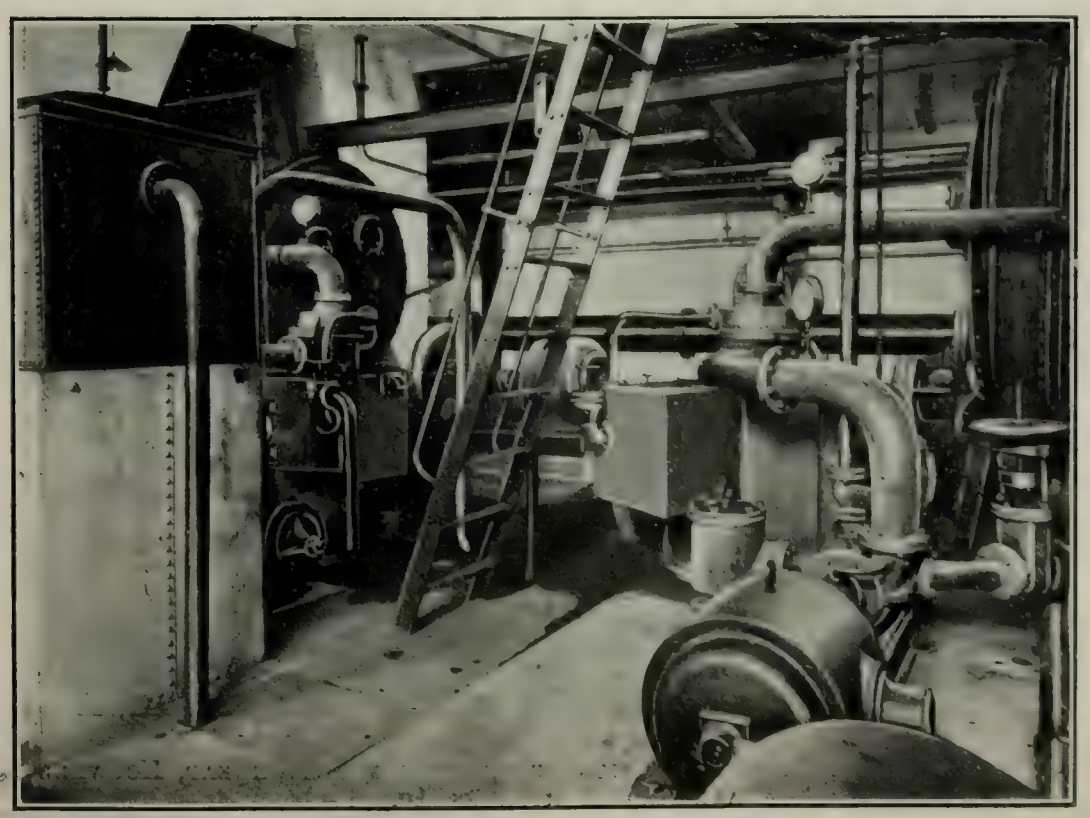
The two 6,000-volt feeders leaving the new station are Callender ·1 three-core paper-insulated lead-covered cables, laid solid in bitumen, together with the pilot and telephone wires; one feeder runs



Three Cooling Towers at the New Power Station; also H.P. Steam Main to Turbines.



View of Splashers under Troughs in Cooling Tower.



Contraflo Condensing Plant, with Kinetic Air Pumps, Tanks, &c., in Basement.

direct to the old generating station, about ½-mile away, and the other reaches the same point *viâ* a sub-station at the South Durham Steel and Iron Co.'s works, where a 400-KW. Westinghouse rotary is installed. The Burn Road generating station, which has now become the Town sub-station, contains two 500-KW. rotary converter plants — duplicates of that installed at the new power station—and these will supply the direct-current load on the town network, thus enabling the 1,500 KW. of high-speed engine plant installed there to be shut down and held in reserve.



REYROLLE IRONCLAD H.T. SWITCHGEAR IN THE OLD GENERATING STATION.

The H.T. supply is controlled by Reyrolle ironclad switch units, this type of H.T. switchgear having been used throughout; the arrangement consists of two sets of feeder and rotary switch units coupled through an interconnecting switch, with an extra switch unit for the supply to the Hartlepool Pulp and Paper Works, where a 400-KW. Westinghouse rotary converter plant is installed.

Both the South Durham Co. and the Paper Works are new consumers; the former will probably require between one and two million units; and the latter, possibly, two million units per annum. In addition to the foregoing, the local tramways will require half a million units per annum, which will be supplied through two 300-KW. B.T.H. rotaries at Burn Road, it having been decided to scrap the 350 KW. of generating plant installed in the original tramways generating station.

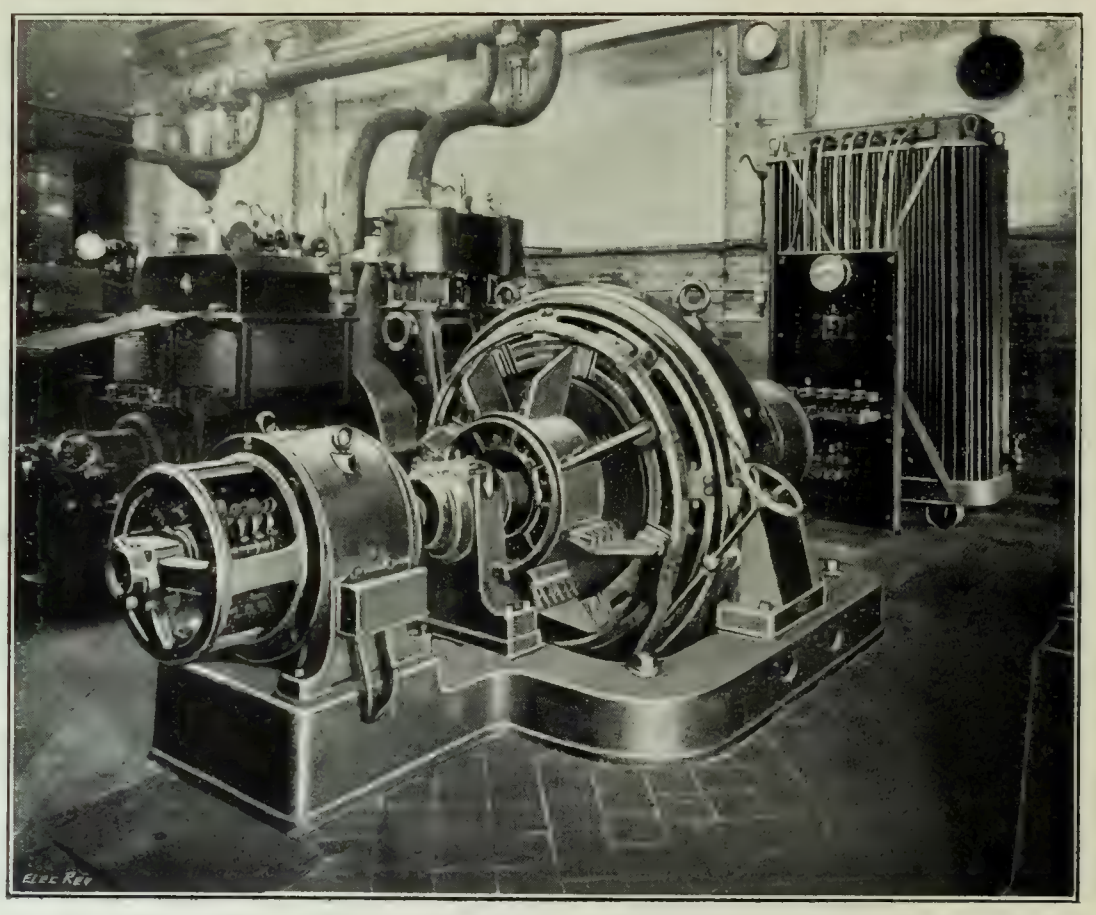
As to the cost of the new power supply scheme, the amounts sanctioned by the L.G.B. were £4,530 for buildings, £28,848 for plant and £3,766 for H.T. cables; further items of £500 for the extension of the battery room at the Burn Road station, and £4,151 for the provision of a Tudor battery of 300 KW. for three-hours capacity, booster, &c., were also sanctioned, and more recently an expenditure of £4,000 has been sanctioned on the new traction plant.

That the Corporation will gain largely by the new plant during the next few years can scarcely be doubted. For instance, the coal and water bills will disappear; the old station is non-condensing, and the last returns show an average consumption of 6½ lb. of coal per unit generated, and the price of coal has risen in a year from 9s. 7d. to 13s. 6d. per ton; the water bill at the old station was approximately £300 per annum. If one considers this in relation to the last published accounts (1911-12), when the total works, distribution, management, &c., costs amounted to £9,183 (on an output of 2½ million units), this amount —which we may assume to apply under the new conditions—will be reduced to £5,200, which, with a doubled output, represents roughly ¼d. per unit.

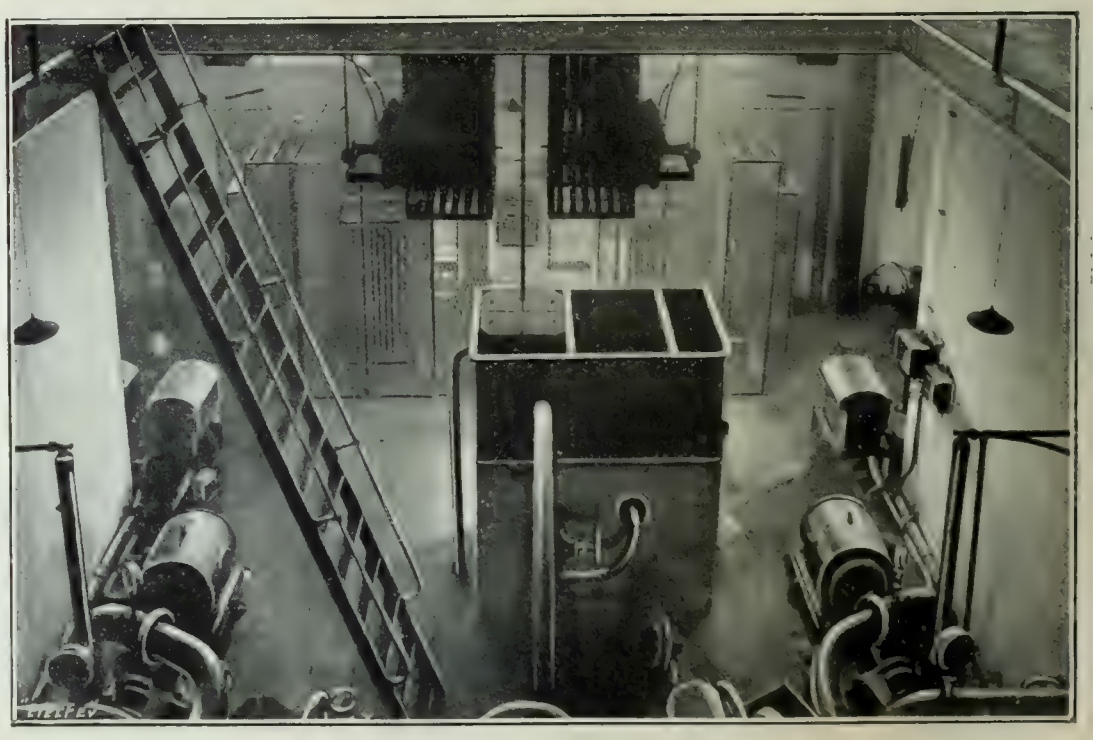
The position cannot, however, be gauged precisely at present, as, with the output probably doubled, production costs will be considerably reduced; on the other hand, the undertaking will lose the revenue from the supply to the Seaton Carew Ironworks, and have to meet extra capital charges due to the new plant.

The future, however, holds out a promise of a very considerably improved position of the electricity undertaking as compared with the past.

It may be interesting to note that power rates at West Hartlepool range from 2d. to 1d. per unit for small consumers, but in the case of large consumers the latter figure may be halved under suitable load conditions. A "restricted hour" power supply at £1 per quarter, plus ¾d. per unit has also proved very popular.



ONE OF TWO 500-KW. SELF-SYNCHRONISING ROTARY CONVERTER SETS AT THE OLD STATION.



VIEW IN BASEMENT, SHOWING STATION TRANSFORMERS, SWITCHGEAR, HOTWELL AND RECORDER TANKS, &C.

Although one does not look for much electrical heating and cooking in the area, Mr. Friederichs offers a flat ½d. tariff for this, to consumers on ordinary lighting tariffs, with an alternative "domestic" tariff based on 10 to 15 per cent. of the rateable value, plus ½d. per unit; from which it will be seen that consumers are even now very favourably placed.

The contract for the whole of the plant at the new station was placed with Messrs. Richardsons, Westgarth & Co., the principal sub-contractors being Messrs. Siemens, the British Westinghouse Co. and Messrs. Reyrolle for the sections of plant mentioned.

In conclusion, we are indebted to Mr. H. F. Friederichs, the borough electrical engineer, for giving us every facility in connection with this article. For the scheme, which has been carried out under his supervision, Messrs. Tennant and Barrs, jointly with Mr. J. F. C. Snell, have acted as consulting engineers.

TELEGRAPH and TELEPHONE NOTES.

(*Concluded from page* 178.)

Imperial Wireless System.—In the House of Commons on Monday, Mr. H. Samuel stated that it had not been possible to publish the terms of the new Marconi contract, because a number of minor points were still unsettled. An alteration of considerable importance had been made in respect of the royalty to be paid to the company. The latter had found that in British East Africa, where the largest of the stations was to be erected, its inventions were not protected by patents; this station required six separate aerials, to communicate with Egypt, South Africa and India, and the company was not prepared to erect the installation if it were to receive no royalty for the use of its inventions there. The company had previously refused repeatedly to subdivide the royalty, and to allocate portions of it to different portions of the installation, but had now agreed to accept that condition provided that the royalties should be paid also in respect of the East African station. The contract would, therefore, provide that in lieu of a fixed payment of 10 per cent. royalty in respect of each station, 4 per cent. should be paid in respect of the internal transmitting apparatus, 2 per cent. in respect of the internal receiving apparatus, 2 per cent. in respect of the external transmitting apparatus, and 2 per cent. in respect of the external receiving apparatus. Thus, if in any one of these sections the Marconi apparatus were discarded, the royalty would be reduced to a corresponding extent, although the Marconi patents were still used in other sections of the station. By contracting for the erection of six stations instead of three, more favourable terms had been obtained than would otherwise have been possible, and delay had been avoided. The addition of a station at Hong-Kong had not yet been decided upon.

The Prime Minister stated that the debate on the contract would take place at the middle of next week.

In the course of a reply to letters in the *Times* written by Mr. Amery, the Postmaster-General denied a number of the statements of the former, and said that the agreement of 1909 for the purchase of the Marconi coast stations had no application whatever to the Imperial wireless chain. It was not true that Major O'Meara, when engineer-in-chief of the Post Office, was not consulted on the matter; Major O'Meara had attended a meeting of the Committee advising him on the subject, and had signed a memorandum relating to the necessity of actual tests before a tender from the Poulsen syndicate could be considered.

Referring to the letter from Sir Joseph Larmor, Mr. Samuel cordially approved of his views, and stated that he had already enlisted the assistance of Mr. Duddell for a period of years, on the recommendation of all his colleagues on Lord Parker's Advisory Committee, as well as of others, as the scientist best qualified to lead in such a task. With him would be associated the ablest of the engineers dealing with wireless telegraphy attached to the various Government departments. When occasion arose, a Committee, analogous to Lord Parker's, would be invited to meet to consider particular aspects of the problem. The letter concludes:—"The scientific man who regards the Imperial wireless stations from the standpoint of the theorist would wish them to be from the outset the perfect products of long and patient experiment. But the strategist says he must have them now. The Government is compelled to pay heed first to the strategist, while reserving full scope for the theorist as well. We go now to the contractors who have the experience, the designs, the staff to enable the stations to be quickly built. Once built, the Government takes complete control of them. It forms its technical committees; it trains its scientific staff; it places its new stations at their disposal for experiments; and it retains full liberty to replace whatever system is first installed by whatever better thing their later researches may discover or evolve."

In reply to questions in the House of Commons, Mr. Samuel stated that a distance of about 60 miles should be sufficient to prevent interference between neighbouring high-power stations. He would not consider applications for licences to private companies to carry on competing business on the Imperial wireless route within the next few weeks.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Victoria. — September 9th. Common-multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

Queensland.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

Austria.—August 8th. The authorities of the North-West Austrian Railway, in Vienna, are inviting tenders for an electric power installation, including a number of motors at the railway workshops at Ruriburg.

Vienna.—August 8th. Supply of electric transmission plant and motors in six lots, viz.:—(1) Chief and secondary distributing switchboards; (2) feed and distribution cables and lines; (3) seven 24-H.P. polyphase motors; (4) two 13-H.P. ditto; (5) one 8-H.P. ditto.; (6) one 5-H.P. ditto. Particulars, Abteilung IV/4 der k.k. Nordwestbahndirektion, Vienna XX (enclosing postage and 2 kr.), and tenders to Einreichungs-protokol der k.k. Norwestbahn-direktion, Vienna.

August 11th.—Supply of telegraph apparatus for the years 1914, 1915, and 1916. Particulars free of the Post-Okonomieverwaltung. 17, Postgasse, Vienna I.

Trieste.—September 29th. Supply of an electrically-operated floating crane, with all accessories complete, including a Diesel electric plant. Particulars and forms from K. K. Lagerhäusern, in Trieste. Deposit 5 per cent.

Canberra.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary, Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Belgium.—August 9th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine), are inviting tenders for the supply and laying of a quantity of telephone cable in the Namur district.

Brighouse.—August 9th. Cable and feeder pillars for the electricity department. See "Official Notices" to-day.

Bury.—August 25th. One 2,000/3,000-kw. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" to-day.

Canary Islands.—August 9th. The municipal authorities of Puerto de la Cruz (Canary Islands) are inviting tenders for the concession for the electric lighting of the town during a period of 21 years.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" to-day.

France.—August 23rd. The municipal authorities of Issoudun (Indre) are inviting tenders for the establishing of an electricity generating station for lighting and power purposes in that town.

Ilford.—August 11th. Motor tower wagon, for the U.D.C. Tramways Department. Mr. L. E. Harvey, tramways manager.

Italy.—August 13th. The Italian naval authorities at Spezia and Naples are inviting tenders for the supply of a quantity of electric wire and cables. The same authorities at Venice are also inviting tenders until the 19th inst. for a quantity of similar material

Littleborough (near Rochdale).—August 4th. Installation of electricity for lighting the Wesleyan Church, and also for organ power. Mr. E. G. Pearson, secretary, 89, Todmorden Road, Littleborough.

London.—Royal Mint.—August 12th. 200 tons of copper in ingots. See "Official Notices" to-day.

General Post Office.—September 1st. Stores Department (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Newport (Mon.).—Re-winding 1,500-kw. three-phase alternator. Mr. A. N. Moore, electrical engineer, Town Hall.

New Zealand. — September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of energy from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Norwich.—August 12th. One 3,000-kw. turbo-alternator and surface condensing plant; rotary converters; E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Roumania.—August 7th. Tenders are being invited by the municipal authorities of Ruscheii de Wede for the concession for the electric lighting of the town.

Shanghai.—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

BLOEMFONTEIN.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machines, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" July 25th.

Spain.—August 9th. The Spanish Ministry of Public Works in Madrid are inviting tenders for the concession for the construction and working of an electric tramway between Baeza and Linares.

Tenders have just been invited by the municipal authorities of San Bartolome de la Torre (province of Huelva) for the concession for the electric lighting of the town during a period of 20 years.

Spanish North Africa.—August 11th. The *Gaceta de Madrid*, of July 14th, contains a notice to the effect that tenders will be received at the offices of the General Directorate of Telegraphs in Madrid for the installation and working of an urban telephone system in Melilla.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" to-day.

Warrington.—August 6th. (1) E.H.T. feeder panel; (2) earthenware conduit for one year, for the Electricity Department. See "Official Notices" July 18th.

Wigan.—August 2nd. Best quick-firing slack and (or) washed peas for the electricity works during 12 months. Estimated 15,000 tons. Electrical Engineer, Bradford Place, Wigan.

CLOSED.

Atherton.—The U.D.C. has accepted the following tenders:—

T. Croft & Sons.—New sub-station.
General Electric Co.—Switchboards, &c.

Barnstaple.—The T.C. has accepted the tender of Messrs. Cory Bros., of Cardiff, for coal for the electricity works, at 18s. 6d. per ton for large, and 11s. 6d. per ton for small.

Belgium.—Four concerns submitted tenders to the municipal authorities of Farciennes (province of Hainaut) for the establishment of a central electric lighting station in the town, the lowest being that of the Société des Usines du Hainaut, of Couillet.

Bradford.—The T.C. has accepted the following offers to supply additional quantities of tramcar equipment at the same prices as in, and as an extension of, their present contracts:—

Siemens Bros. Dynamo Works, Ltd., 100 motors, 50 resistance sets, and 100 circuit-breakers
Hurst, Nelson & Co., Ltd., 50 trucks.
Dick, Kerr & Co., Ltd., 100 D.B. Form K4 controllers.

The tenders of Cole, Marchant & Morley, Ltd., and Collier Bros., Ltd., have also been accepted for the supply of 50 power brake sets, and for 30 miles of 0000 grooved copper trolley wire, at £2,698, respectively.

Canada.—WINNIPEG.—The Canadian *Electrical News* states that a contract has been awarded to Messrs. Vickers, Ltd., Montreal and Sheffield, for manufacture, delivery and erection of three 5,000-K.V.A. generators and auxiliary parts.

Croydon.—Tenders for the supply of coal to the electricity works have been accepted as follows:—

Cory Bros. & Co., Ltd.—250 tons of Tynebedw, at 28s. 9d. per ton.
Wm. Cory & Son, Ltd.—4,000 tons of Muirfield Peas, at 17s. 4d. per ton.
J. H. Gillman & Co.—250 tons of Mapperley Loco Hards, at 19s. 9d. per ton, 4,000 tons of Donisthorpe & Mapperley Nuts, at 18s. 6d. per ton.

The Education Committee has accepted the tenders of Mr. S. E. Hunt, at £90 and £75, for electrically lighting the Mitcham and Brighton Roads schools.

Derby.—The E.L. Committee of the T.C. has accepted the tender of Messrs. E. Morley & Sons, for the construction of turbine beds at £1,225; and the tenders of Mr. T. Walker, Parsons Bros., and Snape, Ltd., and the Derby Coal Co., Ltd., for coal for the electricity works.

The Tramways Committee has accepted the tender of Mr. G. F. Tomlinson; at £2,632, for doubling the tramway in Kedleston Road.

Doncaster.—The Tramways Committee has accepted the tender of Messrs. Arnold & Son, at £2,524, for extending the car shed in Greyfriars.

Eccles.—The tender of Mr. E. Beal has been accepted by the T.C., at £39 10s., for installing electric light at the Green Lanes Science School. The tenders of S. Hooley & Son have also been accepted for annual supplies of slack to the electricity works, at 11s. 3d. per ton; and best selected house coal at 19s. 7d. per ton.

Falkirk.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for A.C. meters.

Huddersfield.—The T.C. has accepted the tender of Messrs. J. Proctor, Ltd., for a coal elevator for the electricity works.

Hungary.—Messrs. Ganz & Co., of Budapest, have secured a contract for the construction and equipment of a system of electric tramways in the town of Funfkirchen.

Heston-Isleworth.—The Electricity Committee has accepted the tender of Messrs. W. Cory & Son, Ltd., for the supply of Bynteg anthracite coal for the year ending June 30th, 1914, at 20s. per ton, delivered at Brentford docks, G.W.R.

The National Boiler Insurance Co. having intimated that the economiser at the electricity works, in its present condition, is unfit for further use, the Electricity Committee has accepted the offer of Messrs. Green & Sons, Ltd., for supplying the necessary new tubes and superintending their erection, for the sum of £238.

Kingston-on-Thames.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for coal for the electricity works.

Leyton.—The tenders received by the U.D.C. for electrically lighting the Church Road School were as follows:—

E. Beckwith & Co., Ltd.	£473
Boulting & Sons	588
C. H. Cathcart & Co.	555
J. T. Halsey (accepted)	376
Jordan & Plaford	541
Lund Bros. & Co.	567
Mackie & Co.	639
Private Telephone Co., Ltd.	499
"Ray" Electric Co.	547
Ryan & Son	425
M. Sims	435
Smeeton & Page	499

The Education Committee of the U.D.C. has accepted the tender of Mr. H. H. Taylor for installing the electric light at Goodall Road and Mayville Road Schools, at £44.

Rawtenstall.—Tenders are to be obtained for mechanical screens for the electricity works; a recorder is also to be obtained.

London.—L.C.C.—The tenders received for additional switchgear for the Shoreditch, Camberwell and Woolwich sub-stations and the central car repair depôt were as follows:—

Spagnoletti, Ltd. (recommended)	£1,000
Johnson & Phillips, Ltd.	1,068
Ferranti, Ltd.	1,100
Switchgear & Cowans, Ltd.	1,141
Eckstein, Heap & Co., Ltd.	1,331
A. Reyrolle & Co., Ltd.	1,388

Chief officer's estimate, £950.

The Fire Brigade Committee recommends that the offer of J. C. Braun, Premier-Werke A.-G., Nurnberg, to supply a petrol-electric chassis for an escape van for £930 be accepted. The same firm will also deliver two petrol-electric chassis for fitting to Magirus ladders for £2,222, Messrs. Magirus, Ewald & Lieb, of Ulm, supplying two of their ladders for £1,300. The Committee is advised that "petrol-electric motor appliances suitable for the purposes of the Brigade cannot be obtained in this country."

The Highways Committee has received tenders for five miles of 0000 grooved trolley wire for the overhead system of tramways per mile, as follows:—

	£	s.	d.	
Thompson & Co. (French manufacture)	87	15	0	
F. Smith & Co. (accepted)	93	6	8	(less 2½ per cent.)
	(£81 13s. 4d. per ton.)			
B.I. and Helsby Cables, Ltd.	94	0	0	(less 2½ per cent.)
T. Bolton & Sons, Ltd.	91	13	0	

The Highways Committee is to invite tenders from selected firms for rubber sheets, for use in connection with the tramways.

Tenders are also to be invited from selected firms for the provision of testing plant for polyphase electricity meters.

Six motor-cars are to be obtained for use in the tramways department, and tenders for the same are to be invited from selected firms.

It is proposed that a Sub-Committee of the Education Committee be empowered to open the tenders for installing electric lighting at four schools during the recess and to accept the lowest satisfactory one in each case.

The following tenders were received for the electric lighting installation at the new Hackney fire station:—

G. E. Taylor & Co. (recommended)	£162
Tredegar & Co.	196
H. J. Cash & Co., Ltd.	238
Finch & Wheeler, Ltd.	254
Cox-Walkers, Ltd.	357

Engineer's estimate, £197.

The tenders from selected firms for condensing water-pipes in the bed of the Thames at the Greenwich generating station are to be dealt with during the recess; also those for the switchgear required in connection with the new turbo-generators.

MARYLEBONE.—The following tenders have been accepted by the B.C. :—

Babcock & Wilcox, Ltd.—Four motor-driven fans, £1,588 (delivery to be made at the rate of about one a year).
J. P. Hall & Sons, Ltd.—Boiler feed pump, £319.
T. Press & Co.—Cleansing work at Rathbone Place sub-station, £79.
W. H. Allen, Son & Co., Ltd.—Duplicate armature to canal circulating pump motor, £222.

WOOLWICH.—The tender of the Sturtevant Engineering Co., Ltd., has been accepted by the Council at £188, for the supply of wet-air filters for filtration of the supply of air for ventilating the turbines at the electricity works. The derrick crane which has for the last six months been hired for work in connection with the erection of the Globe Lane electricity station is to be purchased from Messrs. Scott & Middleton, at £250, less the rent already paid.

HAMMERSMITH.—The B.C. Electricity Committee recommends for acceptance the tender of Messrs. Chamberlain & Hookham, Ltd., for two-rate meters. A time recorder is to be obtained from the International Time Recorder Co., for £35 10s.

Tenders are to be invited by the B.C. for the electric lighting of Uxbridge Road Tabernacle; also for a motor to be attached to the existing generator, to be supplied to Messrs. Gwynnes, Ltd., under their agreement with the Council.

Luton.—The Electricity Committee of the T.C. has accepted the following tenders for extensions at the works :—

W. Dunham & Sons, Luton.—Buildings, coal bunkers, &c., £8,566.
Babcock & Wilcox, Ltd.—Roofing steel work, £1 210.
Alphons Custodis Chimney Construction Co., Ltd.—Chimney, £1,290.
Clarke, Chapman & Co.—Two water tube boilers, £5,050.

Sevenoaks.—The Sevenoaks and District Electricity Co., Ltd., has entered into a contract with Messrs. Crompton & Co., Ltd., for the erection and equipment of a generating station, and to supply and lay about 22 miles of feeders and distributing mains, &c., at £29,730.

Southampton.—The T.C. has accepted the following tenders for annual supplies of coal to the electricity department :—

Bradbury, Son & Co., Ltd.—Newbury small coal, 13s. 9d. per ton.
Phœnix Wharf and Coal Co., Ltd.—Small coal, 15s. 9d. per ton.
J. R. Wood & Co., Ltd.—North Country small, 15s. 9d. per ton.
G. J. Eveson Coal and Coke Co., Ltd.—Ibstock small, 13s. 6d. per ton (subject to test).
Cory Bros. & Co., Ltd.—Scotch pearls, 14s. 9d. per ton.

Stoke-on-Trent.—The Electricity Committee of the T.C. has accepted the tenders from the following firms for coal :—

Sneyd Colliery, Ltd.—Cockshead slack.
Shelton Iron and Coal Co.—Great Row slack.
Bakewell and Butterworth.—Swadlincote nutty slack.
Mossfield Colliery Co., Ltd.—Slack.

Walsall.—The Electricity Committee of the T.C. has accepted the tender of the Harris Patent Feedwater Filter (1910), Ltd., for a water softener, at £345; and that of Messrs. Normans, of Wolverhampton, for a steel and iron boiler house at the generating station, at £397.

Willesden.—As a result of competitive trials just completed, an order for 67 long-burning flame arc lamps of the "Metroflam" magazine type, has been placed with Messrs. Johnson and Phillips, Ltd.

Repeat orders for lamps of this type have been placed during the month by the Newcastle Corporation, the Tyne Improvement Commission, and Messrs. Hawthorn, Leslie & Co., Ltd., Hebburn.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 2nd. Annual general meeting, at 2 o'clock, at Wood Memorial Hall, Newcastle-on-Tyne. Paper open for discussion, "Lighting Efficiency of Safety Lamps," by Mr. T. A. Saint. To be read or taken as read :—"Notes on Coal-mining in the United States of America, with Special Reference to the Treatment of Coal-dust, and Haulage by Electric Locomotives," by Mr. S. Dean; "The Comparative Inflammability of Mixtures of Pit-gas and Air by Momentary Electric Arcs," by Prof. W. M. Thornton.

The Cruise of the "Alde."—The Batti-Wallahs' Society has, for the fourth time, had placed at its disposal by one of its past presidents—Mr. Riggs—his sailing barge *Alde*. The party going for the cruise this year is to be limited to 16. Comfortable cabin beds, electric light, and, to beat all, a complete range of electric cooking apparatus—what more can be desired, save good weather and ample provisions? The sailing day is to-day, and if what was the case a week ago is still true, there are yet a few vacancies, so interested parties had better get on to the 'phone straightaway ("Regent 3661," Mr. A. J. Greenly, entertainment secretary, 116, Charing Cross Road, W.C.). Batti-Wallah members can have the whole period of the cruise aboard from August 1st to August 11th for £3 10s., or they can spend a couple of week-ends with the party for, of course, a smaller sum.

Electric Vehicles in America.—The annual convention of the Electric Vehicle Association of America is to be held in Chicago on October 27th and 28th next.

NOTES.

Lead.—The market continues to show exceptional firmness, with a ready demand for all the metal coming in and no important alteration in the broad outlines of the position. The scarcity remains, and everything arriving is immediately taken care of, though it must be admitted that there is not much new demand. This, however, is not to be looked for at the present very high range of values, which shows every indication of lasting for a long time yet. Even if the Mexican situation were straightened out at once, it would require some time for industrial affairs to settle down to approximately the normal, and meantime there would still be a shortage of material forthcoming. Prices can hardly go higher without more or less seriously interfering with the progress of consumption, indeed at to-day's level the manufacturer who would stock up, would be showing more hardiness than prudence, but really the position is one of exceeding gravity for users of the metal. It has been suggested that leading parties have been, and are still, holding back lead in Spain and Australia, but such statements entirely fail to reflect the truth, for abroad, as at home, there is nothing but scarcity to be met with. Prompt and near delivery metal is taken up with avidity by consumers, and now and again a little demand for forward metal asserts itself. The premium on near deliveries is still very noticeable, and this of itself tends to restrain new buying for far ahead, because consumers judge the position as none too good, when so large a difference as 20s. to 25s. exists between prompt and three months' ahead deliveries. On a broad view there is not yet any indication of a relaxation in the stringency being in sight.

Rings in Lead.—A German contemporary reports that a piece of lead pipe which had been buried, partially embedded in cement, for 24 years, showed, when cut, 24 red and 23 yellow oxide rings in that section which had been in the cement. The pipe which had been in the earth showed no such phenomenon. The two rings per annum were, doubtless, formed during the wet and dry seasons, the variation in moisture being responsible for the two degrees of oxidation. It would be interesting to hear whether a similar occurrence had been observed in lead-sheathed cables.

The "Paragon" System of Electrical Power Transmission.—On July 18th an application by the Maschinenfabrik Oerlikon for Letters Patent No. 19,890/1912 came before the Comptroller-General, in respect of opposition to the sealing of the same by Mr. William P. Durtnall, inventor and patentee of the "Paragon" system of ship propulsion and petroleum-electric railway traction. Mr. F. Bosshardt appeared for the applicants, and Mr. Durtnall handled his own case in person.

The invention sought to be patented related to improvements in driving electric locomotives, motor-boats and the like, wherein the driving shafts were to be rotated by means of polyphase alternating-current motors, supplied with current from polyphase alternating-current generators, which were to be carried on the vehicle and driven by steam engines, turbines, oil or gas engines. The speed was to be regulated by varying the speed of the prime mover.

Mr. Durtnall asked that the patent should be refused, and argued that anything not specifically mentioned in his specifications was either there by inference or was common knowledge, so that there was no subject matter in the applicants' specification that would justify the grant of letters patent.

The Comptroller-General's judgment was in Mr. Durtnall's favour with costs, as follows :—

"The Comptroller-General having given the matter his consideration, has come to the conclusion that he ought not to allow a grant in this case. The combination suggested by the applicants clearly embodies the opponent's combination; and the additional features suggested are apparently for the most part well known in themselves, and cannot be said to supply any patentable matter. In other words, the main principle of the combination has already been suggested by the opponent, and the other features relied upon constitute no inventive step. The patent must, therefore, be refused, and I award the opponent, Mr. William P. Durtnall, the sum of £3 3s. in respect of his costs, and direct the said sum to be paid by the applicants, Maschinenfabrik Oerlikon."

Colliery "Electricians."—A sequel to the incidents referred to in our issue of March 14th, page 418, came up at the Chesterfield Police Court on July 19th, when the manager of the Langwich Colliery was proceeded against by the Home Office, for various infringements of their regulations. After a prolonged hearing, the magistrates found no alternative to the infliction of a fine; and it is to be hoped for the benefit of all concerned in the industry that all responsible authorities at collieries will realise the necessity of securing properly qualified men for their electrical work. We recall that the electrician in this case who is, we see from the *Derbyshire Times*, no longer with the company, was under the impression that from four 100-volt lamps, arranged in series, the maximum pressure to earth was 100 volts and safe. He had had several years' experience, and was obviously of the class of wiremen who do things by rule of thumb, and have but the slightest, if any, theoretical knowledge.

Parliamentary.—VARIOUS BILLS.—In the House of Commons on July 22nd, the Lords' amendments to the Rhondda Tramways (Railless Traction) Bill were agreed to.

In the House of Commons on the 28th ult., the Central London Railway Bill and the Kent Electric Power Bill were read a third time.

American Electrical Developments at the Cauvery Falls, India.—An American Consul (Mr. H. D. Baker) on special service in India refers in a report, recently sent home to the States, to the extension works which are in progress in connection with the Cauvery Falls water-power undertaking in the native State of Mysore. From these falls 10,000 H.P. is at present being transmitted 92 miles to the Kolar gold fields, and about 2,000 H.P. somewhat lesser distances to the two cities of Bangalore and Mysore, where it is used for electric lighting and industrial purposes. The new extension will increase the water power available for the gold mines at Kolar by 7,000 H.P., and also will permit a fair increase in the power for use at factories in Bangalore. The original installation, which took place in 1900, cost £574,000, and the new electrical installation will cost £94,000. There is, however, to be a further large expenditure of about £534,000 on a huge dam and reservoir across the Cauvery River at the town of Kannambadi, about 15 miles distant from the City of Mysore. This is to be used both for increased water power and for irrigation. It is anticipated that its construction will not only ensure the steady supply of water the year round for power for industrial purposes and for existing irrigation in the Cauvery River valley, but it will also allow for an increasing power supply as future demands arise, and also for additional irrigation to the extent of 150,000 acres. The dam will have a total height of 124 ft. above the river bed when completed. The depth of storage will be 118 ft. There will be a canal on the north bank of the river about 100 miles long, capable of irrigating about 150,000 acres. The work will be constructed in two stages. In the first stage the dam will be raised to a height of 97 ft., so as to store a depth of 80 ft. of water, or 11,030 million cb. ft.

It appears that all the electrical equipment for the new installation is to be manufactured in the United States. A contract has been signed for the purchase of two 1,500-KW. generators and twenty 1,750-KW. high-voltage transformers, together with switchgear, to be supplied from Schenectady, at a cost of about £30,000. The Consul remarks: "Leading electrical firms in England and Germany bid competitively with American firms on this equipment, but the English bids were about 20 per cent. higher than the accepted bid of the American firm, and in the case of German firms their guarantees were not considered so satisfactory as those of the American firm. The new turbine installation, as in the original plant, will be from Zurich, Switzerland. In the new installation the voltage will be raised from 35,000 to 70,000 volts. An interesting feature of the new high-tension line installation will be the use of iron poles with cross-arms having porcelain insulators, which are to be supplied from Pittsburg, Pa., at a cost of £40,000. This iron-pole construction is deemed advantageous on account of the white ant difficulty with timber, and also because of local scarcity of tall enough trees for poles. The first Cauvery Falls water-power scheme was at the time of its inception one of the most important long-distance transmissions in the world, and attracted much special interest in the United States at the time, because it was one of the first notable instances of American manufacturers and American engineers participating so prominently in a great project so far from home. This scheme was originally carried out, and has always been subsequently managed, by American engineers appointed for this purpose by the Government of Mysore, and the electrical equipment which has always proved most satisfactory was all manufactured in the United States. The present electrical engineer in charge, who will also direct the new installation, is Mr. C. F. Beames, a citizen of New York State. Very brilliant financial results to the Mysore Government have followed this enterprising undertaking. The original capital outlay has now been practically all covered in subsequent profits. The plant is now netting in earnings about $500,000 a year, which is a substantial source of revenue. The charge to customers for power is about $50 per H.P. per year. A large augmentation of the profits is anticipated from the additional installation."

Sports.—The initial athletic gathering promoted by the London Electric Railways Association took place on the 26th ult. at Stamford Bridge Ground. A full list of winners appeared in the *Referee* on Sunday last.

Appointments Vacant.—Jointer for West Hartlepool electricity works; chief station superintendent for the new combined tramway and public power and lighting generating station, with outlying sub-stations in Perth, for the West Australian Government (£450); engineering clerk of works, for Rhondda U.D.C., Glamorganshire; two shift engineers (32s.), for Aberdare U.D.C.; electricity showroom assistant (£60), Ilford U.D.C.; engineer-in-charge at Darlington Corporation electricity works (£2, rise to £2 5s.); electrical engineer, for Postmaster-General's Department, for the State of Queensland (£528 to £600 per annum); assistant mains superintendent (35s.), and a junior shift engineer (25s.), for Southport; switchboard attendant for Lancaster (27s. 6d.). See our advertisement pages to-day.

Fatality.—A correspondent writes:—"A motor-lorry driver named Tom Roxborough (34), of Ravensthorpe, employed by Messrs. W. & R. K. Lee, doublers and spinners, Sowerby Bridge, met his death on Thursday last week whilst cleaning the boiler of his engine. He was working at the Mirfield Motor Wagon Works garage, by the light of a movable electric lamp of about 230 volts. It is believed he put his foot on a live wire, or that he came into contact with a "jack," which sent the current through his body and killed him almost immediately. He leaves a wife and five young children."

Windmills for Generating Electricity.—The principal component of a windmill is the wheel, the spindle of which is turned parallel to the direction of the prevailing wind (by a guide vane), in order that all blades may work uniformly. To avoid wasteful eddy currents, the blades should not be too close together, and should not extend to the centre of the wheel. The following table shows the horse-power which can theoretically be realised from a 28-ft. wheel exposed to winds of various velocities:—

Speed of wind, M.P.H.	H.P.	Speed of wind, M.P.H.	H.P.
2·25	0·04	22·5	40
6·7	1·1	33·5	135
11·2	5·0	45·0	520
15·7	13·0	67·0	1,080

The power available should increase with the cube of the wind velocity (since the kinetic energy of the air particles increases with the square of their velocity and the number of them striking the wheel blades per second increases in direct proportion to the wind velocity). It is not practicable to construct a mill which will utilise with equal efficiency a light breeze and a strong wind, hence the curvature and setting of the blades should be such that the mill works most efficiently when exposed to a wind of the velocity generally prevailing in the district concerned. If a wheel be designed to utilise with maximum efficiency a wind of 22·5 M.P.H., it will not run in a 7-M.P.H. breeze, since the power corresponding to this wind is less than the power required to overcome the light-load losses of the wheel and its gearing. Breezes of 8 to 15 M.P.H. are much more common than 20-M.P.H. winds, hence it is generally advisable to employ, for driving lighting or other dynamos, a very light wheel which will start work in a 3·5-M.P.H. wind, and which can still be used when the wind rises to 10 M.P.H. Such a wheel could not be exposed fully to a 30-M.P.H. wind, and for safety a device should be mounted on the main wheel, so that when the wind pressure exceeds a certain limit, the inclination of the blades is changed, against the control of a spring, in such a manner as to reduce the effective area exposed to the wind. The control springs may conveniently be set so that they come into operation when the wind velocity exceeds 16 M.P.H., and so that the output of the mill is constant in winds above 18 M.P.H.; there is thus secured maximum total annual output. Dynamos employed with windmills should not be excited from the battery, since the voltage of the latter may be very low after a long period of calm weather. The automatic main dynamo switch should operate when the machine voltage just equals that of the batteries, and mercury contacts should not be used.—*E.T.Z.*

A Useful Hint (from Glover's Almanac).—Among all the difficulties of getting old houses wired for electricity, the central station commercial man's problem really becomes acute when he tackles the rented dwelling. The tenant, of course, in most cases welcomes electric light, but the landlord usually remains obdurate when asked to invest from $25 to $75 additional in property from which he expects no increase of return. It was an astute contract agent who hit upon the scheme of getting the tenant's agreement to pay from 50 cents to $1 more per month, provided the landlord would wire the premises. With this offer cheerfully acquiesced in, the central station could approach the owner, showing him that the $6 to $12 yearly increase in rental allowed liberal interest on the small investment involved in the wiring, besides leaving a surplus to retire the principal in the course of a few years. The property was thus left with a permanent improvement, worth as a real estate increment several times the actual outlay, although acquired at no expense whatever to the owner.—*Electrical World.*

That Abominable Habit.—At the Bradford City Police Court on Tuesday last week, Ben Dickinson, of 482, Rooley Lane, Bradford, was summoned for spitting on a tramcar. Another passenger alleged that the defendant caused him annoyance through spitting on the floor, and upon his remonstrating with the defendant and drawing his attention to the by-laws of the Corporation he became very abusive. The defendant denied that he had been spitting on the car, but the conductor of the car stated that he saw marks of spitting on the floor by the defendant, and upon this a fine of 5s., including costs, was imposed. It was once the custom to put up a notice in American tramcars to the effect that "Those who expect to rate as gentlemen must not expectorate on the floor," and that "Passengers are requested not to spit; gentlemen won't!" Whether it be by pleasantries such as these or by the strong hand tramway authorities do well to try to stamp out this disgusting and dangerous habit.

Institution Note.—Victorian Institute of Electrical Engineers.—At the meeting of this Institute held at Melbourne on June 26th, two 10-minute papers were read as follows:—"Tests on Fire-Resisting Materials," by Mr. Noel Murray; "Historical Electrical Progress in Victoria," by Mr. F. W. Chambers. Mr. W. J. Newbigin also delivered his Presidential address.

The Holidays.—The British Thomson-Houston Co.'s Works at Rugby will be closed from to-night until Tuesday morning, August 12th. The office staff will be in attendance as usual.

Inquiries.—Makers of electrically-heated case-hardening plants are asked for.

Educational Notes.—City and Guilds of London Institute.—The Council of the City and Guilds of London Institute has awarded the diploma of "Associate of the Institute" to the following matriculated third-year students who have completed a full course of instruction in electrical engineering:—E. A. Richards (Siemens Memorial Medal), R. S. H. Boulding (Siemens Memorial Medal), D. Dunham, G. J. Websdale, D. H. Linsley, N. H. Barker, U. Singh, L. B. Hobgen, L. G. Lloyd, H. B. Lee, A. G. C. Holroyde, V. H. G. Parker, J. C. Elmer, R. C. Wrinch, J. P. Clifton, H. A. Denison, W. Ryley, N. D. Edingborough, A. H. Hall, P. Jackson, H. Singh Siddhú.

An announcement respecting the electrical engineering courses at the University College, Nottingham, for next session, appears in our advertisement pages.

The Extraction of Atmospheric Nitrogen.—The International Nitrogen Co., of Wiesbaden, and the Nitric Acid Co., of Cologne, have disposed of their patents relating to the extraction of nitrogen from the atmosphere to the Electrochemical Industry Co., of Wiesbaden and Cologne. The former two companies have hitherto carried on works for the production of nitric acid at Patsch, near Innsbrück, where the local supply company furnished to them about 70,000,000 KW.-hours per annum at an exceptionally low price. As now taken over by the Electrochemical Industry Co., the Patsch works is to be used for the manufacture of calcium carbide and cyanamide, the plant to be capable of producing 8,000 tons per annum. Since this announcement was made in the second week of July, the International Nitrogen Co. has published its accounts for 1912 showing a loss of £4,700, and increasing the deficiency to £43,000. This fact probably explains the transfer of the undertaking to the company in question.

Electrical Anæsthesia.—The system of producing local anæsthesia with the electric current, devised by Prof. Leduc some years ago, has been developed and made suitable for ordinary applications. The apparatus was demonstrated last week at the laboratories of Messrs. W. Watson & Sons, Ltd., London.

Rifle Match.—On July 24th, the Siemens Dalston Works Miniature Rifle Club tried conclusions with the Poplar Electricity Works' team, who are members of the Electrical League, the result being a win for the Siemens team. The average score of the "drawn wires" was 95·5 out of a possible 100. Mr. Horace Bowden opened the shoot for Poplar and scored many bulls. The match was keenly contested, and a return match will be arranged.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Leicester T.C. decided on Tuesday to increase the salary of Mr. T. R. Smith, chief electrical engineer, from £600 a year to £700 with two further annual increments of £100 each.

The Erith U.D.C. has appointed Mr. Lionel H. Saynor, general assistant at the electricity works, to succeed Mr. R. N. Mayne as chief assistant electrical engineer at £160 per annum, rising by £20 a year to £200, which is to be the maximum.

Mr. James J. Murphy has been appointed electrical installation inspector under the municipal council at Shanghai, China. Prior to his departure for Shanghai, Mr. Murphy was presented with a dressing case by his friends at Ebbw Vale.

Mr. F. Selley, first-class assistant mains superintendent to the Marylebone undertaking, is to be promoted to chief assistant, at a salary of five guineas per week.

Mr. H. A. Harding, assistant mains engineer to the Metropolitan Electric Supply Co., Ltd., London, and formerly assistant electrical engineer to the Acton Council, has been appointed electrical enginer to the Bognor undertaking, under the Bognor Gas Light and Coke Co. His address is now: Electricity Works, Argyle Road, Bognor.

Mr. V. Goulding, senior shift engineer at the Heston and Isleworth Electricity Works, has resigned his position to take up an appointment at the Battersea Electricity Works. Before leaving Heston-Isleworth, Mr. Goulding was presented with a suit case by the staff, and the chief engineer, Mr. P. E. Rycroft, voiced their feelings by wishing him every success in his new position.

Mr. R. G. Barlow has been promoted to the position of second shift engineer at Heston-Isleworth electricity works, and his salary increased to £102 per annum; Mr. A. Sadler, an improver, has been appointed third engineer, at £78.

Mr. J. P. Rowell, switchboard attendant at the Lancaster Corporation Electricity Works, has been appointed charge engineer at the Bootle Electricity Works. Mr. Rowell is the third switchboard attendant from Lancaster who has obtained a post elsewhere during the past three months. Mr. R. T. Carleton was appointed to take charge of the plant at the Winter Gardens, Morecambe, in April, and Mr. W. G. Coates left to take charge of one of the sub-stations at Manchester in May.

General.—We learn with interest that Mr. E. P. Barfield, who has for the last six years rendered very active and enterprising service at Dalston, as manager to the incandescent lamp and fittings department of Messrs. Siemens Brothers Dynamo Works, Ltd., will be leaving that firm later in the year, in order to take up an important position which he has accepted with the Edison & Swan United Electric Light Co. Many of Mr. Barfield's friends in the electrical industry will recall that it was with the Ediswan Co. that he was connected at the outset of his career. Mr. Barfield has witnessed very large developments at Dalston during the period named above, and progressive schemes are still in hand. He has done a great deal to cultivate the social side of life, which means so much in connection with an industry of this character. We understand that he will not actually be leaving the Dalston works for some little time.

Prof. Wm. A. Bone, D.Sc., Ph.D., F.R.S., Professor of Chemical Technology, of the Imperial College of Technology, inventor of the Bonecourt system of flameless incandescent surface combustion, and technical adviser to Bonecourt Surface Combustion, Ltd., has been awarded by the Franklin Institute of Philadelphia, U.S.A., its Howard N. Potts gold medal for distinguished work in Science or the Mechanic Arts, in recognition of his work on "Surface Combustion," upon which subject he gave a lecture before the institute on October 30th, 1911.

The marriage has taken place at All Saint's Church, St. John's Wood, of Mr. Ernest Sydney Heurtley, M.I.E.E., and Miss Ena Mary Dent, daughter of the late Mr. Arthur Douglas Dent, and of Mrs. E. L. Swatman, of Sutton, Surrey.

Mr. A. A. Collie has severed his connection with the Sterling Telephone and Electric Co., Ltd., and joined the engineering staff of Marconi's Wireless Telegraph Co., Ltd. (Betulander Automatic Telephone system).

Will.—We read in the *Times* that the late Mr. James Watts Courtenay left estate of the gross value of £85,832; net personalty, £71,064.

NEW COMPANIES REGISTERED.

Central Argentine Light and Power Co., Ltd. (130,216).—Registered July 21st, by Charles Humphries & Co., 17-18, Basinghall Street, E.C. Capital, £100,000 in £1 shares. Objects: To generate, develop and accumulate electrical power at the Falls on the San Juan River, Province of San Juan, Argentine Republic, and elsewhere, to carry on the business of an electric light, power and supply company, and to adopt an agreement with the Isla Syndicate, Ltd. The signatories (with one share each) are:—C. W. Pearson, 3, London Wall Buildings, E.C. company secretary; H. Willinbrock, 64, Hamilton Road, Highbury Park, N., registrar; R. A. Cooke, 31, Lorne Road, Stroud Green, N., clerk; G. B. Winby, 7, Lawn Crescent, Kew Gardens, S.W., clerk; H. Read Smith, 3, London Wall Buildings, E.C., chartered secretary; H. J. Linford, 3, London Wall Buildings, E.C., company secretary, A. J. H. Angier, 121, St. Mary's Road, Ilford, shorthand writer. Minimum cash subscription, 10 shares; the directors are to number not less than three or more than seven; no persons had consented to act as directors to July 19th. Qualification, £250; remuneration, £200 each per annum (chairman, £250); secretary, H. Read Smith. Registered office, 3, London Wall Buildings, E.C.

C. R. Construction Co., Ltd. (130,287).—This company was registered on July 24th, with a capital £25,000 in 1,000 "A" ordinary shares of £1 each and 80,000 "B" ordinary shares of 1s. each, to carry on the business of constructors of public works and conveniences including railways and tramways in Argentina or elsewhere, and to adopt an agreement the parties to which are not named. The subscribers (with one ordinary "A" share each) are:—P. G. Thurston, 33, Fordel Road, Catford, S.E., solicitors' managing clerk; W. H. White, 48, Hibernia Road, Hounslow, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Smiles & Co., 15, Bedford Row, W.C.

Lighting Press Syndicate, Ltd. (130,328).—This company was registered on July 25th, with a capital of £400 in £1 shares, to establish, print and publish the *Lighting Journal and Engineer*. The subscribers (with one share each) are:—A. W. Robinson, 116, Charing Cross Road, W.C., electrical engineer; A. J. Greenly, 116, Charing Cross Road, W.C., journalist. Private company. The number of directors is not to be less than two or more than three; the first are A. W. Robinson, A. J. Greenly and W. Riggs; remuneration, £25 per annum, divisible. Registered by Donald S. Ball, 167, Strand, W.C.

British Ljungstrom Turbine Co., Ltd. (130,312).—This company was registered on July 25th, with a capital of £25,000 in 10s. shares, to carry on the business indicated by the title, and to adopt agreements (1) with the Aktiebolaget Ljungstroms Angturbin and Wm. Beardmore & Co., Ltd., and (2) with Mr. R. S. Portheim. The subscribers (with one share each) are:—C. J. Lunn, 17, Townsend Road, South Tottenham, clerk; A. Hawthorn, 34, Marlowe Buildings, Calvert Avenue, Shoreditch, clerk. Private company. The number of directors is not to be less than two or more than three; the subscribers are to to appoint the first; qualification, £1,000; remuneration, £100 each per annum and a percentage of the profits. Registered by Nicholson, Graham & Jones, 24, Coleman Street, E.C.

Abcar, Ltd. (130,262).—This company was registered on July 23rd, with a capital of £5,000 in £1 shares, to manufacture and sell carbide of calcium and other similar products, &c., to acquire any invention relating to electricity, electro-chemicals and other electro products, &c. The subscribers (with one share each) are:—C. Bingham, 11 Queen Victoria Street, E.C., merchant; M. H. Thorp, Penshurst, Sheridan Road, Merton Park, articled clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first three; remuneration as fixed by the company. Registered office, Room 223, at 11, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the further extent of £500 on July 1st, 1913, of debenture dated July 10th, 1911, securing £5,000, has been filed. (Previously paid off £500.)

Harvey Electro-Chemical Co., Ltd.—Debenture dated July 9th, 1913, to secure £1,000, charged on the company's uncalled capital. Holder: A. F. Forster, 28, Lincoln's Inn Fields, W.C.

James Keith & Blackman Co., Ltd.—Issue on July 21st, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Reason Manufacturing Co., Ltd.—A memorandum of satisfaction to the further extent of £300 on December 1st, 1912, of mortgage dated May 1st, under an agreement dated January 15th, 1900, securing £1,200.

Babcock & Wilcox, Ltd. (65,805).—Capital, £1,760,000 in 100,000 pref. and 1,660,000 ord. shares of £1 each. Return dated May 8th, filed June 21st, 1913. All shares taken up; £360,000 paid on 360,000 ord.; £1,400,000 considered as paid on 100,000 pref. and 1,300,000 ord. Mortgages and charges: Nil.

Musselburgh and District Electric Light and Traction Co., Ltd.—A memorandum of satisfaction to the extent of £500 on July 22nd, 1913, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 25th, 1913. 23,600 shares taken up; £286,000 paid. Mortgages and charges: £3,000.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated May 15th (filed June 19th, 1913). 6,500 shares taken up; £61,000 paid on 6,100; £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

THE directors' report for the year ended December 31st, 1912, states that although the volume of business has been maintained, a proportion of the contracts on which the company has been engaged were entered into in previous years and at the low prices which then ruled. This circumstance, coupled with the serious effects of the coal strike and of other strikes in the steel industry which occurred in the spring of the year, and the consequent general advance of the cost of materials, have adversely affected the year's operations, and the directors regret that their expectations of improved results have not yet been realised. The largely increased cost of insurance under the Workmen's Compensation Act and under the new National Health and Unemployment Acts has also been an adverse factor. As proposed in the last annual report, a committee representing the shareholders and other interests was formed to consider the scheme of reduction of capital and for raising fresh capital which had been prepared by the directors. Several conferences took place between the directors and this committee, and at a meeting held on September 26th, 1912, the following resolution was unanimously passed :—

The Committee having heard the explanations of the directors and considered various schemes for dealing with the situation, are of opinion that the scheme submitted by the directors for reduction of capital and for raising additional capital is, as amended by the Committee, the most suitable proposal for carrying on the company, and should be recommended for adoption.

An issue was accordingly made of £86,620 (part of £100,000) prior lien second debenture stock, which was offered to the first and second debenture-holders and to the preference and ordinary shareholders. Of this amount, £39,743 was taken up, and a further amount of £11,300 was subsequently placed, also at par, making a total of £51,043 allotted. The scheme for reduction of the share capital to deal with the accumulated balance to debit of the profit and loss account, is delayed pending the completion of the accounts for the current year. The company has acquired a licence to manufacture the Ljungström steam turbine, which promises remarkable economies in steam consumption, and for which a large demand is anticipated. The first set of this type is now in successful operation at the Willesden power house of the North Metropolitan Electric Power Supply Co. The sum of £7,675 was expended during the year on new machine tools, for the purpose of enlarging the company's manufacturing facilities on the engineering side. These tools were of types requiring special construction, and the delay thereby involved only allowed of partial advantage being derived from them during the period covered by the accounts. The contracts in hand have been secured at more satisfactory prices, and, given a period reasonably free from labour troubles, the outlook is now more favourable. During the year opportunities have occurred, and been utilised, of realising at a profit some of the securities held by the company.

The twenty-fourth ordinary general meeting was held on Wednesday at Electrical Federation Offices, Kingsway, W.C., Mr. Emil Garcke presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that at the last meeting he stated that the progress which they were making towards a better state of things, although slow was nevertheless very clear and definite, and that their loss on trading had been gradually reduced from £40,000 in 1908 to under £6,000 in 1911. He also expressed the hope that the accounts for 1912 would, at any rate, show an equilibrium between profits and expenses, including all the debenture interest and other charges, and the directors therefore considered that the time was opportune for carrying out the long delayed reorganisation of the capital account. The balance-sheet then presented was made up with a view to showing what, in the opinion of the directors, should be the reduction of capital, and they recommended that a committee of shareholders and representatives of debenture-holders should be appointed to confer with the directors on the scheme of reorganisation and on the position of the company generally. All the gentlemen who had volunteered to serve on such a committee were accordingly appointed, several conferences took place between the committee and the directors, and, finally, a resolution was unanimously adopted in which the committee expressed the opinion that the scheme submitted by the directors, as amended by the committee, was the most suitable proposal for carrying on the company. Accordingly, a circular was issued last October to the shareholders and debenture-holders, in which the whole position was explained, and an offer was made of £86,000 of prior lien participating second debenture stock, part of £100,000. The share and debenture-holders took up their *pro rata* allotments to the extent of £39,743, and a further amount of £11,300 was subsequently placed, also at par, making a total of £51,043 allotted. The circular also stated that the scheme approved by the Committee provided for the reduction of the share capital of the company, as suggested in the last annual report, and stated that, after the new stock had been issued, the directors would call extraordinary general meetings of the shareholders to consider, and if deemed advisable, to proceed with the reduction of capital. Owing, however, to the time taken up by the negotiations for placing the new debenture stock, the end of the year was reached before the whole of the £51,000 debenture stock was allotted, and, therefore, the directors felt that it would be better to postpone proceeding with the application to the Courts for sanction to reduce the capital. There was no object to be gained by effecting a reduction of capital until they were in a position to make profits, and had the prospect of being able to pay dividends upon the reduced capital, and although they might seem to be slow in attaining that position, they were nevertheless making decided progress in that direction. Having expressed the thanks of the directors to the Committee of Shareholders for their help in placing the affairs of the company on a better basis, Mr. Garcke said that dealing with the balance-sheet, there was an increase in the figures on each side over the figures of 1911 of about £16,400. The expenses were about £4,700 more than in 1911, but that was not surprising, considering that the output from the works was much larger. Indeed, the amount of work in hand at the end of the year was larger than it had been for several years. The increases in the expenses applied to many of the heads, but were not large in any of them. Salaries were £1,326 up; law expenses were £356 up, insurances were £1,100 higher, and they spent £1,184 more on the maintenance of plant and buildings. Debenture and other interest was £1,300 higher. On the other hand, directors' fees were £150 down. Advertising expenses were £1,150 less, and they had saved £237 on their expenses at the old Victoria works. The credit side of the profit and loss account showed that the profit on trading was £3,867 less than in the preceding year, but the profit on sale of shares was £6,519 more than in the preceding year, and they showed a net loss for the year of £7,700 as against a loss of £5,700 in 1911. He was very sorry that their expectations of being able to show at least an equilibrium between the expenses and the receipts, were not realised in the past year, but the result, though regrettable, was unavoidable. Having referred to the serious effect which the coal strike had had on the business during the year, he said he was glad to say that during the current year they had been free from labour troubles in their particular business, though there still continued to be a good deal of unrest amongst workmen engaged in the engineering industries. In their business, it was especially of importance that they should be able to carry on in harmony with their workmen and without the harassment of labour disputes. Many of their contracts took months, and, in some cases, even years to finish; and as the prices had to be fixed at the time the orders were booked, it was manifestly essential that they should be in a position to carry out those contracts at the same wages as ruled at the time they were entered into, otherwise all calculations might be upset, and business, which showed a fair margin on the estimates, might end up on the wrong side. To protect themselves as far as possible against those dangers, they had latterly endeavoured to make agreements with the Trades Union, by which the district rates for the different classes of labour they employed were settled, to stand for a definite period without modification up or down, and he was glad to testify to the fact that those agreements, when made, were loyally and honourably observed by their workpeople. Speaking generally, the contracts now on their books had been secured at more favourable prices. There was a better feeling among the manufacturers engaged in the industry, and the tendency which was so noticeable a year back for competing firms to take work at prices showing the barest margin of profit was gradually disappearing. It was, however, only right to point out that better prices brought with them one serious drawback—he referred to the increase of foreign competition. So long as home manufacturers were willing to accept contracts at unremunerative prices, this market had no attraction for the foreigner, except in particular cases where some special object was to be served by "dumping," but directly prices stiffened sufficiently to show a fair profit, the competition from abroad became active, so that what they gained in one direction they were liable to lose in another. Foreign competition in electrical engineering work was very real and serious and could not be measured by the amount of the imports alone. At previous meetings he had referred to their work as builders of turbo-generating plant, and he was pleased to say that in this department they had well maintained their reputation. In pursuance of their policy to keep thoroughly abreast of the latest improvements in steam turbines they had identified themselves with the Ljungström turbine. That was a Swedish invention which had been very carefully worked out and tested before being put on the market. It was original in design, strongly protected by patents, and promised great economy in steam consumption, a feature of importance for situations where coal was high in price. The

first set of this type—a turbo-alternator of 1,500 H.P. capacity, was started to work a couple of months ago at the Willesden power house of the North Metropolitan Electric Supply Co. where it was in successful daily operation under full service conditions. They had orders in hand, and in immediate prospect for these machines, and were looking forward to a large demand for turbines of this size. They built great hopes on the development of this new turbine, for ever since he had acted as chairman of the company, he had been endeavouring to find some branch of manufacture in which they could specialise with a view to producing a standard output. That was not easy in the present condition of the electrical industry in this country, and he was very glad, therefore, that they were able to take up the manufacture of a machine which was fully protected by patents, which was cheap to manufacture, and which possessed merits in advance of other machines in the market, and, moreover, which was within the capacity of the company's works to make on commercial lines. On the rolling stock side they had, beside the usual standard lines of tramcars and trucks, railway passenger coaches and wagons, turned out considerable numbers of motor-omnibus bodies of different types, principally for service in the Metropolitan area. Practically the whole of the bodies on the blue M.E.T. omnibuses on the London streets were of their make. That was a line of manufacture for which they were especially well equipped, and in which they hoped to continue to do good business. The volume of all orders secured during this year had so far been well maintained. As he had already said, they were getting better prices, and concurrently they were making special efforts to keep their works' expenses down. This was the fourth year in succession he had appeared before them as chairman. When, in 1909, he accepted the position, he did so without any illusions as to the nature of the difficulties to be encountered and the responsibility of the position. But he thought that it would be only for a year or two, for the purpose of assisting to carry out a much needed rearrangement of capital—he had no idea that the work was so uphill and that progress would be so slow. If they re-elected him that day, he proposed to hold the position for another year, and if by then the situation had not materially improved, he thought it would be right that he should give someone with fresh energies, and perhaps greater resources, an opportunity of retrieving the fortunes of the company. Meanwhile, they thought it might be advisable to try the experiment of appointing one or two additional directors who had influences of a kind that would be useful to the company and who might be able to help to improve the position. On that occasion they proposed the election as a director of Mr. Spagnoletti, who had been connected with the industry for many years, and who had expressed his willingness to lend them a helping hand.

Mr. B. S. Broadhurst, the managing director, seconded the motion.

Mr. Marchmont pointed out that this year, taking into account the profit of £6,519 realised on the sale of shares, the company had made a loss of £7,700. That meant to say that without that profit on shares, which would not be available another year, they would have made a loss of £14,000. Under these circumstances, he asked the directors what prospect there was of the company doing better next year. He thought the time had come when the whole position ought to be seriously grappled with. If it was not done to-day, it would have to be done next year, and he could see no good in putting the matter off.

Mr. Bush said the chairman talked about "hoping" that things would be better, but hope would not make a business, or bring customers or profit. It seemed to him that the position wanted to be tackled in a very serious way, for there was a business with a capital of about three-quarters of a million of money, which really showed a loss of about £15,000. Unless something was done soon, bankruptcy stared them in the face.

Mr. Grey said he would like to know whether other companies were in a similar position. He believed that, speaking generally, electrical engineering companies were doing fairly well. Of course there was competition, but he believed that prices were improving, and he should have thought the Brush Co. was in a position to compete with anyone who came along. He did not see what they could do, unless they wound up.

Mr. Green suggested that it might be possible to amalgamate with other similar concerns, by which a large saving might be effected in administration expenses, and the closing down of some of the works.

The Chairman, in reply, said he did not wonder that the shareholders were dissatisfied. It was exceedingly disappointing that they should be doing all this hard, good, genuine work, and not be able to show any result to the shareholders. The directors quite appreciated that they could not bring the company round simply by "hoping." That would be a very foolish policy to pursue, and the figures as to the turnover showed that they relied on something much more than bare hopes—they were putting life and blood and tissue into the concern in a manner that very few who were not engaged in similar businesses could have any idea of. If they were in any other country the same amount of energy that they were using would produce gigantic results. The Committee which met the directors came to the conclusion that nothing more could be done than the directors were doing—that was to keep on struggling. That was all they could do except commit suicide by going into bankruptcy, and he did not see that that would put the shareholders or the debenture-holders into any better position. If the company was unsuccessful it was not because of unsuccessful management. If they were the only company manufacturing electrical apparatus in this country showing poor results, it would be a very bad inference indeed that there was something wrong with the management, but the facts were that they could look round amongst the various electrical manufacturers in the country and they would find evidence of intense struggle and of enormous effort and exertion without corresponding result. There were two or three companies that were paying moderate dividends, but nothing whatever in proportion to the work they did, or to the high skill brought to bear, and the sacrifices that they had made in the past, but the large majority of electrical manufacturing businesses in this country were no better than they were. The suggestion of amalgamation was one that was worth considering, but it was not always possible by putting two or three losing companies together to produce one successful concern.

The report was then adopted.

The chairman was re-elected on the board, and Mr. Spagnoletti was elected as a director.

Monterey Railway, Light and Power Co.—The directors' report for 1912, states that, notwithstanding the unfortunate political situation which continues to exist, and the consequent general commercial depression prevalent throughout the country, the balance-sheet shows a satisfactory increase of gross and net earnings in all departments. The financial result of the year's operations are summarised as follows:—Gross income, $518,428; less interest on debenture stock, $292,743; leaving $225,684. The dividend on the preference stock absorbed $25,000, the surplus being consequently $200,684. This result, produced under unusual conditions, is gratifying, but it is not due to any general enlargement of the company's operations, nor to the new business which naturally follows the normal increase of population and commercial expansion of a prosperous community. The year has not offered attractive opportunities for expansion of operations or for the investment of new capital, beyond expenditures necessary to protect the interests of the company under the several State concessions. The directors, however, believe that with a return of normal commercial conditions throughout the Republic a general expansion of the company's business would result, with a corresponding increase of earnings.—*Financial Times.*

Continental.—France.—A new company has just been formed at Ressons-sur-Matz, with the title La Société du Secteur Electrique de la Vallée du Matz, to establish a small central electric lighting station in the district.

La Société des Acieries Electriques d'Aiguebelle is the name of a new company which has lately been formed at Aiguebelle (Savoy) with a capital of £50,000, to put down a plant to utilise the water power of the River Roche near that town, and to equip works for the production of steel by the Chaplet electrical process.

Russia.—A company is in course of formation in St. Petersburg with a capital of 1,000,000 roubles, and the title the Baltic Co. of Electrical Undertakings, for the establishment of an electricity generating station on the banks of the River Aa in Liflande.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1913, at the rate of 5 per cent. per annum (the same as in 1912), carrying forward on the six months' trading £17,747 as compared with £13,614 last year. Warrants will be posted on August 15th. On the City undertaking, after providing for debenture interest and dividend on the preference shares, £10,401 is carried forward as compared with £5,388 last year.

Compania de Electricidad de La Provincia de Buenos Aires, Ltd.—An extraordinary general meeting will be held at Capel House, New Broad Street, London, on Saturday, August 2nd, for the purpose of passing resolutions increasing the capital £1,100,000 by the creation of 25,000 addition shares of £4 each, and extending the directors' powers of borrowing and raising money by £200,000 beyond the limit fixed.

Stock Exchange Notice.—The committee has ordered the under-mentioned securities to be quoted in the Official List:—

Automatic Telephone Manufacturing Co., Ltd.—360,000 Ordinary shares of £1 each, fully paid, Nos. 1 to 360,000.

Metropolitan Electric Supply Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th last at the rate of 4 per cent. per annum, payable August 13th. This is the same rate as paid in 1912.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended June 27th, 1913, amounted to 1,053,088, compared with 1,012,739 units in the corresponding four weeks of 1912.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors announce an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the past half-year. The rate in 1912 was the same.

Metropolitan Railway Co.—The directors announce an interim dividend on the ordinary stock for the past half-year at the rate of 1½ per cent. per annum, leaving a balance of £4,773.

Chelsea Electricity Supply Co., Ltd.—The directors announce an interim dividend at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares for the half-year. The 1912 interim dividend was at the same rate.

Westminster Electric Supply Corporation, Ltd.—Interim dividend for the half-year at the rate of 10 per cent. per annum on the ordinary shares, as compared with 9 per cent. paid last year.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange markets have not yet drifted into their usual August condition of placidity. There is a fair amount of business going on—patchy, of course, but still providing a certain amount of work for the House as a whole. The principal feature is activity of American Rails, reflected in a mild manner by some of the telegraph shares. Business in Marconis has fallen away to something of a flicker; but, on the other hand, there is a good deal of interest in most of the Mexican securities.

The Home Railway market received a much-needed fillip by three or four unexpectedly good dividend announcements, which came to counteract the unfavourable effect produced by the Great Eastern and South-Eastern declarations. Thanks to this, the market recovered its previous losses, though the Undergrounds remain dullish. The absence of accounts and meetings in respect of the first half of the year has placed an unexpected restraint upon the public attention usually paid to Home Railways during July and August; and most of the financial critics are urging strongly the desirability of the companies issuing some kind of financial statement by way of showing how they stand, up to the end of the first six months.

Metropolitan stock went back to 45½ upon the dividend declaration, at the rate of 1½ per cent., though this, as a matter of fact, was equal to market anticipations. Districts keep about 33, and no further changes have occurred in the Central London group beyond a point rise in the Deferred Assented stock. London United Tramways Debenture stock continues to droop, and is now no better than 56. This is due in some measure to the success of the 'buses over the trams. As it was pointed out a fortnight ago in this journal, the unfair conditions under which the trams are labouring, as compared with the 'bus companies, are exciting comment. Even those who do not love the trams acknowledge that the hardship of the competition may lead to the whole question being ventilated by local bodies before long.

Electric Lighting shares are extremely quiescent. The prospectus has been circulated of the Sevenoaks and District Electricity Company, Ltd., an undertaking with a capital of £40,000, in shares of £1 each. The prospectus states that a contract has been entered into with Cromptons, Ltd., under which they undertake to erect and equip the generating station, to supply and lay out 22 miles of feeders and distributing mains, and to do other necessary work, for the lump sum of £29,730 1s. 6d., payable in cash.

The activity in Yankees alluded to above has caused rises in American Telephone and Telegraph stock and Collateral Trust bonds, Anglo-American Preferred, Direct United States shares, New York Telephone bonds, and West India and Panama Ordinary shares, the improvements ranging from $\frac{1}{16}$ to a point. The rise in Direct United States shares is 7s. 6d. West India and Panama Second Preference fell ⅛ to 9⅝, and Commercial Cable Debenture is ½ down. Great Northern Telegraphs eased off to 30½, and Mackays are a little lower. In the Eastern group the more pacific news from China encouraged improvements in Eastern Ordinary, which went up 1½, and in Eastern Extensions, which gained ⅛. Westerns are 2s. 6d. higher. Globe Preference eased off to 12.

Marconis, as a group, are weak, the report of the Spanish and General Company causing pronounced disappointment. The price of the Spanish shares dropped to 7s. 6d., being rather nominal even at that; while Canadians dwindled to 8s. 6d., and Americans to 15s. 6d. The parent company's shares shed 5s., the delay in the announcement of the dividend leading to uneasiness, although in explanation of this it was rumoured that the company desired to fix up the new contract with the Government before declaring its dividend and issuing the report. The proposed terms of that new contract made the dull market rather duller. National Telephone Deferred moved languidly between 27¾ and 28½; a further return of capital is to be made immediately.

The Mexican Utility division fell into further depression, owing to dramatic falls in the prices of some of the country's railroad bonds, these ranging from 2 to 10 points during the week. In some of them smart recoveries ensued, and thereupon the market for the utility issues firmed up a little. It cannot be said, however, that there is any too much confidence felt at present with reference to these; and on the week, Mexico Trams show falls of 2 to 3 points, the company's Common shares having shed the latter amount and standing now at 87½.

Mexican Light and Power descriptions are steady. Rio Trams and Sao Paulo Trams have both risen ½, but Brazil Tractions at 86½ are 1½ down. Anglo-Argentines are better, although the only quotable change is a rise of ½ in the 5 per cent. Debenture stock. Southern Electric of Buenos Ayres 5 per cent. Debenture stock gained a point to 98. City of Buenos Ayres Trams rose to 5$\frac{7}{16}$. The British Columbia stocks have held their rises, and the 4½ per cent. Debenture stock is ½ higher. Canadian General Electric Common eased off to 109. Georgia Light and Power shares have been moving quickly and erratically.

Manufacturing issues show no special changes, beyond a rise of 10s. in Telegraph Constructions to 36. British Westinghouse 4 per cent. Debenture is 2 points down; Henley's Debenture hardened to 101.

The continued rise in the price of copper has imparted pronounced strength to most of the Copper Mining shares, the movement in the metal being engineered very largely from New York. Rubber shares remain dull, the various proposals for re-establishing the price of the commodity being at present too vague to influence either rubber or rubber shares. What speculative interest exists just now is being devoted mainly to the steadily rising oil share market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21 10	10s. inc.
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8¾d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅝d.	⅛d. dec.
c „ Tube (brazed)	„	8⅛d.	1d. dec.
c „ „ (solid drawn) ..	„	7⅝d.	1d. dec.
c „ Wire, basis	„	7⅞d.	¼d. dec.
c Copper Tubes (brazed)	„	10⅞d.	⅛d. dec.
c „ „ (solid drawn) ..	„	10½d.	⅛d. dec.
g „ Bars (best selected) ..	per ton	£84	£1 inc.
g „ Sheet	„	£84	£1 inc.
g „ Rod	„	£84	£1 inc.
d „ (Electrolytic) Bars ..	„	£66 10	..
d „ „ Sheets ..	„	£84 10	..
d „ „ Rods ..	„	£72	..
d „ „ H.C. Wire	per lb.	8½d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	3/9	1d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	55/3	3½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£21 5 to £21 10	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£184 to £185	£2 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals ..	per ton	£50 to £328	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Japan.—The Tamagawa Electric Tramway Co. reports a net profit of £2,161 for the last financial half year. After paying the dividend on the preference shares £847 is being carried forward.

The Tokio Narita Electric Tramway Co. reports a net profit of £3,221 for the last financial year; a dividend of 5 per cent. is being declared.

County of London Electric Supply Co., Ltd.—The directors announce an interim dividend on the ordinary shares for the half-year ended June 30th, at the rate of 5 per cent. per annum, less tax. Last year the interim dividend was at the rate of 4 per cent.

National Telephone Co., Ltd. (In Liquidation).—It was announced that a further distribution, equal to 22 per cent. (4s. 4 8d. in the £), was to be made on Wednesday, the 30th ult., to the deferred stockholders whose names appeared on the registers of the company when finally closed on February 25th last.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9½ — 10½	..	5 14 3
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅝	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8½ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 4⅝	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	98 —100	..	4 10 0
County of London, Ord. ..	10	6	6	10⅝ — 11⅛	+ ⅛	5 7 10
Do. 6 % Pref.	10	6	6	11½ — 11¾	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅝ — ⅞	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅛ xd	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7⅞ — 8¼	+ ¼	5 9 1
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7¾	..	5 16 8
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	8	2½	2½	1⅜ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8½ — 8⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 8
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 98	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	—1½	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 18 9
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2⅜ — 8½	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	5	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 98	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	107 —111	—1	6 6 2
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	5/8 — 13/16	..	6 3 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	8	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/32 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	7/16 — 9/16	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99½ —101½	+ ½	4 18 6
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	57 — 61 xd	..	6 11 2
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	..	7 4 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	86 — 89	—1	5 12 4
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5	5½	124 —128	+1	4 5 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	9⅞ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	11/16 — 13/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	99½ — 99⅝	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	130 —133	+1	6 0 4
Do. Collat. Trust	$1000	4	4	90½ — 92½	+ ½	4 6 6
Anglo-American Telegraph ..	Stock	8	8	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	108 —109	+ ½	5 10 1
Do. Def.	Do.	80/-	80/-	23¼ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7 9/16 — 7 13/16	..	5 2 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82½ — 84½	— ½	4 14 8
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15⅝ — 16⅜	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅜ — 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	6⅜ — 7⅛	+ ⅜	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	126 —129	+1½	5 8 6
Do. 8½ % Pref. Stock ..	Do.	8½	8½	74 — 76 xd	+ ½	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	92 — 94	..	4 5 1
Eastern Extension	10	7	7	12 — 12½	+ ⅛	5 10 2
Do. 4 % Deb.	Stock	4	4	92 — 94	+1	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11⅛	..	5 5 9
Do. 6 % Pref.	10	6	6	11⅝ — 12¼	— ⅛	4 18 0
Great Northern Telegraph ..	10	18	20	29½ — 31½	— ½	6 7 10
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	79 — 81	—1½	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3½	— ⅛	5 14 3
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅞ — 3	— ⅛	5 13 4
Monte Video Telephone, Ord. ..	1	8	6†	1 — 1⅛	..	5 8 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98⅜ — 99⅜	+ ⅛	4 10 3
Oriental Telep. and Elec. ..	1	8	10	1⅜ — 1⅝	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	— ½	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	8¾ — 9⅜	..	10 5 2
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 4
Do. 4 % Debs., 1,500 guar. by Braz. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2 3/16 — 2 5/16	+ 1/16	4 17 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅝ — 9⅞	— ⅛	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12½ — 13	+ ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	£ 1	Nil	Nil	1/16 — 1/32	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	8 — 10	..	..
Do. Do. Deferred ..	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	..	7 6 4
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	75 — 77	..	3 18 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 18 9
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 3
Do. Def.	100	2	2	76 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	78 — 80	+1	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1903	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼ — 2⅜	..	Nil
Hastings Trams, 6 % Pref. ..	1	5	6†	1 7/32 — 1 9/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	78 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	9/32 — 13/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/32 — 3/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	54 — 58	—2	6 15 7
Metropolitan Railway Consol. ..	100	1⅞	1⅝	45¼ — 45¾	— ½	3 11 0
Do. Surplus Lands	100	2⅛	2⅜	61 — 63	..	4 7 4
Do. 8½ % Deb.	100	8½	8½	83 — 85 xd	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Con. Pref.	100	8½	8½	78 — 80	..	4 6 5
Metropolitan District Ord. ..	100	Nil	Nil	32¾ — 33½	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 8½ % Gtd.	100	8½	8½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	3½	3/32 — 13/32	..	..
Do. 5 % Pref.	1	6	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3⅜ — 3⅝	..	Nil
Do. "A"	1/-	4½	..	3/8 — ½	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	109 —111	+1	5 8 1
Do. 4½ % Bonds	100	Nil	4½	98 —100	..	4 10 0
Do. 5 % Income	100	3	6 †	90 — 91	+ ½	6 11 10
Yorkshire (West Riding), Ord.	5	..	..	¼ — 5/16	..	Nil
Do. 6 % Pref.	5	..	3†	3 5/16 — 3 13/16	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	£ 5	5½	5½	4¾ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	96½ — 98½	+ ½	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	99 —101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	5	5	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	85½ —87½	+1½	6 17 2
Brisbane Trams Invt., Ord. ..	£ 5	5	8	6 7/16 — 7 3/8	..	5 8 6
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	123 —128	..	6 5 0
Do. Pref. Ord.	100	6	5	112 —117	+1	5 2 7
Do. 5 % Pref.	100	5	5	102½ —105½ xd	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102 xd	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	+ ½	4 7 2
Calcutta Trams, Ord.	£ 5	7	5†	5 5/8 — 6 1/8	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 8 1
City Buenos Aires Trams (1904)	£ 5	5	5†	5 5/16 — 5 9/16	+ 1/16	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	£ 1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord. ..	£ 1	Nil	..	1/32 — 1/16	..	..
Do. Pref.	1	6	..	1/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	5	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	£ 5	..	6	4½ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	86½ — 87½	—1	5 11 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 — 101	..	4 19 0
Mexico Trams Com.	$100	7	7†	86 — 89 xd	—3	7 17 4
Do. Gen. Con. 5 % Bonds ..	..	5	5	87 — 90	—2	5 11 1
Do. 6 % Bonds	100	6	6	85 — 88	—2	6 16 4
Para Elec. Rlys. & Lt., Ord. ..	£ 5	10	10	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅞ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord. ..	£ 1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	£ 5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	+1½	4 19 6
Do. 5 % Mort. Bonds ..	100	5	5	92 — 94	+ ½	5 6 5
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99½ — 101½	+ ½	4 18 6
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	+ ½	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video ..	£ 5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	5	6	4⅜ — 5⅜	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	£ 1	6	..	9/16 — 13/16 xd	..	7 7 8
Do. 6 % Pref.	1	6	6	23/32 — 27/32 xd	..	7 2 6
Babcock & Wilcox	1	28	16	22 23/32 — 8 1/32	..	5 5 7
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord. ..	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/4 — 7/8	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	£ 5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5 7/8 — 6 3/8	..	4 14 1
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref. ..	£ 5	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb...	100	4	4	62 — 66	—2	6 1 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	£ 5	15	15	10⅜ — 11⅜	..	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3⅝ — 3¾	..	5 6 8
Do. Deb...	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	..	..	..	.. — ..	..	..
Do. Deb...	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	£ 1	5	Nil	1/16 — 1/8	..	..
Do. Pref.	1	6	6	3/4 — 7/8	..	7 18 10
Edison & Swan, A, £8 paid ..	£ 5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1½ — 1¾	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	£ 2	3¾	5	1½ — 1⅝	..	7 5 6
Do. Pref.	2	7	7	1⅞ — 2⅛	..	6 11 9
Greenwood & Batley, Pref. ..	£ 10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	£ 10	5	5	9⅜ — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	£ 5	15	15	12 — 12⅜	..	5 17 8
Do. Pref.	£ 5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb...	100	4½	4½	100 —102	+ ½	4 8 3
India-Rubber, G. & T.	£ 10	..	7½	11½ — 12½	..	6 2 5
Do. Pref.	£ 10	5	5	9 — 10	..	5 0 0
Telegraph Construction	£ 12	17½	20	35 — 37 xd	+ ½	6 7 2
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	£ 1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	£ 5	Nil	..	1/4 — 3/8	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

TRADE STATISTICS OF JAPAN, 1912.

The following statement, showing the imports into and exports from Japan of electrical and similar goods during the year 1912, is taken from the recently issued official trade statistics; the figures for 1911 are given for purposes of comparison, and notes of any increases or decreases are added :—

	1911. Yen.	1912. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain ...	109,000	370,000	+ 261,000
„ Germany	1,963,000	2,385,000	+ 422,000
„ Belgium	67,000	125,000	+ 58,000
„ Austria	11,000	9,000	— 2,000
„ United States ...	179,000	608,000	+ 429,000
„ Other countries ...	13,000	2,000	— 11,000
Total ...	2,342,000	3,499,000	+1,157,000
Rails.—			
From Great Britain ...	229,000	137,000	— 92,000
„ Germany	1,837,000	671,000	—1,166,000
„ Belgium	216,000	575,000	+ 359,000
„ United States ...	3,220,000	2,475,000	— 745 000
„ Other countries ...	2,000	81,000	+ 79,000
Total ...	5,504,000	3,939,000	—1,565,000
Posts for electric wire materials for building, &c.—			
From Great Britain ...	719,000	505,000	— 214,000
„ Germany	205,000	383,000	+ 178,000
„ United States ...	1,138,000	1,174,000	+ 36,000
„ Other countries ...	58,000	85,000	+ 27,000
Total ...	2,120,000	2,147,000	+ 27,000
Submarine and underground cables.—			
From Great Britain ...	179,000	203,000	+ 24,000
„ Germany	197,000	3,000	— 194,000
Total ...	376,000	206,000	— 170,000
Insulated electric wire.—			
From Great Britain ...	1,490,000	2,622,000	+1,132,000
„ France	66,000	15,000	— 51,000
„ Germany	1,758,000	2,485,000	+ 727,000
„ Italy	85,000	4,000	— 81,000
„ United States ...	297,000	261,000	— 36,000
„ Other countries ...	4,000	1,000	— 3,000
Total ...	3,700,000	5,388,000	+1,688,000
Parts of electric cars.—			
From Great Britain ...	199,000	Not	—
„ Germany	496,000	shown	—
„ United States ...	764,000	separately.	—
Total ...	1,459,000		
Steam engines.—			
From Great Britain ...	364,000	218,000	— 146,000
„ Germany	60,000	45,000	— 15,000
„ United States ...	123,000	98,000	— 25,000
Total ...	547,000	361,000	— 186,000
Gas engines, petroleum engines and hot-air engines.—			
From Great Britain ...	758,000	989,000	+ 231,000
„ Germany	237,000	167,000	— 70,000
„ Belgium	—	7,000	+ 7,000
„ Sweden	49.000	114,000	+ 65,000
„ United States ...	32,000	55,000	+ 23 000
„ France	33,000	52,000	+ 19,000
„ Other countries ...	—	6,000	+ 6,000
Total ...	1,109,000	1,390,000	+ 281,000
Steam boilers.—			
From Great Britain ...	1,465,000	1,000,000	— 465,000
„ Germany	27,000	89,000	+ 62,000
„ United States ...	185,000	86,000	— 99,000
„ Other countries ...	1,000	—	— 1,000
Total ...	1,678,000	1,175,000	— 503,000
Water turbines and Pelton wheels.—			
From Great Britain ...	Not	59,000	—
„ Germany		790,000	—
„ France	shown	7,000	—
„ Switzerland ...		15,000	—
„ Sweden	separately	7,000	—
„ Other countries ...		3,000	—
Total ...		881,000	
Dynamos, electric motors, &c.—			
From Great Britain ...	745,000	1,323,000	+ 578,000
„ Germany	1,407,000	1,199,000	— 208,000
„ Italy	—	2,000	+ 2,000
„ Switzerland ...	16,000	7,000	— 9,000
„ United States ...	943,000	1,605,000	+ 662,000
„ Other countries ...	3,000	5,000	+ 2,000
Total ...	3,114,000	4,141,000	+1,027,000
Wattmeters.—			
From Great Britain ...	Not	188,000	—
„ Germany	shown	189,000	—
„ United States ...	separately	147,000	—
Total ...		524,000	
Cranes.—			
From Great Britain ...	394,000	738,000	+ 344,000
„ Germany	46,000	53,000	+ 7,000
„ United States ...	136,000	110,000	— 26,000
„ Other countries ...	2,000	8,000	+ 6,000
Total ...	578,000	909,000	+ 331,000
India-rubber and gutta-percha, crude.—			
From British India ...	237,000	282,000	+ 45,000
„ Straits Settlements	1,383,000	1,642,000	+ 259,000
„ Dutch India ...	161,000	146,000	— 15,000
„ Great Britain ...	935,000	461,000	— 474,000
„ Germany	7,000	39,000	+ 32,000
„ United States ...	253,000	321,000	+ 68,000
„ Other countries ...	84,000	138,000	+ 54,000
Total ...	3,060,000	3,029,000	— 31,000

The exports of electric machines and parts thereof from Japan in the years 1911 and 1912 were as follows :—

To China	161,000	171,000	+ 10,000
„ Kwantung Province ...	145,000	101,000	— 44,000
„ Philippine Islands ...	3,000	7,000	+ 4,000
„ Siam	4,000	1,000	— 3,000
„ Australia	3,000	4,000	+ 1,000
„ Hong Kong	34,000	28,000	— 6,000
„ British India	7,000	14,000	+ 7,000
„ Straits Settlements ...	7,000	5,000	— 2,000
„ United States	5,000	2,000	— 3,000
„ Other countries ...	9,000	7,000	— 2,000
Total ...	378,000	340,000	— 38,000

Yen = 2s. ⅛d.

American Patent Law.—The Electric Club, of Chicago, recently appointed a Committee on Patent Legislation, consisting of seven members (with Mr. M. G. Lloyd as chairman). This Committee has studied the proposals for legislation now before Congress and has unanimously recommended that Congress be urged to provide for a commission to be made up of independent non-partisan men of national reputation, chosen from different walks of life, including representatives of inventors, manufacturers, patent lawyers, the Federal Courts and the general public, to thoroughly study and investigate all phases of the American patent system and its needs for betterment and the operation of patent systems in other countries, and that no legislation be passed until such commission has reported its findings to Congress. The Committee holds that such legislation when enacted should include changes in the administration of the Patent Office which will permit of more thorough work and result in the recognised validity of any patent issued by it until the same has been declared invalid by a Patent Court; and it favours the creation of a Court of Patent Appeals to have final jurisdiction in all patent cases. It strongly disapproves of both form and substance of the Oldfield Bill, and would regard its enactment as highly prejudicial to the interests of both inventors and the general public, except that the provision limiting the duration of a patent to 19 years from the date of application is approved.

The Activity of the Berlin A.E.G.—The directors of the A.E.G., reporting on the position of business on July 15th, state that notwithstanding the decline in a number of industries through the general condition of trade, the company's degree of activity shows a large increase. For the first 10 months of the past financial year the figures concerning the invoiced turnover and the orders on hand exceed in value those for the corresponding period of the previous year by over £4,500,000, and the liquid assets are completely sufficient for the monetary requirements devolving upon the company. A Berlin newspaper points out in this connection that the statement does not contain any special expression respecting future developments, and that it is difficult to form an opinion on the question, as sales and orders are combined, so that it is uncertain how much of the £4,500,000 applies to unfilled contracts and how much to orders already completed

SILITE AND ITS USES IN SCIENCE AND INDUSTRY.

[BY OUR BERLIN CORRESPONDENT.]

Carborundum or silicon carbide,* which, in 1893, was first produced in the electric furnace by Acheson, has an hexagonal crystalline structure of remarkable hardness, and cannot be melted at ordinary pressures. Attempts have been made to utilise it for the manufacture of electric heaters (rods, tubes, &c.), and for many other purposes in connection with which the silicon carbide must be reduced into the form of shaped solid objects. This, however, proved impossible unless considerable amounts of binding

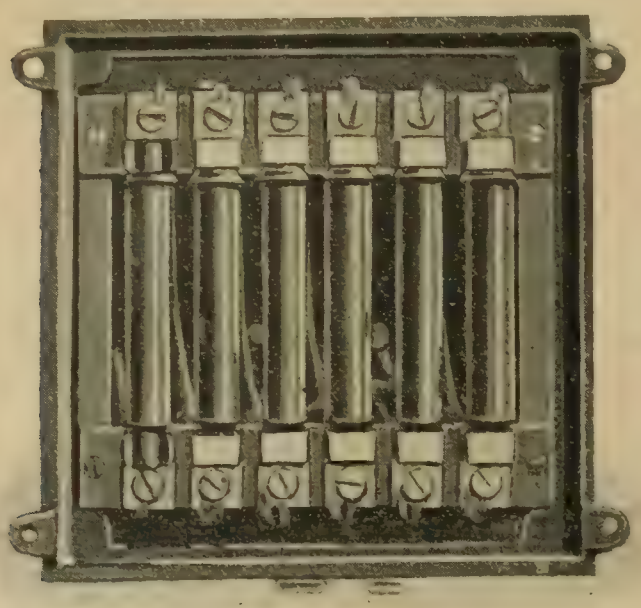


Fig. 1.—Compact Rheostat with Silite Rods.

materials, such as clay, were used to keep the carborundum powder together, thus increasing the porosity of the material, impairing its solidity and reducing the electrical conductivity to a minimum.

The problem of producing out of silicon carbide rods, tubes and other shaped objects possessing not only a satisfactory electrical conductivity, but, at the same time, high density, strength and mechanical resistance to chemical agents and high temperatures, was first solved in 1904, in a process patented by Messrs. Siemens Bros. & Co., of Berlin-Lichtenberg, by adding free silicon to the silicon carbide, mixing the two substances as intimately as possible, and shaping them as desired. The binding matter used in this connection may be volatile or carbonisable, when the carbon precipitated combines on heating with the silicon contained in the material. Though binding materials eventually remaining in the shaped object can likewise be used, they are, of course, less desirable. After shaping the material, it is preferably heated intensely

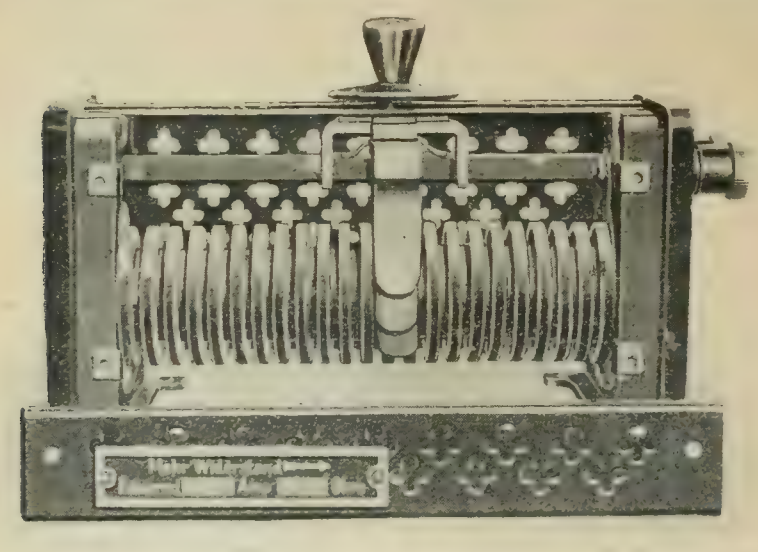


Fig. 2.—Silite Slide Rheostat.

n the electric furnace to the temperature at which a non-porous body as homogeneous as possible will be formed.

Messrs. Siemens Bros. & Co.'s process is presumably based on the fact that silicon carbide with silicon forms a carbide of a lower order. This hypothesis is mainly borne out by the physical condition of any objects thus obtained, which seem to be perfectly homogeneous and of a crystalline structure entirely different from the initial material.

Further progress in the same field was made in the following year (1905). By heating the objects shaped and compressed from silicon and silicon carbide in an atmosphere of nitrogen, the silicon was made to absorb nitrogen while forming silicon nitride to bind

* See also "Silundum," Electrical Review, December 18th, 1908, p. 1070.

the silicon carbide into a material of extraordinary density and solidity.

The electrical heaters thus produced, however, showed the disadvantage of a gradual variation in electrical resistance when continually exposed at glowing temperature to the open air. This drawback was eventually eliminated in a process patented by Dr. Egly, which allows heaters consisting exclusively of silicon carbide to be obtained. These possess a remarkable electrical conductivity, and on account of their mechanical, thermal and chemical strength, are particularly well adapted for the purposes of electric heating. As shown by numerous tests made at Messrs. Siemens' works, they will stand even the most sudden variations in temperature without suffering any damage ; objects manufactured by this

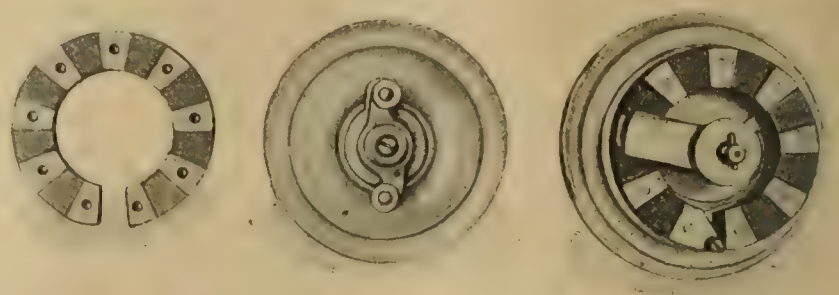


Fig. 3.—Silite Dimming Switch.

process can, for instance, be drenched with water when at a bright red heat without showing cracks, fissures or any other damage.

Messrs. Siemens Bros. & Co. have now taken up, on a commercial scale, the manufacture of all sorts of solid silicon carbide objects, which are brought out under the designation of "silite."

Silite is a material which combines two qualities of the highest importance for technical purposes, viz., a satisfactory electrical conductivity coupled with a high heat resistance. Silite objects can be mainly subdivided into three groups destined for different purposes, viz. :—

Group 1.—Silite as electrical resistance material for permanent loads at incandescence temperatures, especially for high momentary loads.

Group 2.—Silite for heaters to be exposed to permanent incandescence temperatures.

Group 3.—Silite as fire-proof material readily standing any sudden change in temperature.

The scope of silite objects belonging to Group 1 has of late increased beyond any expectations. Wire resistances, as previously used, are replaced more and more by silite resistances for excess voltage cut-outs, lightning arresters, slide switches, &c. Regulating and starting resistances of any kind are made of silite in the form of rings, rods, tubes, &c., in fact, the most diverse forms and approximately for any resistance desired, the specific resistance of silite objects being readily varied within wide limits. The temperature coefficient of silite is negative, the more so as the specific resistance at normal temperature is higher. Apart from the chemical and physical superiority of silite as compared with wire resistances, its low space requirements are to be noted. In

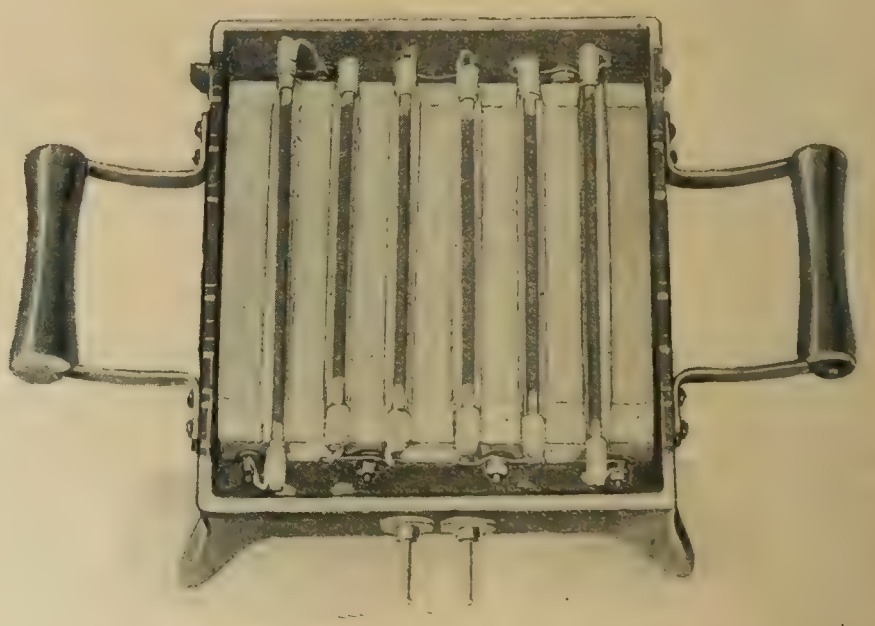


Fig. 4.—Silite Hot-plate with Top Removed.

fact, silite resistances hardly take up a quarter of the space occupied by wire resistances. This point is of especial importance for many installations in industrial works, on board ship, &c.

In order to be able to control electric lamps in dwelling-houses like gas flames, from full brightness gradually down to a feeble glimmer, switches comprising silite segments are used, which can be operated by any unskilled person.

Silite objects of Group 2 are preferably used for heating, standing as they do incandescence temperatures of 1,200-1,400° C. The specific resistance of this group varies between 3,000 and 900 at normal temperatures and between 1,000 and 4,000 at temperatures of 1,000 to 1,200° C. and upwards. From 900 to 1,000° C. the specific resistance undergoes practically no variation, a fact of the highest importance in connection with silite heaters. Silite

objects of Group 2 have given excellent results as dish-heaters, heating and chafing plates, grills, toasters, heating cabinets, cigar lighters, curling-iron heaters, &c. In the electric kitchen, silite apparatus are used just like gas or coal ranges over which they possess the advantage of absolute safety and greater cleanliness. Combined heating plates, with two heating positions, are especially suitable for private kitchens.

Silite heaters are frames into which the silite elements are inserted in parallel or series connection; in the former case the sides of the frame at the same time serve as current conductors, thus forming a large radiating surface which, as soon as the current has been switched on, gives off its heat to the surroundings. Parallel connection affords the advantage of allowing the load

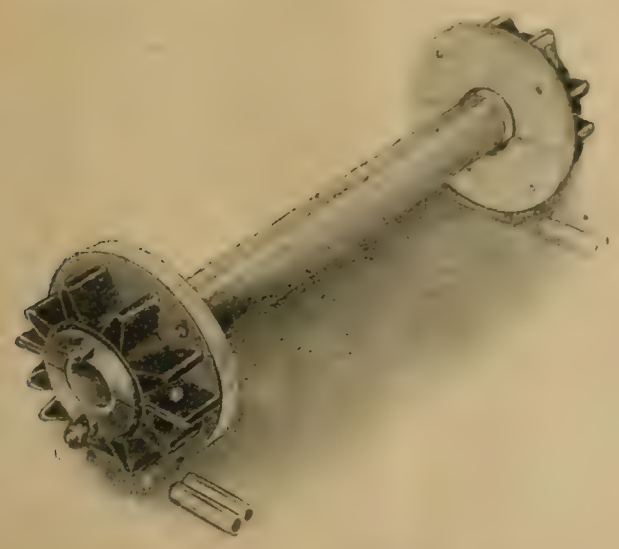


Fig. 5.—Silite Heating Tube.

on each element to be so chosen as to make it insensitive to fluctuations in voltage. As the mass of the silite elements and furnaces is reduced to a minimum, they do not accumulate any superfluous heat.

Being also designed in the form of heating tubes up to about 75 mm. in clear width, silite is exceedingly well adapted for the annealing of wires, *e.g.*, tungsten wires, to be used as metal filaments for incandescent lamps and for the manufacture of hardening furnaces for the most diverse kinds of steel in instrument making, &c. The silite material of Group 2 is very easy to work, and is readily filed, sawed, bored, &c.

Silite objects of Group 3, besides being used as electrical conductors for loads below incandescence temperature, mainly serve as fireproof bodies, which can be readily exposed to sudden changes in temperature. Such silite conductors, on account of their excellent thermal conductivity and impermeability to gases, have been especially appreciated as protective tubes for pyrometers, fireproof tubes, &c.

A special form of silite heater is the electrical radiation furnace patented by Messrs. Siemens Bros., in connection with which a heating rod (*e.g.*, of carbon) is so arranged as to be free to expand

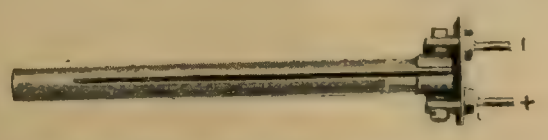


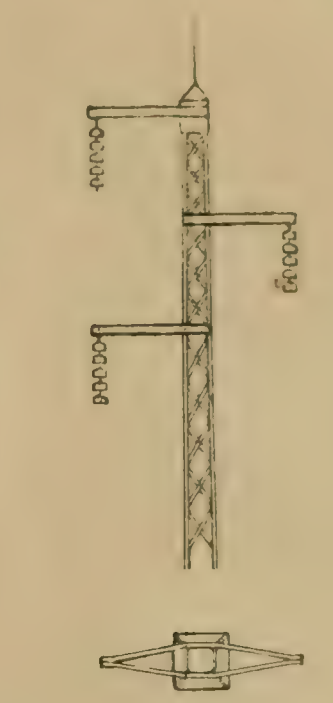
Fig. 6.—Slotted Silite Heater.

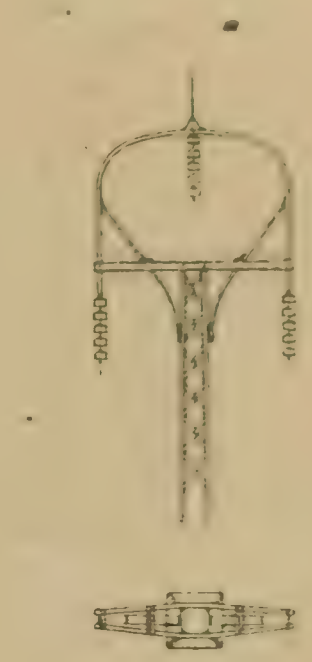
at least at one end, thus avoiding any variations in form due to excessive heating. This rod is enclosed with a proper interval, in a silite tube as airtight as possible of Group 3. In order to allow this tube also to follow any heat expansion, it is likewise arranged with at least one end free to expand. Atmospheric oxygen must be prevented as far as possible from entering the interior of the tube, lest the heating rod be burnt too quickly. This, in spite of the mobility of the heating rod and tube, is effected by inserting the ends of the rod in relatively long sockets communicating with the tube by an airtight connection. The heating rod and tube may be connected together through the intermediary of an electrically-insulating layer.

An Italian Transaction.—The Siemens-Schuckert Co. has disposed of its tramway in the town of Pisa to the Societa Ligure-Toscana di Elettricita, of Leghorn. The latter now proposes to increase its share capital from £440,000 to £880,000 for the purpose of undertaking other schemes, including the construction of hydro-electric works on the River Serchio, the extension of the network of distributing mains and the conversion of the overland tramway in the province of Pisa to electric traction. It is stated that the Swiss Electrical Industry Co., of Basle, is subscribing for one-third of the additional share capital, whilst the balance will be provided by the old group of financial interests as represented by the Italian Southern Railway Co., which is now an investment company, and by Belgian capitalists. The Ligure-Toscana, which is devoting increased attention to tramway work, paid a dividend of 6½ per cent. for 1912, as compared with 6 per cent. in 1911 and 5½ per cent. in 1910.

NEW HIGH-TENSION MAST CONSTRUCTION.

In three-phase transmission schemes for 50,000 volts and upwards, in which suspension insulators are used, it has hitherto been usual to place two conductors on one side and the third on the other side of the mast—an unsymmetrical arrangement developed in the application of pin insulators (see fig. 1). Messrs. Breest & Co., Berlin, have recently placed on the market the new type of mast illustrated in fig. 2, in which one conductor lies in the mast axis and the others symmetrically on either side of it. This arrangement is made possible by the use of a comparatively light looped structure encircling the top conductor and serving for the suspension of the lower conductors. The appearance of the mast is undoubtedly improved in the new design; this is a point of con-





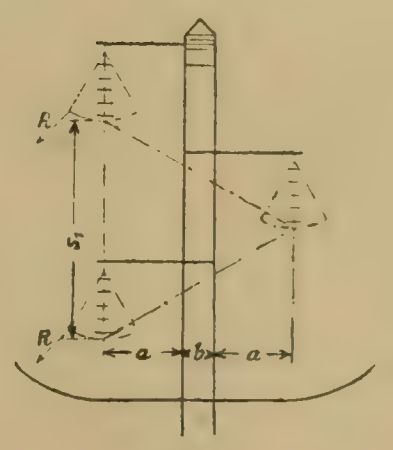


Fig. 1.

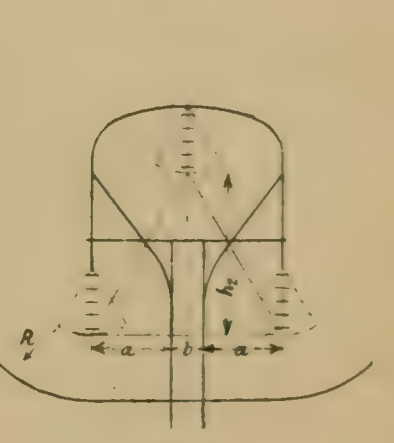


Fig. 2.

siderable importance in the present stage of development of high-tension transmissions, but more substantial advantages are also offered by the new mast.

Where suspension insulators are used, the distance between conductors is primarily determined by the minimum distance which must be maintained between them and the metal work of the mast, allowance being made for the possible swing of the wires. By simple geometrical considerations it will be seen that in fig. 1—

$$s_1 = 2\,(2a + b) / \sqrt{3},$$

while in fig. 2:—

$$h_2 = \sqrt{3}\,(2a + b) / 2, \text{ so that } h_2 : s_1 = 3 : 4.$$

On a 100,000-volt line $(2a + b)$ may be 3,000 mm., in which case $h_2 = 2{,}598$ mm. and $s_1 = 3{,}464$ mm., the difference in height, in favour of the new construction, being 866 mm. This saving is due to the more favourable arrangement of the conductor triangle, and to the smaller size of the latter for a given factor of safety. The reduced height of the mast and the symmetry of its loading results in a considerable saving in constructional materials.

In the new design, the top loop-member forms a perfect earthing frame for the top conductor and a single curved cross-frame, as shown, serves to catch either or both of the lower conductors should the insulators break. The resultant of the weight of a 25 or 50 sq. mm. line, and the maximum wind pressure to which it may be exposed, is inclined at less than 45° to the horizontal, so that a single catch arm on the old type of mast only affords adequate protection to the lowest conductor (see fig. 1); for satisfactory protection, it is necessary, in the latter case, to provide an earthing loop or bracket for each conductor—a costly and unsightly construction. The new construction affords the best possible protection to the top line against damage by lightning.

To avoid the necessity for threading the conductor through the top loop, one joint in the latter is left to be completed after the line (which is first laid out on the ground along the route), has been raised, slipped into the loop and attached to the insulators. Section or strain masts are very similar to intermediate masts

except that they are of heavier build and have no slot in the loop-member for threading the conductor, such provision being here unnecessary since the conductor itself is interrupted at section masts.

ENERGY DENSITY.*

By CHARLES P. STEINMETZ.

While electric energy is the most convenient form to transmit and distribute, there exists no economical method of storing electric energy: the electric storage battery does not store electric energy, but stores chemical energy, by double conversion from electrical to chemical during charge, and from chemical to electrical during discharge. It is thereby limited in economical usefulness. As the result, electrical energy essentially plays the part of the connecting link joining the source of energy—nature's fuel supply or water-power—with the energy consumer.

As energy storage is essential throughout all modern industrial life, the maximum weight and space efficiency which may be reached with the different methods of energy storage are of interest.

Chemical Energy.—1 kg. of hydrogen contains 33 KW.-hour stored chemical energy, which is set free as heat in combustion. 1 kg. of gasolene contains about 13 KW.-hour, and 1 litre of gasolene about 10 KW.-hours of stored chemical energy. 1 kg. of the lightest storage battery contains less than 120 watt-hours of stored energy.

Mechanical Energy.—The highest mechanical energy density obviously is found in the rifle bullet or cannon ball; and, at the highest bullet velocities of about 1,000 m.-sec., represents 0·14 KW.-hour per kg. Thus a tungsten bullet (sp. g. 20) carries nearly 3 KW.-hour per cb. dcm. (litre) of volume—that is, approaches the energy density of chemical storage. Thus the impact of a tungsten bullet approaches the destructiveness of the detonation of the same volume of high explosive. This explains the interest taken in the introduction of tungsten as bullet material.

The highest velocities in rotating machinery are reached in the revolving rim of the steam turbine disk, approaching 200 m.-sec., and representing a stored energy of 5·6 watt-hours per kg. of rim weight.

Hydraulic Energy.—As the highest heads of water-powers, of about 1,000 m., the energy density would be only 2·8 watt-hours per kg. or litre of water, and thus would be less than one-thousandth of the energy density of chemical storage. However, the ease and simplicity of storing large quantities of water in reservoirs make hydraulic storage of economical importance.

Electrical Energy.—Dielectric: At the limits of disruptive strength of the most resisting material, mica, of 1 million volts per cm., the energy stored in the electrostatic field is only 0·05 watt-hour per cb. dcm. or litre, *i.e.*, is insignificant compared even with mechanical storage.

Magnetic: At the highest magnetic densities ever reached in iron (of B = 60,000 lines of magnetic force per cm.^{2}, at H = 40,000) the energy density is 28 watt-hours per cb. dcm. or litre—of about the same magnitude as in the average storage battery.

In power-limiting reactances, under short-circuit conditions, in the air field inside the reactance, energy densities as high as 2 watt-hours per litre are reached.

Electrolytic Disinfecting Fluid.—Dr. F. W. Alexander, the Medical Officer of Health for the Borough of Poplar, in his annual report for 1912, states that at the seven depôts the electrolytic fluid was still in great demand, the output being 54,388 gallons for the 12 months. The cost of material in manufacturing this quantity of fluid was £101 2s. 2½d., made up as follows:—Electricity, 9,555 units at 1½d. per unit, £59 14s.; chloride of magnesium 4 tons, £18; salt, 8 tons 2½ cwt., £13 16s.; caustic soda, £7 16s.; water, £1 12s. The fluid was supplied to four L.C.C. public elementary schools for spraying and cleansing class-room floors, 960 gallons being thus used. In regard to swimming baths, 4,832 gallons were supplied to the Poplar Baths, 5,527 gallons to the Bow Baths, and 1,110 gallons to the Island Baths, and the superintendents of these establishments repeat their statements that the addition of the fluid prevents the formation of slime in the water; the slime is not found at the bottom of the baths when they are emptied, and there is no offensive smell when the baths are being cleansed. Dr. Alexander's statement contains lengthy quotations from a paper by Dr. J. Graham Forbes on "Pollution of Swimming Baths," in which he remarks that, apart from what has been done by Dr. Alexander, the subject of remedying the dangers of infection lurking in our swimming baths has not been seriously met by medical officers. The Royal Sanitary Institute has also appointed a Committee to investigate the question of purifying bath water, and in their report, the Poplar electrolytic process, with the results of which they were very much impressed, is described.

* *General Electric Review.*

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

Imperial" writes:—"I have a client who wishes to light his house from an existing plant at his works close by: to accomplish this it will be necessary to erect an aerial wire across a field and a public road. I shall be glad if you will, through the medium of your "Legal Query" column, answer the following questions:—(*a*) Can an owner object to aerial wires crossing his land, providing no poles or other fixings are attached to his property? (*b*) Can the local authority prevent aerial wires crossing a public road provided that the attachments and supports are on private property? (*c*) Can my client supply and charge for electric current to his neighbours? The works and house in question are situated in a town where gas is supplied by a local company, but there is no electrical supply."

*** As to (*a*) the answer to this question is in the affirmative. An owner of property has a perfect right to prevent any wire being suspended over it, whether supported by posts on his land or not. To stretch a wire over a man's land is to commit a trespass which would be restrained by injunction (see Levy *v.* National Telephone Co., Ltd., *Times*, December 18th, 1897).

As to (*b*) it is difficult to answer this question without more information. Strange to say, while persons or companies supplying electricity under the terms of a provisional order or special Act could not in any event suspend cables over roads without the consent of the local authority, this rule does not apply to a private person, unless some special statute prevents it, or unless the soil of the highway is vested in the local authority.

As to (*c*) the answer is in the affirmative, provided (as seems to be the case) there is no authority supplying electricity in the district (see Electric Lighting Act, 1909, Sec. 23).

Electricity Consumption as a Trade Barometer.—An innovation, as it would appear, in connection with the ascertainment of the upward or downward movements in trade and industry at any particular period is proposed to be periodically undertaken by a Cologne newspaper in the sense of the publication of statistics relating to the monthly consumption of electrical energy in a fairly large area in that part of Germany. The newspaper, which has just made a beginning in this direction, has already secured promises from the managers of a number of works to send in their monthly returns regularly in the future, these comprising all the works in the Government districts of Cologne and Dusseldorf. All these undertakings have forwarded returns for April and May, as compared with the corresponding months in 1912, and the results are set forth as follows:—

Production in the Month of April.

	1912. Kilowatt-hours.	1913. Kilowatt-hours.
Direct current:—		
Output for lighting and power ...	966,611	1,310,075
„ „ tramway working ...	3,108,597	3,589,075
Alternating current:—		
Output of works	23,870,152	32,478,703
Purchased from outside sources ...	3,165,744	7,845,570
Total	31,111,104	45,223,423

Production in the Month of May.

Direct current:—		
Output for lighting and power ...	920,422	982,096
„ „ tramway working ...	3,516,240	3,564,635
Alternating current:—		
Output of works	24,846,698	30,741,174
Purchased from outside sources ...	2,985,827	6,826,173
Total	32,269,187	42,114,078

It will be observed that whilst the production in May of the present year indicates a very considerable increase over the equivalent month in 1912, the output and purchase in May experienced a large diminution as contrasted with the preceding month of April. Although the customary decline in the lighting demand in May was slightly responsible for the reduction in the production or consumption, it is concluded that by far the greater portion of the shrinkage in May must be attributed to the slower course of business in trade and industry in the districts concerned. It is, however, impossible to draw definite conclusions on the question at present, as the works frequently do not keep separate accounts for lighting and power consumption respectively. Not only so, but the question of new connections to the distributing systems, especially in cases of the substitution of electric power for steam, gas, or other form of power, has also to be taken into consideration, and the figures have consequently to be accepted with a certain amount of reserve in forming an opinion of the general situation of trade and industry in those districts.

ELECTRICITY SUPPLY CHARGES.

By A. W. B.

With a view of furthering the efforts that are now being made to increase the use of electricity for domestic and other purposes, the following information and curves may be of interest and utility to those publicity engineers and canvassers generally who are attached at the present time, or should be, to all electricity supply stations.

One of the chief uses of the curves will be to give the engineer who is canvassing for a supply, the means to lay before any prospective consumer the approximate amount of his expenditure for a supply of electricity per annum and his average price per unit on any estimated consumption (in the event of the scale of charges for supply not being based on a flat rate), and also a graphic illustration of the fact—"That the more electricity the consumer uses, the cheaper it becomes to him, and therefore the more he can afford to increase the use of a supply when once installed." This knowledge, although one of the axiomatic facts of electricity supply and one which has long been acknowledged inside the central station, has been only recently, or comparatively recently, by means of the maximum demand, Norwich, and similar systems of charging, placed in the hands of engineers and canvassers to be used for the benefit of the general public.

Although systems of charging for electricity apparently vary very widely, the majority should be found, on close examination, to be based on the same principles and in essentials to be practically identical, as, obviously, apart from the flat rate method of charging (which to be at all a fair and equitable method, necessitates the individual careful consideration of every prospective consumer's class of demand and the probable total consumption of current per annum) there can be only one correct underlying method or principle in the first instance on which any universal system of charging for a supply can be based, although, naturally, this first principle can be elaborated widely to suit different localities and conditions.

There have been, in the past, many systems advocated, and in the present and future, probably many more will be brought forward; without prejudice, however, to the numerous other systems of charging, there is little doubt that for general simplicity and universal application the maximum demand and Norwich systems are easily holding their own for the two main classes of supply, viz., bulk and domestic, respectively, at the present time, and therefore this article is based on the application and use of these two systems as being the most representative of a method of charging by system rather than on a flat rate.

Taking first the maximum demand system as the earliest introduced, it is found that the prospective consumer is expected to pay a certain sum annually, a portion of which is allocated to cover the standing charges of the electricity undertaking, the other portion being required to pay for the actual amount of electricity supplied during this period.

Theoretically, the amount required to cover the standing charges (the standing charges is that sum of money which is required annually to pay the interest and sinking fund, or capital charges on the undertaking, the whole of the cost of management, rent, rates, taxes, insurance and distribution, together with a proportion of the wages and maintenance charges of the generating station, such proportion being generally a half) is such a sum as would be obtained by dividing the whole of these standing charges by a figure proportionate to the consumer's maximum demand on the total plant installed; this figure would, however, if actually obtained in this way, be found to be of a varying character, owing to increases in the works plant, balance of plant for stand-by purposes, and possibly a large mains cost incurred in order to reach the prospective consumer, and which would not be of service to the supply authority for other possible consumers, thus rendering a charge based only on this principle more or less liable to constant alteration and error in order to maintain an equitable figure.

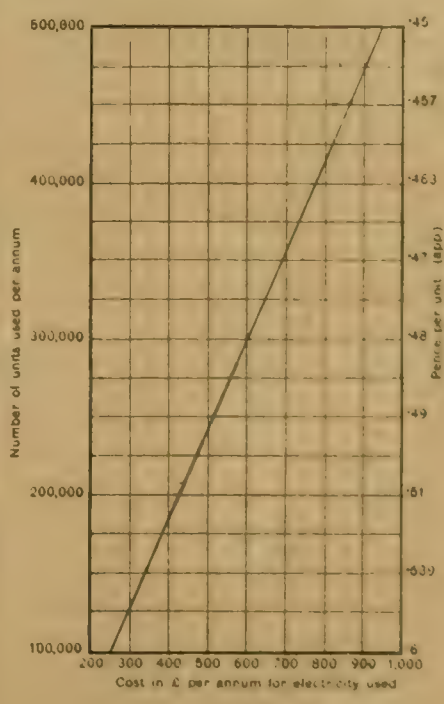
Practically, dealing first with the capital charges, this sum is such as would under modern conditions and prices (thus enabling a competitive figure to be attained) pay for the proportion of plant that would have to be installed to meet the consumer's maximum demand, or, in other words, the charge would be fixed by taking into consideration the cost both of new plant, the already installed plant, and a proportional charge for stand-by plant; as the other charges automatically adjust themselves to any increase in output, no alteration will be necessary and they can be included as before. The only other addition would be the cost of mains to the consumer in a case where the consumer is some distance from the existing mains, which extra charge would be met, either by the consumer paying directly, or by a slight increase in the maximum demand charge until such cost had been liquidated.

In actual practice, such standing charges will be generally found, in the case of stations of moderate capacity, to be covered by an annual charge to the consumer of from £4 10s. to £5 per kilowatt of his maximum demand, such maximum demand not being a momentary overload, but one of, say, 15 minutes' duration; the time limit precludes any dispute which might arise in the event of a short circuit or accident to any motor-driven machine occurring, or anything causing a heavy momentary demand to be registered on the meter.

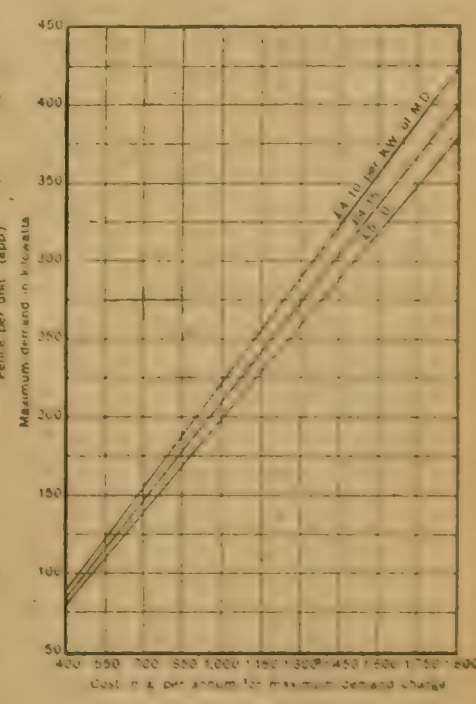
The next point to be considered is the actual cost of supplying the current, apart from any other costs which have been already incurred and which are provided for in the maximum demand charge; this will be found to vary largely, chiefly according to the cost of fuel and the plant load factor of the station itself, it may therefore be accepted (without going largely into statistics, which are outside the present scope), that the cost of the current supplied will be met by the fuel cost, a proportionate amount of the wages and maintenance charges, together with the oil and engine-room stores generally, added to which would be a fair trading profit, according to circumstances.

Taking an average station having a load factor of 20 per cent. per annum, in a position to buy coal at, say, 10s. per ton and selling about 3,000,000 units per annum, also assuming modern plant, then other things being equal, a further increase of 250,000, 500,000, 750,000 and a million units could be supplied at an approximate average price (pence per unit) of 0·47, 0·445, 0·42, and 0·4 respectively.

Utilising these figures as a basis charge, then the cost of supplying 100,000 to 500,000 units per annum more would be, after allowing a small percentage for contingencies and profit, on a sliding scale of 100,000 units at 0·6d. to 500,000 units at 0·45d. The cost of current per unit for any intermediate number of units used per annum can be readily



Curve A



Curve B.

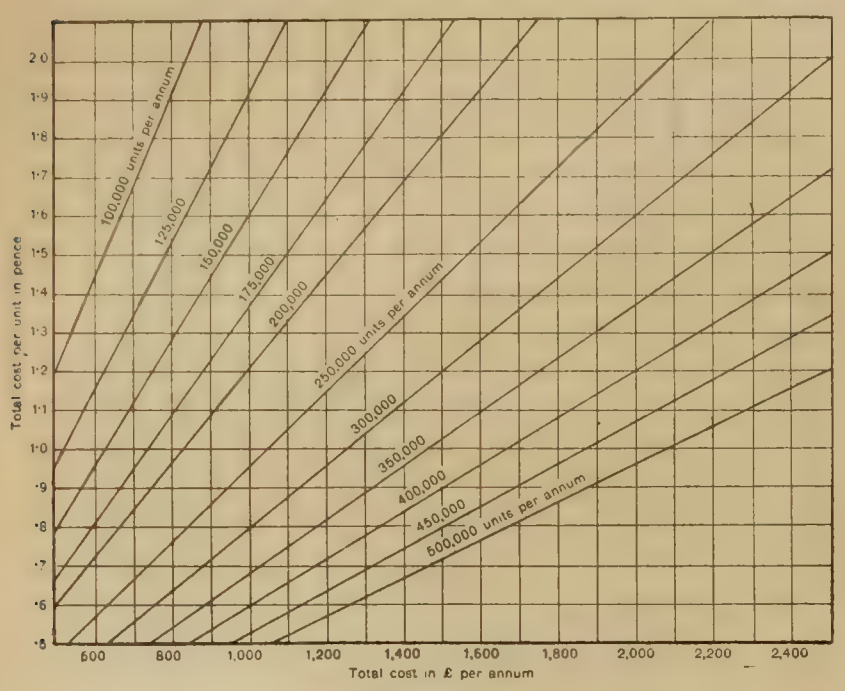
ascertained from the reading on the right-hand side of Curve A.

The curves immediately following are based on these figures, together with the maximum demand charges already mentioned, viz., £5, £4 15s. and £4 10s. per kw.

Curve A shows the annual charges due to a given consumption in units; B shows the annual charges created by a given maximum demand; C is a set of ordinary cost curves

by means of which the total cost per unit may be easily determined ; as an example, it is required to find the total cost per annum and total cost per unit for a supply of 400,000 units on a maximum demand of 130 KW. at the maximum demand charge of £4 10s. per KW., then Curve A shows the cost to be £770 ; Curve B shows a cost of £585 ; therefore, the total cost per annum is £1,355, and over this sum on C, opposite the units per annum curve, is found 0·813d., the required cost per unit supplied.

Turning to the Norwich system of charging for the supply of current for domestic purposes, a practically similar state

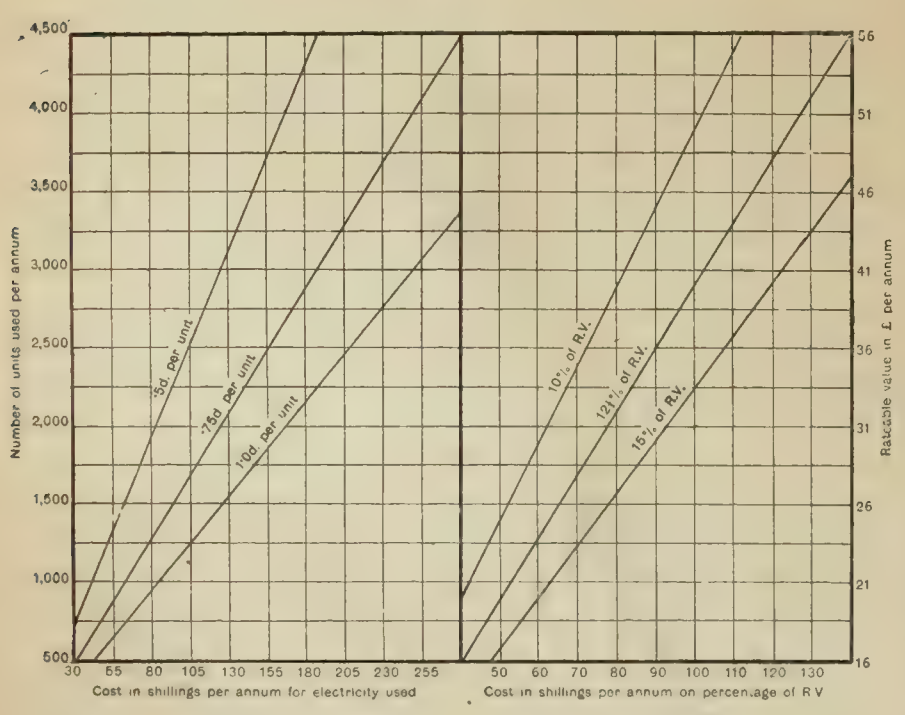


Curve C.

of affairs exists, with the exception that there is no direct charge for the maximum demand ; but in place of this, there is a variable charge based on the net assessment or rateable value of the house to which a supply is to be given, such variable charge being usually a percentage on the rateable value. In other words, the maximum demand figure is obtained, not of one particular house, but of an average house of that particular rateable value.

Obviously, a varying rateable value differentiates between the grades or sizes of houses, the class of probable consumer and the possible use made of a supply of electricity ; thus there is, to all intents and purposes, a sliding scale, which is, for any particular house, a charge corresponding to the maximum demand charge on a large bulk supply.

This percentage charge naturally varies according to the position of the town in which the supply station is situated, and depends on whether the assessments are high or low as



Curve D.

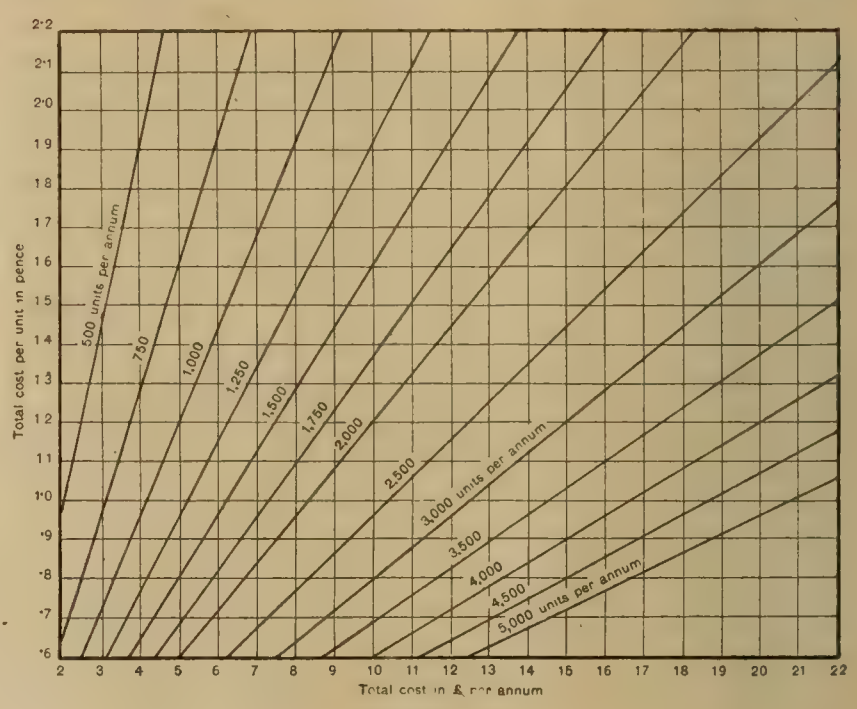
Curve E.

regards the letting value of the properties, &c ; however, generally speaking, a charge of from 10 per cent. to 15 per cent. on the rateable value has been found sufficient to cover the standing charges of the supply authority for that class of consumer ; after these charges have been met, the actual supply can be given at a very low cost per unit, this latter being also comparable to the cost of current for a bulk supply.

The actual cost of current per unit supplied naturally varies between different towns, as previously shown, but a charge of from 0·5d. to 0·75d. per unit should more than cover the cost of supplying the current for such purposes as a general domestic supply, leaving, say, the mean of the percentage charges on the rateable value (12½ per cent.) to cover the standing charges and margin of profit.

A supply taken on the basis of 12½ per cent. on the rateable value and 0·5d., or even 0·75d. per unit, would provide the average household with "Electricity for Everything," at a cost, taking all the advantages to be obtained from such a general use of electricity into consideration, of from 10 per cent. to 20 per cent. cheaper than the use of gas for illuminating and either coal or gas fires for heating and cooking generally, and to this must be added the convenience of electricity, which, unfortunately, cannot be directly shown as favourably as it should be when dealing with the matter on a monetary basis only.

Again, Curve D shows the annual cost due to a given consumption of current, Curve E shows the annual cost for any given rateable value, and Curve F is a set of cost curves



Curve F.

framed to meet the curves D and E ; these curves would be used by the canvasser in a similar manner to the maximum demand curves. For instance, given a house having a rateable value of £41 per annum and having an annual consumption of 3,500 units, then on a 12½ per cent. of the rateable value and 0·75d. per unit basis, the total costs could be easily ascertained in a few moments, from Curve E as £5 2s. 6d. plus £10 19s. from Curve D, giving a total annual cost of £16 1s. 6d. at an average total cost per unit for *lighting* and all other purposes of 1·1d., which cost is obtained from Curve F, as shown previously.

New Units.—At the recent Convention of the National Electric Light Association, in Chicago, the Committee on Measurements favoured the adoption of the myriawatt, about which there had been considerable debate during the past year. The advantage associated with such a step was held to be that of a unified system of measuring both the input and the output of steam engine generator sets, making the important item of efficiency more readily apparent. The use of the term "Kelvin" to displace the established KW.-hour was opposed on the ground of ambiguity, and because Lord Kelvin's name is being proposed for an important electrostatic unit.

Dr. C. P. Steinmetz deprecated the addition of units of a hybrid character to the nomenclature of the electrical industry, contending that the existing supply appeared adequate for present needs. The proposed "myriawatt" for boiler rating was a makeshift unit, and one might as well use the kilowatt or the megawatt. Even the adoption of the term "Kelvin" for the KW.-hour had not found large acceptance, because it was a mixture of units of different characteristics and not an absolute unit on account of the hour factor.—*Electrical World.*

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A very successful convention of the Canadian Electrical Association was held in Toronto recently. This Association is affiliated with the National Electric Light Association of the U.S.A., and as such bars all men connected with municipally-owned works from its membership. There is now a movement on foot to extend the scope of the Canadian Association so as to include municipal men.

A plea has also been put forward recently for the formation of an Institution of Municipal Engineers, which should include electrical engineers, and another proposal, as an amendment to this, recommends that the municipal engineers be enrolled as a new section of the existing Canadian Society of Civil Engineers.

In a paper read in June, by Dr. W. W. Andrews, on "The Scientific Utilisation of Natural Resources," before the Union of Saskatchewan Municipalities, the possibility of utilising the enormous quantities of straw in the West, for power production, was dealt with. The author's personal analysis of the straw was as follows :—

Volatile hydro-carbons, 64 to 72 per cent.
Moisture, 6 to 10 per cent.
Fixed carbon, 21 to 24 per cent.
Ash, 6·5 to 8·2 per cent.

The paper goes on to say : "It is found that slight charring of the straw solves the problem of reducing the straw to a powder fine enough for briquetting, and also that pulped potatoes form an excellent binder. . . . It will thus be seen that the farm may not only produce all the fuel necessary for household and power purposes, but the small towns or villages may be supplied with fuel from the neighbouring farms.

"How enormous the possibilities are will be shown from the following :—Suppose we think of a square 40 miles each way, with Regina as the centre. If 24,000 acres be left out for the city and vacant places, and supposing that one-half of the remaining area is given to grain crops, 250,000 tons of this fuel may be produced every year for all time, nearly all of this coming from a distance of less than 20 miles from the city."

Though the author does not touch on this point, there is no doubt that such fuel could be used in gas producer plant to economically generate electric power for use in the district.

The Winnipeg Board of Control is considering the electrification of the waterworks high-pressure pumping plant, which is at present operated by gas engines. The estimated cost of the change is about £10,000, and it is calculated that this would soon be saved by eliminating the cost of keeping up the fires for the producer plant.

The Commission of Conservation is preparing a report on the water power of Western Canada, in which a great deal of information will be given respecting the water powers of British Columbia. The mainland coast and the vicinity of the Grand Trunk Pacific Railway are receiving attention at present, presumably because these will be the most accessible and best situated regions for immediate development.

The city of Brandon in Manitoba is just about completing the electric tramway system, and it is expected that the cars will shortly be running. A by-law has recently been passed authorising expenditure amounting to £30,000 on extensions.

In these notes there was recently a brief account of a report by a consulting engineer on the subject of additional power for the Calgary Electricity Works. Apparently at least one of the recommendations of this report has been adopted, as a by-law has been passed authorising additions, including gas-fired boilers and turbo-generators of 6,600 H.P. capacity.

The town of Grenfell, Saskatchewan, proposes to spend about £3,000 on an electric lighting plant and will vote on a by-law shortly.

The Medical Officer of Health of Toronto has just issued a set of regulations respecting the trams and other public conveyances. The number of passengers to be carried is limited to one and two-fifths of the total seating capacity. Each tram is to be provided with a Fahrenheit thermometer and no cushions on the seats or backs will be allowed except such as can be readily cleansed and disinfected. Efficient ventilation and heating are to be provided, and all the straps must be composed of, or covered with, celluloid or other non-absorbent material.

The Provincial Board of Health must approve the regulations before they can be properly put into force.

Anyone who has travelled on Toronto trams during the rush hours will endorse the policy of the M.O.H. as being a very good move in the right direction. The extent of overcrowding at present allowed is extremely dangerous, especially to the public health, and more particulary so in winter, when owing to the extreme cold the cars are kept very much closed up and often greatly overheated—the atmosphere is sometimes like that of a foul den.

Owing to the recent failures of the transmission lines of the Hydro-Electric Power Commission, the question of an emergency plant for Toronto has been taken up, and a joint report was made a few days ago by the Commission's chief engineer and the new general manager of the Toronto hydro-electric system, Mr. Couzens, who has recently arrived from England, in which the provision of a plant for emergency and peak load purposes was recommended. The use of both steam and oil engine-driven sets will be considered, the probable capacity of the plant being in the neighbourhood of 20,000 KW.

It is understood that the city of Hamilton is also taking up a similar question.

The Mainsman's Nightmare.

A sinuous Network held me fast,
  Thrown round me by the Genius of the Mains,
And thro' the meshes grimaced vast
  Armies of Faults, like little stabbing pains.
Upon my chest there sat a Kit
  Of Jointer's tools, pouring hot compound down
My throat, which, parchéd as the Pit,
  Felt like a Furnace Flue. Then did I drown
In scalding Insulating Oil,
  Which closed around my horror-stricken head,
Whose hair electrified did coil
  In snaky spirals, then turned cherry red,
And stood straight out like prickly quills
  Upon the fretful porpuntine. A Mob
Of Megohms danced like Whip-poor-wills ;
  And then methought I lost my blighted job,
And all the mains on earth went dead.
  Then blew up with a frightful, fearful shock,
And fifty thousand guns struck one o'clock,
  And half a million lamps crashed to the ground,
Till all the vibrant earth reeled round,
  Re-echoing with elemental sound.

* * * * *

Here I awoke in horrid sweat, and found
The cheap alarm clock had gone off its head,
And it was 8 a.m., and I abed.

J. A. M.

In *Glover's Almanac.*

Resuscitation from Electric Shock.—The report of a Commission on resuscitation from electric shock to the N.E.L.A. Convention, stated that so far as the amount of ventilation of the lungs was concerned, the Schaefer method, reinforced by the extension of the arms forward, was decidedly better than that suggested by Silvester. This advantage, taken in conjunction with its greater simplicity and safety, caused the Commission to vote unanimously in favour of the prone-pressure method of artificial respiration as an effective means of giving immediate aid. A booklet on resuscitation has been prepared as the outcome of the work.

Even a relatively poor method of artificial respiration, if begun immediately, may maintain life and permit ultimate recovery in cases in which an ideal method, with all the resources of the laboratory and hospital, would be ineffective after a few minutes. The Committee emphasised the wide publicity which the "pulmotor" had received through the daily Press, but pointed out that the pulmotor had lacked scientific, surgical and medical sponsors. Efforts to obtain scientific details and other reliable information bearing upon specific cases in which the pulmotor had been used, led to the conclusion that the cases available to the Committee did not furnish convincing proof of the necessity or exceptional value of this apparatus.

The report described the mechanical method of artificial respiration used by Dr. Metzler, which has commendable features. The Commission recommended this apparatus as a satisfactory means of continuing artificial respiration, and suggested that in cases of suspended breathing the modified prone-pressure method be supplemented as soon as possible by the use of the apparatus.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,151. "Switches of the tumbler kind." W. J. Charles. (Divided application on 22,477, 1912, April 3rd, 1913.) July 14th. (Complete.)

16,160. "Dynamo-electric machines." J. H. Gath. July 14th.

16,167. "Direct-current and alternating-current electric motors." H. H. Jowers. July 14th.

16,198. "Electrically-operated rotary constant-speed device." R. P. Howgrave-Graham. July 14th.

16,202. "Apparatus for the support of the receivers of table telephone instruments." A. Bonnin. July 14th.

16,208. "Controllers for electrical apparatus." A. Mond. (Maschinenfabrik Oerlikon, Switzerland.) July 14th.

16,214. "Electric heating apparatus for water and other fluids." H. de Kok. (Convention date, November 30th, 1912, Germany.) July 14th. (Complete.)

16,248. "Electric glow-lamps." G. Zahikjanz, S. Gatman and G. van Zwonenberg. July 15th.

16,254. "Electrical lamps." J. Ernst and C. Endre. July 15th.

16,257. "Electric miners' lamp with fire-damp indicator." J. C. Rigaux. July 15th.

16,262. "Device for transferring pressure from rigid bodies to electric insulators." M. Hedlund. July 15th. (Complete.)

16,267. "Telephone exchange systems." Western Electric Co., Ltd. (F. T. Woodward, United States.) (Divided Application on 1,902 of 1913, January 23rd). July 15th. (Complete.)

16,268. "Circuits for electric signalling." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. July 15th.

16,269. "Means for and methods of changing the frequency of alternating electric currents." A. M. Taylor. July 15th.

16,297. "Syrens for submarine signalling." Signal G.m.b.H. (Convention date, July 29th, 1912, Germany). July 15th. (Complete.)

16,298. "Receivers for submarine sound signals." Signal G.m.b.H. (Convention date, July 29th, 1912, Germany.) July 15th. (Complete.)

16,299. "Refractory fibrous material and process of making the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 15th.

16,341. "Electric arc lights." J. T. Morris. July 16th.

16,344. "Counting trains for electricity meters." A. Mascall and Chamberlain & Hookham, Ltd. July 16th. (Complete.)

16,349. "Electrical stop-motions for knitting and like machines." G. Stibbe. July 16th.

16,376. "Prepayment devices for telephone systems." Siemens & Halske Akt.-Ges. (Convention date, July 17th, 1912, Germany.) (Complete.)

16,384. "Electric heating and cooking apparatus." H. H. Cressall. July 16th.

16,391. "Cooling electrical machines." Allgemeine Elektricitats Ges. (Convention date, July 16th, 1912, Germany.) July 16th. (Complete.)

16,392. "Electric dinner or service lifts." F. Hodgson. July 16th.

16,403. "Replacement fuses for electric circuits." G. O. Donovan. July 16th.

16,413. "Railways safe-running devices." A. R. Angus. July 17th.

16,428. "Electro-motors for portable electric drilling machines." G. F. D. Campbell. July 17th. (Complete.)

16,435. "Duplex telegraphy and the like." H. G. Barwell and Eastern Telegraph Co., Ltd. July 17th.

16,438. "Method of, and means for, firing submarine mines and torpedoes." A. C. E. Rateau. July 17th. (Complete.)

16,454. "Electric switches." Siemens-Schuckertwerke G.m.b.H. (Convention date, June 7th, 1913, Germany.) July 17th. (Complete.)

16,468. "Processes for making boron nitride." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 17th.

16,474. "Illuminated advertising apparatus." E. Buhlmann, Jun. (Convention date, September 24th, 1912, Germany.) July 17th. (Complete.)

16,481. "Process of manufacturing a cobalt electric lamp-filament." C. Kanazawi. (Convention date, July 17th, 1912, Japan.) July 17th. (Complete.)

16,485. "Electric and gas radiator." V. Lacasse. (Convention date, July 17th, 1912, Belgium.) July 17th. (Complete.)

16,526. "Dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., and G. H. Taylor. July 18th. (Complete.)

16,538. "Automatic and semi-automatic telephone systems." Siemens and Halske Akt. Ges. (Convention date, September 10th, 1912, Germany.) July 18th. (Complete.)

16,540. "Electro-deposition of iron." S. O. Cowper-Coles. July 18th.

16,541. "Process for the electro-deposition of lead." S. O. Cowper-Coles. July 18th.

16,542. "Process for coating or plating metal sheets with other metals." S. O. Cowper-Coles. July 18th.

16,565. "Manufacture of electrolytic iron." Societe "Le Fer." (Convention date, August 2nd, 1912, France.) July 18th. (Complete.)

16,566. "Magneto-electric ignition apparatus adapted for use in connection with internal-combustion engines." G. G. M. Hardingham. (Mafam Motor Apparate G.m.b.H., Germany.) July 18th. (Complete.)

16,584. "Starting devices for switches of electric motors." T. Knight and J. R. Maule. July 19th.

16,601. "Apparatus for heating liquids electrically." British Electric Heater Co., Ltd., and C. Kratt. July 19th.

16,609. "Means for operating electrical switches." Mackenzie Drysdale and Displayer Co., Ltd. July 19th.

16,641. "Indicating recording and controlling devices." Soc. de L'Elektricite Nilmelior and E. Colas. (Addition to 827/10. Convention date, July 20th, 1912, France.) July 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Apparatus for Electric Sterilisation of Closet Seats and the Like. K. Gasiorowski. 26,485. November 18th.

Electro-magnets for Producing Mechanical Movements. K. Miram. 27,922. December 4th. (December 4th, 1911.)

Dynamo-electric Machines. Electric Construction Co. and N. Pensabene. 7,651. March 29th.

Electrical Winding Gear for Clocks and the Like. L. J. Aron and C. Wiener. 9,154. April 18th. (June 29th, 1912.)

Telephone Systems. H. P. Clausen. 15,057. June 27th. (March 11th, 1912.)

Control Gear for Naval Ordnance. E. Saqui and S. A. Farrell. 15,279. July 1st.

Telephone Exchange Systems and the Like. W. Aitken. 15,292. July 1st.

Filament-Supporting Devices for Incandescent Electric Lamps. Julius Pintsch Akt.-Ges. 15,486. July 2nd. (November 21st, 1911.)

Railway Signals. R. H. Stockdale. 15,548. July 3rd.

Electrical Distribution Junction Boxes or Apparatus. British Insulated and Helsby Cables, Ltd., and H. Allwood. 15,706. July 5th.

Electric Toasters and the Like Devices. E. C. R. Marks. (Landers, Frary & Clark.) 15,961. July 8th.

Means for Electrically Lighting Road Vehicles or other Rolling Stock. L. Krebs. 16,024. July 9th.

Apparatus for Testing Electrical Measuring Instruments. G. North. 16,730. July 17th.

Thermal Switches. A. McPherson. 20,464. September 9th.

Electrical Terminals. H. G. Longford and W. A. Clark. 20,775. September 12th.

Electrical Incandescent Lamps. H. F. J. Truss. 23,453. October 14th.

Magnetic Speedometers. R. Haddan. (Stewart & Clark Manufacturing Co.) 23,597. October 15th.

Manufacture of Metal-filament Electric Lamps. W. L. Pakenham. 24,361. October 24th.

Electro-magnetic Separators. Maschinenbau-Anstalt Humboldt. 24,643. October 28th. (October 27th, 1911.)

Locking Devices for the Gates or Doors of Electrically-controlled Lifts and the Like. F. Barlow. 25,258. November 4th.

Watertight Insulating Plug for Submersible Vessels. Siemens Bros. and Co. and W. D. Le Corney. 28,646. December 12th.

Automatic Apparatus for Controlling the Period of Artificial Illumination. J. H. Gill. 29,928. December 30th.

1913.

Time Switches for Electrical and other Purposes. H. F. J. Thompson and J. H. Bowden. 1,496. January 18th.

Speed Control of Prime Movers. Siemens-Schuckertwerke Ges. 1,596. January 20th. (January 19th, 1912.)

Control of Electric Motors for Driving Screw Propellers. Siemens-Schuckertwerke G.m.b.H. 2,136. January 27th. (January 27th, 1912.)

Electromagnetically-Operated Diaphragms for Producing Sound. E. A. Graham. 4,197. February 18th.

Railway Safe Running Devices. A. R. Angus. 6,330 and 6,652. March 22nd. (Divided application on 7,081 of 1912. March 22nd.)

Electric Motors Applicable for Driving Kinetographs. I. Kitsee. 10,519. May 5th. (Divided application on 14,880 of 1912. June 26th.)

Apparatus for Transmitting Movements or Positions of Indices by Means of Multiphase-wound Bodies. E. Beckmann. 130. January 2nd.

Method of Reducing Telephonic Disturbances. O. B. Blackwell and G. A. Anderegg. 2,508. January 30th.

Electric Transformers. Claudius Ash, Sons & Co., Ltd., A. B. Jones and W. G. Lee. 2,697. February 1st.

Electro-magnetic Service Meter for Telephone Exchanges and for other Purposes. Siemens Bros. & Co., Ltd., and E. A. Petithory. 2,762. February 3rd.

Accumulator Traction on Prussian Railways.—

After careful tests extending over several years, the Prussian State Railway authorities are steadily increasing the number of accumulator-driven cars on their lines. In 1907 only six such cars were in use, whilst now the number has increased to 200. Without any revolutionary change in design or construction, the possibility of using accumulators successfully for this purpose has thus been established in a striking manner. By means of maintenance arrangements with the accumulator manufacturers the financial risks to the users are reduced to a minimum, and enable an exact predetermination of the cost per car-mile to be arrived at. The energy required for charging is produced under the most favourable and economical conditions. Under these circumstances, a cost of not more than ·7d. per KW.-hour can be counted on, and, allowing 70 per cent. for the (watt) efficiency of the battery and 85 per cent. for that of the motors, the cost per H P.-hour at the wheels works out at only about ·87d.—a price which neither benzine-electric cars nor the ordinary steam locomotive can approach.

The Prussian Railway results also enable some idea as to total cost to be arrived at. The accumulator cars consist of two distinct wagons connected by a coupling, and are capable of carrying a total of 100 passengers. The Tudor accumulator battery is placed in two compartments—one at the point of the double car, and one at the back. Of the six wheel axles two are fitted with motors. Each motor is rated at 85 H.P., and the battery is of sufficient capacity to cover a journey of 100 km. (62 miles) without recharging. The speed attained on the level is 37 miles per hour, and 22 miles per hour on a 2·5 per cent. gradient. The weight of the car complete, but without passengers, is 55 tons, of which 17½ tons is for the accumulators. The cost of the car is about £3,600.

The energy consumed is very moderate—amounting to about 2·3d. per car-mile, if as much as 1d. per K.W.H. is allowed for the cost of current. The total cost per car-mile, allowing for operating cost, maintenance, interest on capital and amortisation, amounts to about 8½d. Even if the cost of energy were doubled the total cost would work out cheaper than that for benzine-electric cars, recent tests on which have shown a cost of something like 12¼d. per car-mile.

With steam traction the cost is so high that two accumulator cars could be run for the same amount. The chance of doubling the train frequency without increased cost should greatly aid in popularising accumulator traction on railways.—*La Technique Moderne.*

THE

ELECTRICAL REVIEW.

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THE RATING OF TRAMWAYS.

FOR some time those who are responsible for tramway undertakings have been under the impression that the track through the streets is subject to special treatment at the hands of the rating authorities. It goes without saying that some measure of relief from the full burden of rates would be of enormous advantage to tramway enterprise; and in our view the exemption would also be justifiable. In the first place, the duty of repairing the roadway between and for some distance on either side of the metals, has always been imposed upon the tramway authority. That in itself constitutes a claim for exemption from some part of the district rate. In the second place, the competition of the motor-'bus, which practically pays no rates at all, has rendered it more and more difficult for the electric tram to pay running expenses. As we shall presently see, however, these considerations have but little weight with those who have to administer the law. The measure of relief which the tramway has enjoyed may be stated in two words. In respect of property of certain special classes the general district rate is made, not upon the whole, but upon one-fourth part only of the net annual value. Amongst these classes are (*a*) land used only as a canal or towing path for the same; (*b*) land used only as a railway constructed under the powers of any Act of Parliament for public conveyance.

The contention that tramways, such as we know them ordinarily, are entitled to be treated as railways, was first put forward in the case of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority (1892) I. Q.B. 357. There the appellants under the powers given them by certain local Acts of Parliament conducted a tramway communicating by points and switches with a railway in their possession, which was worked by them in conjunction with a railway, and which had been constructed under an Act of Parliament. It was held that the land occupied by the tramway was not "used only as a railway" within the meaning of the Act, and that the appellants were not entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. Mr. Justice Wills, in giving judgment, said: "The legislature when it passed that Act did not think it necessary to define a tramway, and as definition is always '*periculosæ plenum opus aleæ*,' I shall follow the example of the legislature and not attempt to define either railway or tramway. It appears sufficient to say that no ordinary person has any difficulty in distinguishing between the two. It seems to me, therefore, that the exemption in favour of railways cannot have been intended in the Act of 1875 to cover tramways."

Thus it came about that in 1892, tramways, as ordinarily known, were held to be not exempt. Then the light railway made its appearance, and it has actually been held that,

although a tramway and a light railway may be physically similar in every detail, the light railway is exempt, while the tramway is not! In this connection reference need only be made to the case of Wakefield and District Light Railways Co. *v.* The Wakefield Corporation (1908), A.C. 293. In that case, a company were the owners of a light railway constructed under an order made under the Light Railways Act, 1896. The railway, which physically resembled a tramway, was laid along certain open streets, and the order, while preserving to the public their ordinary right of passage over the highway, provided that the company should have the exclusive use of the railway for carriages with flange wheels. The company having been assessed to the general district rate in respect of their occupation of the railway, it was held upon the construction of Sec. 12 Sub.-Sec. 2 of the Light Railways Act, 1896, that Sec. 211, Sub.-Sec. 1 (*b*), of the Public Health Act, 1875, applied to light railways; that, notwithstanding the user by the public of the surface of the streets in exercise of their right of passage, the company were occupiers of the land used only as a railway constructed under the powers of an Act of Parliament for public conveyance within the meaning of Sec. 211, and were consequently entitled to be assessed to the general district rate in respect of the said railway at one-fourth only of its net annual value.

Founding no doubt very largely upon this decision, it appears that the Metropolitan Electric Tramways Co. preferred an appeal from their rates in the Tottenham district on the ground that they were entitled to exemption both in respect of the tramlines belonging to them, which were part of a light railway, as well as in respect of the tramlines which were really part of a tramway. The facts which have already been reported were these. The company owned, occupied, and worked as one connected system a tramway and a light railway, which were constructed in and along certain public streets and roads in the district of an urban council. The tramway and the light railway were constructed and worked under and subject to the provisions of certain local Acts and Orders; they had a junction with each other, and were worked by electricity on the overhead system. They were identical as to mode of construction and materials used, and the rails of each were laid with their uppermost surface level with the surface of the highway; the same carriages were used upon them, and ran through from the one on to the other, and the electrical energy used for working both the tramway and the light railway was generated at the same power station and thence transmitted over a common system of cables and mains to sub-stations. It was held by the Court of Appeal that the tramway was "land used only as a railway constructed under the powers of an Act of Parliament" within the meaning of Sec. 211, Sub.-Sec. I (*b*), of the Public Health Act, 1875, and that the company were therefore entitled in respect of their tramway to be assessed to the general district rate at one-fourth only of its net annual value. In this case the decision in Swansea Improvements and Tramways Co. *v.* Swansea Urban Sanitary Authority (*supra*) was over-ruled.

It is this decision of the Court of Appeal which has itself been over-ruled by the House of Lords. In the course of his judgment Lord Moulton said:—

> If it were admissible to speculate as to the motives of the Legislature in exempting railways from the full burden of the rates, I should be inclined to adopt the views expressed by Mr. Justice Earle in the case of The South Wales Railway Co. *v.* The Swansea Board of Health. He there says:—"The general scheme of the enactment is that the occupiers of the classes of property most benefited by the expenditure of the district rates shall be liable to be rated at a higher rate, the occupiers of the classes less benefited at the lower rate." This fully accounts for the exemption of railways running on their own lands and partaking of few, if any, of the advantages of municipal expenditure so far as their line is concerned. But tramways are not in the like position. The public streets provide them not only with support for their rails, but also, as it were, with arrival and departure platforms, for they collect and deposit their passengers all along the route which they take. I can think of no class of property within a town which more directly, and to a fuller extent, reaps advantage from municipal expenditure, in the way of construction, maintenance, lighting and sewering of streets (which forms so large an item of municipal expenditure), in addition to its dependence on the general prosperity of the town, which is secured by municipal expenditure on other objects. Tramways seem to me so little *in pari casu* with land solely occupied for railways in the matter of meriting exemption from rates that I have the greatest doubt whether any responsible authority in 1875 would have proposed to exempt tramways from the full burden of rates, or if they had proposed it, the Legislature would have granted it."

He then went on to point out that in point of fact the Light Railways Act had been abused, inasmuch as it had been put in force by astute promoters who saw that an advantage could be gained by putting forward schemes for tramways in the guise of light railways.

The conclusion of the whole matter is that where a tramway runs along the street and joins on to a light railway, the latter undertaking is entitled to exemption, while the former is not! If ever the famous *dictum* of Mr. Bumble anent the law of England were justifiable, this is surely the occasion. In future those who desire to invest in tramways will do well to enquire whether their property is in reality a tramway or a light railway.

COAL, GAS AND ELECTRICITY.

We have it on the authority of Mr. D. A. Thomas, of the Cambrian Coal Combine, that "Old King Coal is a Merry Old Soul," and when we observe the prices at which electricity supply undertakings are entering into contracts nowadays we are inclined to add that he has good reason to be so. Exceptional and continued industrial activity, even in these days of electric driving, means a big demand for fuel, and when owners can fix their own figures, consequent upon everybody wanting more of their commodity, they are naturally in high spirits. Borough and other electrical engineers who have to pay these higher prices will not find any relief by wondering how far minimum wage legislation and how far industrial and naval activity are to blame for their heavier burden. Some of them have turned to their Diesel engines with a sigh of relief as saving them from high coal price troubles in the future, only to be confronted with possibilities in the direction of oil fuel prices and shortage. And so Mr. Thomas continues his merry song foretelling for his majesty a merry life for many years yet to come. "The total quantity of oil in the world to-day available for fuel purposes was less than 2 per cent. of the total production of coal, and how was 2 per cent. going to take the place of 100 per cent.?" But Mr. Thomas is not the only performer in this summer festival, for Sir Corbet Woodall, the chairman of the Gas Light and Coke Co., has been addressing his shareholders. Now he, too, is interested in the price of coal, but he has to *pay*, and we can imagine the heart of the Cambrian owner rejoicing as he learns from Sir Corbet that his coal is costing him more by hundreds of thousands sterling per annum. The Gas Co. has been passing through "times of stress" with "abnormal prices of coal," but the end is not yet, for contracts extending over the next 12 months have been made at prices even materially higher than those paid last year; it is estimated that those contracts will involve an additional expense of about £175,000! And yet Sir Corbet Woodall is a merry old soul too, and the reason of his contentment is not far to seek, for he is able to show an advance of 432,000,000 cb. ft. of gas sold in the past half-year, as compared with the corresponding period of 1912. But instead of calling for his pipe, his glass and his fiddlers three, the Gas Light chairman settles harder to his task, merely telling his shareholders that this circumstance of progressive business may be taken as furnishing gratifying evidence of the "resources available to the company in times of stress." Electrical men who want to know what is the probable course of future coal prices will undoubtedly listen with full respect when so big a coal consumer as Sir Corbet expresses himself on that matter. He says that while it is impossible to forecast the future with any degree of confidence, he will be greatly surprised if the price of coal does not show a material reduction by the time the

present contracts have expired. What are to be the causes working to that end he does not indicate; whether a falling off in trade, or a more settled outlook abroad, or what else, it is useless to surmise. But returning now to that reference to available resources. The Gas Light and Coke Co. continues to add thousands of new gas stoves to its mains every year; this we presume is the principal "available resource," and the company certainly does endeavour to cultivate this field in an enterprising way, as the average consumer will tell us. We hope the day will be hastened when electrical men will cut as easily into the gas cooking load as they have already done into the gas lighting load, when it will be as easy to get the consumer to take the electric as it is to get him to take a gas stove. Education is largely what is required. Gas stoves are giving way in places to electric, but the gas authorities have still a vast number of people to cater for who have neither electric nor gas cooking service in their homes. Presumably these form a large part of the "available resources" mentioned.

One other word from the speech of Sir Corbet Woodall calls for attention from electric supply men. He says that the National Gas Exhibition is receiving active support from the majority of the gas undertakings of the Kingdom, and that it will be opened by the Lord Mayor on October 1st. We will add nothing further at this stage save a hint that October should be a month of greatly increased commercial activity on the part of all electric supply authorities in and around the metropolis. Were the Electric Supply Publicity Committee not listless it might have given an energetic lead. But as matters stand, nobody would dream of looking that way for leadership. Apparently it lies in a comatose condition! We must all help ourselves—unless we are to look to the "Point Fives."

Rubber.

In spite of all the attempts made to infuse cheerfulness into the rubber market, the tone remains one of comparative dejection, and in all probability the ultimate course of prices is to a still lower level. There is no doubt that the Near East can produce rubber in enormous quantities at, say, 1s. 3d. a lb., and the tonnage produceable at this figure or thereabouts, is bound to increase as new plantations get into bearing, and as methods of production are improved. All attempts artificially to hold up prices are bound to fail in the long run. It is no use for syndicates or groups to put their heads together to hold back material, or to endeavour in other ways to manipulate the market, for all such schemes will inevitably recoil on the heads of their promoters. No doubt shareholders would welcome any development tending to arrest the dry-rot in the prices of rubber and of the shares of producing companies in the Near East and elsewhere, but no development arising out of the manipulation of supplies can be attended with permanent good. It is futile to talk of ultra-pessimism on the part of the investing public. The investing public have been hard hit, and have in too many cases seen their capital dwindle down to a fraction of the original investment, while the utmost that can be reasonably hoped is that the increased output of the plantations may go some way towards making up the deficit in the price per lb. Somewhere round current prices the market is finding a temporary resting place, but it must not be anticipated that even these figures can last, for the tendency of supplies is to increase, and the manipulation of the market for fine hard Para is a weak spot. Brazilian Para rubber stands at an altogether abnormal level compared with the plantation product, and it is only a matter of time for a readjustment to take place; and this is far more likely to be effected by a fall in Para than by an appreciation in the price of plantation. The proposal to form a Rubber Companies' Shareholders' Association may be a good one, but it can hardly succeed in evolving a formula for freeing the rubber market from the logical effects upon prices of growing production. As for the rumoured formation of an "International Rubber Syndicate" under the auspices of the Belgian Government, with a capital of 50 million francs, for the purpose of restricting output, in conjunction with the Governments of Holland and Brazil, the scheme can hardly be put forward seriously. No doubt if it were put into operation it would cause a temporary rise in the price of rubber, but the trouble would be to make it effective. It would, however, be a capital thing for the plantations in the Near East, who could increase their output then without any fears as to the consequences. The Belgian Government is, of course, concerned mainly, because of the effect which the fall in the price of rubber is having upon the prosperity of the Congo Colony, and it would, no doubt, be supported more or less whole-heartedly in any possible scheme by the Antwerp rubber dealers, a pretty influential body.

The world's consumption of rubber in 1912 was about 111,600 tons, of which the Middle East contributed some 28,600 tons, while this year it is computed that the consumption will amount to approximately 120,000 tons, of which amount the Middle East is expected to contribute a matter of 45,000 tons. This implies an increase in the output of the plantations in the Middle East of 16,500 tons compared with last year, but there is an offset against this, for the production of wild rubber is being materially reduced, while consumption is decidedly on the increase. Taking the two factors together, the increase in production may be practically counterbalanced by the anticipated reduction of 7,500 tons of wild rubber and the expected increase of 9,000 tons in consumption. There is not the smallest doubt that the collection of wild rubber has become a losing industry at current prices, and the complaints of the Congo traders referred to above reflect the degree to which they have been hit. Further than this, the Mexican revolutionary disturbances have entirely dislocated the guayule industry, and the cessation of production from this branch of the wild rubber trade only serves to accentuate the falling off in supplies of material of this character.

Copper.

Copper has had a most interesting market lately, and one which has shocked with surprise the many pessimists who have been prophesying all sorts of calamities and preaching prices down to an unheard-of figure. The fact is that a wave of pessimism has lately passed over all the markets, and while this was sweeping over people's heads they had no time to think of the blue sky above. Now that the wave has ebbed, and the sun is found to be still shining, there has been a gasp of relief and a much more happy frame of mind has developed. So far from the world being threatened with a deluge of copper, as was being foretold a few months ago, the shortage increases in intensity from month to month, owing to one reason or another, but undoubtedly one of the most powerful has been the enormous volume of consumption. On top of this, however, there have been other factors at work, and the most potent recently has been the strike at the Nichols refinery in America, which caused a reduction of 8,000 tons in the United States refinery production last month. Now further labour troubles have developed, this time in the Lake Superior region, which produces about 100,000 tons of copper a year. The trouble seems to be of a radical nature, involving the recognition of the men's union, which has been persistently refused by the mine-owners, and the result is that production has ceased over the whole district and there is reason to fear that water is getting into the mines. If this be so as the consequence of pumping operations having been stopped at certain mines, the outlook is grave in the extreme. In any event the world cannot well do without the 100,000 tons a year which the Lake turns out, and even the temporary shut-off of 8,000 tons a month cannot be regarded with other than the gravest anxiety. The influence which the strike has had upon the market is well shown by the considerable advance in prices sustained lately. There has been a very large run of demand on both sides of the Atlantic, and producers have sold heavily and are now quite well situated for the next couple of months or so. Much depends upon the news from the Lake Superior district, and any appreciable amelioration of the labour condition there would probably bring about a sharp temporary reaction in prices.

D

PIECEWORK AND BONUS SYSTEMS OF WAGES PAYMENT.

By "ZAHLER."

The introduction of any system of piecework or bonus system of payment into a works can be looked at from two points of view, as follows :—

1. As a means of ensuring that for every pound paid in wages, a pound's worth of work is done.

2. As a means of utilising the self-interest of the worker to secure his co-operation in increasing output, and decreasing costs.

As regards the former of these, it may be stated that with modern conditions of factory organisation, the underlying idea is a fallacy. The only method of preventing wages being paid for which no useful work is performed, is personal good management. Good management will result in absence of such waste, no matter what the system of payment may be. Thus, there are large concerns running successfully in which all the workmen are paid simply on a time basis.

An example of this is mentioned in the *American Machinist* of May 31st, 1913, page 761, where it is stated that the 15,000 operatives of the Ford Motor Co. are all paid by the day. Similarly, numbers of successful concerns may be enumerated working on any of the many different methods which have been introduced during recent years.

Good Management.—It might be remarked here that the question of good management above referred to is practically wholly one of personnel. No greater mistake can be made than to imagine that any system can take the place of an intelligent and zealous staff. If the officials be thoroughly well chosen and organised, with mutual confidence between themselves, and a graduated responsibility and power from the highest to the lowest, a good result will be obtained with almost any system. On the other hand, if the staff be unsatisfactory, then the best system in the world will not be a success.

It follows from this, that the second point of view given above is the one from which this subject should be studied, the object aimed at being to transform a reasonably good state of affairs into a still better one ; in other words, to enable the business to develop and improve, and, in addition, to relieve the staff of a good many routine matters, so that they can give their attention to the new developments which are continually necessary.

Pure Piecework.—Before going any further, it is necessary to mention one class of business in which the piecework system pure and simple suffices for the whole of the management, as far as the workpeople only are concerned. This is where the worker is paid so much each, or per dozen, or per gross for his work, be it little or much, independently of any minimum amount of wages per day or week whatsoever. This system, of course, obtains in many parts of the country in many manufacturing trades, as it did in the coal mining industry before the passing of the recent Coal Mines (Minimum Wage) Act. In the engineering and allied trades, however, it only applies in the simpler and undeveloped branches. Especially it applies in what may be described as the "single piece" industries—that is, when the product is finished in one operation by a single workman.

Directly one gets to the highly specialised trades in which the final product is the result of a great many operations, then the pure piecework system cannot be used. We may take it, moreover, that the whole tendency nowadays is for the workman to demand a guaranteed minimum wage, and it may be stated that the great majority of manufacturing engineering works in this country now do this. It is, however, when a system of bonus, or piecework, is superimposed upon a guaranteed minimum wage based upon time rates that certain difficulties crop up of which some are dealt with in the remainder of this article.

Balance and Debt System.—In this system the workman is engaged at a certain weekly rate which amount (*pro rata* to the time spent in the works) the workman receives whether the amount earned, reckoned on the piecework basis, amounts to his time rate or not. That is to say, all work given out is priced at so much per article. At the end of the week the total earned is added up ; if it comes above the man's time rate he receives the excess as a "balance." If, on the other hand, it comes below the time rate, the man nevertheless receives the time rate, the deficit being booked against him as a "debt." This debt must be paid off by the workman out of any subsequent "balance" before he receives payment of any balance he may earn in the future.

"Debts" Not Legally Recoverable.—It may be stated that, generally speaking, the debts spoken of in the preceding paragraph are not legally recoverable by the master. Formerly, however, this was not so, and it may be in certain instances they are legally recoverable now. Under such conditions, it has been asserted, and the writer believes with good authority, that the creation of "debt" has actually been encouraged by the employer. This has been the case where the workmen have been highly skilled, and there has been keen competition among the masters for the workmen's services. The fact then that the workman in the event of his leaving in "debt," could be prosecuted by his former employer, gave the latter a hold over him and prevented him accepting a higher offer of wages from another manufacturer. Such a state of affairs would, of course, only exist in a trade consisting of small employers, and it is impossible under the usual present day conditions of large factories. We must, therefore, consider the "debt" as being only a nominal or fictitious one, and, as a matter of fact, in the year's balance-sheet it is always written off as already lost and is never included among the credit items.

Effect of the "Balance and Debt" System on the Workmen.—The effect which this system has on the workman simply depends upon the mental attitude which the man is induced to take up. In some cases he accepts the situation frankly, and in the event of an accumulated debt does his level best to clear it off and again to earn balances. A particular case which came before the writer's attention at a machine tool works in Lancashire illustrates this. In this works the system was carried to the extent that if a workman left a job in debt it was a condition of employment of his successor that he should take up the debt and work the same off before drawing any balance. In the case in question the work consisted of the assembling and fitting of engine lathes, the work being undertaken by small groups of fitters under a leading hand. In this instance the leading hand took up the work with approximately £20 debt on it and in a comparatively short period paid the whole of it off and then earned very good wages. The secret of this was that the man was convinced that the prices paid were fair and had sufficient self-confidence to tackle the work with certainty of success.

As stated before, the mental attitude of the workman was the determining factor. It must be confessed, on the other hand, that often the effect of an accumulated debt is very different to the case just related. The workman then regards the debt as something impossible to be got over, and ceases to endeavour to work up to the piecework rate. This state of affairs is really the very worst which can exist in a workshop. If a man is working on a purely day rate, his sense of fairness will generally induce him to give a fair day's work in return for his wages. But a pieceworker up against a debt which has got out of his control neither has the sense of fair-dealing to urge him on nor the hope of increased wages. He speedily deteriorates as regards his own output and spreads disorganisation and dissatisfaction around him. Such a state of affairs must be put a stop to at all costs.

Difficulties of the "Balance and Debt" System.—In a preceding paragraph it was stated that when a piecework or bonus system was superimposed upon a day rate of pay, difficulties were encountered. If the work be purely repetitional, or simple in character, these difficulties to a large extent disappear. The state of affairs is soon reached when the majority of people in the workshop approximate to each other in output capacity, and are all working at the same day rate ; no "debt" worth speaking of is created, most of the people drawing large or small bonuses depending upon the energy and intelligence they put into their

work. It is when one comes to work of a varied nature, not of a repetition character, necessitating the employment of men of varying capacities and different day-work rates, that the difficulties appear.

For example: A certain job may be undertaken by a semi-skilled person who is rated, say, at 25s. per week. After some time spent on the work, he becomes highly skilled on that particular work, and earns, we will say, 32s. per week on piecework. Now, it might be necessary to place another man upon the same work to deal with a temporary rush. A man similarly skilled in that operation may not be available, and it may be necessary to employ a skilled mechanic, rated, we will say, at 40s. per week, on the job. Now this man, not having the manual dexterity on the particular work that the other has acquired by long practice, will, at the same piecework rate, go heavily into debt. It might be said that this should be prevented by increasing the day rate of the semi-skilled man to equal that of the trained mechanic and raising the piecework rate accordingly. But this would not be just. The skilled mechanic is paid at a higher day rate because the employer always has his trained skill available for any work which he might require. On the other hand, the semi-skilled man is only highly efficient on the particular job on which he has, by long practice, acquired rapidity of production. Any manager of a shop where work of a varied nature is carried on will agree that difficulties similar to the one just related are continually occurring. In short, when two men of different day rates are employed upon the same work, the one, because of his relatively higher day rate, goes into debt, and the other draws a balance.

Another difficulty which may be cited is that of new workmen, or workmen going on to new jobs. Of course, if the work is a continual repetition, this may be got over by not permitting the worker to go on to piecework until he has acquired sufficient dexterity to earn a balance at the settled piecework rates. This, however, is impossible in any shop where work of a varied nature is carried out.

It is not necessary to dwell upon this phase of the matter longer, as by following out the line of thought indicated, many other difficulties can be foreseen and are, as a matter of fact, encountered. As a result of these, various other systems of payment have been put into use in different places. These will next be considered. It may be said that they are all characterised by the absence of any "debt" being booked against the workman, the sole inducement to the exertion of the energy and intelligence of the workman being the hope of extra reward over and above his guaranteed daywork rate.

"*Balance*" *System of Piecework.*—This system is the same as the "balance and debt system," except that there is no such thing as debt. Of course the latter system comes to the same as the "balance" system alone if, owing to continuity of work, &c, all the pieceworkers continually draw balances, as is indeed the case in many works. In the "balance" system, however, even if the worker does not earn his day rate, his total of piecework being below this, nevertheless debt is not booked against him. On the next job he may earn a balance which is then paid him without regard to the fact that on the former job he may have been paid more than the piecework rating. The result of this is that the workman approaches each job afresh unburdened with the weight of an accumulated debt. It is obvious, however, that the system lends itself easily to abuse and necessitates careful supervision on the part of the foremen. Of course it is necessary for the workmen to keep time cards on which the time taken on every job is recorded. This is not always done with the "balance and debt" system.

Premium Bonus System.—In effect this is very similar to the "balance" system, in that the workman is paid as a minimum his day rate, and no debt is booked against him if he fails to do the work in the standard time. Instead, however, of pricing the work at so much per piece, a standard time is fixed within which the job should be accomplished. If the workman finishes within a shorter time, he is paid at his day rate for the time spent plus a bonus equal to this day rate for half the time saved.

This method of paying a bonus equal to half the time saved, although, of course, being quite an artificial arrangement and having no particular meaning, has resulted in the system being looked upon with suspicion by the workman, owing to the fact that he thinks that he is entitled to payment for the whole of the time saved. Consequently, the introduction of the system has encountered great opposition. It should be noted that the amount of the bonus depends upon the man's day rate. Thus, if he saves one hour and is rated at 1s. per hour his bonus is 6d. If, on the other hand, he is rated at 9d. his bonus is 4½d. In this the system differs from the fixed bonus system suggested below.

Differential Bonus System.—This is a system introduced in America and for which very excellent results have been claimed resulting in increased pay for the workmen, increased output and decreased cost of production. Some details of the working of the method are given in the *American Machinist*, Vol. 38, page 779. It is very similar to the premium bonus system described in the preceding paragraph, except that instead of the workman receiving as a bonus a fixed proportion of the time saved, the proportion is fixed by a sliding scale, it being the higher the shorter the time taken. There is, however, from the workmen's point of view the same objection as to the premium bonus system. To this must be added the difficulty that it is very complex and difficult for a relatively uneducated man to understand.

Exaggerated Results Claimed as the Result of the Introduction of Systems.—It is not out of place here to utter a word of protest as to the absurd lengths to which some writers have gone in claiming advantages for their different pet systems. This is particularly the case among the writers on the so-called "scientific management." The methods advocated by these writers are excellent as far as they go, but carried to the extreme lengths proposed by some authors, they only induce ridicule and contempt in practical men.

An example of this is afforded by a book written by Mr. Frederic A. Parkhurst, and entitled "Applied Methods of Scientific Management." One of these applied methods consists of very lengthy written instructions with the application of a bonus system to the charwoman. As an example, the eleventh and twelfth written instructions for the morning's work of this official may be cited :—

	Min.	*Hrs*	*Bonus in decs.*
11. Thoroughly sweep the superintendent's office, dust the furniture and clean out wash basin; then return to locker room, taking the superintendent's cuspidor along. Thoroughly clean the same, leave pail and mop in its proper place, take broom along and return the superintendent's cuspidor, and continue to tool room	9	·15	·0075
Rest period, if wanted	12	·20	·010
12. Thoroughly sweep both departments of the tool room, remove chips, clean the hand basin in the corner, empty cuspidors, then go to die shop	24	·40	·020

and so on.

It is to be presumed that the charwoman in question carries about with her a copy of the instructions and refers to them from time to time to see whether she shall dust the superintendent's arm chair before she cleans his "cuspidor" or *vice versa*. When the office is spring cleaned, presumably, the standing instructions are withdrawn and a fresh lot prepared and doubtless passed by the directors as correct. It will also be good news to the "Weary Willies" that in the works in question a bonus may be earned by "resting." But the whole thing is of course absurd, and illustrates what an awful result happens to a man if he lets his mind be run away with by one idea.

Coming back to what was stated in the early part of this paper, all systems must be adjuncts to an efficient staff. System is like fire—a good servant but a very bad master.

Fixed Bonus System of Wage Payment.—The difficulties which are incident to the various systems hereinbefore described, may be, to a very large degree, got over by the employment of a system of fixed bonuses, depending upon quickness of production. In order to introduce this system, the shops are, first of all, divided into zones depending upon the average value of one hour's work in that particular section. A fixed bonus per hour saved is then settled for each zone. Thus, in Section 1, it may be agreed that the

bonus per hour saved shall be 6d. In Section 2, 5d., in Section 3, 4d., &c.

For each job, then, a time allowance is fixed, depending upon the time that would be taken by the average workman for that zone when working at a fair day rate velocity. The fixed bonus is then paid the worker for all time saved on the standard time, over and above, of course, his day rate of wages for the time spent. Thus, a man may be rated at, say, 10d. per hour working in a zone where the bonus is 6d. per hour saved. The standard time for the job is, say, five hours, and the workman completes it in $3\frac{1}{2}$ hours. He is paid $3\frac{1}{2} \times 10$ plus $1\frac{1}{2} \times 6 = 44$d., *i.e.*, at the rate of 12·6d. per hour.

In pre-estimating the selling price the labour costs would, of course, be reckoned at $5 \times 10 = 50$d., so that the final result should be a saving to the employer and an increased wage to the man. The particular point to bear in mind is that the bonus paid is totally independent of the time rating of the man. Thus all difficulties due to men working together on the same work at different time rates disappear. The question of whether the piecework rates fit in with the time rates of the workman never arises. Moreover, if the man be rated low and acquire special skill on a particular job the cost of production will be low, while the proportion of bonus to day rate drawn by the worker will increase and thus render him the more and more satisfied.

SOME CHIEFS I HAVE MET.

[COMMUNICATED.]

While the primary object of the technical Press is the dissemination of technical knowledge, at times an article dealing with more human and personal matters relieves the studied monotony of a plethora of technical articles, besides which personal experience dealing with employers and employés is often of great interest to those young men just entering upon a business career. It is, therefore, the intention of the author in this short article, to deal with the personalities of the chiefs under whom he has worked in the course of his career.

The writer's first essay in the supply world was made when he secured a junior post on the staff of a London company. The remuneration was the princely one of 30s. per week, and the recipient, being young and enthusiastic, persuaded himself that his services were worth at least four times that sum. After a few months' time, strenuous endeavours were made to imbue the chief with the same idea, but he was of adamant on the point, suggesting that "the honour of being attached to his staff was in itself sufficient remuneration for the poor services rendered." It was, therefore, necessary to explain that "the honour" did not provide the recipient thereof with shirts and collars, food and lodging, &c. As this argument had not the desired effect, and as the chief did not appear keen on continuing the discussion, it was deemed wise not to pursue the matter further, but to look out for a more remunerative post elsewhere. On a suitable post turning up, the chief was approached for a testimonial, which he declined unless the applicant undertook to resign within three months whether he secured another position or not. This arbitrary offer was declined, and the job-seeker applied without the recommendation requested. On receipt of the news that his application had been successful (jobs were easy to get in those days) the chief was sought in his private lair and informed of the fact. Rather a stormy scene followed, the chief maintaining that he had been treated in an underhand manner, that members of his staff immediately they became useful left, &c., &c. I mildly pointed out to him that if their usefulness had been recognised in a practical manner such eventualities would not have arisen. He, however, maintained a haughty and injured air, and thus we parted.

My next attempt was in municipal service. The chief was young, able and intensely enthusiastic and imbued with a tremendous sense of his own importance. The assistant he required was a man who never made mistakes or omitted "to do those things which he ought to have done or did those things which he ought not to have done." As this qualification is extremely rare in the case of young men of limited experience, and as what is right or what is wrong is often a matter of personal opinion, it will readily be understood that the position of the writer and his successors was an unenviable one, and my relations with this gentleman terminated very suddenly. On reviewing this episode in after years it became apparent that the fault lay on both sides, and that both chief and assistant should recognise that each is human. If this fact were more fully realised it would tend to the maintenance of harmonious relations, which would naturally be to the benefit of the undertaking. Enthusiasm is a quality to be commended in both chief and assistant, but when it is carried to the extent of asking an assistant, after 12 hours' strenuous duty to "come along and clean out the main flue" at 12 o'clock on Saturday night, the chief peeling himself for the fray as he issues his order, one feels that enthusiasm can on occasion be carried too far.

Out of a job, with but a few pounds in one's pocket, and too independent to seek the aid of the parental exchequer, the acquisition of another job was a matter of vital importance. However, success soon attended the writer's efforts. A certain municipal station was very short-handed, due to what in these days would be classed as a strike having occurred, owing to alleged tyranny on the part of the chief towards his subordinates. As the Committee wisely decided that discipline must be maintained, and as the inquiry held by the members into the alleged tyranny had a negative result, the strikers were requested to seek other pastures, and vacancies occurred. In view of this incident, the prospects of a happy life did not seem particularly bright; but as necessity knows no law, it was worth risking the supposed tyranny of the chief, knowing that one week's notice would terminate the engagement if the worst occurred. On arrival at the works I was cordially greeted by the chief; and I can understand his cordiality, as he and one assistant had for some time been running the station between them, while it was whispered that the synchronising during that period alarmed the drivers greatly. The interview was terminated by an invitation to partake of tea and bloaters at the chief's residence. This gentleman proved one of the nicest men one could possibly work under, always being genial and friendly, and quite willing to listen to any suggestions his assistants might make for the better running of the station. Unless he is like the leopard, it is hard to realise any circumstances under which he could be charged with tyrannical treatment of his subordinates. The salary paid the assistants was the usual "thirty bob," this being the arbitrary value placed upon our services by the Committee in spite of the remonstrances of the chief. He, however, frequently found his shift men a job in their spare time at 8d. per hour, and never worried them as to the length of time they took over the work. Therefore, if the engineers were not anxious to limit their time at the works to eight hours per day, it was quite possible for them to augment their income very considerably, in spite of the dictum of the Committee.

After a pleasant two years' sojourn, the writer secured an appointment as chief assistant at another municipal station. Here the chief proved a gentleman in every sense of the word. Unfortunately, however, the station was not paying, and the Corporation was very chary of launching out into a bigger scheme in view of the fact that substantial deficits were being made annually with monotonous regularity. The chief, a most capable man, was of quiet and unassuming demeanour, and, as one of the Committee told me privately, "too much of a gentleman, and unable to talk." He, soon after my advent, secured another position, and the Committee decided that it was desirable to introduce fresh blood. They quite made up their minds they wanted "a man who could talk," and, all credit to their discernment, *they got him!* Soon after his arrival he made things hum; he recommended practically everything his predecessor had advocated for years, and, strange to tell, these suggestions were adopted without a murmur. This gentleman eventually constituted himself Committee, Town Clerk and Corporation, as well as engineer, and declined to be guided by anybody,

completely ignoring the instructions of the Committee and Corporation. This policy worked well up to a certain point, but when these autocratic methods were adopted towards consumers and potential consumers, trouble was bound to follow, and the Corporation, while afraid to bring matters to a head, secretly longed for a return of the old quiet time—even if accompanied by the old bone of contention, the annual deficit.

The writer put in a very strenuous two years with the "talkative engineer," that gentleman leaving the work to his subordinates while he did the talking and took unto himself credit for everything done.

As to the sequel to this gentleman's career, in view of his vocal abilities, he required a great deal of "lubrication," and it came about that as time went on he spent most of his time at a local hostelry, boasting to members of the Corporation (who occasionally called and hinted regarding his frequent presence) that "He guessed he could do all his business by 'phone," pointing to the instrument in the bar parlour. This and other matters eventually became a matter of such publicity that the chief was compelled to resign, his post now being filled by a "mon o' few words."

THE PRIVATE INSTALLATION.

[FROM OUR LEGAL CONTRIBUTOR.]

THERE is often considerable doubt in the minds of those who are in a position to make and use their own electricity as to whether they can do so without encroaching on the preserves of the supply authority. Again, a difficult question often arises as to whether, when a man has an installation of his own, he can use the mains as a stand-by should his own plant break down. Finally, the man who is hardly in a position to run a private installation merely for the service of his own premises.

The Electric Lighting Act, 1882, does not make any provision at all for the regulation of the supply of electricity otherwise than under a provisional order or a special Act. Thus, after that Act was passed, whereas persons who supplied electricity under a provisional order were subject to rules made by the Board of Trade in carrying out the details of their undertaking, the owners of an installation who furnished their neighbours with a private supply were under no restriction whatever. For instance, by regulations made under the Act of 1882, the use of aerial lines was very much restricted; but these rules only applied to statutory undertakers.

In order to bring private supply companies under the jurisdiction of the Board of Trade a special clause was inserted in the Act of 1888. By Sec. 4 of that Act it was provided that where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street, for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose, in such a manner as not to be entirely enclosed with any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a licence or provisional order, the Board of Trade may, by notice served upon the body owning or using the line, require that such line shall be continued and used only in accordance with the conditions and rules which they may prescribe.

A proviso exempts from the operation of the section "every electric line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises." Thus a man who erects an installation for the supply of his own house, or factory premises need pay no attention to the regulations. Any person failing to observe the regulations and orders of the Board of Trade is subject to penalties.

To avoid the necessity of drawing up sets of rules for every case, the Board of Trade have issued regulations drafted to meet the requirements of this section, the general effect of which is very similar to those which have to be observed by companies and local authorities which supply electricity under statutory powers. To deal with them at length would be beyond the scope of the present article. It may be pointed out, however, that Regulation 2 prohibits earth connection, except in the manner there provided. Regulation 4 limits the pressure between any two conductors or between any part of either conductor and the earth, to 3,000 volts. Regulation 14 substitutes 100,000 watts for the 3,000 volts in the ordinary regulations as the limit which a high pressure line may be used for transmitting. Regulation 17 provides precautions against injurious affection by induction; while Regulation 18 contains special provisions for the protection of the Postmaster-General.

Compliance with the Board of Trade regulations does not always completely protect a man who supplies electricity in the manner above described. He may have to observe certain by-laws issued by the local authority of the district in which his works are situated.

Thus he may find it necessary to lay his mains across a highway, and in seeking to do this he may come into conflict with the local authority who have control of the highway. This will probably be the case if the local authority are themselves supplying electricity in their district under provisional order, as they will naturally desire to restrain competition by every means in their power.

Dealing first with the question of overhead wires, it is clear law that unless the local authority own the soil of the highway, they cannot entirely prevent the suspension of overhead wires if placed at such a height that they are completely out of the way of the traffic. This point was made quite clear some years ago in a case which was decided in the High Court. Those who wish to lay cables across the highway have only to make an arrangement with the landowners on either side by which they can obtain leave to erect posts for the suspension of the cables. In the rare case, however, of the local authority owning the soil of the road, it will be within their power to absolutely prevent any cables being so suspended, as the presence of such cables constitutes a technical trespass, the continuance of which may be restrained by an injunction.

It should also be observed that in urban districts the local authority, by adopting Part II of the Public Health Acts Amendment Act, 1890 (53 and 54 Vict., c. 59), may acquire power to make by-laws for the prevention of danger or obstruction to the public from posts, wires, tubes, or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of that part of the Act), for the purpose of any telegraph, telephone, lighting, railway signalling, or other purpose. Again, in the case of London, overhead wires can only be erected in accordance with by-laws made under the London Overhead Wires Act, 1891.

Coming now to the question of laying mains beneath the surface of the road, it may be stated, broadly, that no private person has any right to break up the surface of the road without the consent of the highway authority. Further, there is a section of the Public Health Act, 1875, which prohibits any man from placing a tunnel of any kind under a highway without consent.

Having dealt with the conditions in which a private supply installation may be conducted, it is now necessary to take note of recent legislation dealing with the matter. The legislature appears to have been compelled to wait for 10 years before it was found possible to add anything to the Act of 1899.

The first section in this Act (Sec. 15) which is material to our present purpose deals with the question of supplying electricity to premises having a separate supply. It is in the following terms:—"Notwithstanding anything in the Electric Lighting Acts or in any Act of Parliament or Provisional Order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for these premises; the sum

to be so paid shall be determined in default of agreement by arbitration."

The necessity for some such section arose from the fact that before this Act was passed it was quite competent for the owner of a private installation to use the "mains" when there was a breakdown. He could not be refused a supply simply because he happened to have an engine and dynamo of his own. But for this section undertakers could not insist upon a minimum sum in excess of that authorised by their order, which is usually 13s. 4d. per quarter.

But, perhaps, the most important section in this Act from the point of view of the owner of a private installation is Sec. 23, which deals with the question of competition between the owner of a generating plant who desires to supply his neighbours, and the local or other authority supplying under, or by virtue of, a provisional order.

The Section provides: "Where in any area a local authority, company, or person is authorised to supply electricity under Act of Parliament, or under licence or provisional order, granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company, or person to commence to supply or distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament, or by licence or provisional order granted in terms of the Electric Lighting Acts: Provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

"Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic."

The second proviso will become of less and less value as time goes on. It is interesting to notice that since the Act came into force, no case has arisen in which this section has been discussed, or in which any attempt has been made to enforce it. Indeed, it is not easy to understand how or by whom it is to be enforced. Apparently it would be for the local authority or company to institute proceedings for an injunction to restrain interference with their rights. But there is nothing to show that a ratepayer in a district might not himself move in the matter on the ground that the possible competition would tend to diminish the profit of the public undertaking.

In conclusion, we may refer to one question which often arises. Suppose a man were to take a supply from the station at power rates. By so doing he would thus get the current at a less cost than he would have to pay if it was used for lighting purposes. He could well afford to have a motor-generator and supply himself and his neighbours with electric light. Would this be legal? It is conceived that any such use of a motor-generator is illegal. For a man to take a supply of electricity at motor rates and use it for lighting purposes is little short of a fraud on the supply company.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Accidents in Electric Lifts.

Absence from England for some weeks has prevented the writer from following the above correspondence, but, perhaps, it is not yet too late for another letter.

"Helicon" (July 4th) correctly states that on June 27th Mr. Cooper and Mr. Barlow defined the danger in Mr. Cooper's mind, but they had not previously done so. "Helicon" incorrectly assumes that this danger as now described was "obscure" to us. He overlooks the fact that we referred to it in our first letter, and to means for avoiding it, and reverted to the latter point on June 27th.

"Helicon" proposes that closing the switch should come last in order of time. This is a most attractive ideal, and one which has probably presented itself to more than one student of the subject. But everything depends on what has to be sacrificed to attain that particular object; in short, upon the complete details of the project, and until these are stated no useful opinion is possible.

"Helicon" again refers to a possible broken spring, and adds a bent spindle as impediments to counterlocking. The former has been dealt with, and as to spindles, they were eliminated from any locks years ago.

Turning to Mr. Cooper's letters, that gentleman opened the discussion by a condemnation of all existing locks, and laid down a specification as his own ideal, which, he stated, was conformed to by a single "unique" specimen, since identified as Mr. Barlow's.

We were able to show that at least three other types, including one of our own forms, filled the bill, and recently particulars of a fifth have reached us. Was not Mr. Cooper's generalisation a trifle rash?

On June 27th this correspondent again condemns springs as being inferior to . . . . some device he leaves undescribed. In the same letter he objects to discussion when "no definite particulars are available." He is really very difficult to please.

He expresses a doubt if we understand his specification. We can assure him we do, and met it long ago.

His attempt to place us in a dilemma in respect of our 1905 patent merely indicates inexperience of patent procedure. In point of fact, only one lock was ever made in accordance with the illustration published in the specification, but most of those actually manufactured are protected by the 1905 claims.

His sneer at our policy of prompt improvement at all possible points was, no doubt, regretted when seen in print, and we set against it the later admission that until a few weeks back our 1905 patent was "the best on the market."

Mr. Cooper is wrong in his assumption that we have dropped the form of lock which meets his specification; it is supplied to any customer desiring it.

Mr. Cooper's argument round a recent fatality is getting confused. He was objecting to the uncounterlocking of each, or any, gate at a point before the cage reached floor level, and used the accident to point his objection. We replied that an uncounterlocked zone of 2 ft. 6 in. was a practical necessity, and stated that the accident was not the result of such a provision. He now quotes evidence (the accuracy of which we neither accept or dispute), which, if correct, merely shows that by some mischance the uncounterlocking occurred very much earlier; and, therefore, that the circumstances are not relevant to this discussion. Uncounterlocking must occur somewhere, and all systems are liable to derangement.

The main question was, whether Mr. Barlow's lock was an advance upon previous achievement, and clearly that cannot be usefully discussed till the inventor can table his particulars, and we therefore wish this to be a final letter.

We have shown that things were not so backward as Mr. Cooper imagined, and would close with a reminder that he was comparing a device which had passed through the ordeal of thousands of applications during eight years of life with the one which was, however promising, as yet comparatively untried, and we have some confidence that after two or three years' experience of the new device, if Mr. Cooper cannot repeat his opinion that ours was the "best on the market," he will, at least, look upon it as second to none.

Smith, Major & Stevens, Ltd.

London, *August 1st*, 1913.

A Question of Etiquette.

I am anxious to obtain the opinion of some of your readers as to what is the proper course to pursue under the following circumstances.

During my journeyings about Great Britain I have come in contact with several supply companies who make a big profit out of installation work and who stifle competition by insisting on all sorts of absurd regulations (bluff, of course, but rows only make customers suspicious) for contractors;

at the same time these same companies do disgraceful work themselves, *i.e.*, bare wires under floors and down partitions, motors, &c., unearthed, and all the other shifts of jerry wiremen are made use of.

Do your readers think that it would be unprofessional to call the attention of the Board of Trade inspectors and the fire offices to this wherever it is found ?

J. Riley.

Inverness, *July 29th*, 1913.

Dry and Wet Air Filters.

As owners of patent No. 19,792 of 1912, which fully covers the application of water spray air filters to electric generators, we were interested in Mr. H. R. Witting's letter in your issue of the 1st inst. The various technical points raised by Mr. Witting, questioning the suitability of the water spray system of filtering the air supplied for cooling electric generators, were practically all covered in the remarks made by Mr. Feldmann and Mr. Bennett during the discussion of Mr. Christie's paper at the recent annual meeting of the Incorporated Municipal Electrical Association. They were so fully replied to at that time that there appeared to be no doubt left in the minds of the majority of those present as to the practical success of the water spray system, but, of course, whether it will be largely adopted remains to be seen. We have built for many years, and are still building, dry air filters for various purposes, but from recent experience we are convinced that the water spray system is far superior for electric generator work.

Sturtevant Engineering Co., Ltd.
Geo. A. Mower, *Managing Director.*

London, *August 5th*, 1913.

CO-PARTNERSHIP.

The Board of Trade is pursuing the subject of co-partnership with admirable tenacity of purpose. A Bill to promote the adoption of co-partnership by statutory, and other companies, has been introduced to the House during the session which is now drawing to a close, of which the following is a memorandum :—

The Companies' (Co-partnership) Bill represents a tentative effort to encourage the principle of co-partnership in the industrial life of the country. The main objects of the Bill are first to enable companies to adopt co-partnership in cases where they would otherwise be debarred from doing so, either by their private Acts of Parliament, or their articles of association ; secondly, to set out in the form of a schedule a model scheme of co-partnership for their voluntary adoption ; and thirdly, to provide that such model scheme shall ordinarily be a condition for granting statutory power to new companies to raise capital, though, of course, without attempting to fetter the discretion of Parliamentary Committees in individual cases. Under this scheme, certificates of partnership in the objects of the company, and a share in its surplus profits, are to be granted to all persons in its regular employment. It is provided that the standard rate of wages shall be taken to correspond with a standard return of 5 per cent. on all paid-up capital, and when the return is higher than 5 per cent., the employé becomes entitled to a bonus calculated at one-twentieth of his existing wages for every extra 1 per cent. paid in dividend. Thus, a company with a paid-up capital of £100,000 and a normal wage-bill of £20,000 would, if it paid 6 per cent., have to give its employés an extra £1,000 or £21,000 in all ; if it paid 10 per cent., £25,000 ; and if it paid 15 per cent., £30,000. Similarly, a workman with a standard wage of 30s. a week would get 31s. 6d. on a dividend of 6 per cent. ; 37s. 6d. on a dividend of 10 per cent., and 45s. on a dividend of 15 per cent. As, however, it is not desirable that the whole bonus should be paid over in cash, it is provided that trustees shall be appointed, to whom, at least, half the bonus shall be paid, and by whom it shall be invested, if possible, in the shares of the company itself. Further, in order to meet the varying circumstances of different industries, it is provided that in the case of registered companies the Board of Trade may allow other regulations to be substituted in individual instances, and, in particular, may allow a lower rate of bonus when salaries and wages bear a specially high proportion of the annual cost of the business of the company. There are also provisions for the election of trustees and directors and for the adjudication of differences.

The Bill provides that the Companies' Clauses Consolidation Acts, 1845 and 1888, shall be amended by the addition to them as a new section of the words : "The company shall have the power to grant and shall be under the obligation of granting certificates of partnership to persons in its employment according to the regulations set forth in the schedule to the Act." Every company incorporated by Act of Parliament and every company registered under the Companies' (Consolidation) Act, 1908, is (if not already so empowered) to be deemed to have power without further authority of Parliament or application to any court to grant certificates in accordance with the regulations contained in the schedule, provided that the company may, with the consent of the Board of Trade, substitute other regulations for these in the schedule, and may in particular substitute some other figure for the figure 5 per cent. per annum as the rate of bonus in Regulation 4 of the schedule regard being had to the proportion borne by salaries and wages out of the total annual expenditure of the company.

The schedule containing the regulations provide (*inter alia*) that the company shall offer the certificates of co-partnership to all persons in its regular employment within the United Kingdom, and that every person shall be deemed to be in the regular employment of a company, who, having worked in its service for three months in any year, is willing within the ensuing three months to sign a contract of service with the company for a further six months on conditions similar to those under which he has already worked, or on conditions which may be agreed between him and the company.

Every certificate of partnership is to entitle the co-partner to a bonus called the co-partnership bonus at the expiration of his contract of service or on his ceasing to be employed by the company, calculated at the rate of 5 per cent. per annum on his salary or wages, for every 1 per cent. above 5 which has been paid by way of dividend, bonus, or interest by the company during its last financial year on the total capital employed in its business.

The co-partners shall in each year elect to be directors of the company, such number of persons not exceeding one-third of the whole board of directors, as may be agreed upon between themselves and the remaining directors, and any director so elected shall enjoy the same rights, privileges and remuneration as any other director, not being the chairman or a vice-chairman or managing director of the company.

There is to be constituted a body of three trustees, of whom one shall be the chairman of the company, one shall be elected annually by the co-partners, and one annually by the board of directors.

The company may pay to the trustees one half (or in the case of a co-partner who so desires the whole) of the co-partnership bonus in any year, and they shall pay to them any portion of the said bonus which may exceed 25 per cent. of the salaries or wages of the co-partners in any year. The sum so paid is to be carried to a special account and proportionally credited to the individual co-partners as from the expiration of the company's last financial year, and is to be invested for them by the trustees either

(*a*) In securities in which trustees are allowed to invest under the Trusts Amendment Act, 1884, the Trustee Act, 1893, or the Colonial Stock Act, 1900, or

(*b*) With the consent of the co-partner in stock or shares of the company itself.

It is further provided that any company which has any part of its capital unissued, may, in lieu of paying any amount not exceeding one-half of the co-partnership bonus, make an issue out of such capital to any co-partner with his consent, and any sum required to be paid in respect of such issue shall be deemed to have been paid by the co-partner, in so far as it does not exceed one-half of the co-partnership bonus to which he is entitled. Provision is made for the voting of co-partners, and, finally, the company may cancel the certificate of partnership in the case of any person who ceases to be in their regular employment for whatever reason. The trustees may, and shall, on his demand, hand over to such a person any sum standing to his credit, and also any share certificates or other documents proving his right to the securities in which they are invested on his behalf, and upon such sums, certificates or other documents being handed over, the liability of the trustees in respect of such co-partner ceases and determines.

INCREASE IN RAILWAY RATES IN CONNECTION WITH THE ELECTRICAL TRADE.

COMMUNICATED.

Although it is practically common knowledge that railway rates have been increased from July 1st, 1913, many of our readers may not know much concerning the inner working of the new Act, so that a few words on the subject may be of interest to those electrical manufacturers and others who forward, or receive, goods over the railway.

There will possibly be an outcry all over the country about the higher rates, as there is little doubt that any increase will greatly affect many trades, and especially the electrical engineering trade. One of the reasons for this is that there are a great number of special or exceptional rates (these rates being lower than the class rates) in force for dynamos and other electrical machinery, and the railway companies' present intentions are that only the special rates shall be increased. We contended some years ago that electrical manufacturers had a grievance against the railway companies for not granting them the same facilities and concessions with regard to cheap rates as were allowed to other traders. Now, when the electrical trade are securing fairly easy rates for the transport of their goods, up goes the special low rates

which they have only derived benefit from for about five years. Dynamos and motors in cases were at one time charged at the second-class rate, which, as an illustration, comes to, say, 40s. per ton. Upon repeated application by certain traders, the railway companies agreed to allow the traffic to come under the Special Rate (which applies between many large centres) for machinery. In this particular instance the special rate was 30s. 8d., so that the reduction was very beneficial to a trader who had to meet foreign competition. Whilst the ordinary class-rate will not be increased, as the railway companies now propose to let it (and all other class-rates) remain stationary, the special, or exceptional rates, will be increased by 4 per cent. A clear idea of the matter may be gained from the following :—

Extract from the Act respecting increases of rates or charges made for the purpose of meeting a rise in the cost of working a railway due to improved labour conditions.

I. (1) Where on a complaint with respect to any increase (within any limit fixed by an Act of Parliament, or by a Provisional Order confirmed by an Act of Parliament) of any rate or charge, under Sec. 1 of the Railway and Canal Traffic Act, 1894, the railway company proves to the satisfaction of the Railway and Canal Commissioners :—

(*a*) That there has been a rise in the cost of working the railway, excluding the cost of carrying and dealing with passengers, resulting from improvements made by the company since August 19th, 1911, in the conditions of employment of their labour or clerical staff ; and

(*b*) That the whole of the particular increase of rate or charge of which complaint is made is part of an increase of rates or charges made for the purpose of meeting the said rise in the cost of working ; and

(*c*) That the increase of rates or charges made for the purpose of meeting the said rise in the cost of working is not, in the whole, greater than is reasonably required for the purpose ; and

(*d*) That the proportion of the increase of rates or charges allocated to the particular traffic with respect to which the complaint is made is not unreasonable : the Commissioners shall treat the increase of rate or charge as justified ; provided that nothing in this section shall be construed as preventing the Commissioners from taking into account any circumstances which are relevant to the determination whether an increase of rates or charges is or is not greater than is reasonably required for the purpose of meeting the said rise in the cost of working.

(2) Where it appears to the Commissioners that the increase of the rate or charge of which complaint is made should for the time being be treated as justified in pursuance of this Act, but that an opportunity should be given after a limited time for reconsidering the increase, they may, in making an order declaring the increase to be justified, add to their order a provision that the question may, after a period to be fixed by the Commissioners, be reopened in accordance with the conditions (if any) made by the order.

(3) Where any such order is made, a complaint may be made as to the increase of the rate or charge under the Railway and Canal Traffic Act, 1894, in accordance with the order of the Commissioners, notwithstanding that the matter has already been determined by the Commissioners.

II. This Act shall not apply to Ireland.

Although the above Act already provides for an increase in all rates where necessary, the railway companies have decided not to increase the class rates, but as already stated only the special rates, and steps will be taken to ensure that the 4 per cent. increase will be equal to, or below, the statutory charges. To prevent mistakes the railway companies have issued the following instructions to their staffs :—

"The rates so charged must not in any case exceed the class rate for the particular commodity concerned, and where the addition of the full increase, as set out above, would result in a higher rate than the class rate, then the class rate must be charged. The increased rates will apply with the same conditions as the existing rates unless the increase results in the class rates being charged, in which case the conditions attached to the class rates will apply. These instructions do not apply to coal and coke, which will continue for the present to be charged at existing rates, or as may be specially advised from time to time."

We are quite aware that railway companies have to pay dividends the same as private traders, but we consider that a 4 per cent. increase on the rate for railway carriage on practically on all electrical plant, may greatly affect the manufacturers' profit.

Seeing that special rates are in operation all over the country for electrical goods, it is easy to understand what difference this 4 per cent increase will make to the carriage on any long-distance traffic, say, from London to the North, especially so on the following goods, which are all generally charged at special rates :— Armatures, commutators, dyamos, electric controllers, electric switch boxes, transformers and coils, end plates for generators, field coils and other parts of general magnets and limbs, motors, rheostats, &c.

In conclusion, it may be said that although these increased rates may seriously handicap the electrical industry, little good can be done by agitating for lower rates, until the Government and traders have seen the effect of the Act upon the railways and trades of the country.

Crystal Palace School of Practical Engineering.— Mr. W. B. Bryan, Chief Engineer of the Metropolitan Water Board, distributed the certificates, &c., at this school on July 31st.

PROCEEDINGS OF INSTITUTIONS.

Wind-Power for the Generation of Electrical Energy.

In the course of a paper on this subject by Mr. W. H. Myers, read before the Electrical Association of New South Wales, the author referred at some length to an installation on the Child system at the house of Mr. P. Waite, near Adelaide, which had been in continuous operation for over two years, with complete success. The author had inspected the plant, and gave the following particulars :—

"The voltage regulation in this instance is only partially obtained by the speed control, a neat system of relays on the main switchboard varying the shunt field resistance so as to further regulate the voltage. Provision is made on the switchboard for the battery to be automatically connected to the generator at full normal voltage (110 volts), and for either half of the battery at half voltage, so that further advantage may be obtained from the lower wind and wheel velocities. End cell regulation is also provided, and the system of supply is three-wire. The wind wheel is 18 ft. diameter, on a tower 60 ft. high. The generator is of 2·5-KW. capacity, with a maximum speed of 1,600 R.P.M., and is shunt-wound. The battery consists of 54 cells of the Tudor type, of a 324 ampere-hours capacity at the three-hour rate. The total number of lamps connected is over 100 of varying candle-powers, and the actual average output (which is metered) amounts to about 3 KW.-hours per night. The plant is also used to operate three flat irons, one radiator, one 1-H.P. motor driving a cream separator, some fans and for occasionally charging the battery of an electric motor-car ; this latter supply, however, is not all derived from the wind-mill. I was informed that the wind-power was amply sufficient for requirements and that, with one exception recently, no mechanical troubles whatever had been experienced. This defect was due to a broken ball in the ball races of the main bearing, and, therefore, in no way belittles the very excellent mechanical design and construction of the plant.

"As a matter of interest, it was noted from the log-book which has been kept that the maximum energy generated in any one day amounted to 16 KW.-hours, although figures of 13 and 14 KW.-hours were commonly obtained. The area of each of the tail vanes is 16 sq. ft. (4 ft. × 4 ft.). About 30 gallons of distilled water are used in 12 months for topping up the battery, and the only other item involving attendance is the adjustment of the Stauffer grease cups, about once per month.

"I saw no sign whatever of wear and tear on the plant, and the battery, as mentioned later, is in excellent condition."

From data he had obtained, he found that in Sydney the average wind velocity was about 8·8 miles per hour ; one could be reasonably certain of velocities averaging 10 M.P.H. or more for fully one-half of each month, and 15 M.P.H. or more for one third of each month. No longer period than four days was on record at Sydney during which a wind velocity of 10 M.P.H. or more did not occur. New Zealand was still more favourably situated in this respect than Australia, as in some districts strong winds blew for weeks at a time.

I.E.E. Students' Tour, 1913.

After several years of tours abroad it was decided this year to hold the annual tour of the Students of the Institution of Electrical Engineers in this country, and Newcastle, the home of the most recently formed Students' Section, was selected. The party left London on Thursday, July 3rd, by the night train, arriving with the early dawn in Newcastle. The first visit was made the same morning to the Elswick works of Messrs. Armstrong, Whitworth and Co., which employ over 20,000 hands. Attention was paid particularly to the ordnance and electrical departments.

In the afternoon a purely "electrical" visit was made to Messrs. Reyrolles. The name is synonymous with switchgear, and in the course of a long visit there was not much missed in that line. An explosion-proof box had been arranged for demonstration ; it was filled with a mixture of air and gas, and then fired with the lid bolted down and with the lid loosely laid on. Flame is prevented from passing outside the box by leaving the flanges roughly machined. The gases can escape through the interstices, but the cooling effect is so great that all flame is extinguished ; in fact, a cold blast is felt on holding the hand beside the flanges when an explosion occurs. When the lid was not bolted down, but merely laid on the box, an explosion of similar intensity lifted it clear of the box and the flame spread all round. The high-tension testing set was next exhibited working up to 100,000 volts, together with its safety switches. Other interesting features were the starting rheostats, with elements made up of metal and compressed carbon powder. The latter, having a negative temperature coefficient, allows the current to grow at a steady predetermined rate, and prevents any excessive rushes. The visitors were entertained at tea by Mr. Clothier, honorary secretary of the Newcastle Section, and several of his staff.

Next morning saw the party early astir to visit Messrs. Parsons's turbine works at Heaton. The outstanding object was the 25,000-KW. set for Chicago, and the machines ranged downward in size from this to a 15-KW. set. The rolling of turbine blades to their finished section in long strips was interesting, and the skill exhibited in the hand-work of straightening the strips was striking. This is really a new trade. A cable-making machine which wound the wires into a flat strip was also seen here ; it was of the same general type as the ordinary machine, but was provided with a flat blade as the core piece, off which the finished cable was drawn.

This arrangement obviates the flattening of the cable to fit it into the slots, thereby preventing damage to the insulation.

In the afternoon a visit was paid to the Harton Colliery, which has a complete electrical equipment. Mr. Georgi, the consulting engineer, conducted the party around the gear at the pit head. The supply is taken from "The" Power Co. (there is only one in that part of the world) at 5,700 volts direct to the winding motors, the most noticeable of the latter being the large Siemens motor at the New Pit. The working face is 2 miles from the shaft, and all the underground haulage is by cable and electric motor.

Next morning saw the party on the way to Carville, but this station is too well known to need any further mention. Perhaps the most interesting part was the control room, where the whole system is laid out diagrammatically, and indicators are provided showing how all the feeders, switches, &c., are connected up, whether alive, and so on. This provides for the complete control of the whole system, extending over 1,400 sq. miles, being in the hands of one man. Another point noticed was the small expenditure on buildings.

The afternoon was devoted to relaxation; the Newcastle Section had arranged for a sail down the River Tyne to Tynemouth, and the visitors joined in. At Tynemouth a brief visit was made to the lighthouse, where vaporised oil and mantles of 1,000 c.p. hold sway, with a 200-c.p. electric lamp as stand-by and oil lamps as a further stand-by. An electric motor, however, is normally used to compress the air for the foghorn and oil feed, there being an oil engine as stand-by. There followed tea and a smoking concert, under the chairmanship of Mr. C. Vernier, supported by Mr. H. W. Clothier, Mr. Georgi and others, the party returning to Newcastle by train.

Sunday morning was occupied by a visit to Dunston, the new station of the power company. This visit was arranged by Mr. Cusworth, of Carville, for a few who were able to stay at short notice, and it was well worth staying for. The switchboard and control house is situated in a separate building about 100 yards from the engine room. The boiler house is as clean as the average station, owing to the use of the suction ash ejector. The ash and clinker are pulverised and dropped into a vacuum tube that removes them and leaves no trace. In the yard were seen some under-running live-rail shields on test, destined for South America.

The welcome and assistance given by the Local Section to the visitors (Mr. Henniker, the students' secretary, needs special mention in this respect) were very well appreciated, and it is believed that the system of visiting a local section, or of the latter visiting London for that matter, is well worth continuing.

LEGAL.

Municipal Wiring Arbitration.

An arbitration recently took place between the Corporation of St. Marylebone and Capt. H. Ramsden, a member of the Council, regarding an account sent to Capt. Ramsden by the sales department for the wiring of his house, the amount of which was in dispute. Mr. R. W. Weekes acted as expert adviser to Capt. Ramsden, and reported that the charge (£76 10s. 6d.) was excessive, and that the work was badly done and ought to be done afresh. The parties agreed to refer the matter to Mr. Albion T. Snell, who, after hearing evidence on both sides, made an award to the effect that £76 10s. 6d. was not a fair price for the work done, but that £48 2s. was a reasonable charge; that having regard to all the circumstances the work had not been carried out on a suitable system nor with the best workmanship, and was not in accordance with the wiring rules of the I.E.E., and that it should be done with enamelled screwed steel tubing on the draw-in system, with 600 megohm grade cables not less than 3/22 s.w.g., no lamp circuit serving more than 10 lamps.

The Corporation was required to pay £30 2s. 6d. for the arbitration fees, £26 5s. to Capt. Ramsden towards his costs, and the costs of it's own expert evidence.

Lambourne & Co. (Manchester), Ltd. *v.* Estin Sheet Galvanising Co., Ltd.

Before Mr. Justice Rowlatt, in the Nisi Prius Court at the West Riding (Yorks.) Assizes, the plaintiffs sought a declaration that they were entitled to be indemnified by the defendants against liability which they (the plaintiffs) had incurred under the Workmen's Compensation Act, 1906. The liability was incurred in respect of compensation for injuries sustained by one of the plaintiffs' workmen.

Mr. E. T. Atkinson, K.C., and Mr. C. F. Lowenthal were for the plaintiffs, and Mr. M. Innes, K.C., and Mr. Mortimer for the defendants.

Plaintiffs' case was that one of their employés (Robt. John Wileman) while engaged upon the work of building two steel-framed sheds for the defendants at South Bank came into contact with a "live" electric wire, which the plaintiffs alleged had been fixed by the defendants for their own purposes, and was in no way connected with plaintiffs' contract. They further alleged that the wire was negligently fixed in that it was not insulated. The plaintiffs had admitted their liability under the Workmen's Compensation Act and from the date of the accident in November, 1912, they had compensated Wileman at the rate of 19s. 3d. per week down to the present time. They now sought to have it established that the man to whom they had paid compensation was injured in circumstances involving a legal liability on the part of the defendants to pay indemnity to the plaintiffs.

The defence was a denial that the defendants were guilty of the negligence alleged, and a denial that Wileman sustained his injuries by contact with a "live" wire. They contended that the man was hurt by slipping or overbalancing himself while standing on an angle bar. Alternately they submitted that the man was guilty of contributory negligence.

The evidence was largely technical, and models illustrating the manner of the accident were brought into Court.

His Lordship gave judgment for the plaintiffs.

The X.L. Electric Company *v.* Aron.

On July 30th, Mr. Justice Neville had before him a motion by the plaintiffs in the action of the X.L. Electric Co. *v.* Aron to commit the defendant for breach of an order made on June 20th last.

The litigation arose over an agreement of assignment of certain patents to the company by Mr. Aron, the inventor, and the order made on June 20th was to restrain him from delaying or preventing, or from permitting to be delayed or prevented, certain patent rights subject to the agreement.

Mr. Simmons, for the defendant, took the preliminary objection that service of the notice of motion, which was for the previous day was bad, as it was served for a day not appointed for motions and did not bear on the face of it that the service was by special leave.

Mr. Peterson, K.C. (with him Mr. Moritz) supported the service, but his Lordship upheld the preliminary objection and refused the motion. Leave was, however, given to serve a fresh notice of motion for the following day.

On the motion coming on on July 31st, Mr. Peterson said he did not desire to press for an attachment, all he wished to do was to protect the patents assigned to the company. If the defendant would do what was required of him the company had no wish to press the motion.

Mr. Simmons asked for an adjournment. New affidavits had, he said, just been served upon him, though the plaintiffs knew all about the matter more than a fortnight ago. The order was made on June 20th, and the company knew the requirements of the Patent Office on June 25th. He asked that the motion might stand over until the first sitting of the Vacation Court (Wednesday, August 6th).

His Lordship said that when he gave leave to serve short notice of motion for that day, he did so to cure an irregularity. He did not intend that fresh evidence should be filed.

Mr. Peterson said he felt some difficulty in proceeding with the matter as it stood, and assented to an adjournment.

His Lordship said he would direct the motion to stand over until the following Wednesday, and give the plaintiffs leave to amend their notice of motion by asking in the alternative for an order to enforce the agreement.

Mr. Simmons asked for costs, and his Lordship said he would reserve the costs. Mr. Simmons submitted that he was entitled to the costs of the motion on the previous day, which had been refused, but his Lordship said he would reserve all the costs. Mr. Simmons asked that they should be reserved to be dealt with by his Lordship personally, not by the Vacation Judge. Mr. Justice Neville said he could not do that. If the Vacation Judge disposed of the motion he must deal with the costs.

The motion was accordingly adjourned, all costs being reserved.

Muir *v.* Chambers.

At the Suffolk Sheriff's Court, a jury assessed the damages in this slander action at £200. Plaintiff, Thomas Muir, is foreman electrician for Messrs. Ransomes & Rapier, Ltd., Ipswich, and defendant, Edward Chambers, was described as a labourer, at one time employed by the firm. Plaintiff claimed that he was much injured in character, credit and reputation by slanders (imputing gross dishonesty, &c.) written and spoken by defendant to the managing director of the firm mentioned.

Torquay Turret Clock.—The large turret clock in the tower at Torquay Town Hall was formally started by the Lady Mayoress on July 30th. This clock has four dials, each 5 ft. 6 in. in diameter. Mr. A. E. Ball, representing Messrs. Gent & Co., Ltd., of Leicester, the makers of the clock, presented the Lady Mayoress with a golden key in the form of a brooch as a souvenir of the occasion. A large installation of Parsons-Sloper secret telephones is also installed in the Town Hall.

Patent Restoration.—An order has been made restoring Letters Patent No. 22,819 of 1908, granted to Thomas John Murday for "Improvements in primary electric clocks."

E

BUSINESS NOTES.

Lead.—Although the lead market showed something of a reactionary disposition in the latter part of last week, there was no reason to be assigned for the backward drift, beyond the fact that it arose from a desire to realise over the holidays. True, there had been a little selling from a somewhat unusual quarter, which was regarded as coming from bears; and the mere fact that attempts were being made to put out short sales was quite sufficient in such a market as that of lead to cause a sharp reaction. Lead has always a narrow market, and the article is often very difficult for a comparative outsider to deal in. Hence the irregular movements occasionally seen even when everything is actually quite sound. As regards the technical position, there is no doubt a considerable oversold account to be adjusted sooner or later, and this is a feature which may in time assume a rather important phase. So far as relief is to be expected, there seems to be not the smallest chance of Mexico contributing to it, for all reports from that distressful country are of the most disquieting character. There has been a very fair run of new demand lately for near deliveries, and some of the big cable people appear to have been in a rather tight place for immediate deliveries, though the tendency has since slackened somewhat. It is no use closing the eyes to the fact that the real position of the article, apart from the day to day fluctuations experienced, and arising from purely local considerations, is one of unabated firmness, and it is only when fundamentals undergo a modification that the intrinsic position of the article will be weakened.

Installation Contracts.—Messrs. Barnets & Soans, electrical contractors, of Burton-on-Trent, have in hand the following installation contracts:—

Crown Maltings, Burton-on-Trent.—Lighting and three-phase power installation for 40 motors with an aggregate H.P. of about 200.
Barnwell Castle, near Oundle.
Creaton Lodge, near Northampton.
Brockhall, near Weedon.
Cranford Hall, near Kettering.
Three-phase power installations for Worthington & Co., Ltd.; Truman, Hanbury, Buxton & Co., Ltd.; and Marston, Thompson & Evershed, Ltd.
New Secondary Schools, Kettering.
New Mining and Pottery Schools, Stoke-on-Trent.
Extension to North Staffordshire Infirmary, Stoke-on-Trent.

The firm have just completed the installation at the New Stoke Town Hall.

Consular Notes.—Russia.—The British Consul at Batoum reports that with a steady production averaging about 250 tons of copper per month, the Caucasus Copper Co. had a fairly profitable year in 1912. The directors of the company decided to proceed with measures for increasing the output of copper. Active steps were taken to carry out this work in 1912, and an additional large furnace was built at the smelting works; new roasters, a dust chamber and other improvements were introduced. A scheme for generating electric power by utilising the waste heat from the furnaces for raising steam was brought into existence, and a new power house equipped with machinery for developing up to 1,000 H.P. was added to the existing electrical plant. The concentration plant of the company was also extended during the year, and another unit to treat 500 tons of ore per diem is now being added to the installations under this head already in operation. It is expected that the new plant will be completed before very long, when the production will be almost doubled. This company's production in 1912 was about 40,000 tons of ore, and about 3,000 tons of copper.

The British Consul at Baku reports that the trade in internal combustion engines there is still progressing, the British makes of both oil and gas engines easily holding their own, but the heavier engines of the so-called Diesel type appear to be monopolised by Russian engineering works. British pumps, more especially transmission pumps, are still selling well. Wire ropes, belting and electric appliances, are shut out by the prohibitive rates of duty, but an American electric manufacturing company has recently secured a large proportion of the local electric business, by building works in Russia. Wire ropes, oil and gas motors and pumps are now practically the only articles in constant demand on the oilfields regarding which there is not a combination or understanding in the trade in question, to the detriment of the purchasing, oil-producing firms.

Later, in his report, the Consul states that the concession for electric trams granted to a Belgian company was not confirmed by the Viceroy of the Caucasus. It is now stated that this matter will shortly be referred back to the town authorities, the various alterations that are now required to be made in the contracts being specified. A refusal of the new terms must be first given to the Belgian company, and it was anticipated that an agreement would be come to and the question definitely settled early this year.

France.—The British Consul at Brest reports that the electric light and power works at Brest are not yet complete, but the town is now lighted by electricity, and work is sufficiently advanced to supply the town and suburbs of Brest with light and power. For the moment the company intend making provision for a radius of 15 miles round Brest, but they are ready to exploit the whole of North Finistère as soon as the demand is sufficient to warrant the enterprise.

Bosnia.—The British Consul at Sarajevo reports that electric light works are being erected at Livno. It is also proposed to obtain 26,000 H.P. from the River Rama for use partly on the Bugojno and Rama line, and partly in mines and industrial undertakings in the neighbourhood. The Aussig Chemico-Metallurgical Association has, it appears, obtained a concession for the erection of a power station at Jablanica, on the Narenta, to provide 21,000 H.P. for the working of a chemical factory, and 5,000 H.P. for the use of the Sarajevo and Gravosa Railway. A Dalmatian syndicate propose to utilise both the Narenta and the Rama below Jablanica for the production of about 9,000 H.P.

Hong Kong.—The American Consul at Hong Kong says that increased and increasing calls for lighting apparatus, fans and various special lamps are reported by Hong Kong importers. General progress is responsible for much of the demand, but the fact that Chinese merchants have found well-placed electric lights more effective and more economical than the lights previously used in their places of business is also responsible for the present increase. The demand for current has been such as to tax the capacity of local plants, while the extensive use of electric light has so directly affected the gas company that a little over two years ago it reduced the price of gas from $3.25 to $2.75 local currency per thousand feet (from 6s. to 5s. 6d. gold at exchange current at that date), and a reduction to $2.60 local currency has been made in the past six months. Further reductions are promised upon the completion of a new installation now being erected. There is also a strong demand for electric light installations ranging from 60 lights up to 30,000 lights, including complete engine and power equipment, dynamos, switchboards and wires and cables. The power desired is almost exclusively kerosene, crude oil or suction-gas motors of few and simple parts, which can be run by native engineers. A contract has recently been let for a considerable plant at Fatshan, a suburb of Canton, which has been secured by an English branch of a concern generally considered American. A small plant for Kongmun is being competed for. The demand for these small plants is growing to such an extent that various American and other foreign concerns are reorganising their South China agencies with a view to handling more business. The demand for electric equipment generally includes all kinds of lamps, lamp-stands and shades, particularly the new varieties of metal-filament lamps; various grades of insulated wires and cables; insulating blocks; and nearly all modern electric novelties. The use of electric irons, toasters, &c., so far is limited to foreign residents here. There is a growing trade in heaters for use in cool weather in Hong Kong and aboard ship. In fact, one of the strongest elements in the demand for all these goods at the present time is that for use aboard ship either in the way of temporary or supplementary installation or for introducing complete lighting systems in vessels overhauled here.

The demand for electric fans of all kinds is greatly on the increase. The demand for fans in Hong Kong is largely for ceiling fans of wide radius and several speeds. The Hong Kong power service is an alternating 100-volt current of 72 cycles per second. However, there has developed a considerable demand for desk fans for use abroad ship, and as a rule direct current is supplied for these. The current in Kowloon and various other points about Hong Kong is direct.

Dominion Republic.—The British Consul reports that a sum of 10,000 dollars has been set aside to bring into a state of efficiency the wireless apparatus already installed in Santo Domingo.

Canada.—The American Consul in Ontario reports that of the three hydro-electric power companies located on the Canadian side of the river at Niagara Falls, one has installed, during the past year, three generators of 15,000 H.P. each. Another will, during the present year or early in 1914, have in operation four additional generators of 13,000 H.P. each, while the third reports a large sum set apart for improvements to be inaugurated in the near future. Taking advantage of cheap factory sites, reliable power, and excellent transportation facilities, seven manufacturing industries of more or less importance have been established in this city during the past year, while a number of previously established factories have doubled their capacity during that time. The city industrial committee is negotiating with a number of manufacturing concerns who contemplate locating in Canada.

The Niagara, St. Catherine's and Toronto Railway (electric) is constructing a branch line connecting the city of St. Catherine's with Niagara-on-the-Lake at the mouth of the Niagara River. The line will be from 12 to 15 miles long, and will add another much-needed outlet for the products of this fertile fruit district.

The "Vita" Electric Heater.—Another simple electric heater which can be immersed in any liquid contained in an ordinary vessel, has been introduced by Messrs. Wagner and Geastley, Ltd., 28, Milton Street, E.C., who are the sole London agents. It can be connected to a lampholder with flex, and takes 440 watts, which suffices to boil a pint of water in five minutes. For many purposes such a device should prove exceedingly convenient

Bankruptcy Proceedings. — James Edwin Stott (trading as James E. Stott & Co.), electrician, 10, Wood Street, Byram Arcade, and 19, Westfield Road, Huddersfield, York.—An application was made at the County Court House, Queen Street, Huddersfield, on July 31st, for the discharge from bankruptcy of the above-named debtor. The Official Receiver pointed out that the receiving order was made against the debtor in March, 1898. At his public examination the debtor failed to produce certain books, which he had destroyed, but he (the Official Receiver) did not suggest that the destruction was done wilfully. Another matter which he thought might be brought before the Court, was that the debtor failed to give an account of how he lost £80 on a contract, but the sole cause of his failure was due to inexperience and youth. Mr. A. E. T. Hincholiffe, in supporting the application

for discharge, said the debtor was only 21 when he launched into business on his own account. He had had no experience in commercial life or financial affairs, but when he commenced business electricity was making rapid headway. He borrowed £50 from his mother, and put some money of his own into the concern. This was his undoing, but he would like to point out that there was no charge of fraud made against the debtor, and no doubt the failure had been brought about by inexperience and youth. It was quite true the debtor lost money on contracts, and he started his business as though he was going to set the Thames on fire. It was then found that he was not making any profits. Debtor had no intention of commencing business again, for a while at any rate, and it was 14 years since the receiving order was made. He ventured to say that if the debtor had made application before the Court for his discharge some 11 or 12 years ago, he would not have been applying for it that day. Debtor, in reply to his Honour, said he could not give any reason how he lost £80 on a certain contract, unless it was by underestimating. His Honour said it was an unfortunate failure, and the discharge would be suspended for three years.

W. R. Wedge, electrical engineer, Albion Place, Northampton.—Receiving order made on creditor's petition, July 28th. First meeting, August 13th; public examination, October 13th; both at Northampton.

Joseph Swainson (J. Swainson & Co.), electrical contractor, 22, Booth Street, Manchester.—First meeting, August 14th; public examination, September 19th; both at Manchester.

Book Notices.—*Universal Directory of Railway Officials*, 1913. London: The Directory Publishing Co., Ltd. 10s.—This useful publication, the contents of which are compiled from official sources under the direction of Mr. S. R. Blundstone, editor of the *Railway Engineer*, contains information relating to Home railway and tramway undertakings, their *personnel*, mileage, motive power, &c. In many cases the names of municipal tramway committeemen are included. Foreign and Colonial systems have also a large amount of space devoted to them. The indexes are both geographical (as to systems) and personal (as to directors and officials).

"Handbook for Wireless Telegraph Operators, working installations licensed by H. M. Postmaster-General." London: Eyre and Spottiswoode, Ltd. Price 3d.

City and Guilds of London Institute Department of Technology. "Programme for the Session 1913-14." London: John Murray. Price 9d. net.

Dissolutions and Liquidations.—H. A. Harvey and Co., Ltd., mechanical engineers and contractors, Norfolk House, Laurence Pountney Hill, E.C.—At the London Bankruptcy Court, on July 30th, the statutory first meetings were held of the creditors and shareholders of this company. Mr. H. E. Burgess, Official Receiver, reported that the company was promoted less than two years ago, with a capital of £50,000, to take over a business which had been carried on by Messrs. Harvey and Lee, under the style of H. A. Harvey & Co., for one year previously. The company paid about £7,000 in shares for the assets of the business, and took over liabilities to the amount of £1,000. The business of the company was chiefly that of exploiting patents and forming companies to take them over. They had spent a good deal of money, and there had been a loss on the trading throughout. In November, 1911, the directors promoted the Harvey Electrochemical Co., to take over the businesses of the Harvey Exploitations Syndicate and the Metal Depositing Syndicates. At a general meeting, held on November 4th, 1912, a balance-sheet was produced, the figures of which could not be borne out by facts. It returned 23,740 shares of 1s. each in a new subsidiary company as being worth £23,740, and in that way a profit of £16,786 was shown, but it could not be justified, because the company had in reality made a loss on the year's trading. On the strength of that balance-sheet further moneys were subscribed for the company's shares which would not have been forthcoming had the true facts been disclosed. The result of the company's trading was that they were now indebted to the extent of £4,800 to debenture-holders, and owed £3,500 to unsecured creditors; the assets were only valued at £4,090, which was not sufficient to meet the claims of the preferential creditors and the debenture-holders. Consequently there could be no payment to the unsecured creditors or the shareholders. The account with the latter showed a deficiency of £27,856. Mr. Wm. A. Henderson, chartered accountant, and the Official Receiver were respectively nominated for the post of liquidator, and the appointment will be decided in due course by the Registrar. The following are the principal unsecured creditors:—

Buck & Hickman	£87	Potter, F. W., & Co., Ltd. ..	£127
General Electric Co.	22	Siemens Bros. Dynamo Co. ..	220
Phœnix Motor Co.	160	Tilghman's Patent Sand Blast	47
Phœnix Dynamo Co.	252	Victoria Dynamo Co.	45

National Telephone Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. George Franklin, 22, Broad St. Avenue, E.C., by August 25th.

Hebburn Boiler Co., Ltd.—A meeting is to be held at 18, Market Street, Newcastle-on-Tyne, on September 11th, to hear an account of the winding-up from the liquidator, Mr. J. Taylor.

With reference to the notice which appeared on page 1022 of our issue of June 20th respecting H. Barder & Co., Johannesburg, Mr. A. Solomon, writing from Johannesburg under date July 14th, asks us to state that Mr. Barder has retired from the firm, and the business is now carried on under the style of the Rand Electrical Co., who take over all liabilities, stock and assets completely, Mr. Solomon being now in sole control. All communications for this firm in future are to be addressed to Corner of Loveday and Anderson Streets, or Post Office, Box 2712. Cables, "Reco, Johannesburg, S.A." Particulars of specialities are invited from manufacturers and wholesale merchants.

Mexican Fuel and Power Co., Ltd.—This company is winding up voluntarily, with the Hon. R. C. F. Chichester, Pinner's Hall, E.C., as liquidator. A meeting of creditors is called for August 11th.

London and Paris Magneto Co., magneto specialists, 154 and 156, Great Portland Street, London.—Messrs. L. Vogler and H. E. Kottmann have dissolved partnership. Mr. Vogler attends to debts and continues the business under the same name.

For Sale.—The Brighouse Corporation Sewerage Committee is offering for disposal electrical and other plant, of which particulars are given in our advertisement pages to-day.

The Holidays.—The works of Messrs. S. Bill & Co., Ltd., Aston, Birmingham, are closed until Monday next, 11th inst. The offices are open.

Private Arrangements.—George Diggins (trading as George Diggins & Co.), 75, Beak Street, London, W., electrical engineer, &c.—The creditors interested herein were called together last week, when a statement of affairs was presented, showing the position as at July 30th. This disclosed liabilities of £300. The assets were estimated to realise £415 net, or a surplus of £115. The debtor started in business nine years ago at Kensington, in partnership. About six years ago the partnership was dissolved, and in 1909 the debtor started at Beak Street, with a capital of £20. Owing to threatening creditors, the debtor had executed a deed of assignment. The debtor made an offer of 20s. in the £ at three, six, nine and 12 months, secured by the deed. It was resolved that the offer be accepted, secured by the composition deed, and that a committee of the three largest creditors should be appointed.

Catalogues and Lists.—Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Eight-page illustrated pamphlet, giving particulars and prices of electric desk and bracket fans. Further fan lists are printing.

Messrs. Krupka & Jacoby, Westminster, S.W.—Illustrated and priced leaflets relating to Holophane reflectors and metallic-filament lamp fittings.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—Pamphlet No. 1,742, containing a fully-illustrated description of their automatic coal crusher and sampler.

Messrs. Siemens Bros. Dynamo Works, Ltd., inform us that they will shortly be revising and extending their "Wotan" Battery Lamp List, but in the meantime they invite special inquiries addressed to the Battery Lamp Department, at Tyssen Street, Dalston, N.E. "Wotan" battery lamps (drawn wire) are manufactured for voltages from 1·3 to 18 from ¼ to 50 c.p.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Booklet No. 17 contains description, with neatly executed illustrations, of their Pulsynetic picture indicators for use in cinematograph theatres, so that whether you are in the lounge, the café, or the entrance hall you can tell the number of the picture that is being shown. Prices are stated. We have also received from the firm a framed picture (in colour), entitled "Flood Tide—Port of Liverpool," showing the new Dock offices and the Royal Liver Building, also large vessels, for which they have supplied electric bells and telephones and electric clocks.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—Eight-page List, No. 3,177, containing illustrated information and prices respecting electric fans—table, lampholder, battery, automatic air, exhaust, ceiling and porthole types, also speed regulators for same.

Trade Announcements.—Owing to increased business, Messrs. Harry Wittasen & Co. have removed to more extensive and convenient premises in 24, Thavies Inn, London, where they are showing their latest designs in electrical glassware.

Messrs. Mann, Egerton & Co., Ltd., have removed the electrical department of their business from 5, Bank Plain, to 21 and 23, King Street, Norwich.

San Francisco Exhibition.—It is understood that neither Great Britain nor Germany will take part officially in the Panama Exhibition at San Francisco, but that, of course, individual firms will be at liberty to do as they please.

LIGHTING and POWER NOTES.

Accrington.—The electrical engineer has been instructed to prepare plans and estimates for an additional water filter to keep pace with the requirements of the boilers at the electricity works; and also to submit an estimate of the sum required for extensions of mains and service cables, and the provision of extra high-tension switchgear and transformers for the ensuing three years, with a view to application being made for borrowing powers.

During the quarter ended June 30th, the Corporation sold 1,183,189 units as against 982,799 units for the corresponding period of last year, or an increase of 200,390.

Aberdeen.—The authorities of Banchery, Aboyne and Ballater are considering a scheme for lighting, by electricity, their respective burghs; the current would be supplied by the Aberdeen Corporation, and sub-stations would be erected at the places mentioned.

Atherton.—The D.C. has made arrangements for the provision of a new electrical transforming station in the centre of the town, and simultaneously with the erection and equipment of the building, the street mains will be sectionalised and duplicated.

Aylesbury.—New Generating Station.—The U.D.C. has decided to proceed with an E.L. scheme, using Diesel oil-engine sets, and to erect a generating station in the centre of the town The estimated cost, with a dust destructor, is £31,387.

Barnsley.—Annual Accounts.—The returns for the last year's working of the electricity department show a total revenue of £15,388, and expenditure in production, management, &c., amounting to £8,352, leaving a gross balance of £7,036. After payment of interest, sinking fund, &c., a net balance of £581 remained; £500 was allocated in relief of the rates, making a total of over £7,000 contributed in this way from the department's profits. The units sold during the year were 2,055,570. The year's profits were on a smaller scale than in previous years, due to increased coal prices and financial charges, and reduced charges for lighting; fortunately, the new turbine and boiler plant helped in the matter of coal, as the following figures show:—

Year.	Units generated.	Coal used, tons.	Coal cost.	Average price, p.t.	lb. per unit generated.
1912 ...	2,021,216	7,680	£2,399	6/3	8·58
1913 ...	2,435,798	6,809	£3,004	8/10	6·27

The whole of the public lamps are electrically lighted, and during the year metallic clusters were substituted for the arc lamps formerly used.

Barton-on-Humber. — Electricity Supply Commenced.—The ceremony of inaugurating the electricity supply for the town, provided by a local syndicate, was at the end of last week performed by the chairman of the Urban Council, Mr. W. A. Stow. The syndicate, whose resident engineer is Mr. Gooch, late of Barrow-in-Furness, has been given the contract for public lighting for 12 years.

Bedworth.—Street Lighting.—The P.C. has signed an agreement with the Leicestershire and Warwickshire Power Co. for public lighting from August 14th.

Bradford.—Street Lighting.—A special Sub-Committee of the Finance and General Purposes Committee, after the matter had been considered by the electrical and gas engineers, has recommended the Council to light the Thornbury and Tyersal districts by means of electricity, and to erect approximately 84 electric lamps in streets in which electricity mains are already laid, the lighting to be charged for at the same rate as in the case of Tong Street, Dudley Hill. The annual charge is to be £4 per 200-watt lantern, and certain gas lamps in side streets are to be converted into electrical lamps at an annual inclusive cost of £2 12s. 6d. per lamp.

The electrical engineer has also been authorised to carry out the necessary works for lighting by electricity, at an annual inclusive charge of £7 per 500-watt lantern, of six main road crossings.

The chairman and deputy-chairman of the Electricity Committee, together with the electrical engineer (Mr. T. Roles) have been appointed to visit certain generating stations at Berlin and other cities on the Continent for the purpose of inspecting turbo-generating plant.

A Financial Report.—In a report which has been prepared by the Bradford city treasurer (Mr. F. Ogden Whiteley) for the Electricity Committee, figures are given which show that the total amount expended on the electricity works and plant has been £932,000, which includes £12,000 paid directly from revenue, and £55,000 from renewals account. Out of this huge amount the present debt is only £502,000, representing 54 per cent. on the full sum. The expenditure on the Bolton Road works, which were erected in 1899, was £41,000, and all but 16 per cent. of this has been paid off, whilst in connection with the cost of the machinery no less than 90 per cent. of the outlay has been extinguished. At the Valley Road works over 50 per cent. of the cost of the land has been paid off, and there is only an outstanding debt of £64,000 on No. 2 Works—38 per cent. of the expenditure. No. 3 Works have only been opened comparatively recently, but one-third of the money spent in building the place and fitting it with machinery has been paid off. Last year the income increased by, practically, £10,000, and the amount contributed to reserve and renewals account to date is £79,000, of which £55,000 has been spent, leaving a balance of £24,000.

At the T.C. meeting when the proposal to borrow £86,250 for new plant was considered, mention was made of the suggested expenditure of £500,000 on new works to replace those at Valley Road, and a question was asked as to whether it would not be better to go on straight away with that work and spend the £86,000 upon that scheme, but it was pointed out that the Valley Road works would always be retained as a transforming and distributing station, and it would pay the Corporation to spend £86,000 on the Valley Road works, even if they were only going to remain there for 10 years, rather than spend £500,000 on new works and pay £40,000 a year in interest and sinking fund.

Bridlington.—The L.G.B. has advised the Electricity Committee to obtain Parliamentary powers to supply electricity outside the borough.

Brighouse.—Electricity at Sewage Works.—The T.C. has decided to substitute electric power for steam power at the sewage disposal works, and to obtain a supply of electric current from the Yorks. Electric Power Co., in respect of which an agreement is to be entered into which will be in force until 1927, instead of 1920, as previously suggested.

Bristol.—A proposal by Mr. Gane, recently adopted by the T.C., urges on the Electricity and other committees the advisability of substituting electricity for gas in buildings owned or controlled by the Corporation.

Canada.—The report for the first fiscal year of the Winnipeg municipal plant, ending April 30th, 1913, shows a deficit of $53,024 88 for the 12 months. It is pointed out, however, that the plant commenced actual earning only last September, and that other delays occurred in connecting up offered business. The total operating earnings of the power department for the fiscal year amounted to $475,509.57. Total charges in the same year, including interest on stock and debentures, sinking fund, and an allowance of $52,862 for depreciation, amounted to $529,442.60. The revenue deficit for the year is, therefore, $53,024.88.—*Electrical World.*

Caton.—Street Lighting.—The installation of the electric light at Caton has already been commenced, and consumers connected up. If funds are available, electricity will be utilised for public lighting in place of the present oil lamps.

Chelmsford.—The T.C. has referred back for further consideration a recommendation by the Lighting Committee to the effect that at present it would not be advisable for the Corporation to take steps to purchase the undertaking of the Electric Supply Corporation, Ltd.

Cheltenham.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £2,000 for mains extensions. The cables are to be extended so as to supply current to the Borough Laundry in the Swindon Road.

Chorley.—Prov. Order.—At a meeting of the T.C. on July 31st, it was reported that the Lancashire Electric Power Co. had written intimating that it was its intention to apply to the B. of T. for a prov. order to authorise the company to supply electricity within the borough. The matter was referred to a sub-committee.

Continental Notes.—Germany.—In connection with the plant which is being put down to utilise the water-power of the River Weser at Dorverden, Messrs. Amme, Gieseike & Konegen, of Brunswick, have secured an order for a number of turbines, the outside diameter of which will be no less than 15¾ ft.—they being described as the largest turbines so far built in Germany.

Portugal.—A scheme is under consideration for the establishment of a central generating station for the supply of electrical energy for lighting and power purposes in the Guarda and Belmonte districts of Portugal.

Corsham.—Mr. Edwards, of Bristol, has informed the local authority that he intends applying for a prov. order for electric supply at Corsham. The P.C., which has had the matter brought to its notice, is in favour of a scheme being carried out.

Dover.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £350 for a period of ten years for the provision of two new superheaters at the electricity station.

Ealing.—The Council has agreed to supply Mr. A. F. Berry with electricity for experimental water heating, at ½d. per unit.

Edinburgh.—At a meeting of the T.C., Councillor Stevenson moved that the surplus on the electric lighting accounts, amounting to £2,169, be applied towards the reduction of the capital money borrowed for electricity purposes. He pointed out that by the increased use of metal filament lamps, the sales for lighting remained stationary. A large scheme of extension was absolutely necessary, and that would involve additional expenditure. Councillor Harrison, moved as an amendment, that the surplus be applied towards the rates, on the ground that the treasurer needed the money. This was seconded, and on a vote, the amendment was carried by 28 votes to 16.

Exeter.—The Governors of the Royal Devon and Exeter Hospital have adopted a scheme for improving the electricity and heating departments at the hospital at a cost of £1,723, under which the entire buildings are to be connected with the municipal supply of electricity.

Fife.—Through the breakdown of a turbine at the Fife Electric Power Co.'s generating station at Townhill, the greater portion of the tramway service in Fife was brought to a standstill on Monday.

Finchley.—The U.D.C. has approved a report of the Electricity Committee which stated that applications had been received from a number of householders and others for a supply of electricity to premises just outside the Finchley area, and in order to avoid any possible delay entailed by approaching the Friern Barnet Council on each set of applications, it had been suggested that the Council might agree (subject to the consent of the B. of T. and the other necessary parties to each such set of

applications) to the Finchley Council supplying any premises within a defined area where the occupiers signifies their desire for such supply. As a result of correspondence with the Friern Barnet Council, a plan of the suggested area had been prepared for the consideration of the latter authority.

Gillingham (Kent).—The T.C. has authorised the electrical engineer to purchase sets of electric cookers for hiring-out purposes.

Glasgow.—Annual Accounts.—The electricity department returns for the year ended May 31st last show that the gross revenue amounted to £345,749, against £319,932 in the previous year, and the working expenditure to £170,640, against £138,515—a surplus of £175,109, compared with £181,417. Out of this the Committee had to meet the interest on loans, sinking fund, &c., which amounted to £117,282, compared with £115,351. This left a balance of £57,827 on the year's working—£66,066 last year—from which there was deducted for depreciation, &c., £50,307, compared with £55,315. This left a surplus on the year's operations of £7,520, against £10,751 in 1911-12; this has been transferred to the credit of the several reserve funds, which now amount to £60,372. The increase of income from all sources amounted to £25,817; on the other hand, the working expenses increased £32,125, principally due, apart from the larger output, to the higher price paid for coal, and also to an increase in respect of rates, taxes and assessments. The depreciation written off the capital account since the inception of the undertakings is as follows: Glasgow, £545,987; Govan, £2,301; Partick, nil. Total, £548,288. Notwithstanding that contracts have been entered into for the supply of coal at an estimated increased expenditure of £5,500 as compared with the year just closed, the Committee recommended that for private lighting purposes the price of current remain at 3½d. per unit, but that the quantity be reduced from an equivalent consumed per annum averaging 650 hours to 600 hours, and that for heating purposes—250 to 500-volt supply—the rate for any quantity of current, equivalent to 1,000 hours per annum of the maximum demand, be reduced from 1½d. to ¾d. per unit, and that the special rate to domestic consumers, for current used for cooking, heating, or other domestic uses, over 800 hours use per annum of the maximum demand for lighting, where energy for lighting and power purposes is taken through the same meter, be ¾d. per unit instead of 1d. The quantity of electricity sold to private consumers during the past year in the Glasgow, Govan, and Partick areas was 60,133,955 units, of which 18,482,899 units were for lighting and 41,651,056 for power purposes, the revenues being £186,018 and £136,058 respectively, while the total number of consumers was 27,848. The total number of motors in use was 8,805, with a total H.P. of 59,144. In connection with the electric lighting of public streets, the Committee has now practically completed the replacement of old type lamps by flame arc lamps in the old Glasgow area. This has so greatly improved the illumination of the streets, that a further order for flame arc lamps has been placed, principally for Main Street, Gorbals. The total of lamps or other current-consuming apparatus connected to the mains was 82,016 KW., and the maximum load occurred on December 18th last, when it was 33,639 KW.

At a recent T.C. meeting, discussion took place over a proposal to send the electrical engineer and a member of the Electricity Committee to the United States for the purpose of getting information as to the largest installations of plant in operation there. Bailie Smith pointed out that the Corporation had purchased a large piece of ground for the purpose of erecting a new generating station, and as their present stations were equal to anything in Great Britain, they wished to see what could be learned by a visit to the largest and best stations in the world, particularly at Chicago. The sum involved in the proposed station would be about a quarter of a million sterling. No consulting engineer would be employed. It was decided, after a long discussion, to send the deputation, which will consist, probably, of the convener (Bailie Smith) and the engineer, Mr. W. W. Lackie.

Gloucester.—Annual Accounts.—The last year's working of the electricity department shows a deficit of £106 after meeting all charges. The revenue increased by £1,100, and the gross profit, £6,747, was £500 more than in the previous year, but extra capital charges on plant, which had not been fully used during the year neutralised this. The output for all purposes was 1,718,000 units.

Great Harwood (Lancs.).—The Proposed Electricity Supply.—It is reported that there is every indication that the local electricity question will soon be settled, and that it is not unlikely that current will be taken from Accrington in bulk. Last week a local sub-committee had a conference with an Accrington Corporation committee, when terms were discussed.

Halesowen.—The Midland Electric Corporation for Power Distribution, Ltd., has applied to the B. of T. for consent to supply current in bulk to the Halesowen Lighting and Traction Co., Ltd. The latter company has informed the R.D.C. that it is about to lay cables for the supply of current in the Council's area under the prov. order obtained.

Havant.—Prov. Order.—The U.D.C. has been informed that a prov. order for electric light at Havant and Emsworth is being applied for by Messrs. Biscoe-Smith & Blagg.

Haworth (near Keighley).—Prov. Order.—The Council proposes to apply at the end of the year for a prov. order to enable it to supply electrical energy.

Henley-on-Thames.—Prov. Order.—The T.C. on July 30th received notice of the intention of Messrs. Foote and Milne, of London, to apply for a prov. order for electricity supply.

Hove.—A Joint Committee, appointed by the T.C. to consider what steps shall be taken respecting the powers obtained to purchase the undertaking of the E.L. Co., has intimated that, before coming to any conclusion, it will be willing to receive, and give careful consideration to, any authorised proposals or suggestions which may be forwarded by persons interested in the matter, such as the taking over and working of the undertaking. Opinions on the question of municipal trading in the borough are divided.

Japan.—Now that the amalgamation scheme between the Nippon Electric Light Co. and the Tokio Electric Light Co. has been dropped, a price-cutting war would appear to have set in with regard to electricity supply in the Japanese capital, three of the companies having just announced a reduction in their charges.

Kingstown.—Considerable discussion has been aroused here by the action of Messrs. Field and Mooney, M.P.'s, in blocking the Parliamentary proceedings to give Kingstown electric light through the medium of a private company which, it is stated, has already spent some £2,000 in preliminary operations. The company in question, when starting operations, made offers to the neighbouring Urban Districts of Dalkey and Blackrock. The Blackrock Council, then negotiating with Pembroke Urban District Council for electric light, did not accept. The Dalkey authorities accepted, but at a later period the agreement fell through owing to the question of overhead or underground wires becoming a point at issue. The company's operations, therefore, became restricted to Kingstown. The blocking of the proceedings comes as an unpleasant shock to the Kingstown Council, which had approved the scheme, and to those interested in the venture.

Limerick.—Last week Mr. A. D. Price, of the L.G.B., held an inquiry into an application of the Corporation for a loan of £9,500, to extend the electrical lighting plant. It was stated that the concern had been working at a loss, £2,000 having been voted last year from the rates to meet the deficit. It was calculated, however, that there would be an increased revenue this year.

Llandudno.—The Electricity Committee has had under consideration a financial statement prepared by the accountant on the result of the year's working of the electricity undertaking for the 12 months ending March 31st, 1913, and it was resolved that the Council be recommended to make a price reduction to consumers as follows:—Maximum demand rate, from 7d. and 2d. to 6d. and 2d.; flat rate, from 4½d. to 4¼d. per unit.

London.—Port Crane Equipment.—As recently mentioned in these notes the Port of London Authority is to install at the Albert Dock 43 electric luffing cranes, each of 60 ft. radius, and of a lifting capacity of 30 cwt. at ordinary speed, with gear to admit of lifting 3 tons at a slower speed. We understand from a usually well-informed correspondent that the contract for the whole of these 43 cranes has been provisionally placed with Messrs. Babcock & Wilcox, Ltd. The cranes will be erected on the north side of the Albert Dock; a total expenditure of £104,000 has recently been authorised for the provision of these new cranes.

Hammersmith.—Street Lighting.—The Works Committee proposes, subject to the concurrence of the Electricity Committee to the terms suggested, to convert 50 side street gas lamps for electric lighting at an estimated cost of £300. The amount proposed to be paid to the Electricity Committee for current, maintenance, &c., is at the reduced rate of £2 7s. per lamp per annum, as against the present payment of £2 14s. for electricity (and £2 6s. 10d. for gas). The question of reducing the charge for the existing electric lamps in side streets (£2 14s., plus 7s. repayment of capital charge with interest) is under consideration.

Lambeth.—The B. of G. has accepted an offer of the South London Electric Supply Corporation, to provide at the infirmary, free of cost to the guardians, a special installation for power supply, so that the lighting supply may be quite distinct from the power supply, and thus prevent the present objectionable fluctuation in the lighting.

City Street Lighting.—The City Engineer's report on street lighting matters shows that there were 402 arc lamps in regular use and 21 experimental arc lamps and 45 metallic-filament lamps in addition, a total of 468 electric lamps in all. The experimental electric lighting consists of 3,000 and 4,000-C.P. arcs and 75-C.P. metal lamps; it is hoped that by next winter the new lighting arrangements under which the city will be illuminated in about equal proportions by electricity and gas, will be nearly complete.

Luton.—The B. of T. has approved the Council's proposal to give supplies of energy at extra-high pressure.

Lytham.—The question of electric lighting has proceeded a step further. The D.C. has had the matter under consideration, and a communication is understood to have been sent to St. Anne's Council, which owns its own electricity works, regarding a supply in bulk. Since the B of T. enquiry into Lytham's application for power to have control over the electric lighting of the town, the question has been carefully discussed.

Manchester.—For the quarter ended June 30th, the distribution of electricity for lighting is 12½ per cent. larger than for the corresponding period of last year. The figures as to the use of electricity for power purposes are 29¼ per cent. ahead of anything recorded before in Manchester.

Nuneaton.—Correction.—In our issue of July 25th the new plant recently started up at the Council's electricity works was referred to as "of B.T.H. make"; we are now informed by Messrs. Siemens Bros. Dynamo Works, that the turbo-generator in question was supplied by them.

Rothesay.—Mount Stuart, Bute, the residence of the Marquis of Bute, is to be completely fitted with electric lighting, heating and cooking, and also a ventilation system worked by electricity. The contract has been secured by a Paisley firm, and the work will be completed in two years. In all there are 2,500 lamps. The number of bedrooms to be fitted is 165.

Rushden.—The E.L. Co. is making preparations for a supply of current, and generating plant is being installed at the works.

Salford.—Sanction is being sought to the borrowing of £6,935, the amount deducted by the L.G.B. from the sum applied for in respect of rotary converter plant.

South Africa.—The new steam turbo-alternator at the Cape Town electric light works in Dock Road was inspected recently by members of the Corporation. This turbine-alternator, which is of 2,000-kw. capacity, was supplied by the B.T.H. Co., and the condensing plant manufactured by Messrs. Richardsons and Westgarth. A 1,000-kw. Peebles motor-converter has also been installed. The plant at the inauguration of the power station in 1903 consisted of two 750-kw., one 300-kw. and one 150-kw. d.c. steam generators; a total of 1,950 kw. In 1909, when the supply to the Government railways and harbours was undertaken, two 400-kw. a.c. steam-driven generators were installed, making the total capacity of the plant 2,750 kw. Subsequently, owing to the supply area being extended to Sea Point and the southern suburbs, and to the general increase of consumers, it was decided to install the further additional plant.

Spilsby.—Messrs. Crompton & Co., of London, have informed the R.D.C. that they intend applying for a prov. order for electric light at Ingoldmells, Winthorpe, Burgh, Croft, Wainfleet and Friskney.

Walmer.—At a meeting of the U.D.C. on July 31st, a letter was received from Messrs. Horace Boot & Partners suggesting that the Council should take advice as to the advisability of taking over a prov. order for electric light, and obtaining current at a low rate from one of the adjoining collieries, and so place at the disposal of the ratepayers a cheap supply of electricity. A member asked when the existing syndicate would be supplying current, and the chairman replied that the matter was proceeding satisfactorily, and he thought that before long there would be something definite to put before the Council. Those interested in the supply were doing all they could to further it.

Warrington.—Electricity Works Fire.—An outbreak of fire occurred at the Corporation electricity works in the early hours of Sunday morning. The fire brigade succeeded in preventing the flames from spreading from the boiler house to the coal elevator, and the fire was not sufficiently serious to cause interference with the electricity supply of the borough.

Watford.—Street Lighting.—The electrical engineer has been instructed to report upon the advisability of lighting Queen Street by centrally suspended lamps.

West Bromwich.—The T.C. has decided to extend the mains at a cost of £800, in order to supply current to the works of Stone Bros., Ltd. A supply is also to be afforded to the premises of D. Gibbons & Co., Hilltop. The former supply is to be by overhead cables.

Willesden.—L.G.B. Inquiry.—An inquiry, presided over by Mr. T. C. Ekin, was held on July 31st last in connection with the Council's application to borrow £4,667 for the erection and equipment of a sub-station at Acton Lane.

Wimbledon.—Loan Sanction.—The sanction of the L.G.B. has been received to the borrowing of the following amounts required in connection with the electricity undertaking:—House services, £1,000; transformers, £800; meters, £1,850; high tension mains, £500; low tension mains, £1,500. The following expenditure will also probably be incurred between now and March, 1915, and borrowing powers are to be applied for:—Mains and house services, £8,560; meters, £850.

Wrexham.—The T.C. has confirmed a proposal of the electricity committee recommending the purchase of three electric ovens, two at a cost of £8 each and one at a cost not exceeding £5, the same to be lent free of charge to consumers during trial.

The electrical engineer has been authorised to negotiate with the Governors of the Boys' Home to be erected in Rhosnessney Road as to terms for a supply of electricity, and with the Wrexham Co-partnership Tenants, Ltd., as to a supply to houses to be erected outside the borough.

Yeovil.—Electric Sewage Pumping.—The T.C. has adopted a scheme for utilising electricity for power at the sewage disposal works, and to reserve gas for use in case of a breakdown. The scheme will entail an expenditure of £960.

York.—Prov. Order.—The T.C. has decided to hold a special meeting on September 1st to consider the advisability of applying to the B. of T. for a prov. order for electricity within the areas of the Great Ouseburn, the Bishopthorpe, the Escrick, the Tadcaster, the Flaxton, and the Easingwold R.D.C.'s.

TRAMWAY and RAILWAY NOTES.

Argentina.—The electrification of the Santa Fé tramways is being rapidly pushed ahead, and it is expected that the first section will be ready early in 1914.—*Review of the River Plate.*

Barking.—Arrangements have been completed with the East Ham T.C. for supplies of current for traction purposes.

Belfast.—At the monthly meeting of the Corporation the closing down of the Ravenhill Road extension, which was being run at a loss of £2,000 per annum, was discussed, and was finally decided upon. The management of the tramway system, it appeared, were against the extension when it was originally mooted, but the Corporation went on with it, with the foregoing results.

Blaydon.—A deputation from the Blaydon governing authorities has waited upon the Newcastle-on-Tyne Tramways Committee, requesting it to secure the necessary powers for running a railless trolley system to Scotswood and Blaydon.

Bolton.—The borough engineer has reported to the Tramways Committee upon the reconstruction of track on the Manchester Road, and has been instructed to arrange for an experimental length of 200 yards to be laid on wooden sleepers fixed transversely.

Brighton. — The Tramways Committee of the T.C. has decided to expend £5,000 on renewing the tramway track in London Road.

Chile.—According to the *Review of the River Plate*, the Senate is preparing a definite project for the electrification of the Santiago-Valparaiso Railway.

Colne.—The Finance Committee reported on July 31st that the costs incurred in connection with the promotion of the Colne Corporation Bill, 1913, for taking over the undertakings of the Colne and Trawden Light Railway Co., amounted to £595.

Continental Notes.—Italy.—An important scheme to utilise the water power of the River Tirson, on the Island of Sardinia, is at present under consideration. In summer the river often runs dry, while in the winter it becomes a torrent, which frequently threatens to flood the district through which it flows. It is proposed to construct a dam having a capacity of 330 million cb. metres, and thus flooding will be prevented and water power estimated at over 10,000 h.p. will be rendered available.

Dartford.—The Tramway Co. has applied for an extension of time for the construction of the electric tramways from Horns Cross to Swanscombe.

Dewsbury.—The Corporation and the National Electric Construction Co. are in negotiation with respect to suggested tramway developments to serve Shawcross, Hanging Heaton, Boothroyd and Dewsbury Moor. No details have yet been made public, but the Council hopes that if the new lines are adopted they may be self-supporting in 12 years' time. The lines will pass through the Market Place and join the system of the British Electric Traction (heavy woollen district), and afterwards branch off at Willans Road leading to Dewsbury Moor.

Dunfermline.—The T.C. is to consider a proposal by the Tramways Co. in regard to the extension of the line to Milesmark. By the Act of Parliament the company is bound to pay £100 per mile to the T.C. for the first three years and £125 thereafter. The company, however, represented that if it was to proceed with the Milesmark extension, it must have a reduction, and it suggested that the payment should be not more than £60 per mile for a period of seven years. The Council agreed to the proposed reduction, but fixed the period to which it applies at five years instead of seven.

Edinburgh.—The tramway strike, after lasting for 12 days, has been amicably settled as between the company and its employés.

Glasgow.—At its next meeting the T.C. is to consider a proposal by Councillor Shedden, that, as a means of solving the question of congestion on the streets, and of giving facilities towards the expansion of the city, the Corporation appoint a special committee to consider the feasibility of establishing a system of tube electric railways from east to west (say Shettleston to Clydebank), and from north to south (say Bishopbriggs to Rouken Glen).

Gloucester. — The working of the city tramways during the last financial year resulted in a loss of £3,700, or £1,400 more than in the preceding year.

Heston and Isleworth.—At the last meeting of the U.D.C. the Works Committee reported that the Tramway Co. had decided to repair their tracks in the district; also, to "slew" the line along Twickenham Road, on the condition that the Council agreed to suspend its powers to acquire the undertaking until 1930. The committee's recommendation to give effect to this arrangement was agreed to.

Holcombe Brook (Lancs.)—L. and Y. Electric Line.—The electrification of the Holcombe Brook branch line of the Lancs. and Yorkshire Railway has been completed, and the running, which was commenced last week, is reported to have been very successful so far.

Japan.—The Jobo Electric Tramway Co. is the name of a new company which has lately been formed in Tokio with a capital of £100,000 to construct and work an electric tramway from East to West on the north-western side of the city.

Leeds.—Alterations are to be made at the Harehills tramway terminus, which will do away with the "shunting station" which has previously caused so much delay. The estimated cost of the necessary alterations is £660.

The sub-Tramways and Electricity (Extensions) Committee has recommended the Council to make application for powers to carry out a number of tramway and railless trolley route extensions which were originally estimated to cost £191,000.

The general manager, Mr. J. B. Hamilton, has been given permission to render assistance to the Bristol Corporation in connection with the projected purchase of tramways in the city.

Leigh.—It is understood that the South Lancashire Tramways Co. is to be asked to construct tramways from Leigh through Astley, which is becoming an important coal-mining centre, to Boothstown, connecting with their present system there.

U.S.A.—What is described as being the first trolley motor-'bus service in the United States has lately been started in the town of Merrill, Wis. The line is about a mile long, and works in conjunction with the tramway system.

Salford.—The Tramways Committee is informing the L.C.C. that it cannot see its way to support the opposition to the terms of a clause proposed to be inserted in the Tramways and Improvements Bill now before Parliament giving the L.U. Tramway Co. running powers on certain lines now being acquired; but, in the event of an arbitration, it would be prepared to give evidence in support of the principle that when one authority is running cars on another authority's lines, the first-named authority should not be allowed to make a profit out of such running.

Southend-on-Sea.—On July 30th a new section of the local tramways was opened linking up Bournes Green with Southchurch; next spring the route will be continued to Thorpe Bay, at a total cost of £30,000. The track is laid on Jarrah wood sleepers.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—A decree accords to Don Landelino Zid a 30-year concession for the installation and working of a telephone network in the Coyle Department of the State of Santa Cruz.

Canada.—Edmonton, Alberta, will spend $1,000,000 on telephone extension work in 1913, the greater part of which will be cable work. The telephone lines in Alberta are all owned by the province and municipalities. The superintendent at Edmonton is Mr. W. R. Griffiths.

French Wireless Proposals.—The new scheme for the creation of an intercolonial wireless network drafted by M. Dalimier, on behalf of the Commission du Budget, contemplates the division of the commercial service into a long-distance and a local network. It authorises the Minister of Commerce, Posts, Telegraphs and Telephones to raise a sum of £631,800 for (1) experiments and trials of new instruments and systems of station organisation; (2) the construction and equipment of wireless stations, including accessory buildings for plants and staffs in the following places:—Eastern lines: Southern France, Tunis, Djibouti, Pondicherry, Saigon and Madagascar. African and South American lines: Southern France, Morocco, Saint Louis, Colomb Bechar, Timbuctoo and Bangui. Pacific lines: Southern France, Morocco, Saint Louis, Martinique, Marquisa Islands, Tahiti, Noumea, Saigon. North American line: Western France. Provision is to be made in each Finance Law for the disbursements involved. A technical committee is to be formed at the Ministry of Commerce to examine all questions related to the service. The Budget Commission, it is stated, has accepted all the stations indicated, excepting Colomb Bechar, which it regards as unnecessary.—*La Lumière Electrique.*

Germany.—It is announced that the agreement between the German Imperial Post Office and the Telefunken Co., which was foreshadowed in the Reichstag this spring, is now complete, and that the head station of the company is in direct connection with the Imperial telegraphic system. The station is at Nauen, 10 miles from Berlin. The Reichstag has already voted funds for the construction of stations at Windhoek (German South-West Africa) and at Togo (German Gold Coast), and these stations will shortly be in working order, while a third station in German East Africa is to be ready by the end of next year. By this means the German Government hopes to be entirely independent of cables.—*Standard.*

Imperial Wireless System.—Last week the new agreement between Marconi's Wireless Telegraph Co., Ltd., and the Postmaster-General for the construction of a chain of Imperial wireless stations was made public. It stated that the execution of the work by the State had been considered, but no existing department could undertake either to erect or to work the stations, and the formation of a special staff for the purpose would involve delay, while, when constituted, the staff would have no claim on the assistance of any company experienced in long-distance wireless telegraphy on a commercial scale. The Treasury, therefore, preferred to place the work of construction in the hands of a contracting company. The consideration of urgency was of prime importance, and had been intensified by the serious delay already incurred. Great importance was attached to the principle of competition by public tender or between contractors on an approved list, when it was possible, but in view of the report of Lord Parker's Committee, to the effect that the Marconi system was the only one capable with certainty of fulfilling the requirements, and as the position had not been materially modified since that report was issued, the Treasury authorised the reopening of negotiations with that company.

There was no doubt that the price of materials had risen considerably since the date of the company's original tender; the new agreement, therefore, provided for the readjustment of the standard price of £60,000 per station, strictly in accordance with market reports as ascertained and certified by the Engineer-in-Chief of the Post Office, up to the date of approval of the new agreement by the House of Commons. No further change in the standard price would be made. A general specification was now scheduled to the agreement, and variations from the specification would involve variations in the price per station. In view of the present conditions of the money market, it was provided that interest at 2 per cent. would be paid on each third part of the purchase money; on the other hand the company agreed that the Postmaster-General should have the right to use the stations for experimental working before completion; that he might cancel the agreement in respect of the stations in India, South Africa and Singapore at any time before their completion, subject to payment for the actual work done, and subject to the Marconi Co. being given the opportunity to tender for a continuous wave system on equal terms with its competitors; and that the royalty payment should be made in respect of each station, independently of the rest, so that the royalty would be modified if Marconi patents were dispensed with at any station, provided that the Government agreed to the inclusion of the East African station (where the company's inventions were not patented) for royalty on the same terms as the other stations. This concession in respect of the East African station was only made when the company consented to sub-divide the royalty payments, as follows: 4 per cent. for patents for internal transmitting apparatus, and 2 per cent. each in respect of external transmitting, and internal and external receiving, apparatus—enabling a proportionate reduction of royalty to be made on discontinuing the use of any one of these sections. The retention of a Marconi patent at one station does not now affect the royalty on the other stations at all; and where it is retained, the only royalty payable is in respect of the one section to which it belongs.

The provision that the Postmaster-General should consult the company before introducing patents or apparatus other than theirs has been dropped, and the power of the company to inspect non-Marconi installations at stations other than those erected under the agreement has been modified to the satisfaction of the Treasury. The company no longer will possess the exclusive right to erect long-distance stations for the Government during the five years from the date of the agreement. A time-limit for the construction of the work is now provided for, with a penalty of £150 for each month's delay. The speed of automatic working to be demonstrated is raised from 50 to 75 words per minute, except in the presence of temporary atmospheric disturbances, and provision is made that if the Government is using a non-Marconi patent at a station on terms arranged with its owners, the Marconi Co. may not, by purchasing it from those owners, convert it into a Marconi patent within the meaning of the agreement. The agreement is not to be binding unless and until approved by a resolution of the House of Commons before the end of August.

Reports by the Engineer-in-Chief of the Post Office and the Inspector of Wireless Telegraphy indicate that, in their opinion, it is not desirable to invite tenders from either the Goldschmidt or the Poulsen companies at present.

Further questions were asked respecting the Marconi patents, in the House of Commons on Monday. In regard to the validity and registration of the patents in various countries, Mr. Samuel repeated that the most careful inquiries would be made before any royalty was paid, but he had not yet decided on the form of inquiry. This drew from a member an expression of surprise that the Postmaster-General should have been negotiating for two years for the use of oversea patents without consulting a competent expert on the registration question; but Mr. Samuel replied that the matter was of importance to the company, as, if there were no patent, there would be no royalty. In regard to the station in British East Africa, Mr. Samuel said that the royalty would be divisible in the same way as for the other stations. He was unable to give any reliable estimate of the amount involved, as it would depend on the quantity of traffic and the rates chargeable to the public, which had not yet been fixed.

Italy.—Parliament has authorised the Minister of Posts and Telegraphs to spend a sum of £2,160,000 in the construction of overhead and underground telephone lines.

Japan.—In connection with the extension of the telephone service in Japan within the present year, it is announced that the funds at the disposal of the authorities are so limited that the number of new installations will not exceed 20,000. In the smaller towns new telephone installations will, it is believed, be suspended for the time being.

Post Office Employés.—According to the *Times*, a ballot of the United Kingdom Postal Clerks' Association (membership 9,000) and the Postal Telegraph Clerks' Association (membership 11,500), has resulted in a joint majority of over 10,000 in favour of the amalgamation of the two unions.

Regulation of Wireless Communication in Germany.—The German Imperial Post Office and the Home Office authorities have jointly issued new regulations in regard to the establishment and working of wireless stations. It is provided that sanction for the erection of a station shall only be given with the reserve of revocation at any time. The officials of the Imperial telegraph service and of the navy and army are empowered to exercise control over the stations. The owner of a station is placed under the obligation to take care that all messages received are kept secret under any circumstances, and the responsible officials are also authorised to suspend working temporarily. In the case of the reception of time signals, weather news, &c., it is stipulated that the apparatus shall work with the prescribed wave length of 1,650 metres, and any variation of this length by 5 per cent. in an upward or downward direction is to be prevented by a prescribed safety apparatus. Special instructions are given for the regulation of public communication between German coast stations and installations on ships. The latter have to be installed according to the conditions and regulations of the International Wireless Telegraphy Treaty, and ships in German ports are only allowed with the consent of the Post Office authorities to maintain a wireless service when in port. The coast and ship stations are placed under the obligation to undertake the mutual exchange of messages without any regard to the particular system used. It is added that the International Bureau of World Telegraphy of Berne is now publishing an official map of wireless stations, giving the nationality, system and the range in each case. Various wireless stations have been established in Germany without legal permission having been first obtained. The transgressors of the law are now threatened with legal proceedings and the demolition of their stations.

United States.—The Attorney-General has entered a civil suit under the Anti-Trust Law for the dissolution of the telephone monopoly alleged to be held on the Pacific coast by the American Telephone and Telegraph Co.

Uruguay.—The Government has been empowered to take up a loan of 380,000 pesos for the extension of the telegraph and telephone network, a portion of the lines is to be laid underground.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Victoria. — September 9th. Common-multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

Queensland.—Brisbane.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" to-day.

Canberra.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary, Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Belgium.—Ostend.—Tenders will shortly be called for for the installation of an electric sub-station at the Parc Léopold. Particulars at the Hôtel de Ville, Ostend.

Bournemouth.—August 27th. Reconstruction of 3 miles (single track) of permanent way for the Corporation Tramways Department. Mr. I. Bulfin, tramway manager. Deposit for specifications, £2.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" to-day.

Brighouse.—August 9th. Cable and feeder pillars for the electricity department. See "Official Notices" August 1st.

Bury. — August 25th. One 2,000/3,000-kw. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" August 1st.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" August 1st.

France.—Havre.—Orders will shortly be placed for 15 electric cranes and the necessary transmission lines and accessories. Particulars of the Chambre du Commerc de Havre.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour: (1) generating plant and equipment, and the lighting of the central station; and (2) the distributing system. The offer may be for the complete installation or for either section. Sealed tenders to "Mons. le Directeur de la Section des Municipalités et Commissions Locales au Ministère de l'Interieur," Cairo. Copies of the *cahiers des charges* and plans can be seen at the same address, or obtained there on payment of 200 piastres (£2 1s.), which will not be returned. A provisional deposit of 2 per cent., or a bank guarantee of 10 per cent. of the value of the offer must accompany each tender.—*Board of Trade Journal.*

Frinton-on-Sea.—August 12th. Public lighting for the U.D.C. Mr. E. M. Bate, surveyor.

Hastings.—August 11th. Electrical installation at several schools for the T.C. Borough Electrical Engineer, Earl Street.

Kirkcaldy.—August 11th. Electric lighting of new school at Pathhead for the Kirkcaldy and Dysart School Board. Mr. W. Williamson, architect, Royal Bank Buildings.

London.—Royal Mint.—August 12th. 200 tons of copper in ingots. See "Official Notices" August 1st.

General Post Office.—September 1st. Stores Department. (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

L.C.C.—August 25th. Electrical installation, 320 lighting points, for Middle Row School, Kensal Road, N.W. See "Official Notices" to-day.

Manchester.—August 12th. The South Manchester Board of Guardians invite tenders for the electric light installation at the new Nurses' Home, West Didsbury. Specifications from F. H. Overmann, 49, King Street, Manchester, 10s. 6d. Tenders to David S. Bloomfield, Clerk to the Guardians, All Saints', Manchester, before August 12th.

Norwich.—August 12th. One 3,000-kw. turbo-alternator and surface condensing plant; rotary converters and E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Puerto Plata.—The Government of the Republic of St. Domingo have voted 400,000 pesos for the improvement of the port, including landing and loading cranes and the building of a generating station. Particulars of the State Secretary for Agriculture and Traffic in Santa Domingo.

Shanghai.—August 26th. Two 5,000-kw. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Bloemfontein.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machinery, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" July 25th.

Spain.—August 24th. Tenders are being invited by the municipal authorities of Almeria for the concession for the electric lighting of the town.

August 25th.—The municipal authorities of Elchi (Province of Alicante) are inviting tenders for the concession for the electric lighting of the town.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" August 1st.

Wimbledon.—September 1st. One 1,500-kw. turbine alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" to-day.

York.—August 25th. Coal for a year from September 30th, for the Corporation electricity works (about 10,000 tons, either unscreened beans, pea slack, rough slack or small peas). Mr. J. W. Hame, engineer and manager, Clifford Street.

CLOSED.

Bolton.—The Electricity Committee has accepted the tender of the Electric Construction Co. for a booster in connection with the storage battery at the electricity works; and that of Messrs. Stewarts & Lloyds, Ltd., for steam and water pipes required at the proposed generating station at Back-o'-th'-Bank.

The Tramways Committee has accepted the tender of Walter Scott for the supply of steel tramway rails and fishplates required in connection with the relaying of the tramway track in Manchester Road.

(*Continued on page* 224.)

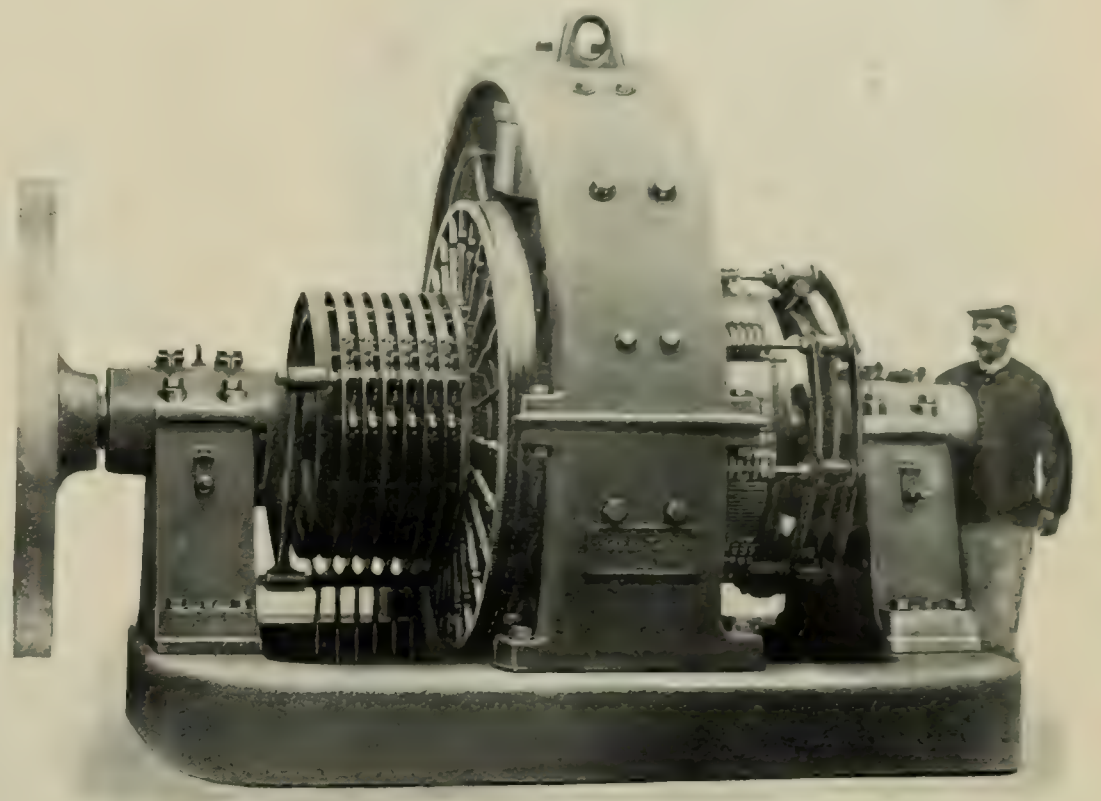
AN ELECTRIC RAILWAY IN THE FRENCH PYRENEES.

By Dr. ALFRED GRADENWITZ.

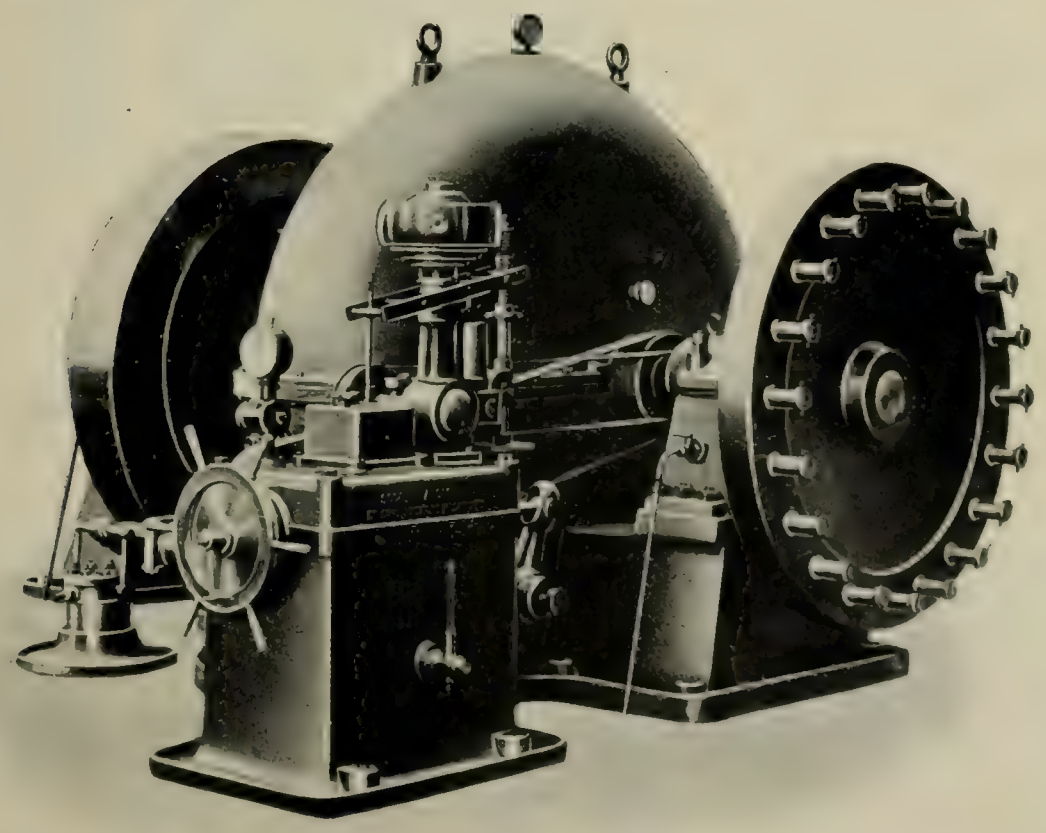
The Villefranche-Bourg-Madame Electric Railway is intended to serve French Cerdagne, and to connect this district with the remaining line of the Compagnie des Chemins de fer du Midi. Its starting point is at the railway station of Villefranche, the terminus of the Perpignan-Villefranche Line, at an altitude of 427 m. From Villefranche it rises in the valley of the River Tèt, up to the Perche defile, which it crosses at an altitude of 1,592 m. After then traversing some kilometres of the Perche Plateau, as far as the Col Rigart, the railway descends rapidly into the Cerdagne plain, terminating at Bourg-Madame, at 1,143 m. altitude and some hundred metres distance from the Spanish frontier. It is 55·96 km. in total length, and comprises two distinct sections. The first of these — from the starting point to Joncet (6·2 km.) —was designed in the first instance with a view to the installation of a standard-gauge railway, and generally offers no gradient superior to 25 per mille, the minimum radius of curves being 300 m., whereas on the second section (from Joncet to Bourg-Madame) are curves 80 m. in radius and gradients of 60 per mille. This part of the line comprises on the eastern slope a number of remarkable works, including the viaduct over the River Tèt at 18·10 km., and the rigid suspension bridge on the Gisclard system, 234 m. in span, at 24·5 km. The line also comprises 18 tunnels, representing a total length of some 2,378 m.

Electric traction was adopted mainly for administrative reasons, the water-power of the Upper Tèt being utilised in a hydroelectric power station situated at Cassagne at about 1,200 m. altitude. The watershed comprises the whole of the Carlitte Lake plateau, the water being collected in a storage reservoir, 13 to 14 million cubic m. in capacity, with a masonry embankment 13 m. high, which raises the water level of the Bouillouse swamps to an altitude of 2,009 m.

The programme to be provided for in constructing this remarkable railway comprised the running of trains 120 tons in total weight throughout the length of the line; moreover, provision had to be made for trains of equal weight to be run 10 minutes after each schedule train.



Double-Current Generator, of 650—1,000 kw.



Pelton Turbine of 1,500 h.p.

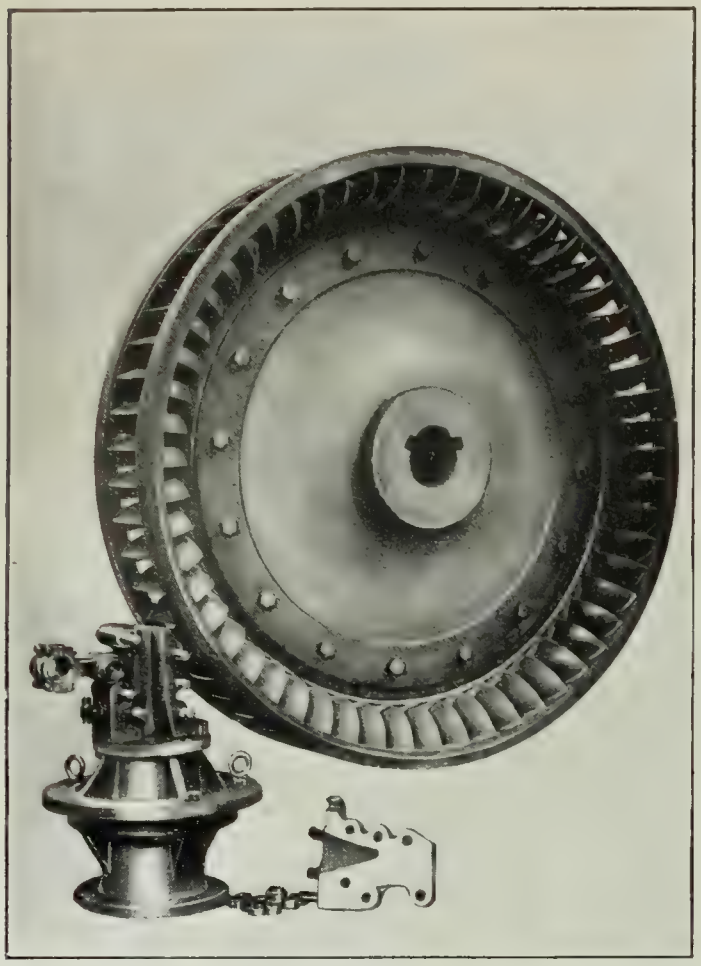
Continuous current was adopted for the operation of the railway, a contact rail installed at the side being used to distribute current to the traction motors, on account of the considerable weights to be transported. Contracts for the supply and installation of the whole equipment were concluded with the Société Alsacienne de Constructions Mécaniques, of Belfort and Mulhouse.

The distribution system comprises five sub-stations, each of which, like the power station, supplies the contact line with continuous current at 850 volts. the average distance between each two feeding points being about 11 km. The sub-stations are connected to the power house by a 20,000-volt line, and they all work in parallel on the contact rail.

The power house contains exclusively double-current generators, which supply as required either 850-volt continuous current for directly feeding the contact rails, or three-phase current at 25 cycles for the feeding of the sub-stations (through the intermediary of the high-tension line). The adoption of double-current generators, which is one of the most remarkable features of the installation, allowed the first cost to be reduced considerably by dispensing with the installation of special D.C. generators.

The equipment of each of the sub-stations consists of rotary converters fed through step-down transformers. This mode of distribution allows an automatic regulation

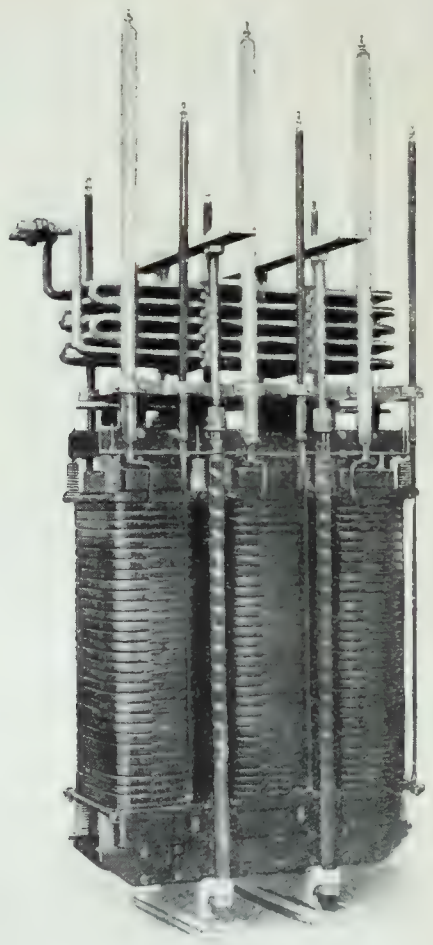
of the pressure to be readily effected at the feeding points of the contact rail. The generators and rotary converters are for this purpose provided with an additional series field winding, calculated with a view to raising the pressure of



Rotor and Nozzle of Turbine.

these machines from 800 volts at no load to 850 volts at full load.

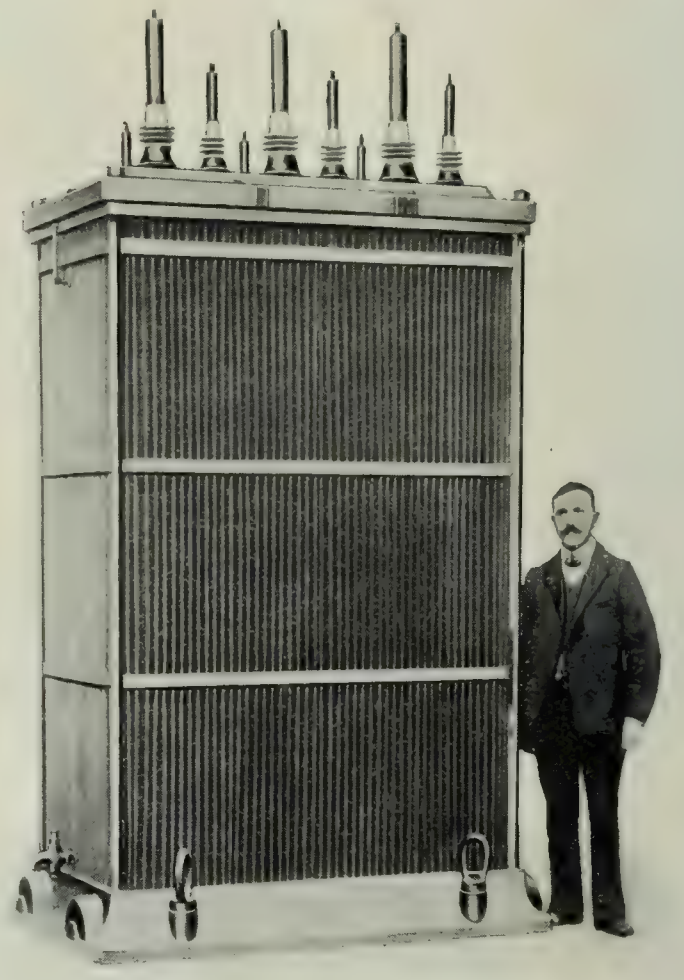
The Cassagne power house is situated on the River Tèt at an altitude of 1,196 m., at 24 km., and 250 m. from the railway. It comprises, in addition to an engine room,



Three-Phase Transformer, 650 kw, 20,000 Volts, with Cooling Coil.

served by a 10-ton travelling crane, a basement where the hydraulic distributor and the transformers are installed. Its aggregate capacity is 6,000 h.p., subdivided into 4 units each of 1,500 h.p. It is designed for utilising a total gross head of about 420 m., the net head being about 380 m. The water is obtained from the River Tèt by means of an intake connected to the forebay by an open masonry conduit 4,426 m. in total length, which passes through two open-air settling tanks. From the forebay run four pressure conduits, 400 mm. in external diameter, which terminate at the distributor in the power house; each of these conduits is 1,001 m. in total length. The distributor, which is made of cast-steel throughout, is situated in the basement, being connected to each of the turbines by an ascending conduit. It is subdivided into two parts, which can be isolated from one another by means of a gate valve situated in the centre. In each of these two parts terminate two twin conduits, a special gate valve allowing each conduit separately to be isolated from the distributor. A gravel catcher and discharge cock have been provided to prevent pebbles and other bodies from entering the distributor. Protection against hydraulic shock is provided—apart from the pressure regulators to be described later—by six safety valves, connected to each of the four conduits and to each of the two halves of the distributor. The ascending conduit to each of the turbines contains two gate valves, controlled by hand and by an electric servomotor respectively.

The turbines, on the Pelton system, have been designed



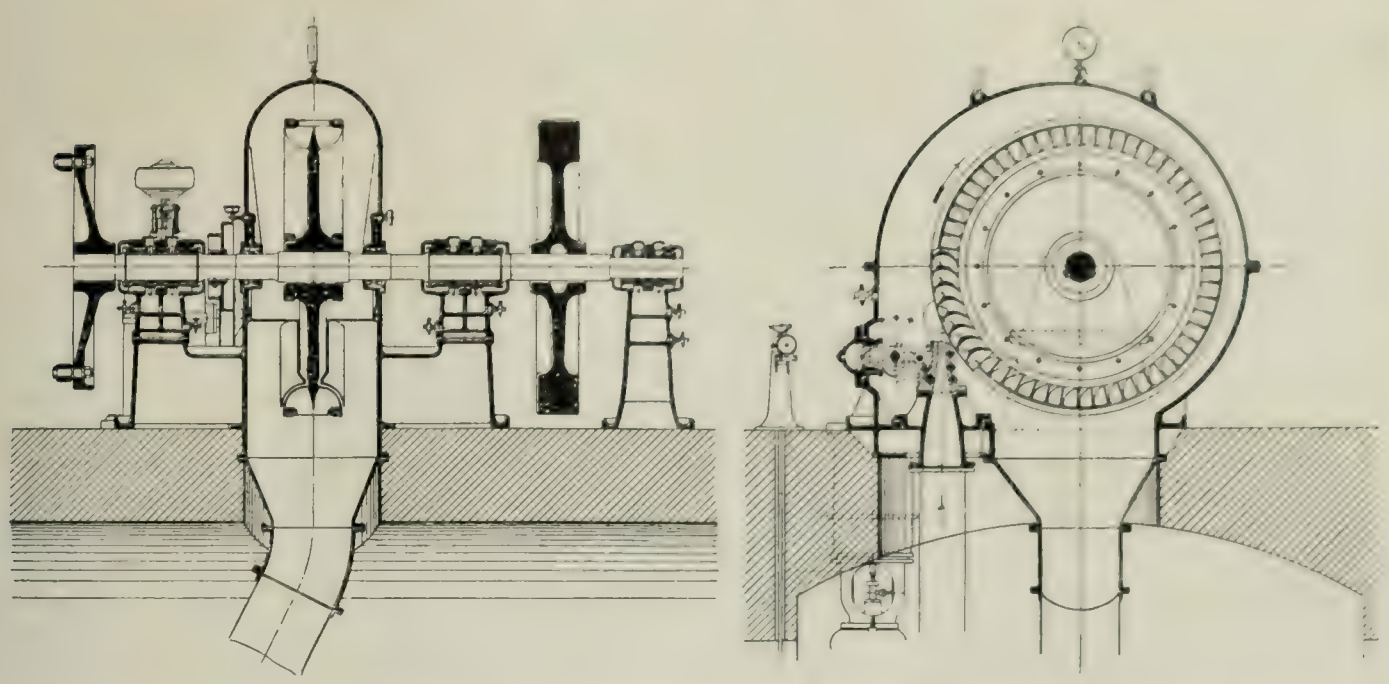
Transformer in Tank.

and constructed at the works of the Société Alsacienne, the output of each unit being 1,500 h.p. at a speed of 375 r.p.m. The blade rim is made of special cast-steel and is provided with bands to deal with centrifugal stresses; it is bolted on a disk constituting the nave, which allows any worn-out parts to be readily replaced. The jet is obtained by a single bronze nozzle, the tongue of which is directed vertically upwards and balanced hydraulically by a compensating piston. On leaving the turbine the water is discharged into a suction tube which terminates in a lower masonry compartment with an outflow towards the River Tèt. This arrangement allows the level difference between the river and the turbines (which on account of the configuration of the site could not be installed any lower) to be fully utilised.

The turbine shaft is of crucible steel, and is connected to the generator shaft by an elastic clutch with removable rubber buffers. It rests on two water-cooled bearings. At the opposite end the extension of the shaft carries a cast-steel fly-wheel, 5 tons in weight and 2 m. in diameter, which is partly supported by a rear bearing likewise provided with water cooling.

The speed of each turbine is automatically controlled by a patented self-contained speed regulator on the Minetti

system. This oil-pressure regulator mainly consists of an oil tank, two single-acting pistons moving in cylinders, which are connected by a rod actuating, through the intermediary of a regulating shaft, the gate valve of the turbine, two rotary high-pressure oil pumps, a distribution valve and a centrifugal governor. Each cylinder communicates on one hand with the pressure pipes of one of the pumps, and, on the other, with one of the discharge openings controlled by the distribution valve. During normal working the distribution valve is in its central position, and uncovers equal parts of the discharge openings of the cylinders, thus allowing the oil supplied to the cylinder to return to the tank without exerting any appreciable pressure on the pistons. As soon as, on account of a variation in torque, the speed of the motor tends to increase or decrease, the distribution valve under the action of the centrifugal governor closes one or other of the discharge openings. The oil supplied by the pump feeding the closed cylinder being unable to return to the tank, then compels the corresponding piston to move, thus actuating the gate valve connected to the piston shaft. As the oil in normal working circulates practically under no pressure, the energy absorbed by the pumps is negligible. A safety valve has been provided to prevent any abnormal increase in pressure. This valve, by a simple manipulation of a lever, also allows the two cylinders of the servomotor to be connected together, thus interrupting the action of the regulator, whenever the regulation of the turbine is to be effected by hand, by means of a special hand wheel. A safety device has been provided to avoid racing in the event of an accident to the governor.



Longitudinal and Transverse Sections of Pelton Turbine of 1,500 h p.

This speed regulator reduces variations in the speed of the turbine in the event of an abrupt relief of 15, 30 or 100 per cent. of the total load, to less than ·5 per cent., 2·7 per cent. and 10 per cent. of the normal figures respectively.

Each of the turbines also possesses a pressure regulator, designed to prevent any hydraulic shock produced by the very quick action of the speed regulator. This apparatus is connected in parallel to the ascending feeding conduit ; it is controlled by the regulating shaft acting on the injector pump, and opens on the feeding conduit a discharge opening which is larger as the regulator works with greater amplitude. It mainly consists of a cylinder arranged at the end of a lever, mounted on and positively connected with the regulating shaft. In this cylinder moves a differential piston submitted on its two faces to the pressure of the water, and provided with a narrow opening which connects the two sides of the piston with one another. This piston controls the opening and closing of the discharge aperture.

When the action of the speed regulator, for instance, tends to reduce the admission of water, the regulator shaft carries the cylinder and its piston along, and the latter, on account of the small cross-section of the piston opening, only makes a relatively small movement. The discharge aperture is thus opened, but the pressure difference on the two sides of the differential piston comes into play immediately, returning the piston to its initial position, and closing again the discharge aperture slowly enough to avoid any objectionable excess pressure.



Details of Expansion Joint and Bonds, and Anchoring Device of Contact Rail.



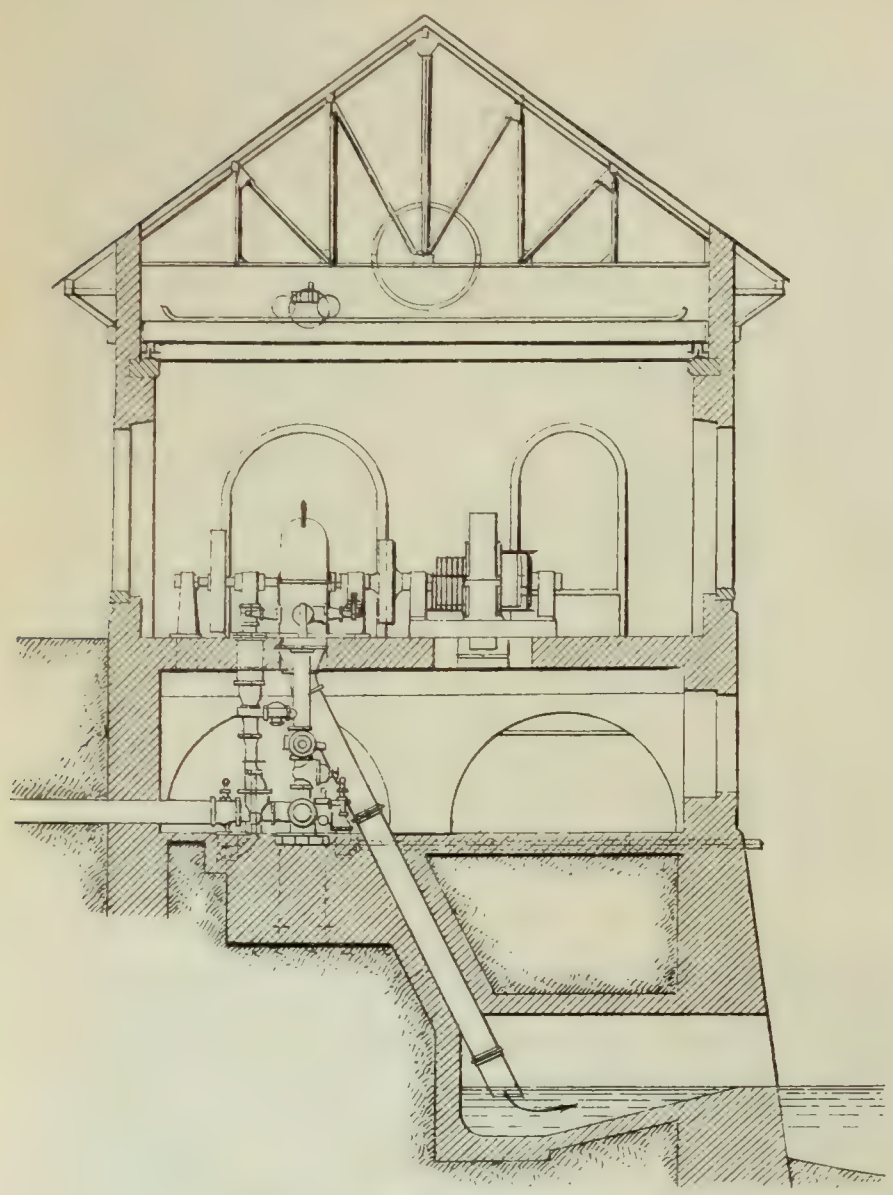
20,000-volt Transmission Line.



Gisclard Suspension Bridge.

The guaranteed efficiency of each turbine, inclusive of accessory apparatus and water leakage, was 75 per cent. Tests on delivery have shown the efficiency to be in reality 78 per cent., or 82 per cent. for the turbine alone.

The electrical equipment of the power house comprises four double-current generators coupled by sleeves to the water turbines, four step-up transformers each connected to



Section of Generating Station.

one of the generators, and, finally, an auxiliary converter set supplying the current required for lighting and for the operation of the servomotors actuating the hydraulic distribution valves.

The double-current generators are of the fixed-field rotating-armature type, and are designed for a normal output of 650 kw., in the form either of 850-volt continuous current or 600-volt six-phase current at the frequency of 25 cycles and the speed of 375 r.p.m.; they therefore have eight poles.

The drum-wound armature is of the ordinary d.c. type, provided with six bronze collecting rings, each communicating with a fixed point of the armature. The field magnet



Electric Train, Villefranche-Bourg-Madame Railway.

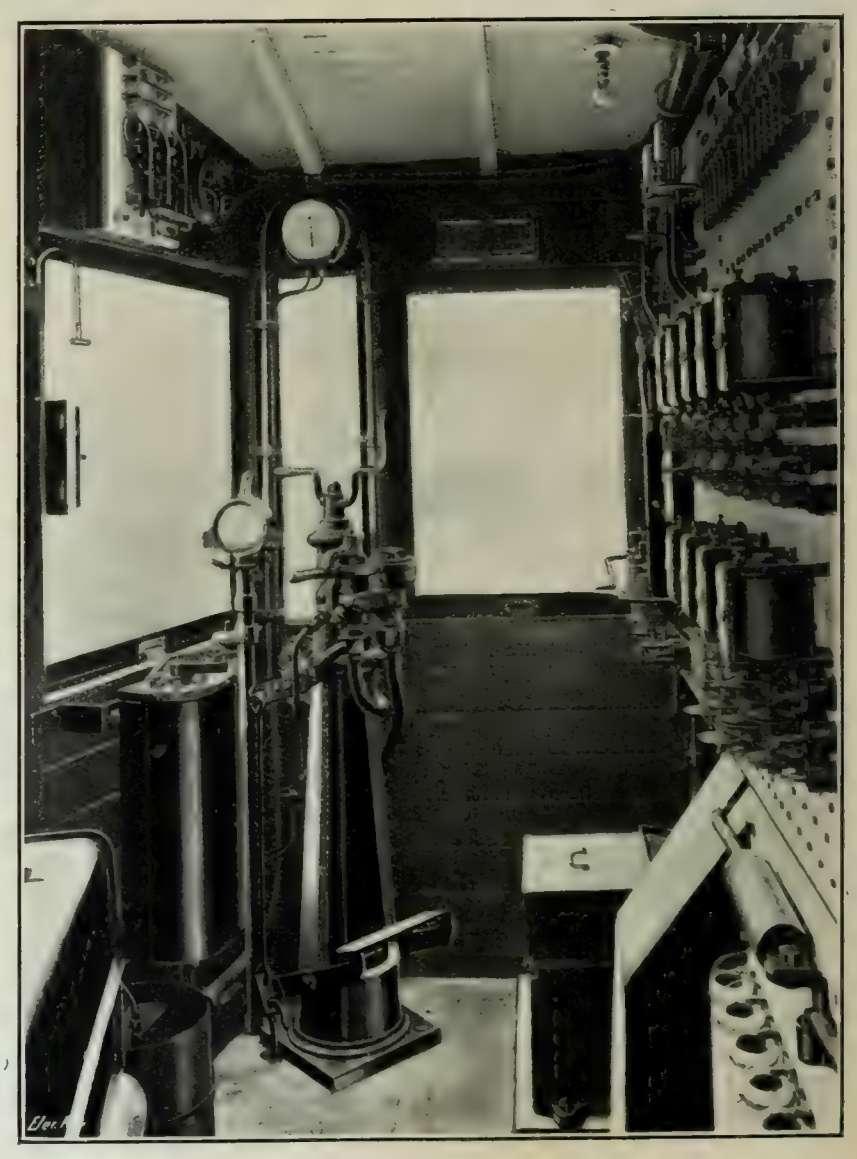
is made of cast-steel with laminated poles, provided with a shunt and a series winding, the latter being so calculated that the voltage of the machine, when working at constant speed as a d.c. generator, rises from 800 to 850 volts, between no load and full load. Apart from the main pole-pieces, the yoke carries eight auxiliary commutation poles, which ensure, with fixed brushes, excellent commutation even at the highest overloads.

These generators are calculated for a maximum heating of 45° C. above the surrounding temperature in continuous operation when yielding an output of 650 kw.; they are also to stand without any abnormal heating an instantaneous overload of 60 per cent., corresponding to a useful output of more than 1,000 kw. The efficiency at full continuous-current load is 93·7 per cent.

The transformers have, like the corresponding generators, an output of 650 kw., at 25 cycles. The primary windings are designed for 600-volt six-phase current, and the secondary windings for supplying three-phase current at 20,000 volts, in star connection.

The transformers are of the oil-bath type with water-cooling by means of a spiral tube in the upper part of the tank. They are calculated for a maximum rise of temperature of 50° C. above the surrounding atmosphere, after 24 hours' continuous working at full load. After an overload of 25 per cent. during two consecutive hours, the rise in temperature does not exceed 60° C. Finally, they are able without any objectionable heating to stand an overload of 100 per cent. during five minutes. Their efficiency at full load is 97·2 per cent., the pressure drop at full load being 1·4 per cent. with $\cos \phi = 1$. Each of them is connected directly to the corresponding generator by cables in which only switches and fuses are inserted; there are thus no bus-bars between the generators and transformers, each transformer with the corresponding generator constituting an indivisible unit.

The switchboard is designed for controlling, apart from the four generator sets, a system of outgoing 850-volt d.c. conductors, and two overhead lines at 20,000 volts. It is subdivided into two separate parts, viz., on one hand the switchboard proper, and on the other the high-tension apparatus which is located at the end of the engine room on



Interior of Driver's Cab.

a special platform. The switchboard proper comprises six white marble panels mounted on metal frames, and installed on a marble platform, situated 0·80 m. above the floor of

the engine room, so as to facilitate superintendence. The four central panels are intended for the generator sets, and the two side panels are set apart respectively for the D.C. line, and for two 20,000-volt lines, together with the coupling switches for the machines working as alternators. The D.C. bus-bars are three in number, the positive bar being connected to the contact rail, and the negative bar to earth, while the third one acts as a balancing bar.

On the D.C. side, the apparatus of each set comprises a double-pole hand switch mounted on the cables terminating at the negative and balancing bars, and an automatic maximum circuit-breaker with a magnetic blow-out protecting the generator against excessive overloads.

On the A.C. side a three-pole oil switch is connected between the secondary windings of the step-up transformers and the 20,000-volt bus-bars. This switch is provided with a self-acting releasing relay on two phases, so as to protect the set against the consequences of a short-circuit between any two phases; a time-lag relay allows the duration of overload, after which the releasing takes place, to be adjusted at will. The circuit-breakers of the generators are, like those of the outgoing lines, situated in masonry cells at the end of the building. They are controlled from the switchboard by solenoids which, like the releasing relays, are fed with 850-volt continuous current, but they are also designed for being operated directly by hand.

The apparatus for coupling the generators when working as alternators comprise an Everett synchroscope, a line voltmeter and a phase voltmeter, all these apparatus being fed by a potential transformer. On the panel carrying these apparatus there are also fixed the switches controlling at a distance the oil switches of the 20,000-volt overhead line. These circuit-breakers, which, like the others, are placed in cells at the end of the room, are provided with releasing relays with time lag in three phases. The 20,000-volt bus-bars are placed horizontally on brackets, and take up the upper part of the engine room. On the wall of the latter are a series of vertical masonry partitions forming cells, through which the conductors connecting the oil switches on the ground floor with the bus-bars pass. Each of the cells contains a disconnecting switch, and, wherever required, a maximum relay controlling the automatic release of the circuit-breaker. The apparatus of the two outgoing high-tension lines is installed on the gable wall of the building and on two transverse walls, and comprises, in addition to lightning arresters, a section switch in each phase.

Protection against atmospheric discharges is ensured primarily by a continuous-action water-jet discharger, and, secondly, by a double set of lightning arresters and self-induction coils. Care has been taken to avoid any accidents likely to result from the casual contact of a high-tension conductor with any metal framework. All frames or metal parts situated in the neighbourhood of these conductors have for this purpose been carefully earthed.

Lighting current for the power house is supplied by a 9-KW. converter set running at 950 R.P.M. This comprises an 850-volt motor connected up to the bus-bars of the switchboard, and a 110-volt D.C. generator, which also supplies the servomotors of the gate valves. Thanks to the extended use of electric remote control, the electrician, without leaving his post at the switchboard, is able to start or stop any one of the generator sets.

The high-tension line connecting the power house to each of the five sub-stations follows almost throughout its course the railway track, and thus is about 55·7 km. in total length. This arrangement simplifies and facilitates the supervision and upkeep of the line.

The overhead line is duplicated throughout its length, and comprises six conductors. It is carried by pinewood poles impregnated with copper sulphate, the maximum spans being 40 m., and the average spans 35 m. The insulators are mounted on two horizontal arms, the upper one carrying two and the lower one four insulators. The standard poles are 11 m. in total length, and are planted in the ground to a depth of 2 m. Three crossings of the River Tèt as well as that of the Jardo ravine, on account of the considerable spans, necessitated the installation of steel girder poles on concrete blocks.

The high-tension porcelain insulators are of the triple-bell type and are amply dimensioned. Before being shipped they were tested at a pressure of 80,000 volts in air and 40,000 volts in acidulated water.

The most serious difficulties were encountered in connection with the tunnels. While some of these could be readily passed over by the overhead line, difficulties of upkeep in the case of some other tunnels rendered the installation of overhead lines practically impossible. Such tunnels were traversed by means of armoured and lead-sheathed cables passing through their interior and fixed to the tunnel vault by means of clips embedded in the masonry. These cables, which were also constructed at the works of the Société Alsacienne, each have three cores of 10 sq. mm. cross-section. Care was taken to protect them against excessive atmospheric pressures by installing lightning arresters at the end of each tunnel. In order to allow any damaged section to be rapidly isolated from the remainder and the load to be transferred from one line to the other, six section posts were installed, at the Cassagne power house and at each of the five sub-stations respectively. These section posts, situated outside in the immediate neighbourhood of the station buildings, each consist of a horizontal metal frame carried by four poles at a height of about 7·60 m. above the ground. This frame carries, in addition to the insulators, section switches of the horn and air-gap type, which are actuated from the ground by means of a handle controlling a system of levers.

After the inauguration of the railway line, the Compagnie du Midi, for reasons independent of the Villefranche-Bourg-Madame Electric Railway, were induced to substitute for the conductors above described between the Cassagne power house and Villefranche, a double line constituted of six aluminium conductors (three of 30 sq. mm. and three of 70 sq. mm. cross-section respectively) carried on ferro-concrete poles.

All five sub-stations are situated in the immediate neighbourhood of the railway. Their electrical equipment is identical, and comprises duplicate plants, each consisting of a step-down transformer feeding a rotary converter. While their normal output is 600 KW., each of these sets is able, during periods of 15 minutes separated by intervals of equal duration, to supply 1,000 KW., as well as to stand momentary overloads of up to 1,200 KW.

The primaries of the transformers are designed for a pressure of 20,000 volts, and their secondaries for supplying six-phase 600-volt current to feed the rotary converters. The design of these transformers is very similar to that of the step-up transformer in the power house.

The rotary converters supply continuous current at 850 volts; they have 12 poles, and run at 250 R.P.M. They resemble the generators with respect to their constructional details, but for the absence of auxiliary poles, which in the present case were not required to ensure good commutation at all loads.

The contact line consists of a rail of extra soft steel supported on sandstone insulators. This rail is of the double-headed type, and weighs 39 kg. per metre; its composition was chosen so as to ensure an electrical resistance as low as possible, the proportions of the various impurities not exceeding the following figures:—Carbon, 0·09 per cent.; silicon, 0·09 per cent.; sulphur, 0·05 per cent; phosphorus, 0·03 per cent.; manganese, 0·42 per cent.

This composition corresponds to a specific resistance practically equal to 6·5 times that of copper.

The insulators each consist of a rectangular block of varnished sandstone, slotted on the top to receive the contact rail. So far from resting directly on the sleepers of the railway track, these insulators are placed on creosoted pine-wood brackets plugged on the sleepers, and are thus able to adjust themselves to suit the contact rail. The latter rests on the insulator through the intermediary of a tie-plate of anti-friction metal. The centre of the contact rail is 600 mm. from the inner edge of the adjoining rail, and the upper edge of the contact rail 250 mm. above the travelling level of the track. The contact rail was placed as high as possible in order to reduce to some extent the risk of break-down due to snowfalls.

The electrical equipment of the contact rail is completed by section switches installed in boxes alongside of the track, which allow either part of the station tracks or the section of the contact rail between two neighbouring stations to be

isolated at will. The contact rail is provided with a series of mechanical arrangements intended to counteract the effects of heat expansion, which are bound to occur, especially in the upper parts of the line, where variations in temperature in the course of a year reach a total amplitude of about 70° C. The contact rail has, therefore, been subdivided into a certain number of sections which are solidly anchored in the centre and fitted at the ends with sliding expansion joints.

The current return is effected by the travelling rails, which are of the Vignoles type with angle fish-plates, weighing 30 kg. per m. The two lengths of rail are connected together at points 100 m. apart by transverse tinned copper wires. The contact line is connected up to the switchboards of each of the five sub-stations and the power-house by an armoured lead-covered cable 500 sq. mm. in cross-section.

The rolling stock comprises 20 two-bogie motor-cars, viz., 10 passenger motor-cars and 10 motor-vans, the electrical equipment of all of which is identical.

The passenger motor-cars each contain between the two driver's cabs a first-class compartment with eight seats, a second-class compartment with 32 seats and a luggage compartment. Each motor-van contains only one separate driver's cab, the other driver's stand being at the opposite end in the car itself. These motor-cars have been constructed to the order of the Société Alsacienne at the works of Messrs. Carde et Fils et Compagnie, of Bordeaux.

The equipment of each motor-car comprises four traction motors each of a normal output of 50-55 H.P., driving the axles through the intermediary of a simple set of gears in the ratio of 1:4·3. Each motor is wound for 375 volts, the two motors of the same bogie being permanently connected up in series for a total pressure of 800-850 volts.

The electrical equipment is designed for electric braking on going down hill—the motors working as dynamos on resistances. The motor control is on the Sprague multiple-unit system, each controller comprising three forward positions and one reverse, as well as three electric braking positions.

Heating is effected by electric heaters located below the passengers' feet and in the driver's cabs respectively. Each of the lighting circuits comprises seven series lamps fed at a pressure of 800-850 volts, and a balancing iron resistance intended to ensure an approximately steady feeding voltage of the lamps, in spite of fluctuations in the voltage of the mains.

The electrical equipment allows the following approximate speeds to be obtained on different gradients with a total load of 40 tons per motor-car :—On the level, 40·4 km. per hour ; on a gradient of 25 per mille, 34 km. per hour ; on a gradient of 60 per mille, 20-21 km. per hour. The maximum speed authorised on gradients of less than 33 per mille is 50 km. per hour. Apart from the motor-cars, the rolling stock comprises 14 two-bogie passenger trailers and about 150 two-axle goods cars of various types.

CONTRACTS CLOSED.

(*Concluded from page* 218.)

Bridlington.—The T.C. has accepted the tender of Mr. W. B. Wilson, of York, for coal (1,500 to 2,000 tons) for the electricity works.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs Johnson & Phillips, Ltd., for electric cable.

Burnley.—The Corporation Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for turbo-alternator, rotary converters, switchgear and other work, at £12,860. A supply of cables has been ordered from B.I. and Helsby Cables, Ltd.

Canterbury.—The T.C. has accepted the tender of the East Kent Colliery Co., Ltd., of Tilmanstone Colliery, for fine slack coal for the electricity works, at 16s. per ton ; and that of Messrs. Wm Cory & Son for Nixon's navigation large steam Welsh coal, at £1 11s. 5d. per ton, and Rochester house coal screenings or Scotch washed singles, at 19s. 10d. per ton.

Cleckheaton.—The U.D.C. has accepted the tender of the Cleckheaton Colliery Co., Ltd., for 1,000 tons of coal for the electricity works, and that of Messrs. W. H. Sharp & Sons for 250 tons.

Eccles.—The Public Lighting and Electricity Committee has accepted the following tenders :—

Triumph Stoker Co.—Mechanical stokers, £423.
Messrs. Sugden.—Superheater, £85.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. G. Gates & Son, of Frindsbury, for extensions to the engine room and boiler house at the electricity works, at £1,928.

Glasgow.—The T.C. has accepted the offer (£1,369) of the North British Lifting and Moving Appliance Co., Ltd., for 16 sets of worm-gear hoists for the abattoirs at Moore Street.

Halifax.—The Tramways and Electricity Committee has accepted the following tenders :—

B.I. and Helsby Cables, Ltd.—6,000-volt overhead three-phase line, £1,076.
Balcke & Co., Ltd.—Water cooling tower, £950.

Lancaster.—The Borough Education Committee has accepted the tender of Mr. H. Renton, of Morecambe, for the electric light installation at the Grammar School, at £344.

The Tramways Committee has accepted the tender of the Electric Car Co., of Preston, for two top-deck covers for tramcars.

London.—Shoreditch.—The Guardians have accepted an estimate (£65) of the Hackney B.C. for installing electric light at the Branch School. The wiring is to be in screwed grip tubing.

Bermondsey.—The Board of Guardians received the following tenders for alterations and additions to the electric light installation at the Infirmary :—

Malcolm & Allan, Ltd.		£712
Wm. Langley		700
W. J. Gray & Son		609
G. H. Cathcart & Co.	(10s. per point extra lights)	545
A.E.G. Electric Co.		545
W. Mackie & Co.		496
S. C. Robson	(12s. 6d. per point extra lights)	495
W. R. Reynolds, Ltd.	(accepted)	449

Middlesex.—The County Council has accepted the tender of Messrs. Martyn & Co., at £1,960, for electric light fittings required at the new Guildhall.

Mirfield.—Messrs. A. Brook & Co. have secured the contract for installing the electric light at St. Paul's Church, Mirfield.

Paisley.—Messrs. A. E. Holms, McPhail & Co., have secured the contract for the lighting of the Marquis of Bute's mansion-house of Mount Stuart, Bute. The contract embraces a complete lighting installation for the house, and the provision of power for cooking, heating and ventilation. There will be upwards of 2,500 lights in the installation and the mode of decoration, it is stated, will be on novel lines. The motive power for the plant, though not yet decided upon, will, in all probability, be suction gas or Diesel engines. It is estimated that over two years will be occupied in completing the work.

Peterborough.—The T.C. has signed contracts with Messrs. Willans & Robinson, Ltd., for a 500-KW. generator and steam turbine, and Messrs. F. Danks, Ltd., of Oldbury, for two Lancashire boilers for the electricity works.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co. for welding about 350 tramway rail joints, at 30s. per joint. The following tenders have also been accepted :—

Browett, Lindley & Co., Ltd.—Fixing steel exhaust pipes with special cast-iron bends ; also automatic non-return valve to No. 4 engine at the electricity station, £130.
C. Richards & Sons.—Tie bars for tramways, £177.
Bayliss, Jones & Bayliss, Ltd.—Tie bars for tramways, £205.

Eight months' supplies :—

Le Carbone.—Motor carbon brushes, £70.
Sloan Electrical Co.—Arc lamp carbons, £50.
H. Green & Co. and General Electric Co., Ltd.—Electric motors, £1,500 each.

Annual supplies :—

Clifton and Kersley Coal Co., Ltd.—2,000 tons No. 2 best washed slack, 12s. 10d. and 13s. 8d. per ton according to mode of delivery ; 5,000 tons No. 4 washed nuts, 14s. and 14s. 10d.
A. Knowles & Sons, Ltd.—12,000 tons No. 2 best washed slack, 12s. 10d. and 14s. 1d.
Earl of Ellesmere.—7,500 tons No. 2 best washed slack, 13s. and 13s. 4d.

West Bromwich.—The T.C. has accepted the tender of the Union Cable Co., for cables, and renewed the contract for a year with the Aron Electricity Meter Co., Ltd., for the repair of Aron meters.

Whitwood.—A large order for mining telephone apparatus has been placed with Messrs. Scattergood & Johnson, of Leeds. The installation is to be carried out by Mr. Walter Robb, lighting and power contractor, of Wakefield.

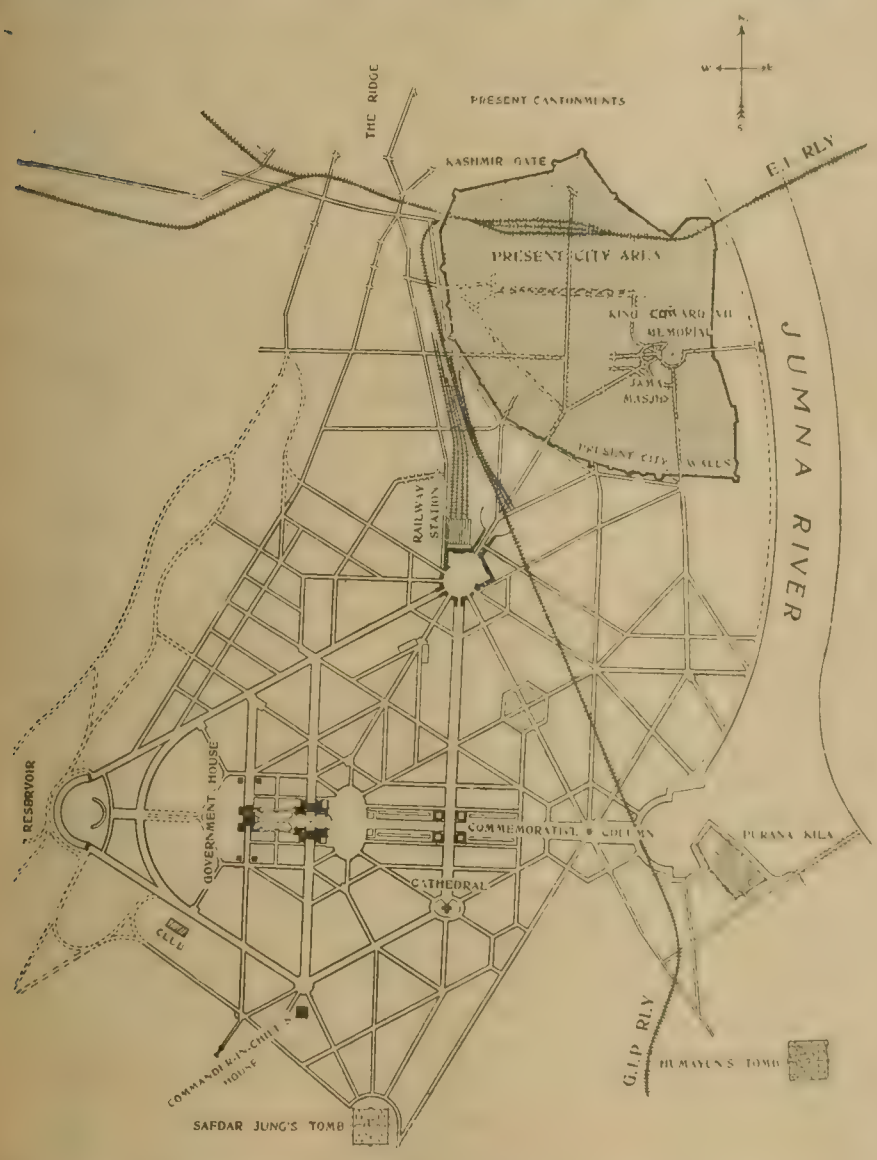
Willesden.—The Electricity Committee has accepted the tender of Messrs. Crompton & Co., at £440, for the renewal of the D.C. switchboard at the Salusbury Road sub-station, and sanctioned a further expenditure during the current year.

NOTES.

Proposed Electrical Manufacturing Rifle League.—A correspondent writes as follows:—"In connection with these works we are running a Miniature Rifle Club, but at the moment we have not identified ourselves with any League. Being an electrical firm (London), we should like if possible to join a League made up of clubs from similar manufacturing firms. There is no such organisation, so far as I am aware, but as clubs are being formed by some other electrical manufacturers, it occurred to me that the time might be opportune for the formation of an Electrical League. If you will kindly make the suggestion in your columns, we could no doubt obtain an expression of opinion on the subject, and in the event of a sufficient number of firms being interested, the matter could be started without delay. As an alternative suggestion, the Electric Supply Companies League may be willing to extend their membership to a limited number of clubs from manufacturing firms."

We need hardly say that we hope that this proposal will receive ample support. We shall be pleased to forward to our correspondent any communications that we may receive (addressed to "Alpha") from those interested in this subject.

The New Delhi.—Our Indian correspondent sends us the accompanying map of new Delhi, which is a reduction of the one published by the Delhi Town Planning Committee, and is interesting as showing the possibilities of future street lighting. The entire electrical work will, of course, be in the able hands of



Mr. J. S. Pitkeathly, C.V.O., the electrical engineer to the new Delhi Province, and it may be taken for granted that an electric scheme worthy of the new capital will be developed in due course.

American Power Plant Fire.—Our Chicago namesake records that the power station of the Commonwealth Power Co., at Albion, Mich., was destroyed by fire on June 30th. During a severe storm a lightning stroke was conveyed into the building from the high-tension lines, and fire was started at the switches. The machinery was damaged beyond repair, and will have to be replaced.

Educational Note.—The next session of the Engineering Department of Edinburgh University opens on October 7th, and particulars are given in our advertisement pages to-day.

Driving Systems for Submarines.—In the course of a long paper dealing with the development of submarines and submersibles and their propelling equipment, G. Berling* deals with several matters of electrical interest. Usually, submarines are driven on the surface by oil engines which also, during such cruising periods, drive dynamos charging a large battery of accumulators. When the vessel runs submerged, the "dynamos" are driven as motors from the secondary cells and the oil engines are shut down. The weight of modern oil engines of type and size suited to this service, averages from 62 to 70 lb. per H.P. (including the necessary starting gear and the main shafting and propellers &c.). Electric motors and the necessary control gear weigh about 132 lb. per H.P., and leading particulars of modern lead accumulators are compared, in the following table, with those of Edison cells:—

	Lead.	Edison.
First cost per H.P.-hour capacity...	7ss. 6d.	2[illegible]s.
Life (discharges)	400 (average experience)	1000 (guaranteed)
Cleaning necessary every... ...	two years	two years
One hour discharge	permissible	not permissible
Per H.P.-hour (3½-hr. discharge)—		
Weight (lb.)	78	72
Space occupied (cb. ft.) ...	0·41	0·51
Ampere-hour efficiency (%) ...	90	75
Watt-hour efficiency (%)... ...	75	55
Voltage drop on discharge (%) ...	10	18
Average voltage per cell	1·92	1·2

Normally, recharging storage cells occupies from 6 to 10 hours, but, since the vessel is bound to remain on the surface during the charging period, it is important that the cells should be able to withstand abnormally rapid charging in case of emergency.

Owing to the very heavy hull construction required to withstand the hydrostatic pressure at depths of 150-170 ft. (with a factor of safety of 2½), and owing to the great weight of the supplementary equipment required to provide for under-water propulsion (85 per cent. of the total driving-machinery weight), it is impossible to increase greatly the speed of a submarine by increasing its tonnage and the H.P. of its surface-driving equipment. The causes mentioned above must always prevent the weight of the driving machinery of a submarine being more than a fraction as effective (in point of power and speed) as that of the machinery in other war vessels. It is a noteworthy fact, however, that only the accumulator-electric motor equipment possesses a sufficiently high "specific gravity" to enable the permissible weight of supplementary ("submerged") propelling machinery to be accommodated in the space available. By carrying cylinders of compressed air or oxygen, it is possible to use the main oil engines for submerged—as well as for surface—propulsion, and, by the provision of oil-fired and steam-soda boilers, it is possible to use the same steam engines for surface and under-water cruising, but in all such alternative systems it is necessary to carry more or less idle ballast to make up the necessary total "submerged displacement," after all the available space has been filled with the air bottles, soda boilers or other supplementary equipment required to make possible the use of the main oil or steam engines when the vessel is submerged.

German Electrical Exports.—Although the promotion by German electrical companies of lighting and traction undertakings in other countries has been adversely criticised at different times on the ground of the withdrawal of capital from the German market, it is becoming recognised that, apart from the dividends received from the foreign investments, the latter are also the means of bringing orders to the manufacturing firms, as is shown by the continued expansion in the exports. During the first six months of 1913, the exports have been as follows, as compared with the corresponding half-year in 1912:—

	1913. *First half.*	1912. *First half.*
Dynamos, motors, transformers, &c. ...	£1,321,500	£1,147,500
Armatures and commutators	189,500	148,500
Secondary batteries and electrodes ...	122,700	155,700
Cables	913,000	542,000
Arc lamps, mercury vapour lamps, &c.	70,200	65,100
Searchlights, &c.	58,100	23,200
Metal-filament lamps	980,000	1,113,000
Carbon-filament lamps	95,200	80,200
Telegraph apparatus	27,500	35,700
Telephone apparatus	181,000	128,000
Safety and signalling apparatus ...	93,000	92,000
Wireless telegraph & telephone apparatus	35,000	37,000
Apparatus for lighting, power transmission, &c.	1,261,000	870,000
Medical apparatus	99,000	98,000
Measuring apparatus	555,000	404,000
Primary batteries	58,000	38,000
Insulating tubes	72,000	60,000

The aggregate value for the first half of 1913 is returned at £6,238,000, as contrasted with £5,119,000 in the equivalent period in 1912. On the other hand, the value of the imports amounted to £311,000 and £254,000 in the same half-years respectively.

Liverpool and District Amateur Wireless Association.—A meeting of this Association was held on July 31st, when it was announced that Prof. E. W. Marchant, D.Sc., and Mr. L. S. Cohen, had both consented to act as vice-presidents. The subject of "extreme" protection against lightning risks was again referred to, when it was suggested that a double-pole two-way switch could be used for the purpose of earthing both aerial and also metal guy ropes, if thought necessary. To-morrow afternoon the Association is paying a visit to the Formby power station of the L. & Y. Railway, with a view to seeing the generation of electrical energy on a large scale, and the feature of the evening was a full description of the Liverpool and Southport Electrical Rail-

* 1913 Jahrbuch der Schiffbautechnischen Gesellschaft.

way, of which Formby is the power centre. The subject was dealt with by the hon. secretary and treasurer—Mr. Samuel Frith, of Crosby. In the course of his remarks, Mr. Frith gave some interesting data, showing the working conditions of the plant.

Forged Share Certificates.—A few weeks ago the existence of a number of clumsily forged share certificates of the Société d'Electricité de Paris was discovered in Paris, and an investigation was at once commenced. Since then an attempt has been made to place such certificates in circulation in Belgium through an exchange bureau at Brussels, but the police were successful, it is said, in arresting the persons. The counterfeit certificates are easily distinguishable from the genuine ones, as not only the colour, to some extent, but also the text does not agree with the original.

International Electrotechnical Commission.—A meeting of the above will be held in Berlin from September 1st to 6th :—

Special committees will meet (Monday) on nomenclature—rating ; (Tuesday) on symbols, prime movers, and rating (continuation). The official opening takes place on Wednesday, September 3rd. Working sessions of the whole commission to draw up, in definite form, various resolutions for ratification at the plenary meeting, occupy Wednesday afternoon and Thursday, followed by the plenary meeting on the Friday.

The special committees on nomenclature, symbols, rating of electrical machinery and prime movers, which have been working continuously since the Turin meeting of 1911, are to hold meetings in Berlin prior to those of the full commission, in order to have a further opportunity of discussing the latest modifications to their reports, suggested by the National Committees. The result of these meetings will be embodied in the reports, which, thus modified, will be considered at working sessions of the whole commission. When agreed to in their final form, they will be submitted to the plenary meeting for ratification.

It is probable that the honour of the Presidency of the Commission, which would have been conferred on M. Mascart, had he lived, will be offered to an eminent French electrical engineer by the Council of the Commission at its closing meeting on the Friday.

Parliamentary.—Metropolitan Electric Railways Bill.—A Select Committee of the House of Commons on July 30th passed the Bill promoted by the Metropolitan Electric Railways for the taking over and enlarging of the City and South London Railway Tube and for other purposes. The only opposition was from the L.C.C., who claimed compensation in respect of the subsoil on the site of the new railways. The Committee rejected the claim.

Appointments Vacant.—Gas manager and electrical engineer for Malvern Council (£350) ; switchboard attendant for Torquay (30s.) ; chief inspector of telephones for the Government of Ceylon (£250, rising to £350, plus allowance). See our advertisement pages to-day.

Trade Announcements.—Messrs. Tetley & Co., of Falcon Works, Salford, announce that in order to centralise the commercial side of their business they have removed their offices to 6, St. Mary's Gate, Manchester, to which address all correspondence should be sent.

The Armorduct Manufacturing Co., Ltd., announce that they have purchased the goodwill and trade marks of the Sunbeam Lamp Co., Ltd., in liquidation.

Iron and Steel Institute.—The autumn meeting takes place at Brussels, from September 1st to 4th, inclusive. A preliminary list of papers has been issued. It includes : "The Electric Refining of Steel in an Induction Furnace of Special Type," by Mr. Otto Frick ; "The Crystallising Properties of Electro-Deposited Iron," by Dr. J. E. Stead and Prof. H. C. H. Carpenter.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Herbert A. Fleet has resigned the position of station superintendent with the Yorkshire Electric Power Co., which he has held since 1904, when the Thornhill generating station was first put into operation.

The salary of Mr. H. A. Kell, assistant to the electrical engineer at Luton electricity works, is to be increased to £180 per annum.

The Morley T.C. has appointed Mr. Tunnicliffe as engineer-in-charge at the electricity works.

Mr. F. P. Seager has been appointed shift engineer at the Manchester city generating stations, at £175 per annum.

Mr. T. H. Heritage, station engineer at the Grantham works of the Urban Electric Supply Co., Ltd., has, on his marriage, been presented by the staff with a silver Georgian teapot.

Tramway Officials.—The Blackburn General Purposes Committee has decided to advance the salary of Mr. J. H. Cowell, the manager of the Corporation Tramways, from £400 to £500, by four annual instalments of £25 a year.

The Tramways Committee of the Rochdale Corporation recommends that the salary of Mr. George Webster, who has been appointed general manager, shall be £350 per year, rising by two annual increments of £25 to £400 per year. Staff changes which have been made include the following :—Mr. F. Ogden, to be chief clerk ; Mr. Richard Bentley, to be chief traffic assistant ; Mr. E. Sidgwick, to be rolling stock superintendent ; and Mr. George Philipson, to be overhead equipment superintendent.

The employés of the Rochdale tramway department on July 29th presented Mr. J. S. D. Moffet, the retiring general manager, who is taking charge of the tramway undertaking at West Ham, with a silver double entrée dish and a silver hot water jug.

The Aberdeen Town Council, by 18 votes to 13, has decided to increase the salary of Mr. Pilcher, tramway manager, from £400 to £450, and thereafter by annual instalments of £25 to £500.

General.—The *Times* states that Prof. Archibald Barr, of the Regius Chair of Civil Engineering and Mechanics, Glasgow University, has intimated his resignation from October 1st.

On the occasion of his marriage, Mr. Reginald Edmund Bridle has been presented with a canteen of cutlery by Messrs. Elliott Bros., their staff and employés, and the young lady members of the staff gave his bride, Miss B. C. Relf, a silver cake basket and sugar basin.

Mr. David M. Fraser, who has for several years acted as managing director of Messrs. Walter Scott & Co. (Edin.), Ltd., has resigned his position in order to take up another appointment in London.

Mr. George Ralph has recently resigned his position as general manager of the Electric and Ordnance Accessories Co., Birmingham, and has joined the staff of the British Thomson-Houston Co., Ltd., Rugby.

Obituary.—Mr. Alfred Apps.—We regret to observe from an announcement in the *Times* "Deaths" column that Mr. Alfred Apps, late of the Strand, London, passed away on July 31st, after a few hours' illness, at the residence of his son at Calne. The deceased gentlemen, who was 74 years of age, was a member of the Institution of Electrical Engineers. We believe an announcement to the effect that Mr. Apps was relinquishing his business interests appeared some months ago. He was for very many years one of the best known London makers of scientific instruments, including electrical and X-ray apparatus. Induction-coil work was his chief speciality.

Mr. J. S. Jeans.—We have to record the death, which occurred on Thursday last week at the age of 67 years, of Mr. James Stephen Jeans, the owner and editor-in-chief of the *Iron and Coal Trades' Review* and other papers. For some years he acted as the secretary of the Iron and Steel Institute and the British Iron Trade Association, and in the editing of proceedings and the preparation of statistics respecting the industries represented by these organisations he was an expert and experienced authority.

Prof. John Milne, F.R.S.—We learn with regret of the death, which occurred at his residence in the Isle of Wight on Wednesday last week of Prof. J. Milne, the world-renowned seismologist. In 1875, says the *Times*, he was appointed to the Chair of Geology and Mining in the Imperial College of Engineering at Tokio, where he had as colleagues Profs. Ayrton, Perry and Ewing. He returned to England in 1895, and took up his residence in the Isle of Wight, where he commenced work upon his well-known observatory. He acted for many years as secretary of the Seismological Committee of the British Association. The deceased gentleman had been ill only for a few days. He was 62 years of age.

Mr. E. A. Sandford.—The death occurred at Plymouth on July 28th of Mr. Edward A. Sandford, chief engineer to the Eastern Telegraph Co., and son of Ald. T. G. Sandford, J.P., of Gravesend. The deceased, who was only 38 years of age, had been invalided home, and he expired as the vessel in which he travelled arrived at Plymouth.

Will.—It is reported that Mr. Anthony N. Brady, the American tram, gas and electric power magnate, who died suddenly at the Carlton Hotel in London on July 22nd last, left estate estimated at $70,000,000.

NEW COMPANIES REGISTERED.

Stella Conduit Co., Ltd. (130,376).—This company was registered on July 28th, with a capital of £6,000 in £1 shares, to take over the business of conduit and tube manufacturers carried on by the Stella Conduit Co. at Bilston, and to carry on the business of manufacturers of steel and iron conduits, tube and flange makers, manufacturers of cycle and motor component parts, &c. The subscribers (with one share each) are:—R. A. Eaton, Green Lanes, Erdington, law clerk ; D. J. Jordan, 68, Walford Road, Sparkbrook, Birmingham, solicitors' clerk. Private company. The number of directors is not to be less than two or more than five ; the subscribers are to appoint the first. Solicitors : Shakespeare & Vernon, 88, Colmore Row, Birmingham. Registered by Jordan & Sons, Ltd., 116 117, Chancery Lane, W.C.

Walker, Clarkson & Co., Ltd. (130,403).—This company was registered on July 29th, with a capital of £5,000 in 3,500 ordinary shares of £1 each and 2,000 founders' shares of 15s. each, to take over from E. R. T. Clarkson, F. H. Walker and the Reason Manufacturing Co., Ltd., certain patent rights, benefits and information relating to the manufacture of electric clocks, and to carry on the business of manufacturers of electric and other clocks, &c. The subscribers (with one share each) are:—E. R. T. Clarkson, 28, Lady Margaret Road, Kentish Town, N.W., tutor; F. H. Walker, 28, Lady Margaret Road, Kentish Town, N.W., machinist; H. F. Reason, Bewlah House, Southwick, Sussex, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are E. R. T. Clarkson and H. F. Reason; qualification, £50; remuneration as fixed by the company. Registered office, 25, Granville Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venezuelan Telephone and Electrical Appliances Co., Ltd.—Particulars of £80,000 debentures, created July 8th, 1913, and secured by trust deeds dated July, 28th, 1890, June 27th, 1907 and July 8th, 1913, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and all property to which it was, on July 8th, 1913, entitled, together with the net revenue arising therefrom and all rights connected therewith, ranking *pari passu* with the charge in favour of the holders of the existing issue of 1st mortgage debentures, for £70,000, and entitled to the benefit of, but subject to stipulations referred to in, above-mentioned trust deeds. Trustees: National Safe Deposit Co., Ltd.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £600, on July 24th, 1913, of charge dated March 8th, 1911, securing £60,000, has been filed.

Manchester Fibrine Co., Ltd.—Deb., dated July 8th, 1913, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital (if any) subject to prior first mortgage deb. for £200. Holder: Miss E. M. Hewison, Winfield, St. George's Crescent, Pendleton, Salford.

South London Electric Supply Corporation, Ltd.—Issue on July 15th, 1913, of £2,809 debentures, part of a series of which particulars have already been filed.

Jackson Electric Stove Co., Ltd.—Debenture, dated July 23rd, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Brighton, 4, Mitre Court, Temple, E.C.

CITY NOTES.

Manaos Tramways and Light Co., Ltd.

The directors' report for the year ended April 30th, 1913, shows that the tramway receipts amounted to £106,148, and the lighting to £44,148, against £109,718 and £35,603 respectively for the previous year. The result for the year is a surplus after meeting debenture interest and sinking fund, of £28,107, which compares with £16,319 for the previous year. The property has been maintained in first-class condition. During the year £21,510 has been spent on capital account, the principal items being four new cars and certain additional track work. This track work is not yet completed. The public lighting has been increased by the addition of 40 arc lamps, making 385 arc lamps. In the private lighting section 471 new customers have been secured, increasing the number of 16-C.P. lamps by 3,895, and making the total number of lamps now connected 18,960, and the monthly receipts for sale of power have increased about 100 per cent. To the balance of £28,107 is added £3,328 brought forward, making £31,435. The directors recommend that there be transferred to the contingencies reserve, making a total to the credit of this account of £15,725 (after writing off an amount of £4,275), £10,000; transferred to renewals reserve, making £21,000, £6,000; dividend on £300,000 ordinary shares at rate of £4 per cent. per annum, £12,000; carrying forward £3,435.

German Electrical Companies.

The Elektra, A.G., of Dresden, which is connected with the Schuckert group and owns, manages, or is otherwise financially interested in, supply undertakings and tramways, reports gross profits of £33,000 for 1912, as compared with £45,000 in the preceding year. After placing £3,800 to depreciation, as against £10,000, and making provision for other charges, the accounts show net profits of £18,900 as contrasted with £29,400 in 1911. It is explained in the directors' report that the profits were derived almost exclusively from current business, whereas in 1911 the accounts included large profits from the sale of securities. The dividend recommended is at the rate of 6 per cent. on share capital of £225,000, being the same rate as in 1911. The loan debt amounts to £112,500.

The Hochfrequenz-Maschinen A.G. für Drahtlose Telegraphie, of Berlin, which disposed of its patent rights (Goldschmidt) to the Compagnie Universelle de Télégraphie et de Téléphonie sans Fil of Paris for £4,000 in immediate cash payment, £60,000 in cash in two instalments payable by April, 1914, and 50,000 deferred shares in the French company, reports net profits of £46,000 for 1912 after extinguishing the deficit of £7,800 brought forward from 1911. The profits have been placed to a preliminary account until a settlement of pending transactions takes place. According to the directors' report, a site for the erection of a German station was obtained at Eilvese, near Neustadt, Hanover, and the station has almost been finished in the present year. On the other hand, the American station at Tuckerton, New Jersey, has also made progress towards completion.

The report for 1912 of the *Continentale Ges. für Elektrische Unternehmungen, of Nuremberg* states that the undertakings in which the company is interested yielded almost without exception more favourable results than in the preceding year. Among these are the suspended railway between Barmen, Elberfeld and Vohwinkel, which produced a surplus of £38,000 as against £36,000 in 1911; the Bergisch light railways and various supply works or tramways in Germany, Austria, France, Italy, &c. After allocating £16,000 to the renewal and redemption of undertakings under the company's management, the accounts indicate net profits and balance forward amounting to £99,000 as compared with £90,000 in 1911. It is proposed to pay a dividend of 5½ per cent. on the preference capital of £1,556,000 as against 5 per cent. in 1911, but the ordinary capital of £44,000 is not yet entitled to participate in the profits.—

Swiss Electrical Companies.

The Aluminium Walzwerke A.G., of Schaffhausen, after allocating £5,400 to the reserve funds, has decided to pay 7 per cent. on the preference capital of £50,000 for 1912, which is the first business year.

The Elektrizitäts Gesellschaft Baden, of Baden, in which the firm of Brown-Boveri is interested, reports net profits of £5,000 for 1912, after having applied £7,600 to depreciation, these comparing with £4,300 and £7,000 respectively in 1911. It is intended to distribute 7 per cent. on the share capital of £60,000, as against 6 per cent. in the preceding year.

The Société Franco-Suisse pour l'Industrie Electrique, of Genera, which was formed in 1898 as an investment and advance company for electrical enterprises, has a share capital of £1,000,000, and loans amounting to £947,000. The gross receipts, according to the directors' report for 1912, amounted to £104,000 from interest, dividends, and other investments as compared with £95,000 in 1911, and the net profits were £56,900 and £47,400 in the two years respectively. A dividend at the rate of 5 per cent. has been declared, this contrasting with 4½ per cent. in 1911.

The Watt. A G. für Elektrische Unternehmungen, of Glarus, which is associated with the Zurich Banks for Electrical Enterprises, reports that the undertakings in which the company is financially interested made further progress in 1912. The net receipts, which resulted entirely from interest on investments, and from commissions, amounted to £25,000, as compared with £23,000 in 1911 on a paid share capital of £280,000. It is intended to pay a dividend of 6½ per cent.—being the same rate as in 1911. The company's loan capital is precisely equal in amount to the ordinary share capital.

The gross profits realised by *Brown, Boveri & Co., of Baden*, amounted to £298,000 in 1912, as contrasted with £225,000 in the preceding year. After placing the sum of £60,000 to the reserve and depreciation funds, as against £22,000 in 1911, the balance permits of the payment of a dividend of 8 per cent. on the share capital of £1,120,000, this rate comparing with 7 per cent. in 1911. It is now proposed to seek the sanction of the shareholders to a scheme for increasing the share capital to £1,280,000 at a time which the directors may consider to be appropriate for the purpose.

The Société Electro-Métallurgique Paul Girod, of Neuchatel, earned gross profits of £27,900 in 1912, as compared with £15,000 in the previous year. After placing £11,700 to the account for depreciation, the balance has been carried forward, so that again no dividend has been paid. It has now been decided to financially reorganise the company by first reducing the share capital from £480,000 to £288,000, and then increasing the capital again to £480,000 by the emission of preference shares, the issue of which has been guaranteed by a financial syndicate.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last at the rate of 8 per cent. per annum. This is the same rate as last year.

Traction and Power Securities Co., Ltd.—A petition for confirming the reduction of capital from £2,000,000 to £1,829,180 was presented to the Court on July 12th, and is now pending. The list of creditors is to be made out as for October 1st.

Japan.—During the month of June last the capital invested in new electrical companies in Japan was £40,000, while £235,000 was raised for the extension of existing concerns.

National Telephone Co., Ltd.—A meeting of holders of third preference shares is called for August 14th to consider the recently-delivered judgment determining the rights of holders of stock.

National Gas Engine Co., Ltd.—The directors announce an interim dividend at the rate of 5 per cent. per annum, less income-tax, on preference shares and 7½ per annum, less income-tax, on ordinary shares for the six months ended June 30th, 1913.

Spanish and General Wireless Trust, Ltd.

The directors' report for the year to June 30th last states that the issued capital is almost entirely represented by holdings of shares in the Compania Nacional de Telegrafia Sin Hilos, a company in Spain which has obtained the concession from the Spanish Government to construct and work commercially wireless telegraph stations in Spain and the Canary Islands. The development of the business of the Compania Nacional has not been as rapid as had been hoped, owing to certain difficulties which arose with some of the Spanish Government departments. Those are now in process of being adjusted, and the business should undergo important developments during the current year. Additional stations will be brought into operation in the course of a month or two which should add substantially to the company's business. In the meantime no revenue has accrued to this company from its holdings in shares in the Compania Nacional, and it is recommended that the amount of £4,654 to the credit of profit and loss account be carried forward.

Mr. Godfrey Isaacs presided at the meeting held last Friday at Marconi House, W.C. He said that the assets of the company were almost entirely composed of shares in the Compania Nacional de Telegrafia sin Hilos, and the progress of that company had not been sufficiently rapid to produce any revenue to this company in the shape of a dividend. Under the terms of the concession from the Spanish Government a number of stations had been constructed, the first of which were at Arnajuez, near Madrid, Barcelona, Soller, in the Balearic Islands, Cadiz, Vigo and Las Palmas and Teneriffe, in the Canary Islands. The business had so far been mainly that of communication with ships at sea, the receipts from which had not been up to expectations. There was already a marked improvement in the station receipts, and the number of messages month by month was increasing. Likewise the installations on board ships. The Portuguese Parliament had recently passed a law rendering wireless telegraphy obligatory on board all vessels of a certain denomination, and no doubt similar legislation would follow at an early date in Spain, which should add considerably to the business of the coast stations. During this year a new station had been opened at Santander, and others were approaching completion and should be open to service within a couple of months. Considerable difficulty had been encountered with the telegraph authorities in Madrid, which had given the directors of the Compania Nacional a great deal of trouble in connection with the International Telegraph service. Under the terms of the concession the company were clearly entitled to conduct that service, but this was questioned by the authorities. They were advised, however, that the matter had now been practically settled. It was hoped that ere long a service would be in operation between Spain and this country, a station on each side being ready to start such a service from the moment the necessary authority on this side could be obtained. Other telegraphic developments had been retarded owing to the wars in Tripoli and Morocco. When the cable broke down between Spain and the Canary Islands permission was obtained by the Spanish company to conduct the telegraph service, and for some months the whole of the telegraphic service between Spain and the Canary Islands was conducted by the Compania Nacional. When, however, the cable was repaired, the postal authorities stopped the service pending the decision as to the company's right to conduct it. The Board were given to understand that this matter had also now been satisfactorily settled and the wireless service would be permanently restarted within the next few weeks. Other business which the company had in contemplation had had to be deferred for the most part, circumstances having been unpropitious.

Mr. A. Marconi seconded, and the report was adopted.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.

The adjourned second ordinary general meeting was held on Thursday last week at the Cannon Street Hotel, E.C., Mr. A. S. Collard presiding.

The Chairman explained that the meeting was adjourned last December for the purpose of awaiting the arrival in England of Mr. C. M. Bamford, who was a director and the resident engineer at Lobito. Since the last meeting Capt. Bennett-Dampier, the chairman, and two other directors had retired, in order to save expenses. He then asked Mr. Bamford to give an account of the present position of the company.

Mr. C. F. Bamford, A.M.I.C.E., said that from the inception of the company they had had a great many difficulties to contend with. One of the chief had been the abnormally wet season during the past two years, which caused the river to keep at a high level and prevented the progress of the works at the dam and power house. When he arrived at Lobito, he found that the contractors had sublet the construction of the dam and power house to local men, who had no knowledge of that class of work, and he found they were putting in bad work and not treating the native labour fairly. The contractors had some difficulty in getting rid of those men and obtaining fresh native labour after the treatment which the former natives had experienced. The shareholders were also aware that Messrs Johnson & Phillips stopped work at a most critical time—when the river was rising and when all possible labour was required to remove the plant and to protect the works. Fortunately, Messrs. Pedersen, Johnson & Brew, a most reliable firm of local contractors, came to their assistance and put their men on and saved the works. That firm had continued the construction and replaced and made good a large amount of concrete work put in by the former contractors, and had also completed the foundations for the new large sluices and a very substantial stone dam to protect the uncompleted works on the north side of the river. The time set down in the concessions for the completion of the whole of the works was very short—a period of about eight months. It had, therefore, been necessary to apply to the municipalities for an extension of time, and he was pleased to say that he had been able to arrange that. Since March last, they had supplied street lighting to Benguella and Catumbella and to Lobito, and from reports which he had received privately he had reason to believe that the public were well satisfied with the light. A number of private consumers had also had their buildings fitted with electric light, and to hasten that work the company last week sent out another wireman. The Government intended to supply electric light in their various buildings in Lobito, Benguella and Catumbella, including the Palace, Customs, Post Offices, Courts and Hospital, and they were now preparing plans and estimates for the buildings. Installations had already been commenced in some of the Government buildings, and the total requirements when completed would amount to about 16,000 c.p. Plans and estimates were also being prepared for installing the electric light in the various railway buildings, offices and workshops at Lobito. To complete a satisfactory installation in those buildings they would require about 12,000 c.p. When those installations were completed, including the municipal street lighting in the three towns, the total supply required would amount to nearly 50,000 c.p., from which a revenue of about £7,000 per annum should be derived. That represented about 1½d. per lamp of 16-c.p. per night. He thought they would agree that the price was not high for a 16-c.p. lamp to towns in Africa over 4,800 miles from England. That supply was quite apart from other consumers, namely, hotels, theatres, clubs, banks, merchants' houses, private buildings, &c. For those it was intended to charge a higher contract rate of about 2½d. per lamp of 16-c.p. per night. Before he left, the president of the municipalities approached him with regard to the company supplying power to their town waterworks. When in Lisbon, the managing director of the Sociedade Agricola de Carsequel informed him that they would be pleased to receive quotations from the company for the supply of electrical energy for their irrigation works at Catumbella. The present load there amounted to 140 h.p., and in the near future would be increased to 500 h.p. That firm was also putting down a complete new sugar plant capable of treating 250 tons of cane daily and they also intended putting down flour mills. Their property adjoined Catumbella, and the company's high-tension line passed over them for a distance of nearly 12 kilometres. Their agent reported that he could place 100 h.p. day load, which he (Mr. Bamford) understood did not include any load required by the railway company for their workshops at Lobito. He also informed them that they had been asked to transfer the Government telephone wires to their poles, for which they would pay the company an annual sum for maintenance and rent. In all probability he believed that in the near future the company would have an offer of taking over the whole telephone system in Lobito, Benguella, and Catumbella, which should be a most profitable business if worked properly.

There being no questions asked, the Chairman formally proposed the adoption of the report, which was seconded by Mr. F. S. Kerr and carried.

Subsequently meetings of the debenture stockholders were held, at which resolutions were passed authorising the directors to issue a further £7,500 in prior lien debentures.

Continental.—The French Cable Co.—The report of the Compagnie Francaise des Cables Télégraphiques of Paris states that the traffic on the Trans-Atlantic line increased during 1912, but reductions in rates for certain classes of messages had to be made in order to meet foreign competition. The bands of insurgents destroyed the line in the Antilles and a claim for an indemnity had been lodged with the Dominican Government. The cable on the line to Brazil and Guyana was frequently interrupted. The accounts show net profits of £17,400, being the same as in 1911. It is stated that as an agreement has at last been reached with the French Government a dividend of 5·90 francs gross is payable for 1912, as against 6·25 francs in the previous year.

The Russian Westinghouse Co.—The accounts of the Russian Westinghouse Co., of Moscow, for 1912, show net profits of £12,819 as compared with £12,745 in the previous year. It has been decided to pay a dividend of 3 per cent., being the same rate as in 1911. It is stated that the company has discontinued its branch at St. Petersburg.

City of London Electric Lighting Co., Ltd.—The directors announce the following dividends on account of the distribution for the year ended December 31st, 1913: On the preference shares, 6s. per share; on the ordinary shares, 6s. per share, both subject to deduction of income-tax and payable on September 15th. Last year the interim dividend was at the same rate.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (at the rate of 5 per cent. per annum), less income tax, for the three months ended June 30th.

Jandus Arc Lamp and Electric Co., Ltd.—The directors recommend a dividend of 15 per cent., carrying forward £2,748.—*Financier.*

Montreal Light, Heat and Power Co.

The annual report to April 30th, 1913, which was submitted at the 12th annual meeting held on June 4th shows that the gross revenue was $5,509,557 and the operating and maintenance expenses were $2,328,440, with a net revenue of $3,181,116, less fixed charges $463,979, leaving a net income of $2,717,137; dividends paid absorb $1,147,500 and dividend payable May 15th, $382,500, leaving the surplus from the year's operations at $1,187,137. From this there is appropriated to depreciation renewal reserve account $550,000, and to officers' and employés' pension fund $10,000, leaving to be transferred to general surplus $627,137. The increased volume of business done by the company during the year indicates the growth of the city and suburbs and is reflected in the gross revenue. The net revenue and surplus earnings show substantial increases over last year, and the statement generally will be considered a satisfactory one. The surplus earnings $627,137, added to those from previous years, brings the accrued surplus to $3,521,243. The continuous growth of the business adds emphasis each year to the necessity of providing adequate reserve for depreciation and obsolescence of buildings and equipment, and in view of the constantly changing methods and equipment, the depreciation reserve must be ample to take care of these conditions. In the meantime this and other reserves are invested in revenue-earning plant, and the public is getting the advantage of the use of a large amount of plant upon which no dividend has to be earned. The needed extensions in the immediate future in both gas and electric departments, in order to meet the demand for service consequent upon the rapid development of the city and suburbs, will be very large, and in this connection in the gas department the company has planned a new manufacturing station of a capacity of 4,000,000 cb. ft. per diem, designed so that it can be increased to 8,000,000 cb. ft.; also an extension of coal gas plant to its present Elm station of additional capacity of 1,250,000 cb. ft. per diem. These works are now under way, and will be completed in part during the current year, and partly during next year. The new district gas-holder, now under construction in the North-West section of the city, will be ready for operation in the autumn, and when started will facilitate the distribution of gas in that section.

In the electric department the directors, during the year, entered into a long term favourable contract with the Cedars Rapids Manufacturing and Power Co., for the supply of 60,000 H.P. from their Cedars development, to be taken as and when required, and in virtue of the agreement it is incumbent upon this company to transmit the power to Montreal. For this purpose a steel tower transmission line will be constructed, and the work, which is already in hand, will be completed simultaneously with the Cedars development. Consequent upon the acquisition of additional hydraulic power from the Cedars Rapids Co. as intimated, and with a view to maintaining a definite ratio between steam reserve and hydraulic power, the company has planned a new central auxiliary steam station of a capacity of 25,000 H.P. (with provision for an ultimate capacity of 50,000 H.P.) to safeguard the company and its customers against possible interruptions and variations affecting its hydraulic supply. This station it is expected will be ready for operation in October of the present year. To afford its customers better convenience, and to facilitate the handling of the company's business, the directors acquired additional land adjoining the present power building, and have arranged for the construction of a ten-story annexe for office purposes. The construction of same is at present under way, and it is expected will be completed for occupation May 1st, 1914. There will also be the usual large extensions necessary to both the gas and electric distributing systems to meet the constantly increasing demand for service in the newer sections of the city and suburbs.

In view of the extensive works and additions under way and in contemplation, it will be necessary to raise new capital, and the directors have passed a by-law authorising an increase in the capital stock of $5,000,000. Only a proportion of the additional capital will be required for the time being.

The directors have just announced a further reduction in gas and electric rates, effective from July, 1913, meter readings. The concession in the gas rate is equal to over 5 per cent., and in the rate for incandescent electric over 9 per cent. It is expected, as heretofore, that additional business will compensate the resultant loss in revenue. The properties and plants of the company and its various subsidiary companies have been maintained in the same high state of efficiency as heretofore, as evidence of which there was expended during the year on maintenance account, $438,367, which, with the appropriation for depreciation renewal reserve as noted, represents a total expenditure and provision in this connection of upwards of $988,368.

Kalgoorlie Electric Tramways, Ltd.

The directors' report for the year ended December 31st, 1912, shows that the gross receipts amounted to £37,917 against £41,472 for the previous year, while the net profits earned were £10,099 as compared with £14,250 for 1911. The directors regret to have to report the continued decrease in traffic receipts, owing to a continuance of the depressed conditions of business which have unfortunately existed in Kalgoorlie for some years. Although many of the large mines are showing good developments at depth, which must add considerably to the life of the mines in question, yet these discoveries have had no immediate effect on the prosperity of the district. The report contains a comparative statement from the company's attorney showing the decrease in the output of gold from the mines, the decrease in the number of men employed and the decrease in profits per ton. The general labour agitation which has prevailed at Kalgoorlie is also a factor against the earning capacity of the tramway. During the current year the company has had to defend itself in the Arbitration Court against an action by its workmen for improved wages and conditions; the actual award is not yet known, but it is anticipated that it will, when given, be an increased burden on the company. The board regret that they were compelled to suspend the payment of interest on the "B" debenture stock since June 30th 1912. The engineer reports as follows:—

Operation.—During the year the cars travelled 614,170 miles as against 621,096 car-miles in 1911, and carried 2,[illegible] passengers as against 2,[illegible] in 1911. The earnings per car-mile in 1912 were 14·[illegible]d. as against 15·[illegible]d. in 1911, with an expense of 10·07d. per car-mile in 1912 as against 9·97d. in 1911. The expenses per cent. of earnings in 1912 were 68·74 as against 62·40 per cent. in 1911.

Power Supply.—The number of units charged by the Power Co. in 1912 was 703,189 (£8,057 18s. 11d.) as against 642,292 (£7,153 7s. 1d.) in 1911.

Rolling Stock and Equipment.—With due regard to efficiency and economy, the whole of the company's rolling stock, plant, tracks and overhead lines have been well maintained during the year.

A further amount of £6,191 of "A" debenture stock has been redeemed in respect of the year under review, and during the current year an additional sum of £6,598 has also been bought for redemption, thus reducing the stock outstanding to £56,780. The board record their appreciation of the work done by the staff in Western Australia during the year, and especially to Mr. Stanley for the way in which he has conducted the case on behalf of the company before the Arbitration Court, for the extra work done, and for the manner in which he has surmounted many difficulties.

The ninth annual meeting was held on Friday last at the London Chamber of Commerce, Cannon Street, E.C., Mr. Allen H. P. Stoneham presiding.

In proposing the adoption of the above report, the Chairman said he was sorry to say that the accounts were not so satisfactory as they could wish, owing, in a great measure, to the depressed state of business in Kalgoorlie and the fewer men employed in the mines. Alongside that they had to face the fact that the company's employés were receiving higher wages than was the case a few years ago, and although the traffic receipts had decreased, the expenses had gone up. Their manager, Mr. Stanley, did all he could to keep the expenses down, and he had had a very arduous time this last year, as the arbitration with the men had been a very hard proposition to deal with. They had to combat the men at every point, and Mr. Stanley made a most strenuous fight; being complimented both by his opponents and the judge on the fight he put up. In addition to their other troubles, they had had to contend with meter troubles. As the shareholders were aware, they obtained their current for working the tramway from the Kalgoorlie Power Co., and it was paid for on a meter rent. They had always had two meters—one to check each other, and for some years the meters agreed. Some five months ago there was a tremendous storm in Kalgoorlie, which damaged their posts and blew down part of the power works, and the meters began jumping about in an extraordinary way, and they had never agreed since. They would not have minded if they had registered less, but, unfortunately, they registered more—alarmingly more. They had called in various experts to calibrate the meters and overhaul them, and at last they had got them to agree within a very small fraction, and he believed that from now their consumption of electricity would be considerably less costly than it had been. He believed that for some months past the meters had been reading wrongly to the detriment of the company, with the result that they had been paying a good deal more for electricity than they ought to. They still had a dispute with the power company as to £300 or £400, which they had gone to arbitration upon. Their traffics had been affected, because not only were there between 4,000 and 5,000 fewer men working in the mines, but there was now a much larger proportion of single men employed there. They had great hopes that the commencement of the Trans-Continental Railway would have helped them materially. That work had been begun, but in a very half-hearted fashion, and, so far, it had not benefited Kalgoorlie. He hoped that the wave for nationalising nearly everything in Australia would reach Kalgoorlie, and that the Government would purchase their tramways, as they had those of Perth. There had been *pourparlers* on the matter, but nothing definite had come from them. The shareholders might be sure that if the board got a decent offer they would recommend it to them for their acceptance.

Mr. C. C. Baker seconded the motion.

Replying to questions, the Chairman said the board were quite alive to the desirability of reducing expenses wherever possible. As to reducing their fees, he would point out that some two years ago the directors' fees were considerably reduced, and there was much more anxiety and work in managing a company that was not paying than there was in looking after a flourishing concern.

The report was adopted.

Perth Electric Tramways, Ltd.—At an extrordinary general meeting held on Friday last, the resolution already passed for winding up the company, was confirmed. Messrs. C. Wren and F. Holyfield, of 30 and 31, St. Swithin's Lane, E.C., were appointed liquidators. The chairman, Mr. O. Wethered, said that there was an excellent prospect of a distribution of £1 a share being made within 10 or 14 days.

Mather and Platt, Ltd.—According to the *Times*, an interim dividend on the ordinary shares of 5 per cent., free of tax, for the half-year ended June 30th, being at the rate of 10 per cent. per annum, is announced.

Anglo-Bohemian Industry, Ltd.

At the statutory meeting of the Anglo-Bohemian Industry, Ltd., held on July 14th in London, Lord Teynham said (according to a report supplied to the *Financial News*) the company's chief occupation had been to make ready for the construction of the plant which was to supply the South Bohemian towns and districts and industries with electrical energy. Some 37 towns and districts have formed a confederation for the purpose of taking their supply of electrical energy from the company's works at Netolitz, and a committee had been appointed to deal with the matter, consisting of the mayor of the royal town of Pisek, several Members of Parliament, district deputies, large landowners, and members of the Board of Trade of Prague, Pilsen and other places. The technical preparatory work would be done without further delay by the Government Board of Bohemia. When the scheme was complete, this company would possess a valuable monopoly, as no power station would be admitted in South Bohemia, except the one belonging to this company at Netolitz. The County Council of Bohemia had worked out a general project for the supply of electricity to the various districts in the whole country. In each district only one monopoly was to be given for the supply of electricity. The connection and division of the various towns and localities were in the hands of the County Council, but works might be constructed by third parties under a guarantee as to capital, interest, and amortisation. The contract for the supply of electricity by the Anglo-Bohemian Industry, Ltd., had been granted by the South Bohemian districts, and preliminary contracts had been signed by the County Council, and had now only to be formally confirmed by the Government, which confirmation would be given before the end of the month. In addition to the towns and districts mentioned, important negotiations had been opened with industrial concerns, including large paper mills and a brewery at Budweis, and a preliminary contract had been concluded with his Excellency Prince Schwarzenberg, by which his breweries and other industries and properties had agreed to take and pay for at least 400 KW. and 2,000,000 KW.-hours per year at a minimum price of 120 kronen per KW., and 7 heller for each KW.-hour. The construction of the electric power stations had been decided upon by three installations, and in consequence the estimates made for the working expense had been made on the basis of each separate construction respectively on each increase of the plant. The first construction would be finished within 15 months, the second during 1916, and the third in 1918. The managing director estimated the net profits from the contracts already entered into at about £30,000.

New Companies in 1913.—The *Investors' Guardian* in the course of its summary of company registrations for the first half of 1913, says: "Notwithstanding the decrease of 18 millions in the aggregate capitalisation of the companies registered during the last six months, there are some notable individual exceptions. In the capitalisation of electrical companies, £4,498,787, there is a gain of about £2,800,000; in chemical and medical, £3,398,122, a gain of £2,500,000, to which the Nitrogen Products and Carbide Co. contributes £2,000,000; in textile manufacturing, £5,945,850, a gain of £2,000,000, more than accounted for by the huge Courtauld registration of £2,500,000; in railways and tramways, £2,459,007, a gain of £1,300,000; in coal and fuel, £3,969,508, an increase of £1,200,000, more than accounted for by the Consolidated Cambrian registration of £2,000,000. The motor, cycle, 'bus and car figures, £4,783,460, an increase of £800,000, proclaims the activity and wide diffusion of the motor-'bus and of the motor-car. Pottery and earthenware, £1,035,330, compare favourably with £225,500; theatres and amusements, £2,561,824, as against £1,279,750, testify largely to the great vogue of the cinematograph, and the formation of the numerous companies for its display. The water registrations are £341,000, as against £208,500. Amongst the principal decreases are finance registrations, from £9,987,437 to £6,281,860 and timber, from £2,547,753 to £988,404."

Northampton Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the half-year ended June 30th.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange returned from its Bank Holiday week-end in a cheerful frame of mind. Parenthetically, and more literally, it ought to be said that about half the Stock Exchange returned, the other half keeping holiday, which the cynical declare means losing less money than is involved in coming to town. The general outlook, however, is not at all bad.

One of the most healthy signs to be discerned at present is the steady way in which industrial stocks and shares of all kinds are moving up. Advances have occurred since we last wrote in such sections as those for Iron and Steel shares, Electric Lighting issues, Telegraph and Telephone descriptions, Brewery stocks, and the like. Notwithstanding the holiday atmosphere, the investor is certainly more willing at the present time to utilise his money in stocks and shares than has been the case for some time past; and a quiet improvement in the price of Consols came as a useful stimulus to markets as a whole.

The batch of dividends declared by the Home Railway Companies must be considered quite satisfactory, and the early disappointment caused by the first declarations has been wiped out by subsequent results. No doubt the Home Railway market would have responded with greater alacrity than it has done, were it not for the absence of the half-yearly statements and meetings, reference to which has already been made in these columns. People are averse from buying stocks and shares in companies, the progress of which is only to be made public—except through the medium of weekly traffic returns—once a year. Barring labour troubles, however, there ought to be a good time in store for the Home Railways through the next six months; and towards the end of the autumn it is conceivable enough that there may be a boomlet on the strength of the anticipated dividends for the full year.

Metropolitans, *ex* their little dividend of 15s., are practically unaltered at 45. In the Central London group the Ordinary and Preferred, both non-assented, were quoted *ex* dividend, allowing for which there is virtually no change in quotations. Districts remain about 33, but Underground Electrics are ⅜ better as regards the £10 shares. The shilling shares have begun to harden, and both Debentures show rises. A feature of the week has been a recovery of five points in London United Tramways 4 per cent. Debenture, restoring the quotation to 61, and so wiping out most of the loss sustained in July. London and Suburban Ordinary and Preference shares, however, have both given way, the price being 7s. 6d. and 12s. 6d. respectively; while the Debenture stock remains at the very wide price of 65-75.

Dividend declarations in the English Electricity Supply group are having a good effect upon the prices, though it is only in the case of the County of London that any change has been made from the usual interim rates. County Ordinary further improved to 11, Westminsters and Metropolitans are both ⅛ higher, and the market holds more strength than may seem apparent, from the fact that other prices are virtually unaltered. The Brush Company has issued one of its usual melancholy reports, showing a fresh loss of £7,700, which has to be added to the already enormous amount to the debit of the undertaking, making altogether £243,000. Negotiations are in progress now to put the finances of the company on a sounder basis, but no further steps are likely to be taken till the accounts for the present year are complete. It is stated that the contracts in hand are at satisfactory prices. Until drastic measures have been taken to secure the reorganisation of the capital account, it is well-nigh hopeless to expect the concern to make any real headway in the direction of earning profits for its unfortunate proprietors.

Other changes in the list of Manufacturing shares are mostly in the upward direction. Castner-Kellners hardened to 3$\frac{11}{16}$. India-Rubber shares rose to 12. There is a steady enquiry for the Debenture stocks of most of the leading companies.

The market in Telegraph and Telephone descriptions is distinctly a good one. In most of the various groups there are improvements. Amongst Anglo-Americans, Direct United States are better at 7, these being ⅛ up, in addition to the dividend of 2s. deducted last week. Anglo-American Preferred retains its rise, but the Deferred stock at 23$\frac{3}{8}$ is ⅛ lower. The Eastern group have been helped by the continuance of satisfactory news with regard to China. Eastern 4 per cent. Debenture rose to 94, the Preference has gained 1½. Eastern Extension Debenture at 93 *ex* dividend has recovered its interest. No further change is to be noted in West India and Panama shares. In sympathy with the good tone of the market, Globe Telegraph Ordinary rose to 11. New York Telephone 4½ per cent. Debentures have once more touched par. National Telephone Deferred, quoted *ex* £22 return of capital, is now about 6½, and it is thought in the Stock Exchange that the final distribution, which will wind up the whole business, may be forthcoming somewhere about the end of October. So far, £97 per cent. has been returned to stockholders; and it is not surprising that those who remain of the original body hold emphatic views with regard to the suitability of the nation taking over the interests of joint stock companies, whatever may be the monopoly which the latter enjoy.

Marconis spurted $\frac{3}{16}$ for the Ordinary, and ⅛ in the case of the Preference, on the dividend expectations. The terms of the company's proposed new contract with the Government have had no influence upon the price of the shares. American Marconis hardened to 17s. 6d.; the Canadians remain about 8s. 6d.

Once again there is a disposition to regard more favourably the various companies in Mexico, and this was reflected in advances amongst the Utility Companies' issues as well as those of the Railways. The principal rises have been secured by the Common shares of the Mexico Tramways and the Mexico Light and Power, but there are also smaller improvements in the bonds of this group. Brazilian Tractions rose 3, to 88 *ex* dividend, and the progress which is being made by this Company is well spoken of. Anglo-Argentine Debentures are harder. Victoria Falls Preference remain at 15s. It is generally conceded that the trouble on the Witwatersrand may be considered at an end, save for minor points awaiting settlement.

The market for copper, the metal, continues to soar, fresh rises being registered almost every day. In consequence, the shares of most of the copper-mining companies are decidedly good. Rubber, too, shows a slight inclination to recover from its low price, optimistic statements at two recent meetings helping to allay apprehension in the share market, where prices are a little harder. It may be noticed, in passing, that in spite of all the invitations advanced to them to come into the open with expressions of their views, the rubber-users, up to the present, have been very retiring and reticent, which, in the circumstances, is just what might have been expected.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 5th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	6	9½ — 10½	..	5 14 3
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅝	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅞ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	£5	10	10	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	£5	7	7	8½ — 8⅝	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	£5	£5	£5†	4½ — 4⅝	..	5 5 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4½ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	£5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	£5	£5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	£10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	£10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	£5	£5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	98 —100	..	4 10 0
County of London, Ord.	£10	£6	6	10⅜ — 11⅛	+ ⅛	5 6 8
Do. 6 % Pref.	£10	6	6	11⅜ — 11⅞	+ ⅛	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	£3	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	£5	..	..	1⅜ — 2	— ⅛	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	£5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	£5	£5	£5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90 xd	..	5 0 0
Hove	£5	9	9†	7¾ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	£5	9	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	88 — 91 xd	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	7¼ — 7⅝	..	5 15 5
London Electric, Ord.	£3	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	£5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	£5	4	4†	8½ — 8⅞	+ ⅛	5 6 8
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	£5	£5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	£10	£6	£6	9½ — 10⅓	..	5 14 3
Oxford	£5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	£5	10	10†	8¼ — 8½ xd	..	5 14 3
Do. 7 % Pref.	£5	7	7	6⅞ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	£4	£5	£5½	2⅞ — 3⅛	— ⅛	7 0 9
Do. 5 % First Mort. Deb. ..	100	£5	£5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	£1	7	7	1 7/16 — 1 9/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	½ — ⅝	..	..
Do. 5 % Cum. Pref.	£5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	£5	10	10	8⅞ — 8⅝	+ ⅛	5 15 11
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅝ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	£5	£5	6	5 — 5½	..	5 14 8
Calcutta, Ord.	£5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	£5	£5	£5	4⅞ — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	£5	£5	90 — 92	—1	5 8 8
Canadian Gen. El. Com. ..	$100	7	7	108 —112	+1	6 5 0
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	£1	£5	£5	¾ — 13/16	..	6 8 1
Do. 5 % Deb.	100	£5	£5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	£5	£5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	£5	£5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	...	5/16 — 5/8	..	Nil
Do. 6 % Pref.	£1	£6	£6	7/16 — 1/2	..	9 12 0
Kaministiquia Power, 5% G. Bs.	$500	£5	£5	100 —102	+ ½	4 18 0
Madras, Ord.	£5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	£5	£5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	£5	£5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	60 — 64	+3	6 5 0
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	..	7 4 4
Do. 5 % 1st Mort. Gold Bds.		£5	£5	85 — 88 xd	+1½	5 13 8
Do. 5 % 2nd Mort. Bonds ..	100	5	5	74 — 77	..	6 9 10
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	£5	£5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	207 —217 xd	..	4 2 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	£5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	£6	£6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	£5	£5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	£5	£5½	124 —128	..	4 5 11
Do. 5 % Con. 1st Mort. Bonds	$500	£5	£5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	£5	£5	90½ — 92½	..	£ 8 1
Victoria Falls Power, Pref. ..	£1	11¼d.	17⅜d.	1 1/16 — 1 3/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	$100	£5	£5	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	£5	£5	93½ — 95½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	130 —133	..	6 0 4
Do. Collat. Trust	$1000	4	4	90½ — 92½	..	4 6 6
Anglo-American Telegraph ..	Stock	8	8	60 — 63 xd	..	4 15 8
Do. 6 % Pref.	Do.	6	6	108 —109	..	5 10 1
Do. Def.	Do.	30/-	30/-	28⅛ — 29⅜	— ⅛	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	£5	£5	104 —106	..	4 15 8
Chili Telephone	£5	7	8	7 5/16 — 7 9/16 xd	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	£10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	£10	10	10	15⅝ — 16⅝	..	5 19 4
Direct Spanish Telegraph, Ord.	£5	4	4†	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	£5	10	10	6¾ — 7½	..	6 13 0
Direct United States Cable ..	£10	£5	4	6¾ — 7¼ xd	+ ¼	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	+1	5 7 8
Do. 8½ % Pref. Stock ..	Do.	8½	8½	75½ — 77½	+1½	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	93 — 95	+1	4 4 3
Eastern Extension	£10	7	7	12 — 12½	..	5 10 2
Do. 4 % Deb.	Stock	4	4	92 — 94 xd	+2	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	£10	£6	£6†	10⅜ — 11¼	+ ⅛	5 6 8
Do. 6 % Pref.	£10	£6	£6	11⅜ — 12⅜	+ ⅛	4 17 0
Great Northern Telegraph ..	£10	£8	£20	29½ — 31½	..	6 7 10
Indo-European Telegraph ..	£25	£8	£8	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	£5	£5	79 — 81	..	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	£1	£0	..	3 9/16 — 3 11/16	+ 1/16	5 8 6
Do. 7 % Cum. Partic. Pref.	£1	£7	..	2⅞ — 3⅛	+ ⅛	5 8 9
Monte Video Telephone, Ord. ..	£1	£6	£6†	1 — 1⅛	..	5 5 8
Do. 5 % Pref.	£1	£5	£5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	+ ¼	4 10 0
Oriental Telep. and Elec. ..	£1	£8	£10	1 3/32 — 1 7/32	..	5 8 6
Do. 6 % Cum. Pref.	£1	£6	£6	1¼ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	£10	£10	£10	8⅜ — 9⅜	..	10 5 2
Submarine Cables Trust ..	Cert.	£6	£6	124 —127	..	4 14 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	£5	£8	£8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	£5	£5	£5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	£10	1½	1½	2 5/16 — 2 1/16	..	4 17 6
Do. 6 % Cum. 1st Pref. ..	£10	£6	£6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	£10	£6	£6	9⅜ — 9⅝	..	6 1 6
Do. 5 % Debs.	100	£5	£5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	£10	7	7†	12⅝ — 13⅛	+ ⅛	5 6 8
Do. 4 % Deb.	Stock	£4	£4	90⅜ — 92⅛	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. 1t. Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 5th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 11/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	8 — 10	..	..
Do. Do. Deferred ..	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	8	37 — 40	—1	7 10 0
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	72 — 76	—1	5 18 5
Central London Railway, Ord.	100	3	3	73 — 75 xd	..	4 0 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 18 9
Do. Pref.	100	4	4	73 — 80 xd	..	5 0 0
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	99 —101 xd	..	4 19 0
Do. Do. 1896	100	5	5	98 —100 xd	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99 xd	..	5 1 0
Do. Do. 1908	100	5	5	96 — 98 xd	..	5 2 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 19/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	½ — ⅜	—1/32	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/16 — 1/16	—1/32	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	+5	6 7 0
Metropolitan Railway Consol. ..	100	17	18	44¾ — 45¼ xd	+ ½	3 11 10
Do. Surplus Lands	100	2⅜	2⅜	59 — 61 xd	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	81 — 83 xd	..	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79 xd	..	4 8 7
Metropolitan District Ord. ..	100	Nil	Nil	33 — 33½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	81 — 83 xd	..	5 8 3
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	3½	3/32 — 5/32	..	..
Do. 5 % Pref.	1	6	5	1/16 — 1/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3¾ — 4	+ ⅜	Nil
Do. "A"	1/-	4½	..	3/8 — 1/2	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	110 —112	+1	5 7 2
Do. 4½ % Bonds	100	Nil	4½	98 —100	..	4 10 0
Do. 6 % Income	100	8	6 †	91 — 92	— 1	6 10 5
Yorkshire (West Riding), Ord.	5	..	..	1/4 — 3/4	..	Nil
Do. 6 % Pref.	5	..	3†	3½ — 4	+ 3/16	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4¾ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	91 — 93	+ ½	4 6 0
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	97 — 99	+ ½	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	+1	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	87 —89 xd	+3	6 14 10
Brisbane Trams Invt., Ord. ..	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4 9/16 — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	123 —128	..	6 5 0
Do. Pref. Ord.	100	6	6	109 —114 xd	..	5 5 3
Do. 5 % Pref.	100	5	5	102½ —105½ xd	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102 xd	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6¼	+ ⅛	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 1/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5 5/8 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	25/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	86½ — 89½	..	5 11 9
Manila Elec. R. and Ltg., Bonds	£1000	5	5	99 — 101	..	4 19 0
Mexico Trams Com.	$100	7	7†	89 — 92	+3	7 12 2
Do. Gen. Con. 5 % Bonds ..	..	5	5	87 — 90	..	5 11 1
Do. 6 % Bonds	100	6	6	86 — 89	+1	6 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅝ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99 —100	+ ½	4 19 0
Do. 5 % Mort. Bonds ..	100	5	5	93 — 95	+1	5 5 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 102	— ½	4 18 0
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98⅓ —101½	..	4 8 9

MANUFACTURING COMPANIES.

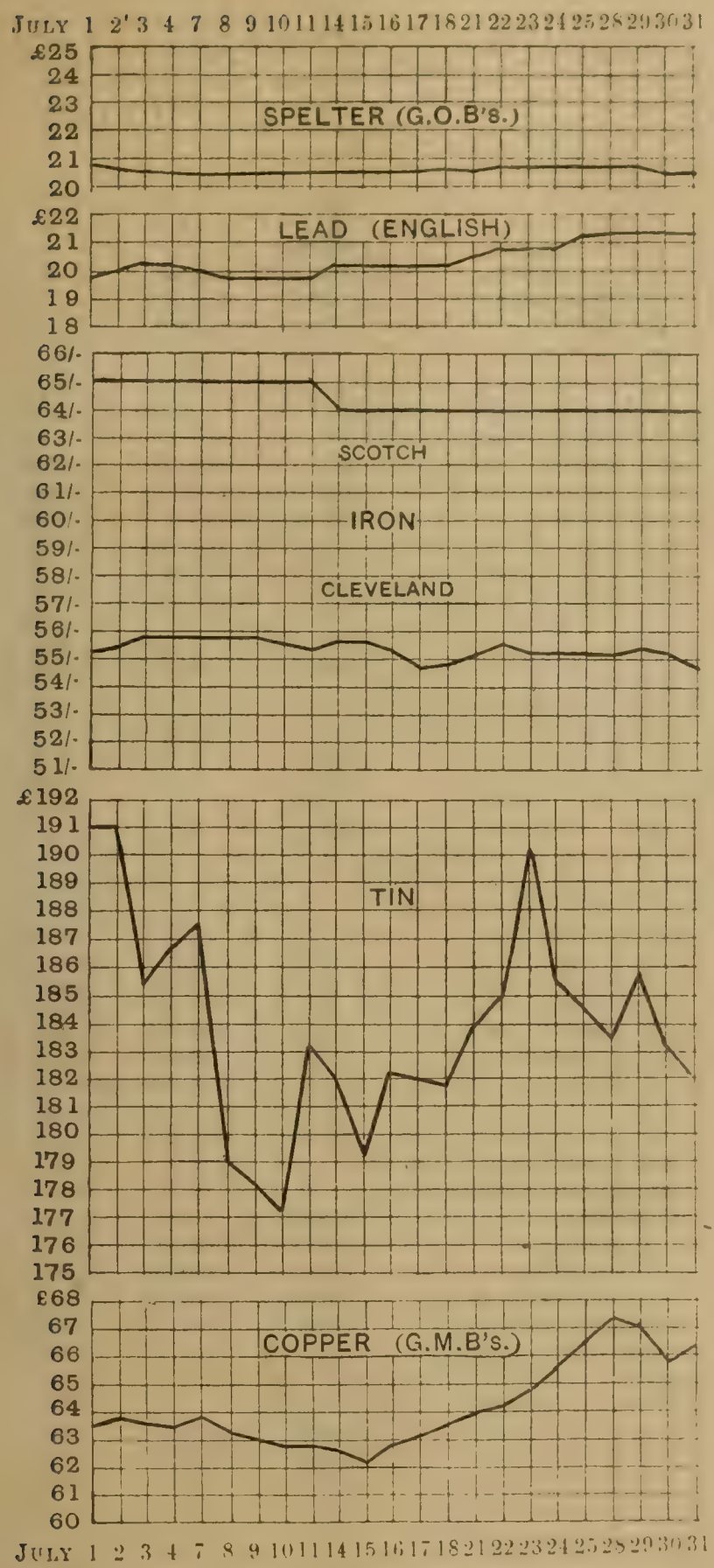
Aron, Ord.	1	5	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	23/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	28	16	25/32 — 9	—1/32	5 6 8
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 3
British Aluminium, Ord. ..	1	Nil	..	¾ — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	¾ — ⅞	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	+1	5 17 8
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5¾ — 6¼ xd	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref. ..	8	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb...	100	4	4	62 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11⅜	..	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3 1/16 — 3 3/16	+ 1/16	5 4 11
Do. Deb...	100	4½	4½	102 —105 xd	+1	4 5 9
Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/8 — 3/4	..	..
Do. Pref.	1	6	6	29/32 — 31/32	..	7 18 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1 — 1¼ xd	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16 xd	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	6	9¾ — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb...	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	11½ — 12½	+ ½	6 0 0
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 7 2
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/4	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

METAL MARKET.

Fluctuations in July.



Copper.—Contrary to what would be expected from the tone of the market, visible supplies (European) for the end of July have maintained their figure, and even appreciated a little. According to Messrs. Merton's statistical circular, the stock in England and France and afloat thereto from Chile and Australia for the end of July was 28,344 tons, an increase of 202 tons over the quantity for the end of June, which goes to make up the 273 tons increase in French stocks. English stocks are down by 1,196 tons. Total European stocks decreased by 2,569 tons, the most marked withdrawal being from Hamburg, 1,857 tons. Arrivals from North America were high, from Spain and Portugal just under average, from Chile an unusually large consignment, and from Australia a quantity above the average, *i.e.*, 4,600 tons, to an average for the last 12 months of 3,845 tons. Total deliveries were 51,854 tons, a quantity which has not been equalled, except in May last, since February, 1912. Stock in American producer's hands, as published by the American Producers' Association, was, for the end of June, 23,578 tons, a reduction of 6,544 tons during May. The world's visible supply at the end of June was 61,774 tons, which is getting distinctly low.

The G.P.O. and Electric Vehicles.—We hear that the G.P.O. are carrying out some trials in the Bristol district with electric motor vehicles fitted with Edison batteries, for the delivery of the mails.

TIMING WATT-HOUR METERS.

In order that the accuracy of a motor watt-hour meter may be deduced by comparing the watt-hours represented by a certain number of disk revolutions with the indications of power measuring instruments and the meter speed, it is necessary that the latter quantity be determined, in precision work, to at least 0·1 per cent. accuracy.

Hitherto stop-watches have usually been employed in timing meters. The errors to which these watches are subject are large and variable, and to attain the desired degree of accuracy it has been necessary to average the results of a number of observations taken over, say, two-minute periods, in order to arrive at a single test figure. Allowing for the possibilities of inaccurate meshing, throwing of the second hand, time error in the watch's movement and the personal error of the observer, it is unsafe to rely upon higher than 0·2 per cent. accuracy when stop-watches are used.

The large amount of code testing of meters carried out at the New York Electrical Testing Laboratories has led to the evolution of more accurate methods of meter timing. In the first place, an ordinary chronograph was substituted for the stop-watch—two series of records being made on the tape by a standard clock beating seconds and by the observer pressing a key at every revolution of the meter disk. An accurate measurement of time was thus secured, but personal error still remained, and to avoid this, the meter was made to record its speed automatically. Messrs. Seaman & Currier devised a method in which contact was made between two platinum

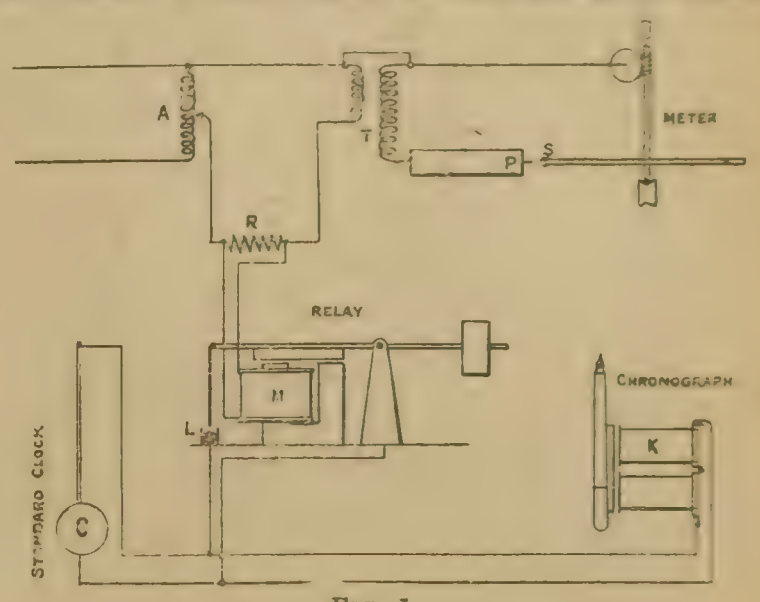


Fig. 1.

tipped wires, or between a platinum wire and a mercury cup, at each revolution of the meter; the times of contact were recorded on an "errometer" (a specially designed chronograph with six pens). Contacts of this type are not, however, permanently reliable, and a new method of attaching them must be devised for each new type of meter tested.

A modified system* has, therefore, been in use since September, 1912, in which a high-voltage spark passes from a stationary point to a point on the meter rotor at each revolution of the latter, and, by its passage, operates a relay controlling the chronograph pen. The high voltage for the spark is provided by a 10,000-volt testing transformer (T, fig. 1). A limiting resistance R is placed in series with the primary, and the supply pressure is regulated by the auto-transformer A. Connections are made as shown; in rotating standards the large pointer forms the moving contact, and the stationary point is a piece of wire held below the glass cover near the dial. In the ordinary house service meter, a 10-milligramme wire is sprung on to the disk to form the moving point S.

When S passes P, a discharge occurs which practically "shorts" the transformer secondary. The rush of primary current increases the voltage across R, and thus operates the relay M (the moving system of which is heavy, gravity-controlled and damped by a spring). The chronograph magnet circuit is thus closed at each revolution of the meter disk, and a standard clock C sends second-signals which are recorded by the same pen.

The insulation of the meter coils is not subjected to a higher P.D. than 120 volts, and the tester can only receive a shock (and then not a dangerous one, since the secondary current is limited to 0·008 ampere), by deliberately touching the H.T. needle point, which is encased in a high insulation tube. A liquid contact in the chronograph circuit gives a record of nearly constant length at all meter disk speeds. The instrument actually employed in the Electrical Testing Laboratories has two pens on a rolling carriage, which is moved the length of a recording drum by a screw thread. The drum speed is governed and is set to give one revolution in 30 sec.; a 1 sec. interval is then represented by two dots $\frac{1}{8}$ in. apart and 0·05 sec. can be easily read by aid of 10 radial lines etched on a microscope cover glass. Red and black inks are used in the two pens, so that two meters can be safely tested at once.

The chronograph charts are worked-up by selecting a meter-mark near the beginning of the record as the revolution-zero and the preceding second-mark as the time-zero. A line is drawn through the second-marks in the same vertical row, inclined lines are drawn through the meter-marks on adjacent rows, and from the time for a

* Described by G. Thompson in the *Electrical World*.

given number of revolutions, the disk speed is computed and the meter accuracy determined in the usual way. The charts can be preserved for any future reference, and since the final accuracy depends only on the precision with which the load is controlled, it is easy to keep well within 0·1 per cent. error.

It is possible that the recording spark may not always jump the gap S P when these points are in the same relative position. Variation in the latter seldom exceeds $\frac{1}{32}$ in.—corresponding to 0·3 per cent. error in one revolution of a 3½-in. disk. If three normal sparks follow one maximum "overleap," the error would be reduced to 0·1 per cent., but, as a rule, the "overleap" is more or less uniform in successive revolutions, and the error, therefore, smaller. The electrostatic field between the meter disk and the fixed sparking electrode is appreciably changed only during the moment in which the moving point sweeps past P (fig. 1), and tests on a "creeping" rotating standard needle, under much less favourable conditions, showed no appreciable change in speed before, after or during the spark. When testing meters in which the field windings are on the front side of the spindle, it is conceivable that the spark current traversing the disk between the poles might exert a torque effecting the rotation of the moving element, but experience shows that this error is negligible, and can, in any case, be eliminated by using test and spark currents of different frequencies.

The new method of meter testing requires only one observer, whose sole duty is to maintain constant load, and a number of meters can be tested at once and in a shorter length of time than is required by the stop-watch method. Using a two-pen chronograph, 20 meters can be timed at one load in 25 minutes (as compared with not less than 40 minutes, employing the stop-watch method and four testers—three of whom would be engaged in meter timing). Where a few meters are to be subjected to a number of tests (for research or other purposes), the saving in time by the application of the new method is very important.—S. M. Powell.

TRADE STATISTICS OF ITALY.

The following figures, showing the imports of electrical and similar goods into Italy during the year 1911, have been taken from the recently issued official trade statistics; the figures for 1910 have been added for purposes of comparison, and notes of increases or decreases are given; the preponderance of German trade and the comparative insignificance of British in most lines will be immediately apparent:—

	1910. Lire.	1911. Lire.	*Inc. or dec.* Lire.
Copper, brass or bronze wire more than ½ mm. diameter.—			
From France	1,372,000	1,455,000	+ 83,000
„ Germany	1,517,000	1,280,000	— 237,000
„ Great Britain ...	125,000	5,000	— 120,000
„ Other countries ...	112,000	173,000	+ 61,000
Total ...	3,126,000	2,913,000	— 213,000
Copper, brass or bronze wire of ½ mm. diameter or less.—			
From Germany	338,000	422,000	+ 84,000
„ France	34,000	34,000	—
„ Other countries ...	4,000	10,000	+ 6,000
Total ...	376,000	466,000	+ 90,000
Boilers.—			
From France	155,000	330,000	+ 175,000
„ Germany	717,000	487,000	— 230,000
„ Great Britain ...	1,715,000	1,803,000	+ 88,000
„ Switzerland ...	139,000	65,000	— 74,000
„ Other countries ...	306,000	255,000	— 51,000
Total ...	3,032,000	2,940,000	— 92,000
Steam engines, fixed without boilers.—			
From Belgium	7,000	15,000	+ 8,000
„ Germany	306,000	504,000	+ 198,000
„ Great Britain ...	1,100,000	1,033,000	— 67,000
„ Switzerland ...	262,000	22,000	— 240,000
„ United States ...	169,000	365,000	+ 196,000
„ Other countries ...	137,000	275,000	+ 138,000
Total ...	1,981,000	2,214,000	+ 233,000
Steam engines, semi-fixed (with boilers), hot-air motors, compressed air, gas, petrol, &c.—			
From France	110,000	145,000	+ 35,000
„ Germany	1,505,000	1,781,000	+ 276,000
„ Great Britain ...	1,590,000	1,608,000	+ 18,000
„ Switzerland ...	599,000	474,000	— 125,000
„ United States ...	231,000	291,000	+ 60,000
„ Other countries ...	376,000	516,000	+ 140,000
Total ...	4,411,000	4,815,000	+ 404,000
Hydraulic machines and water or wind motors.—			
From France	102,000	83,000	— 19,000
„ Germany	1,035,000	1,228,000	+ 193,000
„ Great Britain ...	962,000	555,000	— 407,000
„ Switzerland ...	360,000	168,000	— 192,000
„ Other countries ...	158,000	168,000	+ 10,000
Total ...	2,617,000	2,202,000	— 415,000
Dynamo-electric machines weighing more than 1,000 kg.—			
From Austria	159,000	174,000	+ 15,000
„ France	236,000	749,000	+ 513,000
„ Germany	4,911,000	4,860,000	— 51,000
„ Great Britain ...	945,000	438,000	— 507,000
„ Switzerland ...	1,458,000	353,000	—1,105,000
„ United States ...	64,000	88,000	+ 24,000
„ Other countries ...	236,000	306,000	+ 70,000
Total ...	8,009,000	6,968,000	—1,041,000
Ditto, weighing 1,000 kg. or less.—			
From Austria	106,000	264,000	+ 158,000
„ France	160,000	208,000	+ 48,000
„ Germany	4,685,000	4,365,000	— 320,000
„ Great Britain ...	401,000	294,000	— 107,000
„ Switzerland ...	630,000	306,000	— 324,000
„ United States ...	489,000	195,000	— 294,000
„ Other countries ...	138,000	287,000	+ 149,000
Total ...	6,609,000	5,919,000	— 690,000
Accumulators and metal parts.—			
From Germany	15,000	28,000	+ 13,000
„ Great Britain ...	12,000	3,000	— 9,000
„ Other countries ...	136,000*	23,000	— 113,000
Total ...	163,000	54,000	— 109,000

* Holland, 120,000 lire.

Electric transformers.—			
From Austria	640,000	979,000	+ 339,000
„ France	30,000	20,000	— 10,000
„ Germany	2,586,000	2,302,000	— 284,000
„ Great Britain ...	12,000	27,000	+ 15,000
„ Switzerland ...	827,000	382,000	— 445,000
„ United States ...	—	13,000	+ 13,000
„ Other countries ...	16,000	3,000	— 13,000
Total ...	4,111,000	3,726,000	— 385,000
Parts of dynamo-electric machines and of transformers.—			
From France	78,000	118,000	+ 40,000
„ Germany	632,000	1,127,000	+ 495,000
„ Great Britain ...	60,000	64,000	+ 4,000
„ United States ...	122,000	100,000	— 22,000
„ Other countries ...	161,000	236,000	+ 75,000
Total ...	1,053,000	1,645,000	+ 592,000
Electrical apparatus.—			
From Germany	2,563,000	3,203,000	+ 640,000
„ Great Britain ...	138,000	344,000	+ 206,000
„ Switzerland ...	213,000	193,000	— 20,000
„ United States ...	362,000	235,000	— 127,000
„ Other countries ...	309,000	491,000	+ 182,000
Total ...	3,585,000	4,466,000	+ 881,000
Arc lamps.—			
From Germany	400,000	437,000	+ 37,000
„ Great Britain ...	—	1,000	+ 1,000
„ United States ...	11,000	3,000	— 8,000
„ Other countries ...	34,000	38,000	+ 4,000
Total ...	445,000	479,000	+ 34,000
Electric lamps, incandescent.—			
From Austria	615,000	831,000	+ 216,000
„ France	201,000	215,000	+ 14,000
„ Germany	1,938,000	2,222,000	+ 284,000
„ Great Britain ...	7,000	12,000	+ 5,000
„ Switzerland ...	108,000	159,000	+ 51,000
„ Other countries ...	208,000	384,000	+ 176,000
Total ...	3,077,000	3,823,000	+ 746,000
Carbons of all kinds for electro-technical purposes.—			
From Austria	321,000	212,000	— 109,000
„ Germany	590,000	467,000	— 123,000
„ Switzerland ...	27,000	4,000	— 23,000
„ Other countries ...	10,000	84,000	+ 74,000
Total ...	948,000	767,000	— 181,000

N.B.—25 lire = £1.

REVIEWS.

Essentials of Electricity. By W. H. Timbie. 1913. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The author was formerly instructor in industrial electricity at the Pratt Institute, and the present volume is developed from notes used in short courses of trade lectures delivered to wiremen and others. Only D.C. problems and apparatus are described, and the work is confined to the statement and explanation of facts and laws and their applications. Practical operations constituting the craftmanship of electrical trades are left alone; the volume may be considered a text-book of theory as required by practical electricians.

In Chapter I, the distinction between pressure and current is explained very well by aid of water analogies; the peculiar difficulty experienced by many students in appreciating this distinction is not always allowed for by writers of elementary text-books. Many of the author's analogies are not beyond criticism, but they certainly possess the merit of clearing difficulties by affording a concrete (if not a scientifically accurate) conception of the quantities involved. The illustrations throughout the book are appropriate and clear, and valuable features are the numerous examples and problems in the text, and the concise summaries appended to each chapter. Bearing in mind the limited leisure of the class of men catered for, it is questionable whether it would not have been wise to omit some of the problems. A considerable number of the latter in each group involve exactly similar calculations; if all were worked through, there would be no objection to this redundancy, but there is considerable risk in leaving a selection to the student. It would be a good idea in later editions to italicise or otherwise identify those problems which should be worked at any cost. The omission of answers from the problems is unfortunate; their inclusion could do no harm to conscientious students, and they would form a valuable "control" for workers using the volume (as it is intended to be used), for reference purposes "on the job."

Ohm's Law and its application to simple and compound series and parallel circuits are explained with the same detail and clearness as characterise the opening chapter, and the reader who has read the volume carefully should find it easy to refer, at any time, to the exact section required. In the summary table dealing with parallel combinations, a man in a hurry will probably be annoyed to read that the "resistance of a parallel combination . . . . can be found by Ohm's Law plus a little common sense." A more satisfactory method is given in the text, but such witticisms should be kept out of reference summaries.

Electric power is dealt with in Chapter IV (American coinage being used in cost problems), and wire, wiring and distribution calculations are treated in Chapter V; American wire gauge numbers are used throughout. The principle of action of generators and motors is discussed in the next chapter, and from here onwards such differences as exist between American and English constructional practice in electrical apparatus somewhat detract from the value of the book in this country. "The north pole of any magnet is the place where the magnetic lines come out" is a very fair example of the author's peremptory, unqualified mode of expression—perhaps it is justifiable in such a work as this. Chapter VI also deals with wiring of motor starters, but the method of designing their resistance "steps" is not explained.

Chapter VII deals with the localisation and correction of generator and motor "troubles" in a manner convenient for reference. In Chapter VIII, dealing with primary batteries, it is tacitly assumed that wet or dry Leclanché cells are used and most of the space available is devoted to battery calculations; the "essentials" of electroplating, electrolytic corrosion and secondary cells are dealt with in the same chapter. Under "Wiring Diagrams" are illustrated and described various types of electric bells, buzzers and annunciators; fire and burglar alarms; gas lighters; engine ignition circuits; the telegraph and telephone; railway block signals and electric track switches; special lighting circuits; sign flashers and watt-hour meters. As this section occupies only 33 pages, there is little room for detailed treatment; more space might well have been allocated to telephones and electricity meters and other measuring instruments. The "carriage call" board shown on p. 256 appears to use an unnecessary number of lamps, yet figures "2" and "5" cannot be signalled. Electric heaters and cookers surely deserve some mention in such a work as this.

The book has a useful index and is well produced, but its price is rather high. Alternating-current supply is now so largely used in motor and other circuits that the restriction of the present volume to D.C. facts and laws is likely to limit its sale considerably.

Physikalische Grundlagen der Elektrotechnik. By Dr. F. F. Martens. (Vol. XLVI of "Die Wissenschaft.") Brunswick: Fried. Vieweg & Sohn. Price 7 M. 20 pf.

The book, of which this volume forms the first part, is intended to provide a general insight into the exact principles underlying electrical effects.

It is not an elementary treatise, for a general knowledge of electrical usage is assumed throughout; nor, on the other hand, does it rank with the more advanced text-books on the subject, for it is largely concerned with elementary theory, treated non-mathematically. The writer, however, has a clear style, and treats his subject in a fresh and interesting manner, so that the book will form a welcome and valuable help to the reader of the average elementary text-book in elucidating numerous difficulties which are too often left obscure in such books.

Part II, which is to appear shortly, will deal with the application of the principles here laid down to the construction of electrical apparatus and machinery.

The scope of Part I can be best understood from the chapter headings, which are as follows:—Chapter 1, Permanent Magnets and Their Fields; Chapter 2, The Magnetic Field Linked with a Current; Chapter 3, The Behaviour of Iron and Steel in Magnetic Fields; Chapter 4, Resistance, Voltage and Current; Chapter 5, The Heating Effects of a Current; Chapter 6, Electrostatic Effects; Chapter 7, Effects of Changing Magnetic Fields; Chapter 8, Electrolytic Conduction; Chapter 9, Electrical Effects Produced at the Contact Surfaces of Dissimilar Substances; and Chapter 10, The Various Systems of Units and Their Relations to One Another.

The book is well and fully illustrated.

The Design of Alternating-Current Machinery. By J. R. Barr and R. D. Archibald. London: Whittaker and Co. Price 12s. 6d. net.

This book is intended to be a companion volume to the book on direct-current electrical engineering written by one of the authors (since deceased).

The work opens with a discussion of complex wave forms and harmonic analysis. A useful *résumé* of the methods developed by Profs. Perry and Silvanus Thompson for analysing periodic functions is given. Some numerical illustrations are added, which tend to give beginners a much clearer idea of this somewhat difficult subject than a lengthy mathematical treatment of Fourier series. We are glad to see that the existence of higher harmonics as a possible disturbing factor when the frequency of the harmonics is close to the resonance frequency of the circuit is pointed out in this introductory chapter.

Insulation—really the most important problem in electrical engineering—is treated on modern lines in Chapter II. The essential difference between insulation resistance and dielectric strength is rightly insisted upon, together with the fact that the dielectric strength of an insulator depends chiefly upon its molecular structure. The effect of specific inductive capacity is illustrated by Fessenden's classical experiment. A good description of the apparatus for testing dielectrics is given, in addition to the various factors affecting the experimental results, such as temperature, time, &c. The application of these results to the design of machine insulation is explained by means of curves and tables.

The fundamental principles of transformers, together with descriptions of the leading types, are given in the succeeding chapter, the treatment being quite on ordinary lines.

Chapter IV is devoted to the losses, heating and efficiency of transformers, together with the standard methods of testing transformers. The various points are discussed in a clear manner, and there is a gratifying absence of purely empirical data, where these can be replaced by reasoned principles. A good feature is that the methods of testing are illustrated by figures from actual trials. The limitations of auto-transformers are briefly pointed out.

The design of transformers is dealt with in Chapter V by the mathematical method due to Messrs. Pohl and Bohle. This method is fully described, together with the proofs of the various theorems involved, and the designs of several transformers by well-known firms are worked through.

General considerations concerning alternators—including mechanical construction and the various types of windings—are described in Chapter VI. Mechanical construction is treated in an almost entirely descriptive manner, practically no attention being given to calculations concerning the strength of the various parts. Coloured diagrams are used for illustrating winding schemes, these adding greatly to the clearness of the letterpress.

The theoretical considerations concerning alternators, such as the E.M.F. equation, harmonics due to teeth, magnetic calculations, armature reaction, synchronous impedance, &c., are put forward in Chapters VIII and IX. The treatment is decidedly thorough, being largely based on the methods of the late Prof. Arnold, as given in his book "Die Wechselstromtechnik." A student, after working through these chapters, should face examination papers dealing with alternators with a comparatively light heart. We should have liked to see some examples appended, culled from examination papers if necessary, since these supply an effective test as to whether a student has really obtained an accurate knowledge, and, after all—quite apart from examinations—to be worth anything at all, knowledge must be thorough and accurate.

The various losses occurring in, and the efficiency and heating of, alternators are next examined. The treatment is quite modern; for example, the method due to Potier and Rüdenberg for approximately calculating the eddy-current loss in solid pole shoes is given. The standard methods of testing alternators are also briefly described.

Chapter IX deals with the vitally important subjects of parallel running, forced and free oscillations, &c., the methods used being very similar to those put forward by Dr. Rosenberg in his Institution paper several years ago. The chapter would have been improved had some numerical illustrations of the somewhat complex formulæ been given.

The actual design of alternators is next dealt with. The treatment follows what are now standard lines, and the several necessary constants are well on the safe side. The designs of a number of existing machines are worked through as examples of the method.

The concluding section of the book deals with rotary converters, Chapter XIII discussing transformation ratios, armature reaction and windings, with the aid of coloured diagrams.

Chapter XIV discusses voltage regulation, heating and efficiency, while the final chapter deals with the actual design of rotaries, the methods again being largely those due to Prof. Arnold.

Induction motors are not treated, the authors probably thinking that the book would be too bulky if these were dealt with in a sufficiently comprehensive manner.

Sixteen plates are inserted at the end of the book illustrating transformers, alternators and rotaries by various makers. A good index is appended.

The reviewer's general impression is that the book is remarkably cheap at the price asked, being in this respect an effective contrast with some recent American publications, and he is of the opinion that it will be largely used in technical schools and colleges.—H. G. S.

Radioactive Substances and their Radiations. By E. Rutherford, Professor of Physics, University of Manchester. 1913. Cambridge: University Press. Price 15s. net.

In 1904, Prof. Rutherford published a collected account of radioactive phenomena, entitled "Radioactivity." This was followed a year later by a revised and enlarged edition. During the years that have since elapsed, there has been an immense store added to our knowledge of the subject, and the present volume gives a concise and collected account of all the phenomena in connection with radioactive substances known to-day.

The distinguished author signalises, in the preface, some of the main directions of advance since the publication of his second edition of "Radioactivity." Mainly, this advance has consisted in a great increase in the amount and accuracy of our knowledge of the radiations from active substances, the nature of their absorption by matter, and of their connection with the transformations. The discovery of methods of counting single α particles has proved of great service in obtaining accurate data for the calculation of a number of important radioactive quantities and atomic magnitudes. The discovery of the recoil of radioactive atoms resulting from the expulsion of α particles has been very valuable as a means of separation of radioactive substances, and has also added another very interesting type of corpuscular radiation for study. Our knowledge of the series of transformations in active substances has been much extended. In 1905, 20 of these were known; the number is now 32, and there is some evidence that a few still remain undetected.

In one respect, however, there has been very little change. The transformation theory, advanced in explanation of radioactive phenomona, has undergone no essential modification in the interval. It has stood the test of time and is the only theory which gives a reasonable explanation for the facts. It will be remembered that the hypothesis was first advanced in 1903, by Rutherford and Soddy, that the atoms of radioactive elements are suffering spontaneous disintegration and that radiations accompany their break-up.

One of the most important chapters in the book is that on ionisation of gases by radiation. In this an account is given of the condensation experiments for the verification in a direct way of the theory that the conductivity produced in gases by the various types of radiation is due to the production of charged ions throughout the volume of the gas. Methods of measurement are stated very fully. Among others, the tilted electroscope, the string electrometer, and the quartz Piezo electrique are described. A first-rate account is given of the methods in use for counting the alpha particles, including C. T. R. Wilson's photographic device.

The chapter on the γ ray is very full, and there is a long discussion as to the nature and meaning of these rays. The author is of the opinion that they are of the type of penetrating X-rays. The chapter on the Theory of Successive Transformations gives a good deal of the mathematics of this important subject.

There are three short appendixes. In the first an account is given of the methods of measurement of quantities of radium; in the second there is a brief statement of the remarkable method devised by C. T. R. Wilson for rendering visible the trails of single α and β particles.

Throughout the volume references to original work are consistently stated.

THE ELECTRIC VEHICLE.

Its Limitations and Selling Points for the English Market.

By J. W. BEAUCHAMP.

Within the present year attention has again been directed to the self-contained electric vehicle. The use of stored electricity as a means of propulsion for road vehicles is one of its very earliest applications, and possibly in no other direction had the efforts of electrical engineers met until recently with such disappointing results. The solution of the problem, simple in every respect excepting that of carrying the supply of electrical energy, has received a fresh impetus from the work of Edison, whose storage battery, although representing electrically only a modest advance upon the performance of the lead cell, has been so perfected in detail and construction that it offers to the engineering world a practical means of carrying and retaining electricity apart from its source of production, a facility which will appeal to workers in many fields of science and engineering.

Although the storage battery is used to a considerable extent in connection with public electricity supply, there is so far but little information available with regard to the effect on the supply business which might result if large numbers of batteries were in the possession of private individuals, and such information as is to hand is mostly derived from American practice and through sources which are interested in the exploitation of the electric vehicle.

The ordinary consumer of electric power is stationary with regard to the local supply undertaking, drawing his energy from a point on the mains system convenient to himself and at times of the day which suit the needs of his business; but the possessor of electric vehicles is a mobile consumer of energy, able within limits to draw his supply from points convenient to the supplier, and even to desert him in favour of another within reasonable distance. His convenience may, in many cases, be met by taking charging supplies during those hours when his vehicles are not needed, that is to say, in most cases at the time when the demand upon the supplier is not heavy.

These features of the business in view give the consumer a certain independence of the supplier, and although at the same time they put the latter in a good position for dealing with such requirements, they demand some forethought and attention if the fullest advantage is to be obtained.

It may be of interest to examine the position of the vehicle business to-day and consider the information available from the point of view of the British supply engineer who is seeking further activities for his plant.

The number of electric vehicles in use in this country to-day is not large, but it is by no means so insignificant as is generally supposed. Cabs are in daily use in London, whilst it is stated that a considerable fleet of electric taxis is now being prepared. The silent and rapid electric ambulance is an all too familiar sight in the City and the Dock area of East London. Several of the large West End stores, after trial of the Edison vans, have now ordered considerable numbers, and at least one Continental firm is having success amongst tradesmen with a light cart driven by lead batteries, and a particularly ingenious arrangement of the driving motor on the front axle.

On the Continent the lead battery appears to have made quite a permanent position for itself in connection with a certain class of road transit. Complete fire brigade equipments, tower wagons and light postal vans are used in considerable numbers, whilst one company has produced and sold large numbers of powerful tractors for municipal service. These machines are arranged for the ready attachment of dust vans, slop tanks, street sweepers, and watering carts, or may be used for carting material or for any service where heavy loads are to be transported at slow speeds.

In the States it would appear that light cars of the runabout class have been successful, whilst vans for heavy work, dock traffic and general store deliveries have become very numerous, the total number in use being stated at about 40,000.

Selling Electrics.—In undertaking publicity work with the object of encouraging the use of the electric vehicle and obtaining the business of battery charging, very careful attention must be given to the commercial aspect of the proposition from the user's standpoint under British conditions. A false move in this direction may do much harm, and where the work is put into the hands of a general light and power selling staff, precise limits and instructions should be given and adhered to, and embellishment of facts discouraged. Attention must be concentrated on the class of business which a study of the electric vehicle problem shows to be possible with gain to the user.

In comparison with horse and other methods of mechanical transport, the first cost of the electric is high, but its running cost is low. Therefore, commercial success depends upon obtaining the utmost possible ton-mileage out of the new vehicle. In many cases one of the advantages which it offers to the user is the incentive to overhaul his organisation and system of goods delivery, a selling point which must not be lost sight of.

In certain businesses cartage work consists principally of carrying heavy loads for considerable distances with few stops, as in delivering furniture, pianos, &c. In such cases it is possible to obtain a big day mileage.

In a large business by careful arrangement a van may be worked with two shifts of men, so avoiding to a great extent the cost of keeping it standing whilst the men attached to it take meals.

In other classes of work the opposite conditions obtain. Vans are used to deliver small weights at frequent intervals, covering but a short distance with many halts, as in the business of retailing bread, milk, and other food stuffs.

At present many large undertakings have a system of "distributor" carts going from house to house, and replenished at intervals by "feeder" carts from headquarters. In such a case the use of an electric for the distributing duty might be more expensive than the present system, but employed to feed a number of horse carts it might achieve great economies.

Speaking generally, attention should at first be concentrated on business which calls for the transport of heavy loads at moderate speeds.

For City work the moderate speed of the electric van, coupled with its rapid acceleration and ease of control, is a positive advantage over the higher speed of petrol and steam vehicles, which are only able to maintain a fair average rate in dense traffic by a succession of stops and spurts, destructive alike to the machine and the road. In putting forward the commercial electric van proposition it is necessary to present clearly the salient advantages of this method of road transport, some of the principal of which are enumerated below. Others will be met with from time to time in the course of business and should be carefully recorded.

1. Extreme simplicity and reliability of the motor and controlling apparatus in which there are no reciprocating parts and no mechanical gearing for regulating speeds or reversing.

The electric motor has already replaced to a very considerable extent the use of various kinds of engines for driving machinery in factories; this is largely due to the simplicity of the rotary machine as compared with any reciprocating apparatus in which wear and tear, consumption of lubricants, and risk of breakdown are immensely greater.

All these merits of the tried and tested electric motor are now available for mechanical road transport and they show up most advantageously in comparison with steam and petrol engines, which suffer far more when used for driving vehicles than when stationary, owing to the roughness of roads and vibration.

2. The control of an electric vehicle is of the simplest description, and is furnished by one lever or pedal combined with a steering wheel.

It is unnecessary to dismount in order to perform risky gymnastic feats with the starting handle, as in the majority of petrol cars.

Speed variation and reversal are obtained without clutches or gearing.

Starting and stopping and speed change are smooth and silent.

There is no emission of smoke, cinders or odour, and no back firing or adjustment of fuel or air supply.

Driving becomes merely a matter of steering, and any person can operate an electric vehicle after a simple demonstration.

The efficiency and welfare of the machine are practically independent of the skill and knowledge of the driver.

The driver of an electric business cart is able to keep himself sufficiently clean to handle goods and book private house orders

3. Speed.—The speed of the electric vehicle is limited by its design, and it becomes impossible to exceed a certain predetermined rate even when the van is unloaded, so removing the drawback peculiar to most mechanically-driven vehicles that they may be raced under certain conditions. Records have proved that increase in the speed of a mechanical vehicle beyond its proper limit causes the cost of operating and maintenance to rise out of all proportion to the extra duty obtained. This is particularly the case when the vehicles are lightly loaded, and one of the chief points in favour of the electric van is that it cannot be raced when empty, a proceeding which is most destructive to the ordinary steam and petrol van.

4. Absence of the use of inflammable spirit.

The vehicles are driven and lighted by electricity.

The cost and risk of handling and storing petrol or other fuels and making acetylene are entirely eliminated, and the expense of insurance is reduced.

5. Great reduction in fire risk when on the road and when in garage.

6. The vehicles do not drop liquids on the road. Owing to the simplicity of the moving parts, lubricating is reduced to a minimum, and the oil and grease nuisance, characteristic of most mechanical transport methods, is absent. The waste of petrol and oils has an injurious effect upon the roads, and gives rise to danger of explosion in drains and sewers, whilst extra cost for cleaning is involved and damage done to the rubber of tires, insulated wires, and other parts of the vehicles.

7. Silence in operation is the most striking feature of the electric vehicle, owing to the simple turning movement and the absence of all reciprocating parts, explosions, and changing of mechanical gears. These vehicles, whether in the form of pleasure cars or heavy vans, are absolutely silent, an advantage for which perhaps few are prepared to pay, but one which in the aggregate appeals to everyone very much.

A preponderance of the electric-driven vehicle on our City roads would effect a great reduction in the nerve destroying clatter, which is a feature of them to-day.

A certain type of light electric car has already been put into use for the delivery of milk in residential districts in the early morning. Its silence in operation is one of its chief recommendations, contrasting in a striking manner with the clatter and jingle which are associated with morning deliveries by the horse-drawn cart.

The electric car can be turned in an extremely small radius, in some cases, little greater than its own length ; a feature which gives it an advantage in manipulating heavy loads in railway yards, markets, and other congested areas.

8. Guarantees can be obtained from most battery makers. The Edison Storage Battery Co. offer the following terms :—

" Any defect in workmanship or material will be corrected free of charge if notice be given within one year of delivery.

" If, during six years (or four for traction service) from date of delivery, any cells are found to be incapable of developing full-rated capacity, under normal conditions, we will, at our discretion, either replace them with other cells of full-rated capacity, or repair such cells to restore their full-rated capacity, free of charge, f.o.b. our works, provided that all said cells are installed in a manner approved by us, and that all said cells are cared for and operated in accordance with our standard printed instructions."

Most of the leading makers of lead cells for traction service are also prepared to quote inclusive terms for maintenance based on mileage.

9. Increased useful life of tires. Owing to the simple rotary motion of the electric motor, and the total absence of pounding on the tires, and less slip at starting, it is found in practice that the life of the tires is considerably greater on an electric vehicle than in the case of petrol or steam.

10. The cost of electrical energy at current rates for running these cars and vans varies from one-third to one-half of the cost of the petrol required for motor vehicles of the same carrying capacity.

The cost of coal and petrol has risen rapidly within recent years. In the latter case the price appears to be subject to variations out of all proportion to its cost of production, whereas the cost of electrical energy, although to some extent dependent upon the cost of fuel, shows a steady tendency to fall owing to the rapidly increasing demand which enables suppliers to employ larger and relatively less expensive and more efficient machinery for its production.

11.—The operation of the van is independent of weather and climate, whilst its extremely powerful starting effort makes it most useful in temporary road difficulties, such as soft ground, snow, &c.

The electric wagon can be garaged where horses would not be permitted for sanitary reasons, or on account of the noise which is associated with stables.

12. Speed.—In putting forward the claims of the electric pleasure car, the seller is often met with the objection that its maximum economical speed is inferior to that of the petrol car.

This, at the present time, is true, but it is not so serious an objection as is generally imagined.

In the case of heavy street traffic, owing to certain features of the electric car, its average speed through the working day more nearly approaches its maximum than is the case with the petrol machine.

Moreover, in practice a powerful touring car can seldom be used at its top speed for sufficient length of time to constitute any real advantage to the owner. Powerful cars are rather expensive toys, from which occasionally the owner is able to obtain the luxury of excessive speed for a short time.

In putting forward the small "electric" for business and city work, one of its most promising fields, it is desirable to point out that at the present time owners of large petrol cars use them to a considerable extent for short runs in connection with their business. This is most uneconomical, the petrol consumption, wear and tear of machine and tires being out of all proportion to the benefit gained on these short runs, whilst the massive car helps to add unnecessarily to the congestion of the thoroughfares.

In many cases a business man would find it an economical proposition to reserve his petrol car for distance and pleasure work, and maintain, at the same time, a small and convenient electric "Runabout" for business purposes and evening work in the city.

The spectacle of one man driving himself about the narrow streets of our business districts in a car capable of carrying five or six people along the road at 40 miles an hour, is not infrequently seen, and certainly does more to add to the cost of motoring than the owner generally imagines.

THE USE OF IRON IN ELECTRICAL MEASURING INSTRUMENTS.*

In a paper recently read by Herr Dolbrowsky before the Elektrotechnischer Verein, he discusses the present state of commercial electrical measuring instrument construction, and points out that, considered as engineering structures, a great deal of improvement is still desirable. The demand for increased accuracy has led to the introduction of much delicate work, and, in the writer's opinion, to the sacrifice of reliability and stability. He suggests that this particular branch of electrical engineering has not yet emancipated itself from certain academic rules and ideas, and that future improvements are to be expected by a closer application of the sound engineering methods which have proved so successful in dynamo designing.

One of the established principles, for instance, in the design of the dynamometer type of instrument, consisting of a fixed coil and a moving coil, has been that the presence of iron must be avoided at all costs if accuracy is to be retained. This type of instrument is especially important in connection with alternating currents for which wattmeters are so essential, especially such as can be accurately calibrated by direct-current methods. As hitherto usually made, without iron, these instruments, although often highly accurate when judiciously used, are liable to considerable errors due to outside magnetic fields, and due to deformations which can be easily set up, if they are roughly handled, owing to the necessary absence of solid metallic supports for the coils. Good modern wattmeters of this type seldom have moving systems weighing less than 4 grammes, whilst the maximum deflection torque is only about ·4 cm.-gramme. This small torque involves the use of very delicate jewelled bearings, and makes the whole construction very far from robust.

The introduction of iron into the stationary part of such an instrument, offers the double advantage of increased torque and freedom from outside field effects, but the production at the same time of serious hysteresis and phase errors has been feared, and has prevented its general use.

Herr Dobrowolsky and the Allgemeine Elektrizitäts Gesellschaft have, however, recently succeeded in bringing out a line of dynamometer wattmeters provided with ample iron magnetic circuits, and yet showing a high degree of accuracy. These are known as "Ferro-dynamic" instruments. The arrangement adopted is shown in fig. 1 diagrammatically. Many previous more or less successful attempts to produce instruments of this type have been made, *e.g.*, by Benischke, Lotz, Sumpner, Drysdale, and others, and the chief advance claimed for the new instruments is simply a careful selection of the dimensions so as to enable the advantages due to the high

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permeability of the iron to be obtained without the inaccuracy du to its remanence and hysteresis becoming too great. When a closed iron circuit has been magnetised and the excitation is removed, a certain amount of residual magnetism always remains, as shown by R, fig. 2. In order to remove this, a certain negative "coercive force" c has to be applied. This coercive force may be looked upon as overcoming a certain number of ampere-turns which have become inherent to the iron through its magnetisation, and which tend to maintain the residual flux R. The fact that these inherent ampere-turns are not actually quite constant may be neglected in this connection. If now an air-gap is introduced into the iron circuit and the magnetic cycle is carried out once more between the same limits, the loop will have the long narrow form shown to the right, with an amount of residual magnetism which is far smaller than before. This arises from the fact that whilst the number of inherent ampere-turns are practically unchanged, they now have to

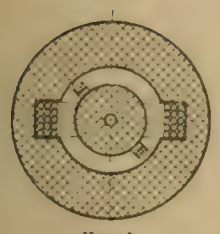


Fig. 1

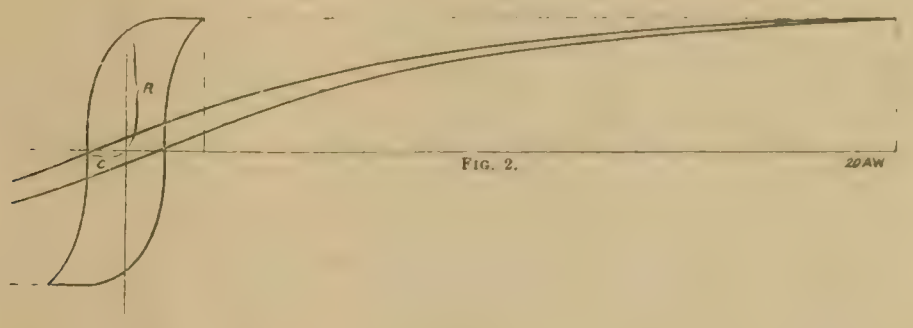


Fig. 2.

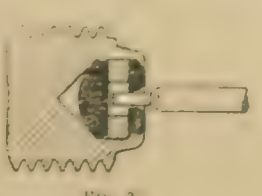


Fig. 3

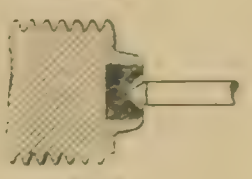


Fig. 4



overcome the high magnetic resistance of the air-gap as well as that of the iron path. Suppose the length of iron path is 10 cm., and the flux density is 5,000 lines per sq. cm. requiring about 2 ampere-turns per cm., so that the total ampere-turns to be applied without any air-gap = 2 × 10 = 20. The coercive force will then have some value less than 20 ampere-turns. Suppose now an air-gap is introduced requiring the application of a total of 200 ampere-turns in order to produce the density of

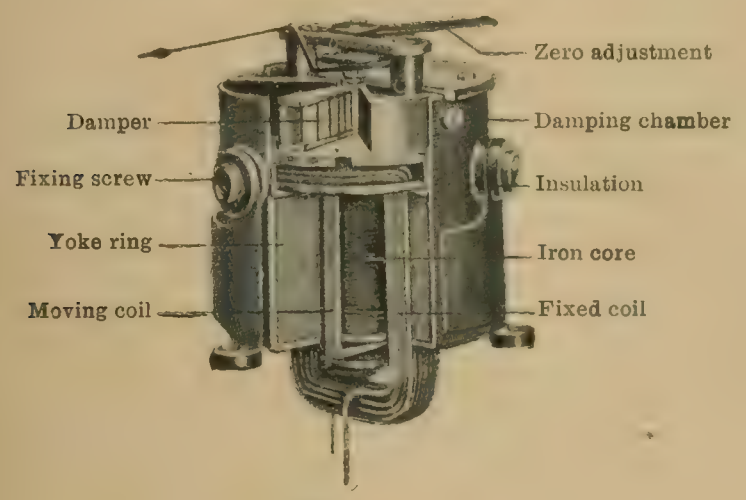


Fig. 6.

5,000, *i.e.*, the total magnetic resistance is made 10 times as great. The intrinsic ampere-turns (or the coercive force) will still be as before—something under 20, and the residual magnetism will, therefore, be reduced to one-tenth of its original value. With greater air-gap the residual magnetism can be still further reduced. This leads to the following general rule :—"The residual magnetism, stated as a percentage of the total magnetism, cannot exceed the



Fig. 8.

percentage which the ampere-turns for the iron path are of the total ampere-turns for iron and air." In order, therefore, to reduce the residual magnetic effect to less than 1 per cent., it is only necessary to arrange for the iron paths to absorb only 1 per cent. of the total applied ampere-turns.

In the A.E.G. ferro-dynamic instruments, for instance, good (alloyed) iron stampings are used, shaped as in fig. 1, so as to give a very short iron path, and with an air-gap of 5 mm. at each side, and it is found that of the total of about 200 ampere-turns applied the iron path only absorbs about 1 ampere-turn. The residual magnetism must, therefore by the rule, be reduced to less than ½ per cent., and experiment fully confirms this. The whole weight of iron is something like 300 grammes, and yet the per cent. remanence is no more than is often met with in modern moving soft-iron instruments in which the whole iron present only weighs perhaps 1 gramme. It cannot, therefore, be said that much iron necessarily means much residual magnetism.

In order to avoid a hysteresis error also, suitable dimensioning is all that is necessary. The effect of hysteresis loss in the iron is to introduce a small phase difference between the current in the magnetising coil and the flux produced by it. The amount of this error depends on the ratio of the hysteresis watts to the whole volt-amperes taken by the coil, and can be made negligible by keeping this ratio small. In fact, the same requirement as for the reduction of the remanence error will remove the hysteresis error, for it has been shown that remanence becomes negligible if the ratio of the ampere-turns used in the iron to the whole ampere-turns of the coil is kept low and the hysteresis error is avoided if the ratio of the watts in the iron is small compared with the total volt-amperes of the coil. Both these results are attained by keeping the length of iron path in the direction of the flux as short as possible, and using a comparatively large air-gap. The total ampere-turns used should not be made too great as that involves much space for the coil, and consequently a long iron path. On the other hand, the ampere-turns must not be too small, as that means a reduced air-gap and reduced volt-amperes. By bearing these points in mind it has been found possible to reduce the phase error to a negligible value. For instance, in one of these ferro-dynamic watt-meters when the current coils and volt coils are supplied from separate sources with exactly 90° phase difference between them, the deflection (which should be zero if no phase error exists in the meter) was found to amount to only ·3 per cent. of the full scale deflection. This extremely small error under such conditions (practically measuring power with a power factor of 0) proves that the meters are amply correct for practical purposes without the use of any kind



Fig. 7.

of compensation, though, if desired, it is quite possible to remove even this very small error by inserting a small inductance in series with the volt coil or otherwise. The following additional data for such a wattmeter are given :—

Total weight of moving system, including spiral springs, air damper, &c., 4 gr.

Maximum deflecting torque (about double the usual figure), ·8 cm. gr.

Ratio torque/weight = ·8/4 = ·2.

Watts lost in the current coil, 2·4.

Watts lost in the voltage coil alone, ·015.

Current in the voltage coil at 100 volts, ·04 ampere.

Coefficient of self-induction of the voltage coil alone, ·007 henry.

Ratio of non-inductive manganin resistance to the copper resistance of the volt coil for 100 volts, 75.

Ditto, for 200 volts, 150.

These figures show that the instruments are well up to the mark of good modern switchboard wattmeters, but have about double the usual deflecting torque.

This alone brings decided advantages with it, such as the use of solid collar bearings, as in fig. 3, in place of the usual delicate jewelled bearing of fig. 4.

Further, the use of the iron renders the new meter extraordinarily free from outside field effects. The whole construction is very compact and enables a flat instrument, as shown in fig. 5, to be obtained for switchboard work with only a comparatively narrow tube containing the mechanism passing through the face of the board.

Further details of the instrument are shown in figs. 6, 7 and 8. The ferro-dynamic instruments are suitable for D.C. as well as A.C., and can be accurately calibrated with D.C.

The principle lends itself specially well to the production of registering wattmeters, for which large deflecting torques are required. Without taking excessive currents, such torques as 30 cm. grammes can be obtained, the volt coil only taking about ·1 ampere, and the phase error not exceeding ½ per cent.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

BRAZIL.—The Government have decided to levy a surtax of 2 per cent. *ad valorem* on all goods imported through the Customs House of Aracaju, in the State of Sergpe, the proceeds of the tax to be used for port works.

H.M. Consul-General at Rio de Janeiro has forwarded to the Board of Trade certain important information as to the charges for warehousing goods in Brazil. It appears that the charges for goods stored in "internal" warehouses are now levied on a uniform basis at all Brazilian ports as follows:—

Up to 30 days	1 per cent. per month.
Up to 60 days	1½ per cent. per month for the whole period.
Up to 90 days	2 per cent. per month for the whole period.
For periods exceeding 90 days ...	3 per cent. per month for the whole period.

The charges do not begin to accrue until the completion of the discharge of each separate consignment into the warehouse. Fractions of a month are counted as a whole month. The percentage rates are calculated on the official valuations of the goods according to the Brazilian Customs Tariff. Thus, for example, in the case of goods on which the rate of Customs duty is 1,200 reis per kilog., representing an *ad valorem* rate (*razao*) of 50 per cent. The official valuation would therefore be 2,400 reis per kilog., and it is on this valuation that the percentage warehousing charges are calculated. It will be seen, therefore, that heavy expenses may be incurred by leaving goods in warehouse for any lengthy period.

Certain classes of goods (as enumerated in Table H, appended to the "Consolidaçao das Leis das Alfandegas") may be *desapchado sobre agua*, *i.e.*, the goods can be cleared and duties paid before they are discharged from the steamer. The advantage of this is, that although such goods have to pass through the warehouses, they are exempt from warehousing charges if removed within three working days counting from the day of entry. If the goods are not removed within that period, they incur double the usual percentage charges. Goods not mentioned in Table H pay one month's warehousing charge, even if they only pass in transit through the warehouse.

CUBA.—The Cuban Government propose to create free ports at Santiago and Cienfuegos for the entry of goods, free of duty, which are intended to be re-imported either in the condition in which they were landed, or after having been re-packed or subjected to industrial processes.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,662. "Electric cables." F. J. Brislee, J. L. Packer and British Insulated and Helsby Cables, Ltd. July 21st.

16,673. "Governors for variable-speed or reversible machines." L. Creplet. (Convention date, July 23rd, 1912, Belgium). July 21st. (Complete.)

16,675. "Electric adaptor or connector." J. S. Holmes. July 21st.

16,684. "Electric batteries and accumulators." F. Sablon. July 21st.

16,691. "Electric water gauges." J. Rajczy. July 21st. (Complete.)

16,693. "Swivel lampholders." C. N. Sowden and D. Wood. July 21st. (Complete.)

16,694. "Swivel lampholders." C. N. Sowden and D. Wood. July 21st. (Complete.)

16,696. "Telephone machine switching systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) July 21st.

16,705. "Trolley heads for overhead electric traction." E. H. Underwood. July 21st. (Complete.)

16,709. "Sockets for electric leads." A. G. Bloxam. (R. Bosch, firm of, Germany.) (Addition to 6,551, 1913.) July 21st. (Complete.)

16,725. "Device for starting and stopping submarine syrens." Signal G.m.b.H. (Convention date, July 29th, 1912, Germany.) July 21st. (Complete.)

16,742. "Pocket lamp with writing attachment." T. Sendler, Jun. (Convention date, February 26th, 1913, Germany.) July 21st. (Complete.)

16,753. "Electric meters." H. Aron Electricitatszahlerfabrik G.m.b.H. (Convention date, March 10th, 1913, Germany.) July 21st. (Complete.)

16,754. "Controlling apparatus for electric circuits." A. Regal. July 21st. (Complete.)

16,770. "Electric incandescent lamps." C. W. Read. July 22nd.

16,791. "Lamp hanger for high-tension series lighting." G. Barker. (Thompson Electric Co., United States.) July 22nd. (Complete.)

16,792. "Apparatus for electrically operating planing-machines and the like reciprocating tools." Lancashire Dynamo Motor Co., Ltd., A. P. Wood and R. S. McLeod. July 22nd.

16,807. "Controlling gear for, or connected with, electrically-driven hydraulic pumps." J. A. Towler. July 22nd. (Complete.)

16,813. "Water-heater by means of electricity." J. A. B. Schlegel and K. Sparr. July 22nd.

16,815. "Cash stamp parcel, or like tray, in combination with an illuminated sign for advertising purposes." R. A. Pantlin. July 22nd.

16,820. "Electrical resistance devices suitable for use as heating elements and as rheostats." A. C. Whish. July 22nd.

16,840. "Change-over switches." H. H. Berry and W. J. Markham. July 22nd.

16,841. "Combined electric switches and plugs." H. H. Berry and W. J. Markham. July 22nd.

16,853. "Stereoscopic X-ray systems." H. C. Snook and E. W. Kelly. (Convention date, August 15th, 1912, United States.) July 22nd. (Complete.)

16,859. "Telephone exchange systems." W. Aitken. July 22nd.

16,885. "Electric switches." H. Lucas and O. Lucas. July 23rd.

16,890. "Interlocking-mechanism, such, for instance, as used in railway signalling." Siemens Bros. & Co., Ltd., and W. E. Scourfield. July 23rd. (Complete.)

16,917. "Method of and means for the production of electric current." W. Dubilier. (Divided application on 14,015/12, June 15th.). July 23rd.

16,958. "Mica earth arresters for use in wireless telegraphy." L. C. Wright. July 24th.

16,963. "Electrical apparatus for internal-combustion engines." W. A. Trier. July 24th.

16,964. "Protective attachment for telephone mouth-pieces and ear-pieces." S. T. Richardson. July 24th.

16,969. "Telegraphic receiving-apparatus adapted to actuate a perforator or analogous device." Eastern Telegraph Co., Ltd., and J. S. Jenkins. July 24th.

16,975. "Electricity meters." J. F. Watts. July 24th.

16,979. "Means for driving dynamos attached to vehicles." C. E. Pehrsson. (Divided application on 18,482, 1912, August 12th.) July 24th. (Complete.)

16,985. "Electrode for uniformly heating interior cavities of a living body by diathermic treatment." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) July 24th. (Complete.)

16,998. "Electrical resonance operated apparatus." H. W. Handcock, A. H. Dykes, and W. Dudbell. (Addition to 1,395, 1913.) July 24th. (Complete.)

17,038. "Automatic switch means for telephone systems." K. E. Ericsson and G. W. Dahlstrom. (Convention date, July 26th, 1912, Sweden.) July 24th. (Complete.)

17,066. "Apparatus for automatically indicating and recording the combined efficiency of a steam motor and coupled electrical generator." R. S. Xenaky and F. Gilman. July 25th.

17,086. "Apparatus for regulating the light-intensity of electric arc-lamps." Siemens-Schuckertwerke G.m.b.H. (Convention date, July 25th, 1912, Germany.) July 25th. (Complete.)

17,092. "Incandescence electric lamps." A. How. July 25th.

17,109. "Arrangements for automatically regulating the conditions of electric systems." H. Longton. July 25th.

17,112. "Temperature alarm." J. F. J. Malone. July 25th. (Complete.)

17,124. "Arrangements for transmitting receiving signals." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 25th. (Complete.)

17,125. "Devices for feeding the paper in recording apparatus." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 25th. Complete.)

17,126. "Measuring instruments for high-frequency currents." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 25th. (Complete.)

17,137. "Electric relay." Siemens & Halske Akt.-Ges. (Divided Application on 3,432/13, February 10th. Convention date, February 12th, 1912, Germany.) July 25th. (Complete.)

17,141. "Aerial signalling appliance." R. B. Bradford. July 26th.

17,156. "Protective arrangements for alternating-current generators." A. M. Taylor. July 26th.

17,164. "Method of localising the radiant point of electromagnetic waves and apparatus therefor." R. Wanibuchi. July 26th. (Complete.)

17,174. "Electrical fuses or cut-outs." C. W. Cox. July 26th.

17,190. "Electric light fittings." C. J. Lane. July 26th.

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Telephone Receivers. A. Plecher. 13,157. June 4th.

Means for Signalling and Controlling the Course of Vessels so as to Assist the present Rules of the Road at Sea and Prevent Collisions and Stranding. D. J. Morgan. 13,463. June 8th.

Imitation Candle Lamps. C. Damey, C. M. Escare and P. F. Escare. 15,456. July 2nd.

Electrodes and Holders therefor for Arc Lamps. M. A. Herwig. 15,927. July 8th.

Telephone Machine Switching System. Western Electric Co., Ltd. (Western Electric Co.) 15,952. July 8th.

Electric Battery Lamps. H. Hunte. 16,126. July 10th.

Thermostats for Controlling Electric Circuits. A. W. Prim and F. W. Roper. 16,317. July 12th. (Cognate application, 27,780, 1912).

Anodes for Use in Electrolytic Apparatus. G. P. M. Lee and W. A. Brame. 16,475. July 15th.

Process for Repairing Electric Incandescent Lamps. E. Cervenka. 16,885. July 19th. (July 19th, 1911.)

Electric Heaters. H. H. Grundy. 18,017. August 3rd.

Vapour Electric Devices. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,372. August 9th.

Electrical Apparatus for Igniting Gas or Inflammable Vapour. F. Nehmer. 18,799. August 16th.

Method and Appatatus for Electrolytically Recovering and Refining Tin. G. Michaud and E. Delasson. 20,557. September 9th.

Controllers for Electric Motors and Like Apparatus. G. Ellison and M. R. H. Mueller. 22,959. October 8th.

Telephone Indicating Apparatus. M. S. Conner. 23,812. October 18th.

Cold Electrolytic Process for the Recovery of Tin from Waste Tinned Metals and Alloys. A. L. C. Nodon. 24,203. October 23rd.

Arrangement of the Exciting Windings of the Rotating Field Systems of Electric Machines. F. Ljungstrom. 24,484. October 26th. (October 26th, 1911.)

Box or Packing for Electric Light Bulbs and the Like. H. W. Burbery, E. N. Hillier and W. A. Thompson. 24,596. October 28th.

Electrolytic Cells. E. A. Allen and H. I. Allen. 26,169. November 14th.

Method of Reducing the Loss of Energy in Lines for Variable Electric Currents. F. A. Becker. 27,535. November 29th. (Addition to No. 65 of 1911.)

Electric Incandescent Lamps for Motor Vehicles. A. A. Godin. 29,149. December 18th.

THE

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LABOUR AGREEMENTS.

THERE was issued a short time ago in the form of a Blue-Book the report of the Industrial Council upon the inquiry which they undertook at the request of the Government into matters relating to industrial agreements. The questions to which their attention had been specially directed were (1) What is the best method of securing the due fulfilment of industrial agreements? (2) How far, and in what manner, should industrial agreements which are made between representative bodies of employers and of workmen be enforced throughout a particular trade or district?

Surely no committee ever had a more difficult question to answer than that first above written.

Your Conciliation Board can draw up an agreement; can seal it with many seals, and obtain the signatures of numerous representatives of employers and men. But there its power ends. Like a court of justice, it can give judgment, but it has no power to enforce the judgment. What is it that makes the decrees of our courts of civil jurisdiction respected? The strong arm of the law seldom has to be used to compel anyone to do anything. If a man has a judgment entered against him, he pays up. If he is enjoined by the Court of Chancery to cease doing something to the discomfort of his neighbour, he obeys the injunction, and pays the costs. He does these things partly out of respect for the law and partly because he knows he can be made to do them, whether he is willing or not.

When the body politic, limiting that term for the nonce to all that is comprised in the phrase "Capital and Labour," is suffering from any complaint, it is the fashion to call in a consulting physician. His name is Industrial Arbitration. He never acts hastily; he considers the case in hand from every point of view. Eventually he writes a prescription or lays down rules for the guidance of his patient. At this point, however, his powers fail. He cannot make his patient conform to his wishes or obey his decrees. The patient can throw the medicine down the sink; or (abandon the metaphor) the workman can wholly disregard the finding of any Court of Arbitration and adopt the down-tool policy.

It is for this reason that one approaches the findings of each fresh Conciliation Board, or Court of Industrial Arbitration, with a feeling akin to disheartenment. The noise of industrial warfare may, for the time, have receded into the distance; but when the present period of trade prosperity draws to a close we shall inevitably hear these noises once more. How would the Industrial Council, the result of whose deliberations we are discussing, propose to secure the observance of the industrial agreement? Let us see what the Council have found and what they recommend. In the first place, they find that agreements between capital and labour have been as a rule kept. We could mention a good many instances wherein they have been disregarded by the men, but this by the way. That the Council recognise

that there can be such a thing as a breach of an agreement appears from their recommendation that no assistance, financial or otherwise, should be given by any association to members breaking an agreement.

The recommendations of the Council may be summarised as follows:—They would have an interpretation clause in every industrial agreement to enable disputes to be decided. While not approving compulsory arbitration, they would approve the adoption of means whereby a dissentient minority, whether of employers or men, could be compulsorily made parties to a conciliation agreement. The Board of Trade, if satisfied after due inquiry that a particular agreement affects the particular trade, should have power to order that "the terms of the agreement, with such modifications as may be agreed, shall be extended to cover the whole of the trade or district. Where an agreement has been so declared to be extended, it shall be an implied term of any contract of service in the particular trade of district that the terms of the agreement shall be an essential part of such contract."

We have said enough to show that the result of the Council's deliberations is marked by a serious inconsistency. While declaring piously against compulsion at one stage, they declare for it at another, on the principle, we suppose, that minorities must suffer. If a particular employer desires to carry on his business in his own way he is not to be allowed to do so; but agreements may be broken with comparative impunity, so far as the men are concerned. We do not favour that ridiculous anachronism—compulsory arbitration; far from it. But we do protest against a form of compulsion which is designed to bring pressure upon employers. That the Committee were by no means unanimously supporting this proposal, appears from the fact that Mr. Siemens did not give his sanction to the report as a whole, while Mr. Ainsworth, Sir Hugh Bell, Mr. Clowes, Mr. Davis, Mr. Devith and Mr. Robert Thompson express their dissent from the proposals of the report so far as they relate to the extension of agreements.

Upon the whole, therefore, this report does not lead us very much further upon the road which leads to industrial peace. Nor are we surprised that the deliberations of the Council are comparatively barren in result.

Ever since the fateful hour when the Legislature began to interfere between employer and workmen, the prospect of agreement by consent has been fading into the distance. The culminating measure in a whole series of disastrous Acts of Parliament was the Trades Disputes Act. Until that measure is removed from the Statute Book we see no prospect of employers falling in with these proposals for settlement by agreement.

Gas-Electrical Plant at Accrington.

The Mond gas producer and by-product recovery plant, which has been in use during the past nine months at the Accrington Corporation Electricity Works, and which we describe elsewhere in this issue, marks a development in municipal central station practice which will be watched with the keenest interest by central station men in this country. As in the case of the West Hartlepool Corporation's exhaust steam plant, described in our issue of August 1st, it is a novelty, in so far as its municipal ownership is concerned, and is equally welcome as another sign of enterprise on the part of the municipal electrical fraternity.

The critical discussions which took place, in the early part of 1909, on Messrs. Andrews & Porter's I.E.E. paper on the use of large gas engines for generating electricity, brought this matter prominently before central station engineers, and in view of the division of opinion for and against the gas engine, the results which accrue from the Accrington installation in the next year or two should form a valuable appendix to the above paper, despite the discrepancy in the size of the installation considered by Mr. Andrews and that installed at Accrington.

Although the Accrington engines are not "large" in comparison with Continental examples running on furnace gas, yet they operate under most favourable conditions as regards load factor, both steam and battery plant being available for peak loads; the fuel used in the producers is a local bituminous coal costing 13s. 6d. per ton and the net result in practice, allowing, say, 1½ lb. fuel per KW.-hour, would appear to be an average fuel cost of ·05d. per unit—a figure which leaves a substantial margin on which to argue the respective merits of gas and steam plant.

We believe that the bituminous producers have given every satisfaction, and that this applies to the plant generally, which, moreover, with further experience of its working, may not unnaturally be expected to yield better results in the direction of by-products. This is a matter of considerable importance at the present day, in view of the noticeable effect which the increased cost of coal has had on the working of modern steam plant, and must be taken into account when considering the respective first costs of the two classes of plant.

Mr. Gray, the borough electrical engineer, has, at any rate, satisfied himself as to the suitability of his plant for meeting the conditions obtaining at Accrington, and we should not be surprised to hear of its being considerably extended in the near future.

Hydro-Electric Works in Norway.

It is announced from Christiania that the Parliament of Norway has passed, by a large majority, a Bill whereby the right of utilising the water-power of the Aura fall in the district of Romsdal is granted to an English company. The latter, in return for the concession, is to make a single payment of £27,400 to the State and the Commune of Romsdal, together with a standing payment of 1 crown (1s. 1¼d.) per H.P. used. The expenditure on the works is estimated at £2,197,000.

It is calculated that the water-powers usefully employed will shortly amount to 250,000 H.P., which can easily be raised to 700,000 H.P., although it is declared that the numerous waterfalls in Norway would be able to yield 10,000,000 H.P. The country itself is declared by many persons not to be rich enough to undertake the exploitation of the waterfalls, and native capitalists also do not come forward, because the State reserves the right of reversion, and even proposes to extend the right. For instance, after a lapse of 30 to 60 years all water-powers acquired by private individuals revert by law to the State without the payment of any compensation. The representatives of the wealthy section of the community contend that the right of reversion should only apply to foreign capital, but the Government has stated that no difference in the matter shall be made as between native and foreign capitalists. It is considered that the grant of the concession to the English company will cause Norwegian capitalists to bestir themselves as they will be unwilling merely to look on while the native water powers gradually pass into foreign ownership, as is now proceeding, seeing that French and German capital is already largely invested in two districts in the country.

Central Station Advertising.

There are signs that central stations are becoming keenly alive to the fact that their business has a commercial side, and they are devoting each year more time and money to advertising. Although much has been done, there is, as we have frequently stated, room for greater energy in this direction. It has been said that a central station's business can be defined as the selling of profitable service, and, as with everything else, before this can be sold, the public who are to become customers must be made to understand what it is they are being asked to buy, and in what way they will be benefited by the purchase. This can only be done by advertising, the methods of which can be divided roughly into two classes, viz., printed advertisement, and that gained by personal contact with actual and prospective users of electricity. It has been laid down, with much truth, that the latter form consists of courtesy to the public at every point of contact, periodical visits to customers in order to solicit criticism and forestall complaints, prompt and cheerful

attention to such complaints as are received, and, as an American would put it, "delivering the goods." It matters little how alluring printed advertisements may be, if the customer is treated brusquely or with scant courtesy whenever he comes into contact with an employé of the station. Everyone connected with the business is a medium through which it can be advertised by courtesy and efficiency.

The success of a central station from a commercial standpoint is in direct ratio to the effectiveness of the service it gives. The public recognises the fact, and demands and insists upon that service being rendered. If it is not, then it frequently goes elsewhere, and the goodwill of the station is impaired, the value of the plant is lessened, its development will cease, and a spirit of opposition to the organisation will be created. The goodwill of the public is perhaps the most valuable asset a station can possess, and it may be enormously developed by personal contact.

Many trans-Atlantic supply companies have formed a complaint department, but it is a moot point whether this is or is not wise. Possibly, with a very large undertaking, it is a good plan to engage a tactful and resourceful representative, whose business it shall be to deal with any member of the public who may have, or who considers he has, a grievance, though it would be unwise to give that name to his department. But no matter by whom complaints are received, it is necessary to remember that the manner in which they are dealt with is of vital importance to the well-being of the station from the point of view of advertisement.

Printed advertisements are of a different nature, and it is well to avoid the personal as far as possible in these; the English character instinctively shrinks from the personal element in an advertisement. The direct form of advertising, in which circulars, leaflets and pamphlets are sent direct to clients, or those whom it is hoped will become customers, is undoubtedly the most useful form that can be adopted. Newspaper advertising is in this connection seldom of great value. If the reading public are keenly interested in the affairs of the central station, a well-written and attractive advertisement may have a certain amount of pulling power, but usually money spent in this way might be employed to better advantage. The case is, of course, different as regards appliances for the domestic use of electricity. Fans, radiators and cooking apparatus can readily be sold through the medium of the local Press, but the general consensus of opinion is that electric signs, and tramcar and omnibus advertising are more useful to a supply authority. Electric signs in particular are of great value, as showing that the station practises what it preaches. It would appear, from a close study of the subject, that whilst all publicity is worth money to the station, the best way in which it can be obtained is by making certain that the service rendered is of as nearly as possible 100 per cent. efficiency, and by coming into as direct and personal a contact with prospective clients as is humanly possible.

The Wireless Contract.

Last Friday, by a division which unfortunately was made to follow party lines, the agreement between the Government and Marconi's Wireless Telegraph Co., for the erection of the chain of Imperial wireless stations was approved by the House of Commons. The matter may, therefore, be considered at an end so far as its political aspect is concerned, and we may look forward to the speedy execution of the contract and the provision of a valuable auxiliary to the network of cables which binds together the scattered members of our vast Empire. We cannot but regret that it ever, through Ministerial indiscretions, became the subject of political controversy at all, being inherently a matter that should be judged only from the highest standpoint of patriotism, with a view to securing the greatest possible benefit to the nation and the Empire. One of the most regrettable features of the party system is its essential hypocrisy; thus the Postmaster-General was bitterly attacked because he would not consent to further delay—had he delayed, however, he would have been no less violently abused for imperilling the safety of the Empire to save a few paltry thousands!

The opposition, as it happened, was all at sixes and sevens on this question, and thus failed to produce any notable result. For instance, Sir Henry Norman, who has seen "every big station in Europe" (but has he seen one big Marconi station?) and is thus eminently qualified to lay down the law on wireless telegraphy, based his opposition on a denial of urgency, while Mr. Bonar Law admitted urgency; the former admitted that the construction of the stations by the Government, which he advocated, would be much more costly than the Marconi contract—the latter, as well as Lord Robert Cecil, declared his belief that the Government would save money by dispensing with the company's services.

Lord Robert Cecil considered the new contract better for the company than the old one—Sir G. C. Marks showed in detail a number of points in which the new contract was less favourable to the company than the first one. It was hardly surprising, therefore, that the only members of the ruling party who voted against the Government were those above-mentioned, who had committed themselves to the policy of construction by the State.

There is one feature, we believe, common to all the speeches in the debate, and frequently put forward in discussions outside the Palace of Westminster—namely, the statement that the art of wireless telegraphy is in a state of rapid development and change. We do not dispute the fact that the industry is in a transitional state—that is common knowledge; but we must enter a protest against the belief that it is undergoing the excessively rapid changes alleged by some of the disputants, especially those least acquainted with the technicalities of the question. We are repeatedly urged to wait and see what a month or two will bring forth. Now, anyone who is familiar with the history of wireless telegraphy must be aware that each important step in advance has cost not months, but years of assiduous development and research; Mr. Marconi himself, although he succeeded in hearing faint signals across the Atlantic in 1901, was not able to commence a commercial service until 1908, and had to abandon it again until 1910. In 1907 the Poulsen company announced its ability to provide a trans-Atlantic service—to this day it has not a single long-distance service at work day and night on commercial lines. The Goldschmidt company is in a similar position. The various rivals of the Marconi company are still, as heretofore, *going to do* something which they have not yet done, and while we do not doubt that they will eventually succeed, we are not prepared to believe that vast changes will take place in the course of one or two months, or even six months. Let it be remembered that the Marconi contract has been on the table for over 12 months already; if others have not been able to prove their ability to achieve the desired end within the past 12 months, why should we anticipate their triumph within "a month or two"?

In this connection we observe, with regret, that an esteemed contemporary makes a distinction between "urgency" and "extreme urgency," and advocates a policy of delay, with a view to the formation of a State department—although it also urges, contradictorily, that "the field for radio-development should be left untrammelled by the heavy hand of the State . . . the most deadening form of tutelage conceivable." The writer uningenously refers to periods of "a few months" allowed by the Postmaster-General for the Poulsen and Goldschmidt companies to demonstrate the capabilities of their respective systems in support of his denial of urgency, not disclosing the fact that the P.M.G. offered to consider these systems *for the second three stations* if proved suitable within a few months, and refused to delay the first three a moment longer than was unavoidable.

Numerous questions arise in connection with the agreement and the other papers recently issued in relation to the contract, but we cannot discuss them in detail here; suffice it to say that, when all the circumstances are taken into consideration, we believe that the course which has been followed by the Government and approved by the House of Commons is that which tends to the best interests of the Empire, and that we do not anticipate any reason for regretting the present decision.

D

THE VEHICLE CHARGING LOAD: A CANADIAN OUTLOOK.

A paper by Mr. C. Rummel on this subject appearing in the *Canadian Electrical News* last month, contained some observations of interest at the present moment to British supply engineers.

It would appear that the company with which Mr. Rummel is associated, although as a general principle preferring to leave the sale of apparatus to private contractors, has in this case been forced to deal directly with the consumers, as the electric vehicle business does not as yet offer sufficient attractions to dealers in petrol and steam cars to induce them to study the subject or undertake the trouble and expense of publicity work and providing garage facilities.

The author has found that where agencies are held for both petrol and electric vehicles by the same firms, the result is positively detrimental to the prospect of the latter, owing to the extra selling effort called for to introduce an article which is comparatively new and untried both to the buyer and the seller.

It may also be assumed that the superiority of the "electric" in regard to cost of repair, maintenance, and its consumption of lubricants and sundries does not commend it to the seller of the more complicated engine-driven vehicle, who naturally looks for any legitimate maintenance business which may arise after the sale is completed.

It is of interest to note that the first "electric" is said to have been sold in Vancouver seven years ago, and, in spite of deficient facilities and knowledge for its proper treatment, the vehicle (a 5-ton truck) is in successful use to-day.

As a result of the slow progress made by the "electric" in the district, the supply undertaking decided at the beginning of the present year to undertake the sale and care of battery-driven vehicles, making the best possible publicity move by purchasing three trucks for its own use. These were employed for meter, arc lamp and overhead line work, and proved satisfactory under exceptional conditions of snow and bad weather.

An assistant with experience in selling electric cars was engaged, and a considerable amount of Press advertising undertaken. Since February an active campaign has been in operation on the usual lines, the company, in addition, offering the use of its own vehicles on trial to carry out delivery work for firms interested in the matter.

In about four months three trucks have been sold by the company and two by private dealers, whilst great interest in the subject has been aroused which, although, no doubt, a satisfactory beginning, only confirms experience on this side to the effect that the early development of this business will be slow, and that those who believe in its future must have the courage to undertake a considerable amount of work and expenditure.

The writer draws attention to the desirability of purchasing standard chassis from the manufacturer, and having bodies fitted to the buyer's wishes by van builders on the spot, which makes for satisfaction in detail, and arouses local interest.

The need of suitable garage accommodation and attention for those who were only able to use one or two vehicles was soon experienced, and the electricity undertaking is now putting up a suitable building in the centre of the city.

From the few figures given it would appear that this establishment will have sufficient space for about 20 trucks to be charged, cleaned and manœuvred; assuming that the bulk of the charging business is done in the night, it may be taken that this garage will be found sufficient to meet the needs of a fleet of 30 vans in daily use in the city.

An estimate recently prepared for a garage of this capacity for an industrial borough in London gave the following approximate allocations of expenditure and revenue :—

Expenditure.	£	*Per unit.*	%	Revenue.		
1. Rent of land ...	50	·036d.	3·6	333,000 units at 1d. to cover cost of energy, attendance, accommodation and handling (no cleaning or repairs included)		
2. Capital charges on buildings and machinery, at 10 per cent. ...	150	·108d.	10·8			
3. Labour	250	·180d.	18·0		£1,388	100 %
4. Electrical energy at cost, 333,000 units at ·5d. ...	694	·500d.	50·0			
5. Profits	244	·176d.	17·6			
	£1,388	1·000d.	100·0		£1,388	100 %

The Canadian Co. is making inclusive monthly charges to cover electrical energy, storage, washing, oiling and minor adjustments, the figures rendered into English money being approximately as follows :—

Capacity of vehicle.	*Charge per month.*
⅓ ton	£9
½ „	9
$\frac{9}{10}$ „	11
$1\frac{3}{4}$ „	12
$3\frac{1}{10}$ „	13
$4\frac{1}{2}$ „	14

Allowing £500 per annum for the cleaning and attention not included in the English estimate, and taking the same number of vans, 30, at the average of the above charges, £11 per month, a figure of £3,460 per annum is obtained as the comparative revenue, and after allowing for the higher charges on buildings and machinery which would probably obtain in Canada, it may be fairly deduced that the allowance for energy alone in the above charges is of the order of $1\frac{1}{2}$d. per B. of T. unit.

Although the local garage owners have shown reluctance to take up the commercial vehicle, it appears that they do a considerable business in private pleasure cars.

These small vehicles are stored, washed, charged and oiled for a monthly charge of about £6 each, which in some cases includes delivery and collection of the vehicle.

It is stated that in the province of British Columbia there are in use 100 pleasure cars and 12 commercial trucks.

Further business done in Victoria and Vancouver in the period mentioned includes two trucks of 2 tons capacity and one of 5 tons.

The author refers at some length to the desirability of the charging load from the point of view of the central station, pointing out that to a great extent distribution costs are done away with, whilst the load for the most part is taken after 9 or 10 o'clock in the evening with the exception of a certain amount of boosting at midday.

Apparently the Canadian central stations have now become fully alive to the possibilities of the "electric" and the rates quoted for charging are entirely satisfactory from the point of view of competition either with horse traction or petrol cars.

The first cost of the vehicle, however, appears to constitute a great difficulty. Five-ton trucks, f.o.b. Vancouver are quoted at £1,500. A 750-lb. electric delivery wagon is quoted at £500, as against a petrol wagon at £160.

The author points out the difficulty which the salesman has in convincing the consumers that in spite of the great differences in first cost, a saving may be effected by buying the "electric."

Apparently, they claim that the saving is to a great extent due to the low price quoted for electrical energy. It would appear, however, from an examination of the costs submitted, that electrical energy accounts for a comparatively small percentage of the cost of operating, and unless the price per unit is unduly high, it does not become a determining factor in competition with petrol or steam.

On this side, those who have done any work in this direction, have already arrived at the conclusion that 1d. per unit is quite a reasonable charge, and that there is no necessity to go lower excepting under special conditions, the more

pressing need being some unified system of rating all over the country, and the provision of ample charging facilities.

These conditions will be the more easily brought about if a reasonable return is obtained for the service given. The whole question is one which at the present time deserves the attention of all supply authorities.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Dry and Wet Air Filters.

With reference to the correspondence on the above subject, one or two points suggest themselves. Apart altogether from the practical difficulties which were fully discussed at the I.M.E.A. meeting, there are a few theoretical questions.

For instance, to what is the cooling due? Is it due to cold air or air plus water vapour? Or, again, is it due to cold air plus water vapour, together with water particles in a fine state of suspension? Having seen the turbo-generator at work at Brighton with the wet cooling appliance, I incline to the view that the cooling is due to water particles absorbing their latent heat of evaporation, together with increased specific heat due to humidity and, of course, the temperature drop.

If this view is correct, it would appear that cloth filtration by abstracting the water or mist particles neutralises a great advantage, and will never compete with wet cooling for generator cooling purposes. Calculation shows that the drop in temperature and raised specific heat due to humidity does not appear to account for everything, and therefore one is forced to conclude that water or mist particles are also present. If evaporation of mist particles at wet bulb temperature is occurring to any extent, then there is no question that a smaller plant is required in the wet process.

It would be interesting to learn the views of others on this question.

W. H. F. Murdoch.

Millhill, *August 8th*, 1913.

Systems of Wages Payment and "Scientific Management."

Your contributor, "Zähler," falls into the not uncommon error of speaking of "scientific management" as though it were merely a system of wages payment. Various piecework and bonus systems of payment have been employed in connection with what is known as "scientific management," but there is nothing specially novel about these systems of payment in themselves, and they are merely employed as necessary incentives to induce the workpeople to keep up to the standards set by the methods of scientific management. If it were claimed that the remarkable results obtained with scientific management were due simply to a method of wage-payment, such claims might well be regarded as exaggerated, but the particular method of wage-payment used is only one detail of the whole scheme of scientific management, with which remarkable results have unquestionably been obtained.

It is easy to make fun of Parkhurst's office-cleaner's schedule, and it is easy, too, to over-systematise. No sensible person imagines that "any system can take the place of an intelligent and zealous staff." But does it follow that no system is of any use? Without good men nothing can be done; but, surely, a good system of management will enable your intelligent and zealous staff to effect a great deal more than they could do without its assistance?

G. C. Allingham.

London, N.W., *April 11th*, 1913.

Shift Engineers.—A Proposal.

I have often wondered at the non-invasion of central station work by the fair sex. I cannot recollect ever having seen one employed even in the clerical department of electricity works.

But for reading the letter by Dr. Larmor in the *Times*, in which he states how men from other occupations would be required for wireless telegraph stations, I should have had some misgivings in broaching the subject at all. However, should station men desire to take up this branch of electrical work, they would be more fitted for it than men from many other occupations.

Taking switchboard work into consideration to begin with, I believe, this occupation is pre-eminently one for the fair sex, especially for those who have had the advantage of higher education and some laboratory experience in the physics department. And what veritable godsends they would be in some stations!

In engine-room work the men appear to have to spend more than half their time doing work which could be done as efficiently, expeditiously, and more economically, by charwomen. And it is a well-known fact that many of the enclosed type of high-speed engines and turbines require practically very little attention, so that here again, one can see opportunities for the fair sex to step in, and, with little training, to perform the duties well.

Yet again, even in the boiler house, with mechanically fed hoppers, &c., those of strong physique would be capable of holding their own!

And I am by no means sure that the fair sex, in a short time, would not be able to give many a shift engineer points, and beat him. And managers would have to look to their laurels.

In Government plants where engineers, no doubt, have some nice soft sinecures, what delectable plums there would be for some fair operators to choose from, and they would, no doubt, efficiently perform what little duties would be required of them in a very short time.

W. E. Pritchard.

August 11th, 1913.

SOME NEW FORMS OF RECORDING INSTRUMENTS.

FOR recording switchboard instruments, it is now usual to require the record to be traced on a system of rectangular co-ordinates instead of, as in the older forms, on special curvi-linear diagrams, as the former are far easier to deal with if any subsequent summation or other evaluation is to be carried out.

Another requirement, for the sake of symmetry in the switchboard arrangements, is that all the instruments, whether recording voltmeters, recording wattmeters, recording double wattmeters or other types, shall have the same outside appearance and dimensions and the method of handling all of them when changing the record sheet must be the same.

From the manufacturers' point of view, this uniformity should extend much further than merely as regards these outside details, for only by the utmost standardisation of working parts can recording instruments, of which comparatively few are required, be produced at reasonable prices.

In order to meet these requirements, Messrs. Hartmann and Braun have recently introduced a new form of recording instrument, some particulars of which recently appeared in the *E.T.Z.*

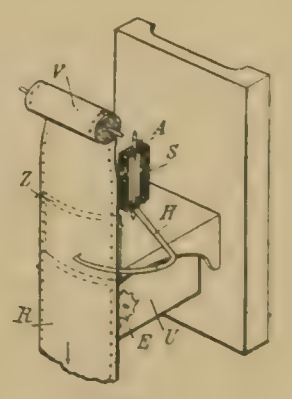


FIG. 1.

The recording arrangement adopted in these is shown in fig. 1 diagrammatically. The working axis A is vertical and parallel to the base plate. Co-axial with A, a cylindrical plate Z is placed, over which the hook-shaped pointer H moves from side to side. The record sheet is carried on a roll at V, and is drawn at a steady speed over the cylindrical plate by means of the spiked wheels E, driven by clockwork. Special clips serve to spread the paper smoothly against the cylindrical surface. The end of the pointer carries a pen and a rectangular co-ordinate record is thus obtained, in spite of the fact that the moving system has the ordinary circular motion.

The arrangement lends itself to a compact construction, as can be seen from the side elevation in fig. 2.

The whole front of the instrument is formed by a glass door, which enables the record to be clearly seen. After passing the pointer, the paper is either allowed to pass down out of the instrument through a slot, or it is automatically wound on to a second drum. The metal clamp in front of the paper, carrying the scale, &c., can be readily moved to one side by a small handle. When so moved, it carries the pointer with it, and leaves the whole front of the paper clear, and ready for removal or renewal.

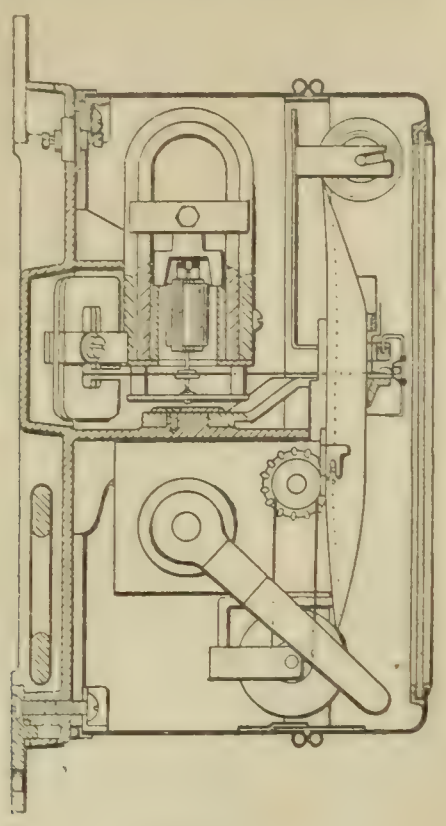


FIG. 2.

The clockwork mechanism is especially powerful, and runs for one month with the normal paper speed of 60 mm. per hour. The spiked driving wheels are geared to the clockwork by an external pair of wheels, whose ratio can be readily altered when desired, so as to change the speed of the record up to as much as 10 mm. per second. The whole of the clockwork can also be bodily removed and replaced by another when necessary.

The special pen arrangement used is shown in fig. 3; B is the paper clamp mentioned above, and over this the pointer moves with its indicator N in front of the scale S. A fork H on the end of the pointer carries the actual pen in the form of a capillary glass tube resting on knife edges, and with its upper end dipping into the removable ink trough T, which runs across the whole face of the paper. The action of the pen is similar to that in the Thomson siphon recorder, and the pen is balanced so that it presses lightly, but definitely, against the paper when moving rapidly. The liability of the fine glass tube to breakage is reduced by covering it with a coating of copper.

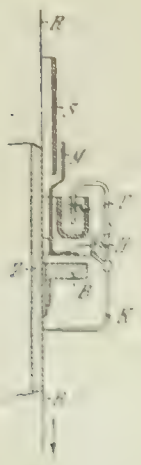


FIG. 3.

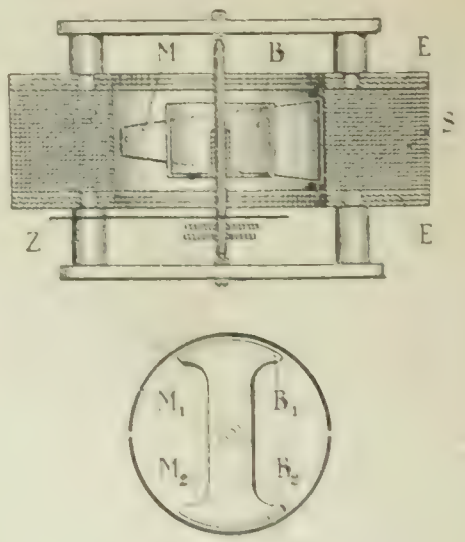


FIG. 4.

The arrangement has proved very satisfactory, and since the ink is not carried by the pointer, it is possible to provide enough for at least one month at one filling.

The meters are made up in three forms as regards outward construction:—(1) In a sheet metal case for mounting on the front of a board; (2) the same for mounting flush with the board; and (3) in a portable form for laboratory use, in a wooden case.

The instruments themselves are distinguished from ordinary indicating ones by having greater deflecting forces, so that the additional friction due to the pen becomes negligible. Magnetic damping is employed, as shown in fig. 2, the backward extension of the pointer serving both as counterweight and damping disk. The pointer comes to rest in from one to two seconds, but, if necessary, this time can be shortened.

Meters of the moving iron type are constructed, as shown in fig. 4. M_1, M_2 are two fixed wedge-shaped iron pieces, which repel the two moving pieces B_1, B_2, when both are magnetised by the coil S. This duplex arrangement serves to prevent all radical unbalanced forces. The former, on which the coil is wound, is made of sheet-iron E, so as to reduce the magnetic resistance.

Moving-coil instruments for direct-current work are especially suitable for rapid recording work, because of their light moving

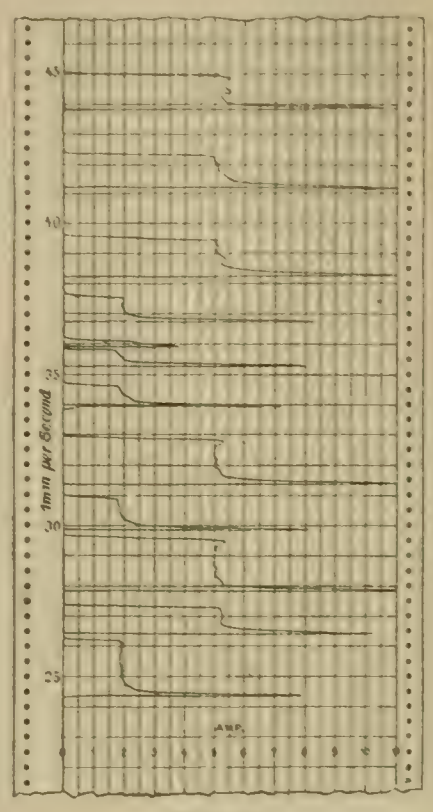


FIG. 5.

parts and large torque. Fig. 5 shows a current record obtained with one of these on a small crane motor with a paper speed of 1 mm. per second.

Hot-wire recording instruments are useful, because a single meter can be used correctly on D.C. or A.C. circuits, and with curves of any shape or frequency, and this reduces the number of instruments necessary—an important point with recording meters, whose cost is naturally greater than that of indicating ones.

The type used has a particularly constant zero, whilst at the same time it is comparatively quick acting.

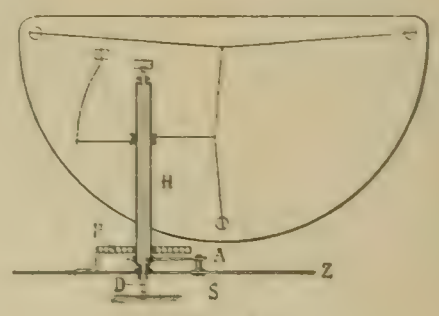


FIG. 6.

Since the pointer of recording instruments must be handled, and damage would result if the pointer of a hot-wire meter were moved over the full scale deflection with the wire in the cold state, a safety device has been introduced, as shown in fig. 6.

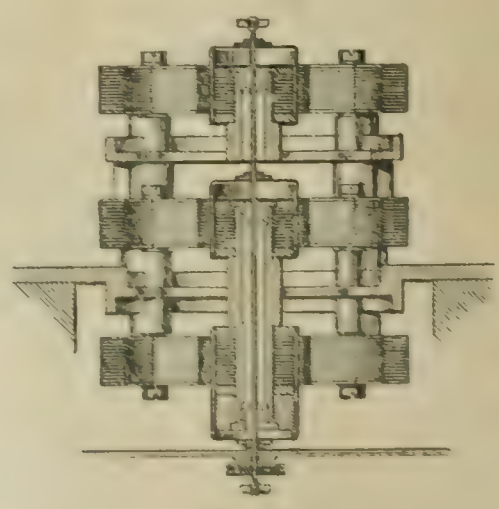


FIG. 7.

The pointer Z is not connected to the wire system rigidly, but through a flexible coupling. When working ordinarily the pointer is deflected by the arm A pressing against the peg S, but if the pointer is forcibly moved further along the scale than the existing wire extension demands, the inner spindle D moves in the hollow spindle H, and only subjects the wire system to quite safe forces through the spiral spring F. When the pointer is released the spring F brings back the peg S against the arm A.

Ferraris or induction instruments of the recording type are made up as ampere, volt and wattmeters, and only differ from the Hartmann & Braun indicating instruments of this type, in having a considerably greater torque. Fig. 7 shows a triple wattmeter of this type for use on four-wire, unbalanced three-phase systems. In spite of the height of this instrument it is still possible to get it into the standard size of case.

Fig. 8 shows a double wattmeter of the electro-dynamometer type, suitable for either D.C. or A.C. circuits. In these the fixed series coil is inside the moving (or volt) coil. Each system is surrounded, as shown, by a laminated iron cylinder, which serves to protect the coils from outside fields and to prevent interaction between the two wattmeters: this also reduces the magnetic

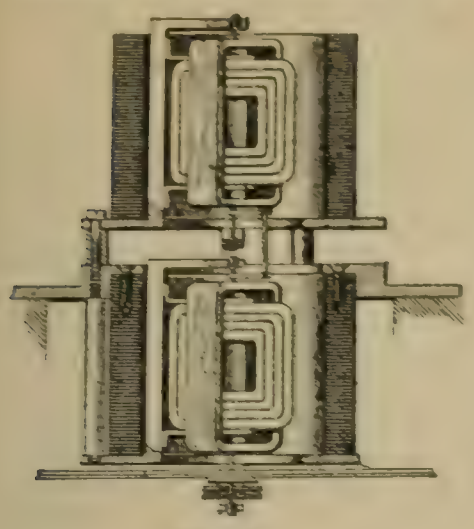


Fig. 8.

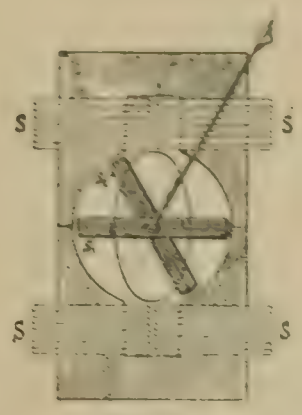


Fig. 9.

resistance and so improves the torque. At the same time the iron is so dimensioned that no appreciable error is introduced either by resonance on D.C. circuits or by the hysteresis effect on A.C. circuits.

The wattmeter scale divisions are perfectly uniform.

Fig. 9 shows a type of recording instrument, made up either as a phase meter or as a frequency meter. It is on the crossed coil principle, and by a suitable use of iron a large deflecting torque is obtained, sufficient to operate the pen even with very low currents in the mains. The readings are practically independent of current and voltage variations over a very wide range. When used as a frequency meter the connections are as shown in fig. 10. The

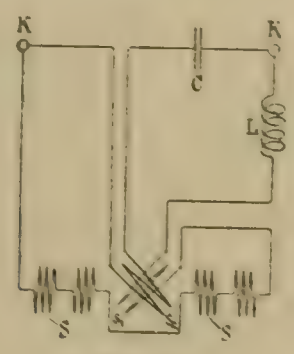


Fig. 10.

crossed coils S_1 and S_2 are mechanically connected together and have no external controlling force. One of them S_1 is connected through the fixed coils S and an inductive resistance L to the supply terminals K as a voltmeter. The other moving coil S_2 is connected to the same terminals through a condenser C. By carefully proportioning the fields due to S and S_1, the frequency readings can be made practically independent of the supply voltage and at the same time a uniform scale is obtained. A 50-cycle instrument will usually have a scale extending from 45 cycles to 55 cycles, or, if desired, from 40 cycles to 60 cycles, and covering the whole width of the paper.

TRADE NAMES AND TRADE DESCRIPTIONS.

[BY OUR LEGAL CONTRIBUTOR.]

Although this subject has been dealt with on many previous occasions in the Electrical Review, it is essentially a topic which merits discussion at repeated intervals. The statute law changes but slowly, but decisions in the Courts are very frequent. Unless the purport of the cases is clearly understood, a trader may be forced into long and expensive litigation.

Apart altogether from the law of trade-marks, the English Courts have, and will, exercise an inherent jurisdiction to prevent one trader adopting the title of another's goods with a fraudulent intent. Again, the law of England will restrain what is known as "passing off." Thus suppose the steel made by a particular firm were to become known throughout England as "Elephant Steel"—so well known that anyone buying "Elephant Steel" would know, or assume, that it was the product of the firm in question, and assume that, in these circumstances, another steel merchant were to stamp his bars with the words "Elephant Steel," the Courts would interfere to prevent his committing this fraud upon the public. This principle would be held to apply whether plaintiff or defendant was a foreigner trading in England. So it is apprehended that if an American firm of steel merchants had acquired what we may term a customary title to a certain name, their use of it would be protected. Again, if an English firm had acquired the right we have indicated, it would not be competent for the American firm to make infringing articles in America, and import them into England to deceive "His Majesty's subjects." Such a proceeding would be restrained and prevented, if the offenders could be got hold of

The fact that the misuse of a name will be prevented was well illustrated in the case of Aerators, Ltd. *v.* Automatic Aerator Patents, Ltd., which was heard by Mr. Justice Farwell early in June, 1903. There the plaintiff company, who are the proprietors of the well-known "Sparklets," sought to restrain the defendants from using the name "Automatic Aerator Patents, Ltd.," on the ground that it so nearly resembled the name of the plaintiff company as to be calculated to deceive. Sec. 20 of the Companies' Act provides that no company shall be registered under a name identical with that by which a subsisting company is already registered, or so nearly resembling the same as to be calculated to deceive, except in certain cases, which are not material to the present discussion. It follows from this that a company has greater rights than an individual in respect of names which are identical, for while John Smith cannot always prevent another John Smith using his own name, John Smith, Ltd., could prevent the registration of any other company as John Smith, Ltd. Mr. Justice Farwell, however, declined to grant an injunction, for the reason that, giving words their ordinary meaning, no one was likely to be deceived. Further, it was not competent for any company or person to claim the sole proprietorship of any word in common use. "For example," said his Lordship, "suppose a company had registered the name of 'Motors, Ltd.,' and another the name of 'Automobiles, Ltd.,' it appears to me impossible to say that they could thereby prevent all other companies from using as part of their titles these two words, which, so far as I know, are the only words which represent the fashionable locomotives of the day, although their sole trade was the manufacture or sale of motors or automobiles . . . In considering whether a name is calculated to deceive, it is, as I have said, material to see what that name is; and if the name is simply a word in ordinary use, representing a machine or an article of commerce, the probability of deception is out of all proportion less than it would be in the case of an invented or fancy word, or even of the name of a place."

Even if a man uses his own name in connection with his business, with intent to defraud, the Courts will prevent him.

In Holloway *v.* Holloway, 13 Beav. 209, the defendant, Henry Holloway, commenced selling pills as H. Holloway's pills in boxes similar to those of the plaintiff, Thomas Holloway, with a view to passing off his pills as the plaintiff's. He was restrained by injunction. Again, where a man named Day having obtained the authority of one Martin to use his name, set up in business as Day & Martin, and sold blacking in bottles with labels similar to those of the well-known firm, he was restrained by injunction. These two cases illustrate the proposition that "fraud vitiates everything." In the absence of fraud, however, a man may use his own name in his own business, no matter what may be the consequences to his neighbours. The case of Turton *v.* Turton may be regarded as a leading authority in support of this proposition. The plaintiffs had for many years carried on the business of steel manufacturers in Sheffield under the style of "Thomas Turton & Sons." In 1886 they were registered as a company, and added the word "Limited" to the above title. The defendants were John Turton and his two sons. John Turton had commenced a business very similar to that of the plaintiffs in 1869, in partnership with one Lawton, under the style of "Turton and Lawton." In 1875 Lawton retired, when John Turton took his sons into partnership under the style of "John Turton & Sons." Owing to the confusion caused by the similarity of names, the plaintiffs sought an injunction to restrain the defendants from carrying on the business of steel merchants and manufacturers under this name, or any name so closely resembling their own as to be calculated to deceive. Much evidence was called as to the confusion which had arisen in Sheffield, but the defendant deposed that the new name of his firm had been adopted for the sole purpose of making known the fact that his two sons had become partners. When the case reached the Court of Appeal, their Lordships refused to grant an injunction. The late Lord Esher said:—

"It is not alleged, and it certainly is not proved, that the defendant did anything in the way of his trade, which tended to give any other meaning to the name in which he carried on his business, or which could give any other meaning to it, than the mere fact that he did carry on his business, and was in partnership with his sons. The plaintiffs have no right to say a man may not use his own name. Upon principle I should say it is perfectly clear that if all a man does is to carry on the same business, and to state how he is carrying it on, that statement being the simple truth, and he does nothing more with regard to the respective names, he is doing no wrong, and there is no *prima facie* case against him."

It was held in a very recent case that the mere surname of an individual, though it may be adapted to distinguish the goods of all persons who bear that surname from the goods of other persons bearing a different surname, is not adapted to distinguish the goods manufactured by the applicant from those of other persons within Sec. 9 Sub.-sec. 5 of the Trade Marks Act, 1905. R. J. Lea, Ltd., Trade Mark, *Re* (C.A.) 29 T.L.R. 334.

The law on this subject may be thus summarised :—

1. A man will not be restrained from simply carrying on his business in his own name, even though confusion may arise.

2. A man will be restrained from carrying on business in his own name dishonestly, *i.e.*, when he not only uses his own name, but uses it in such a way (that is, in conjunction with other circumstances) as to represent that his business or his goods are the business or goods of another trader.

3. If a trader has a trade name for his goods which denotes those goods solely in the market, and distinguishes his goods from similar goods of other traders, so that the trade and the public, when asking for goods under that name, mean and intend to get particular goods emanating from one particular trade source (although they may not know such trader's name) then he is entitled to be protected by the Court against other traders using that name in such a way as to be calculated to pass off other goods as his.

The doctrine of "passing off" may also be illustrated by reference to numerous decisions. In one case, it was held that there was no monopoly in the use of the word "magnolia" as applied to metal, as it had become well known in the trade as a substance peculiarly adapted for bearings in machinery. Where, however, a brewer had manufactured ale at Stone for a number of years, so that his ale came to be known as "Stone ale," an injunction was granted to restrain the defendant, who had only recently come to the town, from selling ale under the appellation of "Stone ale," or "Montgomery stone ale" (Montgomery *v.* Thompson (1891), A.C., 217).

As a trade name is really acquired through the laches of the market, so, too, a trade name may be lost through the laches of the owner. If the owner of a trade name allows his rivals to use his trade name on their goods without objection, it will cease to be his trade name. It will become, in legal phraseology, *publici juris*, *i.e.*, common property. What is the test whereby to ascertain whether that which was originally a trade name has become *publici juris*, *i.e.*, common property? It becomes so when it ceases to be distinctive—when it ceases to denote solely the original man's goods in the market. Of course, it ceases to denote his goods solely if it is habitually used on similar goods by other traders. But this state of things—habitual use by other traders—can only arise with the acquiescence, *i.e.*, by the sanction, of the original trader. If, when he becomes aware that another or others are using his trade name he takes legal proceedings to stop that use, presumably he will succeed ; if he does not, then he will be held to have acquiesced in what is being done, and will be precluded from interfering afterwards. If, therefore, a trader becomes aware that his rights to his trade name are being invaded, he must take steps promptly to assert and protect those rights, if he wishes to preserve them, and he must not content himself with a mere protest, or even with a threat of legal proceedings ; but if the infringer sets him at defiance, he must follow up his threat with the proceedings he threatened.

In the generality of cases between trade rivals which come before the Courts, the plaintiff says :—"I complain that you have passed off your goods as mine, which they are not." In some cases, however, the plaintiff says :—"Your are passing off my goods as yours, which they are not." It seems that the Courts are inclined to prevent the latter form of piracy, just as much as they will prevent the former.

The case of Bullivant *v.* Wright (1897, 13, T.L., R. 201), illustrates what kind of passing off will be restrained by the Courts. The plaintiffs were wire-rope manufacturers and contractors for aerial tramways and cableways. The defendants, who were also wire-rope manufacturers, published a trade catalogue, which contained (*inter alia*) two diagrams, or pictures, of aerial cableways which had been designed and erected some years before by the plaintiffs' predecessors in title. The plaintiffs alleged that the publication of these diagrams by the defendants in their catalogue was a representation that the same had been erected by the defendants. They claimed an injunction to restrain the further publication of the catalogue, and an order for the delivery up of all the catalogues in existence. As a matter of fact, what the defendants had done was to supply new wire cables as they were required during several years. Mr. Justice Kekewich, in the course of his judgment, said : "No reasonable man, seeing these pictures in a book of this kind, would have any doubts that the defendants intended it to be understood that they had erected the tramway. It is as distinct a representation to that effect as if it had been expressed in plain language . . . If it is proved to the satisfaction of the Court in a case of this kind that the defendants did in truth say that the plaintiffs' goods were theirs, I think that, as between rivals in trade, the Court would be justified in drawing the inference that the wide circulation of such a statement would necessarily damage the plaintiffs quite as much as in the ordinary case of the passing off of goods." These observations seem to show that if the plaintiffs had been able to show that they had themselves erected the cableway, they would have had judgment ; but the case was decided against them on another point. We may draw the following conclusion :—That if Jones sells or advertises boots and shoes manufactured by himself in such a way as to make the public believe they are Brown's, and so obtain the benefit of Brown's good name, he may be restrained by injunction.

In a Scotch case, Parozone Co., Ltd., *v.* Johnson Gibson (1904, 21 R.P.C. 317), the plaintiff company invented and applied the name "Parozone" to a bleaching fluid made by them, and it was admitted that they were entitled to the exclusive use of that name as indicating fluid manufactured by them only. Gibson, another trader, also made a bleaching fluid, but said that he never sold it as "Parozone," and when asked for that substance explained that his fluid was not "Parozone." The plaintiff company proved that on five occasions to two persons Gibson, or his servants, sold his fluid in answer to a request for "Parozone," and without explanation. They further proved that Gibson pointed out to two former shop girls the jar where he kept "Parozone," and that it was a matter of daily occurrence for Gibson's fluid to be sold to customers who asked for "Parozone" without explanation. Gibson proved that on some occasions he had explained that his bleach was not "Parozone." It was held on these facts that the plaintiff company were entitled to the injunction.

It is next necessary to deal with the provisions of the Merchandise Marks Acts, which prevent a trader from passing off his goods as those of another trader, and make him criminally liable. The first section of the Merchandise Marks Act, 1887, makes it an offence, among other things : (1) to forge a trade mark ; (2) to falsely apply to goods any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive ; (3) to apply any false trade description to goods ; and (4) to cause any of these things to be done. But it is not to be an offence if the person charged proves that he "acted without intent to defraud." Trade mark in this and the provision next referred to means a trade mark registered at the Patent Office, but it also includes certain foreign and Colonial trade marks, for which the Act itself must be consulted. Sec. 2 (2) makes it an offence to sell or expose for sale, or possess for the purposes of sale or any other trade purposes, any goods or things to which a false trade mark or a false trade description is applied, or to which any trade mark or any mark so nearly resembling a trade mark as to be calculated to deceive, is falsely applied. But it is not to be an offence if the person charged proves "(*a*) that, having taken all reasonable precautions against committing an offence against this Act, he had, at the time of the commission of the alleged offence, no reason to suspect the genuineness of the trade mark, mark or trade description ; and (*b*) that, on demand made by or on behalf of the prosecutor, he gave all the information in his power with respect to the persons from whom he obtained such goods or things ; or (*c*) that otherwise he had acted innocently."

Forging a trade mark is defined by the Act as follows :—"A person shall be deemed to forge a trade mark who either (*a*) without the assent of the proprietor of the trade mark makes that trade mark, or a mark so nearly resembling that trade mark, as to be calculated to deceive ; or (*b*) falsifies any genuine trade mark, whether by alteration, addition, effacement or otherwise ; and any trade mark or mark so made or falsified is in this Act referred to as a forged trade mark. Provided that in any prosecution for forging a trade mark, the burden of proving the assent of the proprietor shall lie on the defendant."

Applying a trade mark or mark or trade description to goods is defined by the Act : "(1) A person shall be deemed to apply a trade mark or mark or trade description to goods who (*a*) applies it to the goods themselves ; or (*b*) applies it to any covering, label, reel or other thing in or with which the goods are sold or exposed, or had in possession, for any purpose of sale, trade or manufacture ; or (*c*) places, encloses or annexes, any goods which are sold or exposed, or had in possession, for any purpose of sale, trade or manufacture, in, with, or to any covering, label, reel, or other thing to which a trade mark or trade description has been applied ; or (*d*) uses a trade mark or mark or trade description in any manner calculated to lead to the belief that the goods in connection with which it is used are designated or described by that trade mark, hall mark or trade description ; (2) the expression 'covering' includes any stopper, cask, bottle, vessel, box, cover, capsule, case, frame or wrapper, and the expression 'label' includes any band or ticket. A trade mark or mark or trade description shall be deemed to be applied whether it is woven, impressed, or otherwise worked into, or annexed, or affixed to the goods, or to any covering, label, reel, or other thing ; (3) a person shall be deemed to falsely apply to goods a trade mark or mark who without the assent of the proprietor of a trade mark applies such trade mark, or a mark so nearly resembling it as to be calculated to deceive : but in any prosecution for falsely applying a trade mark or mark to goods, the burden of proving the assent of the proprietor shall lie on the defendant."

A trade description is defined by Sec. 3 of the Act as any description, statement, or other indication direct, or indirect, as to certain things not material for the present purpose. A false trade description is defined by the same section as follows :—"The expression 'false trade description' means a trade description which is false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description, whether by way of addition, effacement, or otherwise, where that alteration makes the description false in a material respect ; and the fact that a trade description is a trade mark, or part of a trade mark, shall not prevent such trade description being a false trade description within the meaning of this Act. The expression 'goods' means anything which is the subject of trade manufacture or merchandise. The expressions 'person,' 'manufacturer, dealer or trader,' and 'proprietor,' include any body of persons corporate or incorporate. The expression 'name' includes any abbreviation of a name." The description must be false "in a material respect"—which means that it must be materially or substantially false, and not necessarily wholly false ; and it may be remarked that the section does not extend to mere verbal descriptions.

The first offence described consists in doing something illegal to goods ; the second consists in dealing with goods to which something illegal has been previously done. The first is aimed mainly at manufacturers, the second at sellers, wholesale or retail, not being themselves the manufacturers of the fraudulent goods.

As to the first offence, it is not to be held to be committed when the person charged proves (the burden of proof is, of course, on him) that he "acted without intent to defraud." This does not mean intent to defraud any particular purchaser or other individual,

but intent to defraud generally by passing off an article as different to that which it really is. It does not cover what are mere cases of inaccuracy of description.

It remains to consider the effect of some recent cases relating to trade marks. It was held in Andrews *v.* Kuchurich, 29 T.L.R. 181, that Sec. 37 of the Trade Marks Act, 1905, only requires the *bona fide* user of the trade mark—namely, the registered mark, in connection with the goods for which it is registered; it does not in terms require the mark to be "used as a trade mark," and if the registered mark is *bona fide* impressed upon the goods there is a *bona fide* user of the mark in connection with the goods within the meaning of the section although the house mark or other matter is added.

A surname cannot, of course, be registered as a trade mark; and it has been decided that where the Board of Trade has determined that a particular name is not outside the category of registrable trade marks, and has directed the Registrar to proceed with the application for its registration and determine whether the name is a distinctive mark, the Court is precluded from afterwards saying that the name is outside the category of registrable trade marks. (In *re* Trade Mark No. 312,065, and in Trade Marks Act, 1905, 29 T.L.R. 117.)

The principle that a word description of an article cannot be registered as its trade mark is well illustrated by the case of *re* Colgate & Co.'s mark, 29 T.L.R. 326. There the word "Ribbon" was held not to be a registrable trade mark for a dentifrice, inasmuch as the word as used by the applicants was descriptive of the form and character of the dentifrice in respect that it described the manner and form in which the dentifrice came out of the tube in which it was sold.

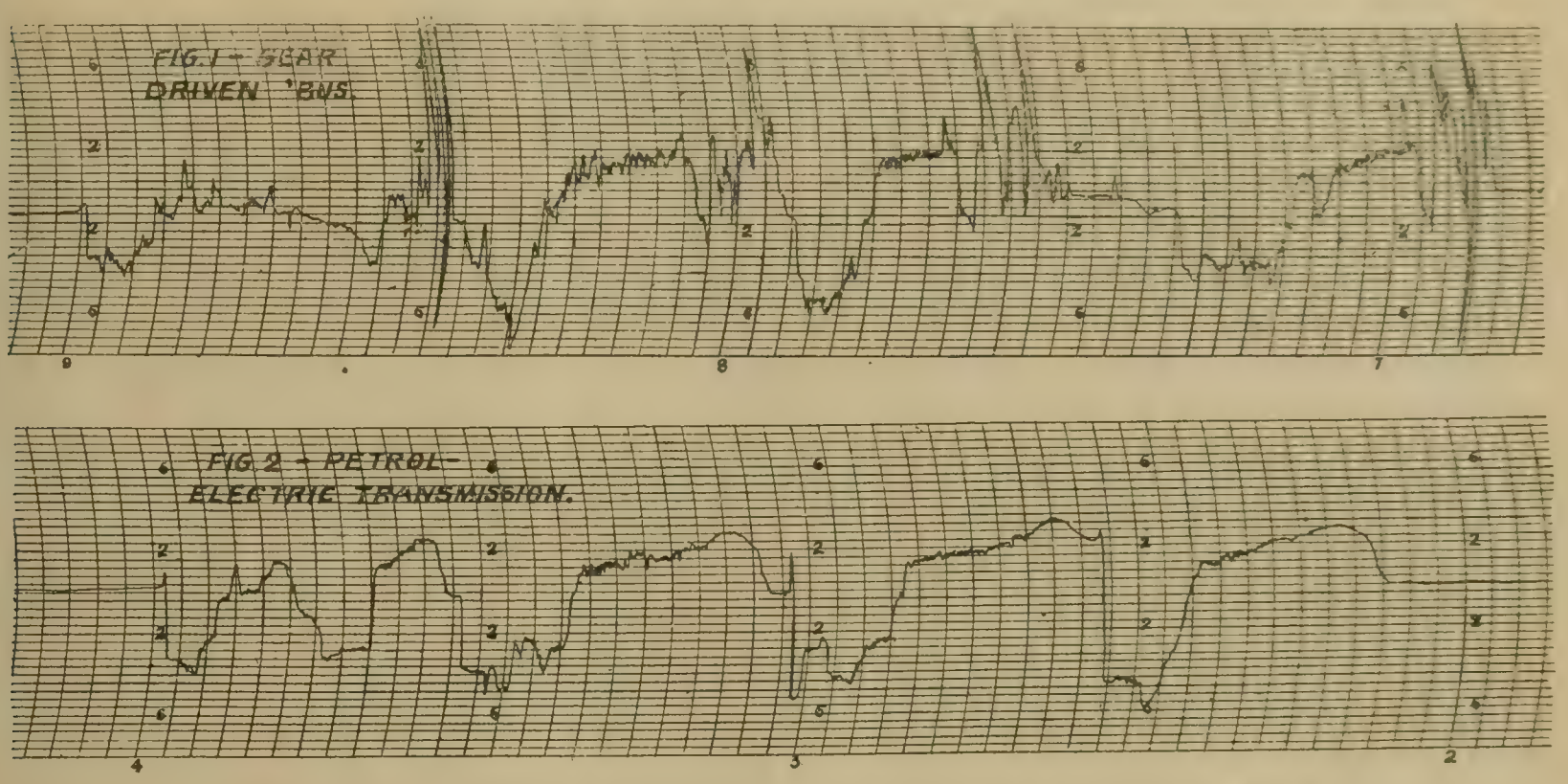
PETROL-ELECTRIC 'BUSES: TRANSMISSION STRAINS AND OPERATING COSTS.

When any vehicle starts from rest, or, in general, changes from one speed to a higher speed, there is required in addition to energy overcoming transmission, road or rail and wind resistances, energy to accelerate the mass of the vehicle. The power required for the latter purpose varies directly with the rate of acceleration. Thus a force of 70 lb. per ton mass of the vehicle will impart to the whole an acceleration of 1 ft. per sec. per sec., while to impart an acceleration of 2 ft. per sec. per sec. requires the application of 140 lb. accelerating force per ton and so on. Obviously, the stresses to which the whole of the vehicle, and in particular the transmission gear, wheels and tires, are subjected will vary with the acceleration and—since a certain speed can be reached in a certain time by the application of a steady acceleration considerably less than the maximum value of the acceleration required if the latter be variable—it is obviously desirable that the acceleration, whether from rest, or from one speed to any other, should be as uniform as possible.

The Wimperis accelerometer has been adopted by the Royal Automobile Club as an instrument for indicating and recording the acceleration of a vehicle under test. A pen controlled by a freely pivoted weight forms a continuous record on a calibrated chart of the accelerations and decelerations to which the vehicle carrying the instrument is subjected. The force doing useful work at the point of contact between the road wheels and ground equals at any moment (acceleration (ft. per sec.^{2}) × wt. of vehicle (tons) × 70) lb. The greater the value of this product, the more severe the strain and wear on the tires and other parts.

The accompanying illustrations are reproduced from accelerometer records taken on a well-known gear-driven omnibus (fig. 1) and on a 40-H.P. Tilling-Stevens petrol-electric 'bus (fig. 2) on the same road and under identical conditions. The rapid and violent fluctuations in the former curve are attributable to the clutch and gear changes, and the advantages offered by the petrol-electric transmission in respect of smooth acceleration and hence minimum transmission strains and minimum discomfort to passengers, as shown in the second curve, are obvious. Though, in the tests during which these records were taken, the Tilling-Stevens vehicle was driven considerably faster than the gear-driven 'bus, the maximum acceleration in the former case was less than 3·5 ft. per sec. per sec. (corresponding to 245 lb. per ton on the road wheels), as compared with intermittent accelerations exceeding 8 ft. per sec. per sec. (maximum strains at rim of road wheels = 560 lb. per ton weight of vehicle), in the case of the gear-driven 'bus.

It is impossible for the driver to accelerate a "T.-S." petrol-electric vehicle at an excessive rate, but since the acceleration is constant, a given speed can be attained more rapidly than in other 'buses of the same rating. The transmission strains in a vehicle employing clutch and gear drive depend largely upon the skill of the driver; by no practical means can these shocks be limited and their magnitude in city service is excessive.



Figs. 1 and 2.—Accelerometer Records of Gear-Driven Petrol-Electric 'Buses.

In addition to the great saving in upkeep of chassis and body effected by the "T.-S." petrol-electric system, the cost of tire renewals is much reduced by the elimination of sudden wide fluctuations in the force exerted at the wheel rim. In running over 3,000,000 miles on "Continental" tires in London, an average service of 20,148 miles per tire has been obtained. The total cost of operating a fleet of 150 "T.-S." petrol-electric 'buses in London, averaged during last year a fraction over 7d. per mile made up as follows:—Drivers, 1·251; tires, 1·098; petrol, 1·067; running, ·868; depreciation, rent, rates and taxes, ·849; conductors, ·847; traffic expenses, ·270; maintenance, ·240; body upkeep, ·235; trade vehicles, ·151; lubricating oil, ·078; lighting, ·069; paraffin, ·021; grease, ·018; clothing, ·001; total, 7·063d. per mile.

The Shops Act.—The report of the Leeds Shops Inspector (Mr. A. H. Rutherford) during the first year of the working of the Shops Act, 1912, has just been issued, and shows that during the 12 months ended March 31st last, 6,069 places of business had been visited, 23 persons had been summoned for offences against the Act, of whom 15 were penalised to the extent of £16 8s. 6d., and the remainder were dealt with under the Probationers' Act, and ordered to pay the costs. The Inspector stated that the greatest difficulties are presented in connection with mixed trades, for in some cases these traders have to exhibit five separate notices. He expressed the opinion that if the Inspectors were not constantly visiting shops and reminding traders of their liability under the Act in neglecting to exhibit one or other of these notices, the practice would gradually fall into desuetude. There were 11,000 persons in Leeds who came under the Shops Act, and during the year it was found that in 2,606 cases statutory notices were exhibited, whilst in 3,044 instances they were not exhibited, and warnings had been given. There were 826 traders exempt from the provisions of the Act. In connection with the weekly half-day holiday, 505 traders closed on Monday, 222 on Tuesday, 3,976 on Wednesday, 145 on Thursday, 54 on Friday, and 327 on Saturday.

IMPERIAL WIRELESS SYSTEM.

On Friday last the new agreement with the Marconi Wireless Telegraph Co. was discussed in the House of Common at considerable length. Mr. Masterman moved that the agreement be approved, and pointed out that the matter was one of urgency; to allege that because nothing had happened through the delay already experienced, nothing would happen if that delay were continued, was as absurd an argument as to say that if a man neglected to insure his house against fire for a time, and suffered no loss, he need not insure it all. No existing Govèrnment department could or would carry out the work; the formation of a new department would involve delay and heavy expense, as well as the payment of royalty on patents; the Treasury was convinced that it was impossible to proceed by open tender, as only one company could show actual constant commercial working by day and night over the distances required for the Imperial chain. If reasonable terms could not have been obtained from that company, the Treasury would have fallen back on the attempt to construct the chain itself, but fortunately the Postmaster-General had been able to extort a very desirable concession with regard to splitting up the 10 per cent. royalty, and had secured a very substantial modification of the right of inspection by the company. The Treasury was satisfied that the best possible bargain had been made, and was sanctioning the contract for the erection of the first three stations, and later of the complete chain.

Sir Henry Norman opposed the resolution on the ground that, in his opinion, no harm would be done by a few months' delay. He thought the work should be done by the State; there would be compensation in efficiency for the delay, and the greater initial cost would be followed by subsequent saving in expenditure. Much of the work was ordinary contractors' work, and a good deal of the wireless apparatus could be supplied ready made. Any electrical wireless expert could do the ordinary everyday work of any system. He was unable to support the ratification of the improved contract, and appealed for further investigation and consideration of the question. Sir G. C. Marks pointed out that the previous contract was recommended to the House as an excellent bargain, and now they were told the same thing with regard to a contract which differed in many respects from the former; the attacks on the old contract had been justified by the new contract. One of his contentions had been that in some cases there might be no patents, and this was so in a place where the largest station would be erected; he asked where else patents did not exist. He could not understand why the agreement should last for 28 years. Many of the points objected to in the old contract had been omitted from the new one. An alternative price should be inserted for purchase outright in place of a royalty. The royalty should be in proportion to the value of the patent. It was for the House to tell the Admiralty officials to do its bidding, and he intended to vote for an amendment as a protest against a department endeavouring to over-ride an industry, and to prejudice the country.

Lord R. Cecil moved as an amendment, that in the absence of a report by any body independent of the Government, the House was not prepared to approve of the agreement. He said that the provision that the Government should not use any continuous-wave system in the three later stations without giving the Marconi Co. the opportunity to do the work, must tie the Government to the company, and assist the latter to establish a world-wide monopoly of wireless telegraphy. The bargain was little better than it was before—the new contract was better for the company than the old one. If the State had done the work itself, he believed the cost would have been less than under this contract. The Postmaster-General would probably have no difficulty in collecting an efficient staff in a few weeks, and a delay of six months was not a very serious risk. It was undesirable that a private company should know every detail of the system employed for military communication. He disliked the methods of management of the Marconi Co., and it appeared to him that the action of the managing director when he offered 100,000 shares in the American Co. to a member of the Government, was susceptible of a very sinister interpretation. In his judgment the decision, which was that of the Post Office alone, was a wrong one.

Mr. H. Terrell seconded the amendment, and complained of the inadequacy of the penalty for delay in the completion of the stations.

Mr. H. Samuel stated that the 1909 agreement with the Marconi Co. was strictly limited to the ship and shore stations, and expressly excluded communication with foreign countries or Colonial possessions. He pointed out that Sir Henry Norman's proposal that the wireless stations should be designed and erected by a committee was hopelessly impracticable, and there was no power to compel the Marconi Co. to supply wireless apparatus ready-made. Not only in England, but also in almost every country, the Government was employing contractors to carry out the erection of long-distance wireless stations, the sole exception being the Australian Government, which was now engaged in litigation with the Marconi Co. on the subject. It did not require a fleet to cut a cable, and the wireless stations were required for communicating not only with the fleet, but also with the outlying parts of the Empire if the cables were cut. Within the last day or two, the Army Council had declared the provision of the stations to be a matter of urgency; the Committee of Imperial Defence, the Select Committee, and the Admiralty had also expressed this view, and the Government could not ign re these repeated expressions of opinion on the part of the authorities responsible for the defence of the Empire. There were six patents of real importance, one of which would expire next year in the United Kingdom, and the last in 1925, and there were about 30 patents of minor value. The company asked for £250,000 for the unrestricted use in perpetuity of all its patents throughout the Empire, and would not reduce the price. Further patents were being taken up, and the contract gave the right to use all existing and future Marconi patents without additional payment. The contract represented the views of two parties, and naturally was very different from what he would have drawn up himself, but he believed it was better than any of the alternatives that were open. The company gave a guarantee of working, to which he attached the first importance, and took all risks. The company provided duplex working, a speed of automatic working higher than in the case of ordinary cables, and the benefit of its experience, which was of the greatest value, as well as Mr. Marconi's personal assistance. The royalty was based on gross receipts in order that the company might have no voice whatever in the management of the stations; if it were to be paid only on profits the company could not be excluded from determining how the stations were to be run and what rates should be charged. It was not anticipated that the royalty would reach anything like the colossal sums that had been suggested. Obviously the Government would not continue to pay a royalty for the use of a single unimportant patent. In voting for the contract the House would be voting for State ownership and complete liberty on the part of the Government to use any system it chose. He preferred to accept the judgment of the Parker Committee and his expert advisers rather than the *ex parte* statements of the advocates of rival systems. It was essential that the State should fit itself to secure the proper management and development of wireless telegraphy, and a small engineering committee consisting of Post Office engineers and possibly one or two from the Admiralty, presided over by Mr. Duddell, would watch the erection of the stations, order experiments to be made, and train the necessary staff. An establishment committee under the Secretary of the Post Office would deal with other matters. The Parker Committee would be maintained as a standing committee. A scheme was being evolved for carrying on scientific research on an adequate scale, which should be in working order before the next session. By that means they would have an efficient organisation under Government auspices which would render the State independent of commercial companies and enable it to develop the service on its own lines.

Mr. Bonar Law thought the arrangement was a bad bargain, and that the industry was changing so rapidly, that it was undesirable to lose the advantage of knowing what would be known in a month or two as to what could be done by other systems, merely because there was to be no autumn Session. He did not agree that there had been a rise in the price of materials, or that money had gone up in value. The Marconi company had not done on a commercial basis anything like what it had undertaken to do under the contract, and was, in fact, awaiting developments in order to enable it to fulfil the contract. He admitted the urgency, but asked what difference a delay of a few months would make. The Poulsen company had offered to give the service required for £40,000 a station, including all royalties, and had been commissioned by the United States Government to build the Panama station, transmitting over a distance 50 per cent. greater; surely it was worth waiting a month or two to see if they could do it, or to wait three months to save £120,000, apart from royalties. If the Postmaster-General had the right to commute the royalties, he would not object so strongly to the contract. He considered that the Postmaster-General did not know how to make a bargain. The company, he believed, was getting a profit on the erection of the stations, and was bound under the Patents Act to supply any patented article at a reasonable price to the Government. He had never known any arrangement by which royalty was paid on gross receipts; there should be some provision by which the royalty could be commuted. The matter ought not to be rushed through instead of giving it reasonable consideration.

Mr. Asquith laid stress on the important strategical considerations at stake, and would not admit that a delay of one or two months could be lightly regarded. He would have preferred that the work should be done by the Government; but that course would have involved enormous additional expenditure and prolonged delay. If the contract were rejected, the only alternative was for the Government to undertake the work. The Admiralty could not spare a man from its own work for any extraneous work, however important, nor could the War Office. There was a provision in the contract that if the price of materials fell, the sum to be paid should be reduced. The opinions of Lord Parker and Mr. Duddell in July proved conclusively that there was no other company that could possibly be safely entrusted with the contract. The work ought to be begun at the earliest possible moment. The Government had a free hand, and the country would get the benefit of all the developments of electrical science in the future.

The amendment was rejected by 221 to 140, and the agreement was approved by 210 to 138.

Litigation in United States.—In view of the numerous electrical arrangements which have lately been introduced in the United States for the starting of the engines of petrol motor-cars, it is not surprising to learn of litigation in connection with alleged infringement of patents. The first action of the kind is that which is being brought by the Dayton Engineering Laboratory Co., of Dayton, O., the owners of the Delco starter patents, against the North-East Electric Co., of Rochester, N.Y.

THE ELECTRICAL HEAT TREATMENT OF TOOL STEELS.

It is nowadays recognised that the value of tool steel depends very much upon the heat treatment to which it is subjected; and with the growing recognition of the necessity for exact temperature regulation, the value of the electric furnace is becoming increasingly apparent. Experience has proved that the quality and performance of the tool depends nearly as much upon its heat treatment as upon the quality of the steel from which the tool is made; and as it is the final process in the production of the tool, heat treatment is most vital. The effectiveness of such treatment depends upon having a furnace capable of being manipulated so as to produce as nearly as possible the desired heat and atmospheric conditions, and a typical furnace which has done very good work in this respect is the Hoskins muffle chamber furnace made by the Hoskins Manufacturing Co., of Detroit, U.S.A.

The heating element in this furnace consists of two piles of flat carbon plates or resisters, one pile being placed on each side of the furnace chamber. Across the top of the chamber is a set of heavy carbon plates connecting the two sets of resisters together. Referring to fig. 1, the carbon resister plates are shown at R, while T represents the carbon top plates. Below the resisters, and extending downward through the bottom of the furnace, are a pair of heavy graphite electrodes, one at each side of the furnace, as shown at E. Between each electrode and the lower resister is a heavier bottom plate of graphite, shown at B, this preventing excessive heating of the electrodes, and distributing the pressure of the electrodes upon the resisters. At the lower end of each electrode is a brass electrode clamp C, which can be raised or lowered by means of the screws and gears shown at S. The electrode clamps also serve as water jackets, in order to keep the electrodes cool while the furnace is working, and the clamps are arranged to be connected by means of a small rubber hose to a ¼-in. water pipe.

Good heat insulation is secured by 6 in. of special porous fire brick on all sides of the furnace chamber, as shown at F. The efficiency of this heat insulation is shown by the fact that when the furnace chamber is raised to a temperature of 2,200° F., the hand can be held comfortably against the furnace case, and hence there is very little loss by radiation. Between the piles and resister plates and the fire brick walls, and also at the bottom of the furnace chamber, is a layer of refractory cement, shown at A in the figure. This cement protects the fire brick from the intense heat of the furnace. Around the graphite electrodes, as a protection to them from the air, is a layer of sand. This sand is kept in position by a thin layer of loose asbestos at the points where the electrodes pass up through the furnace shell.

Although the furnace has a muffle chamber there is actually no muffle used in its construction, and as it is well known that muffles do not stand up successfully against the intense heat required for high speed steels, the advantage from the maintenance point of view is apparent.

An important feature of the furnace is the draught hole which passes through the top and rear of the furnace chamber to the top surface of the furnace as shown at D. A movable cover is provided in order that the draught hole may be closed if necessary.

In order to allow the use of a pyrometer for measuring the furnace temperature, a hole suitable to admit a pyrometer and protecting tube passes from the rear of the furnace chamber to the outside as shown at P. At the front of the furnace are two small hand wheels, and at the lower end of the hand wheel shafts is a pair of bevel wheels S for the purpose of raising or lowering the electrodes. The furnace case, which is built of ¼-in. boiler plate reinforced by angle irons at the corners, is supported at a height convenient for the operator upon angle iron legs. The door of the furnace is of fire brick held by a pressed steel case, and is carefully counterbalanced so that it can be moved up and down readily. This fire brick, of course, prevents loss of heat by radiation, and a small peephole provided with a swinging cover allows the operator to see the interior of the furnace. The furnace is operated on low voltage alternating current, a transformer being used to step down the regular voltage to 20 volts for a small furnace, and to 27·5 for a larger size. Current is passed from the transformer through flexible copper strips to the electrode clamps, and it will be seen that the C^2R heat produced in the resisters gives a purely radiated heat, providing the muffle effect without the disadvantages of a muffle.

When the furnace is up to working temperature, the heat is so equally radiated that the temperature is practically the same in every part of the chamber, and this has a very considerable influence in preventing distortion in the tool which is being heated, in sharp contrast to the way in which the high air pressure of fuel-burning furnaces forces the flame against the surface of tools pitting them and overheating delicate edges and corners, unless the muffle with its usual disadvantages is used. The temperature is regulated very simply by means of the hand wheels. The upward movement of the electrodes compresses the carbon resisters, reduces the contact resistance given to the current, allows an increased current to flow, as shown on the ammeter provided, and results in a rise in furnace temperature: the reverse process is obvious.

The limit of temperature which the furnace will stand is that of the fire-brick walls, and the furnace can be operated at 2,500° F. as a practical limit. It can be brought from cold up to 2,200° F. in 1 hour 15 minutes. In the type of furnace having the chamber dimensions of 6½ in. wide × 5 in. high × 12 in. deep, the maximum power required is 15 KW., while under ordinary working conditions the consumption per 10-hour day is found to be about 72 KW.-hours. In the larger furnaces, 12 in. × 8 in. high × 8 in. deep the heating power is 30 KW., and the average consumption per 10-hour day is 143 KW.-hours.

When the furnace has been brought up to heat, the temperature can be maintained with less than half the amount of current required for the initial heating, and if the furnace is being operated daily, the time and current required to bring it up to heat at the beginning of the day are materially reduced on account of the heat insulation of the furnace lining. It has been found that when the current has been cut off for periods of 12 to 15 hours, the chamber temperatures of such furnaces have been as high as 700° F. or 800° F. The atmospheric control is important, because the successful hardening of tool steels depends very largely upon the conditions of the atmosphere in which they are placed. In general, the chamber atmosphere of a furnace is either oxidising, reducing, or neutral in character. The oxidising atmosphere is responsible for excessive scale, and nearly every fuel-burning furnace, because of the air required for combustion, has an oxidising chamber atmosphere. High-speed steel can be hardened with best results in a neutral atmosphere, while carbon steels are found to be hardened most successfully in a reducing atmosphere. In the furnace described, if the door and draught hole are closed, the highly-heated carbon resisters naturally produce a reducing atmosphere within the chamber. By opening the draught-hole, and admitting a small amount of air at the door, the condition is changed to a neutral one. An oxidising atmosphere can be obtained if desired by admitting a larger amount of air.

The thick layers of carbon at each side of the chamber store up

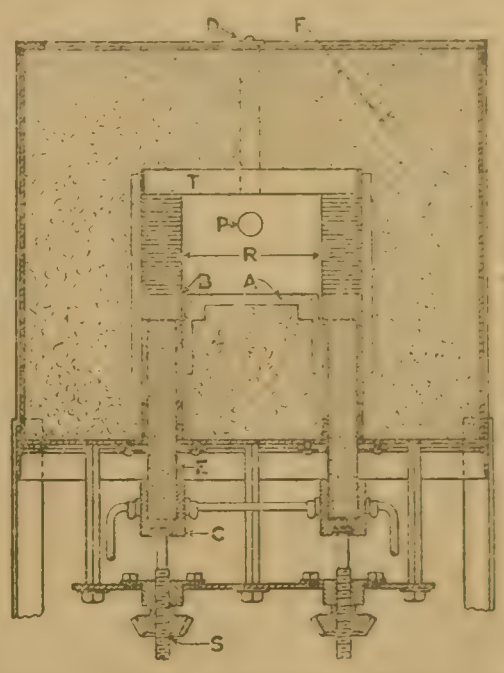


Fig. 1.—The Hoskins Electrical Muffle Furnace.

a good quantity of heat. When a piece of steel is placed in the furnace, this stored heat passes rapidly to the cooler steel and raises its temperature; therefore additional heat produced by the resisters can more quickly raise the steel to the necessary temperature. Rapid heating without danger of overheating is possible, because the chamber temperature can be constantly maintained at the point at which the steel has to be hardened. The tendency for the chamber temperature to drop when tools are placed in it can be immediately overcome by simply sending more current into the furnace and hastening the transfer of heat through the furnace to the tools. As the tools approach the chamber temperature the current can be gradually reduced.

Some rather interesting results have been obtained in the use of this furnace. For example, the maximum output of a bolt manufacturer's pressing dies was 150,000 bolts per set, the dies being made of high-speed steel carefully hardened in a fuel-burning furnace. Similar dies made of the same high-speed steel, correctly hardened in the electric furnace above described, made over 247,000 bolts, while a second set made 320,000 bolts, an increase of over 113 per cent. In another case 22 chasing dies and segmental taps and eight round rods made of three grades of high-speed steel, after being hardened in the electric furnace, showed an average change in size of only ·0011 in. per inch of length. Scleroscope readings taken after drawing the temper showed an average hardness of 79 at the threads on the taps and dies, and 86 for the round rods. All cutting teeth were sharp and clean; the surface of every piece was free from pitting, and there was practically no scale. A comparative test was made by a manufacturer of high-speed drills hardened by the best method previously known by him with exactly similar drills hardened in the electric furnace. Under the same working conditions the drills hardened by the original method, drilled an average of 31 holes against 95 holes by the one hardened in the electric furnace. Other instances could be given, but these are sufficiently impressive to show the increase of tool room efficiency which is gained by the use of electric heat treatment.

Parliamentary.—Various Bills.—In the House of Commons on August 8th the Lords' amendments to the L.C.C. (Tramways and Improvements) Bill and the Metropolitan Electric Tramways (Railless Traction) Bill were agreed to. The City and South London Railway Bill was ordered for third reading.

E

LEGAL.

Corfield *v.* Premier Electric and Hardware Co.

At the Westminster County Court on the 5th inst., before His Honour Judge Woodfall, this case was heard. Mr. Harold Brandon appeared on behalf of Mr. Corfield, the Receiver for the debenture-holders of the Davis Electrical Co., Ltd. The action was brought to recover £24 in respect of goods supplied and delivered to a Mr. Cohen, trading as the "Premier Electric and Hardware Co.," who counterclaimed for about £70. The goods supplied consisted of electrical cable, and the defendant alleged that by reason of the cable being defective, he had suffered damage, for which he was asking for compensation. Their answer to that, however, was that the cable was badly laid by incompetent workmen; that the work was done hurriedly and at a low price. The cable sold was "job cable," and it was described as such in the contract. In support of his case, he quoted Mr. Justice Darling's decision in the case of "Jarretts *v.* The Midland Tire Co.," that "job line, or job goods meant that the goods were supplied with all their faults." A gentleman of Mr. Cohen's experience must have known he was not getting the best English cable at the price he obtained that under review. The first order was a trial one of 17s. only. Afterwards the cable was tested at the Electrical Standardising Institute, and copies of the tests were sent to the defendant. The price then was £6 15s. per mile, which was subsequently reduced to £6 5s. per mile, and the plaintiffs also undertook then to take back any cable which was found defective. Eventually 6 miles of the job wire was supplied, and certain portions returned owing to local faults. On July 15th, 1912, 1 mile of the job cable was supplied; 2 miles on August 8th; 1 mile on August 17th; and on November 4th six more miles were supplied. When they received the last order, however, a letter was written by his clients stating they could not make themselves responsible any more for returns. That letter was not answered by the defendant, and on December 5th two more miles were ordered of the "job cable." On January 5th the defendant returned some coils of cable, and wrote saying that some of it was porous, and that he had had claims made by builders against him (the defendant) in respect of taking the cable out of the houses. As the average price of good English cable was £10 per mile, he asked His Honour to say that having bought "job cable" at £6 per mile, the defendant Cohen could not expect the very best goods without a single blemish. The price negatived any refusal of the contract.

Mr. Harry Emanuel Davis then gave evidence, stating he was now employed as manager and buyer to the Receiver for the debenture-holders of the Davis Electrical Co., Ltd. Previously, he was the managing director of the company. He remembered the cable being supplied to Mr. Cohen after tests had been carried out at the Electrical Standardising Institute. The reports showed that the wire had local faults. The price of the "job wire" was £6 5s., and the ordinary prices of the best English wire of the same size was about £11 per mile, so it was impossible for a trader to buy the best cable at a 100 per cent. discount. The words "job line" meant with all faults, or at the "buyer's risk."

Cross-examined: The Receiver was appointed in November, 1911, and he started supplying this particular wire in 1912.

Mr. Austin Farleigh (counsel for the defendant): What price did you pay for this cable?

Mr. Brandon: I object to that question. I think it sufficient to say it was a job line and sold as such. What it was originally bought for is a trade secret. Witness then wrote down the price he paid for it and handed it to his Honour.

Mr. Farleigh: Can you tell me whether this is English cable?—To the best of my belief I bought it from an English firm as English cable.

Do you object to giving the name of the firm from whom you bought it?—Yes, I do object.

His Honour: Why should you?—Because it would enable Mr. Cohen and other traders to go to that firm without going to us first. That is a trade secret, and I will hand up the name to your Honour.

Mr. Farleigh: Do you know whether this cable, in resistance, was lower than 600 megohms?—It might be a bit lower.

Continuing: He never knew that the defendant wanted the cable in connection with the lighting of some houses at Golder's Green. He did not know what the voltage was at that place, but a transformer could easily be installed to bring it down to the voltage required. The wire could be used for transmission of power. If, however, he was going to put the wire into houses, he would test it first. He further admitted that on July 24th, August 14th and 21st, goods were returned, and all those three returns were full coils of wire.

Re-examined: In all his firm bought 70 miles of this particular wire, and they sold it as "job line," and the only person who objected to it was the defendant. No complaints were made by other people.

Mr. Brandon said that concluded his case, except for the fact he had several witnesses to call in respect of the meaning of the words "job line."

His Honour said he thought it was an accepted phrase.

Evidence was then given by the defendant, Mr. Geo. Cohen, who said he had traded as the Premier Electric and Hardware Co., at 9-10, Cheapside, Golder's Green, N.W., but it was now a limited company. He had been in the trade for 17 years, and had contracts with some of the biggest builders in the district. His work was to wire the houses in carcass as they were being built. At the time he first bought this wire, Mr. Davis called upon him and said it was bankrupt stock and he could let it go cheaply, and also that he would take back any portion of it which turned out unsatisfactory. Mr. Davis knew what he wanted the wire for, and on one occasion he (witness) sent back as many as 31 coils out of 100. The defect were that the coils were broken, and rather than run any unnecessary risks he returned them. He subjected some of the wire to "dry" tests, and found that the resistance was very low, and that it would be dangerous to put it into houses, as it would be likely to cause fire. He received several complaints from the builders whom he supplied, and stood a chance of losing the contracts with them. When the plaintiffs wrote saying they would supply further wire on the understanding no more could be taken back in case of defects, he at once telephoned stating he would not take any more if that was so, and asked Mr. Davis to come and see him. That gentleman did soon afterwards call upon him, and eventually said he would continue to supply the wire and take back any that was defective. He (witness) only took cable from him on those conditions.

His Honour: Why, if you found the cable so defective, did you continue using it?—I was not anxious to use it. Mr. Davis was in my office over an hour before he could persuade me to take any more, and it was only upon him promising to take back any defective portions that I continued with him.

Cross-examined: He denied that the average price for the best cable of the same size was £11. He could buy it at the time, and even now, at £8 to £8 10s per mile. When he bought it from the plaintiffs he thought he was getting the best at £6 5s., because it was bankrupt stock. The price of cable varied very much, according to the fluctuations of the prices of rubber and copper, particularly the latter.

We told you it was a "job line"—Yes.

Did you tell the builders, for whom you wired houses, it was a ob line?—Certainly not. It was nothing to do with them. So long as the wire passed the tests, it was not for them to ask where I bought it. It made no difference to them, and they did not ask where I got it from.

At this stage the proceedings were adjourned until after the Long Vacation.

Electricity in Mines: Breach of Regulations.

According to reports in several newspapers, the Measham Collieries, Ltd., were summoned at the Ashby de la Zouch Police Court on 9th inst., for failing to comply with certain special rules for the installation and use of electricity in mines. It was stated that certain electrical apparatus was not earthed by connection to an earthing system at the surface of the mine or protected so as to prevent accidental contact by persons. There were 18 summonses. The company was fined £105 and £19 4s. costs. Similar charges were preferred against Mr. Thomas Watson, manager of the mine, whose defence was that he was hampered by not being allowed to order what was necessary to remedy the defects, which he had brought to the notice of the director, Mr. Maddell, who, on his part, denied this.

X.L. Electric Co., Ltd., *v.* Aron.

On the motion in this action to commit the defendant for breach of an order of June 20th, coming before Mr. Justice Astbury in the Vacation Court, Mr. Simmons, for the defendant, took the objection that certain exhibits to the affidavits had never been served upon him. The notice of motion, he said, asked for both committal and attachment, and under the rules the procedure in each case was different.

Mr. Hemmerde, K.C., who, with Mr. Moritz, appeared for the plaintiffs, said that he only intended to proceed for a committal, or, in the alternative—and that was what he really asked for—a four-day order on the defendant to sign certain documents. The order on the defendant, in respect of which a committal was asked for, was that he should not delay, or prevent, or permit to be delayed or prevented, an application for the granting of letters patent assigned to the company. To obtain the patents it was necessary that the defendant should sign a certain document required by the Comptroller, and this he refused to do. Without his sanction the application for the patent could not go on, and his refusal to sign the necessary documents, counsel submitted, was delaying or preventing within the terms of the order.

Mr. Simmons submitted that there was no order on his client to do anything, and the Judge, in making the order, had expressly said it was not mandatory.

After further discussion, Mr. Hemmerde said he was not pressing for a committal. What he was asking for was an order on the defendant to sign the necessary documents within a limited time.

His Lordship said the real question was whether the plaintiffs were entitled to a four-day order. Is the defendant willing to obey the order within a reasonable time? Does he want to obey the order, or does he not? Are you willing to obey the order within a time fixed? Mr. Simmons: Absolutely. His client could do it within four days.

His Lordship said he would have the matter definite. The defendant would undertake within four days to sign the specification exhibited, and subsequently any documents required by the the Comptroller, to give effect to that specification. On that there would be no order, except that the costs of the motion would be costs in the action.

Aron *v.* X.L. Electric Co., Ltd.

Mr. Justice Astbury, sitting as vacation judge, on Wednesday, August 13th, had before him a motion by the plaintiff, Aron, asking that a writ of sequestration might issue, and that Mr. Clarence Wheeler, one of the directors, might stand committed to prison for an alleged contempt of Court.

Mr. Hemmerde, K.C., who represented the company, asked that the receiver appointed on behalf of the debenture-holders might be made a party to the proceedings.

Mr. Simmons, for Mr. Aron, said he had to apply that the motion might stand over.

Mr. Hemmerde objected to any adjournment. The whole proceedings, he submitted, were totally vexatious. This was one of a number of vexations with which the company had been threatened. Mr. Aron had threatened to ruin this company, and this was one of his attempts to do so. Rather than have the matter go over, he would rely only on certain paragraphs of his affidavits.

After further hearing, Mr. Hemmerde asked that the motion might be dismissed, with costs.

Mr. Justice Astbury said he could not do that without giving the plaintiff an opportunity of filing evidence in reply.

The motion was directed to stand over for a week.

BUSINESS NOTES.

New Zealand.—The New Zealand Customs authorities have lately given a decision to the effect that "vulcanite cleats for holding electric wires" are to be classified under No. 175 of the Tariff, the duty being 30 per cent. *ad valorem* on foreign goods, and 20 per cent. on British production.

Exhibition.—Messrs. Selfridge & Co., Ltd., Oxford Street, London, W., opened a scientific exhibition in the Palm Court on Monday last, and it is to run until 23rd inst. The exhibits, as detailed in the catalogue, include telephone exchanges, arc lamps, wireless telegraphy and X-ray apparatus, magneto-electric printing telegraph station, "Synchronome" and "Eureka" electric clocks, tungsten lamp manufacture (B.T.H.), the Telewriter, electric incubator, cold light, &c., and there are also electric cooking and heating demonstrations.

Bankruptcy Proceedings.—Frederick Thomas Johnson (described in the petition as Frederick Johnson), 60, Eltisley Avenue, Newnham, Cambridge, electrical engineer.—The receiving order herein was made on a creditor's petition, and, according to the accounts prepared, the liabilities amount to £307, and the assets are estimated to produce £104, leaving a deficiency of £202. It appears that the debtor previously failed in the Kingston Court in 1900, in the Wandsworth Court in 1903, in the Midlands a few years afterwards, and at Blackheath in the name of F. E. Elliot in 1912. He has not obtained his discharge in any of these proceedings, and did not in 1912 surrender to the proceedings. He attributed his present position to insufficient capital.

J. F. Barnes, Oldbury, electrical and mechanical engineer and picture house proprietor.—Receiving order made August 6th at West Bromwich Court on debtor's own petition. First meeting, August 20th, at Birmingham; public examination, September 19th, at West Bromwich.

W. Longdon and V. G. Cobb (Longdon & Cobb, electrical engineers, Nottingham).—First and final dividend, 1s. 4¾d. in the £, payable August 18th at 4, Castle Place, Park Street, Nottingham.

W. Longdon (separate estate).—First and final dividend, 18s. 9d. in the £. See above.

Dissolutions and Liquidations.—Traction Supplies Co., Ltd.—A first and final dividend, 1s. 10½d. in the £, has been paid by the liquidator, Mr. T. Metcalf.

Perth Electric Tramways, Ltd.—A meeting of creditors will be held at 30 and 31, St. Swithin's Lane, E C., on August 18th.

Mitcham Electric Fan Co., Ltd.—A meeting will be held at 6, Broad Street Place, E.C., on September 9th, to hear an account of the winding-up from the liquidator, Mr. A. Goodlet.

British Flexible Shaft Co., engineers, Saltisford, Warwick.—Messrs. J. Sauer and Henry Waterhouse have dissolved partnership. The former will continue the business and attend to debts, &c.

British Electromobile Co, Ltd.—This company is winding up voluntarily, with Mr. R. B. Tyler, 1, Queen Victoria Street, E.C., as liquidator.

Cryselco Holiday and Bonus.—We understand that when the works of Messrs. Cryselco, Ltd., of Bedford, the manufacturers of the Cryselco carbon and metal filament lamps were closed on Saturday, August 2nd, for the August holiday week, the directors generously paid everybody employed wages for the week during which operations were suspended. In addition, a bonus of varying amounts was paid to all girls who had been employed by the company for three, five and eight years, and a special profit-sharing scheme was put in force, operating from June 1st, whereby each employé will receive a bonus each year, according to the profits of the company.

Book Notices.—The August *Journal* of the Tramways and Light Railways Association contains a report of the recent tramway rating case, Tottenham U.D.C. *v.* Metropolitan Electric Tramways, Ltd., and a list of members of the Association.

"Light, Radiation and Illumination." By Justus Eck, M.A. London: The Electrician Printing and Publishing Co., Ltd. Price 6s. net.

The recent lecture on "The Working Fluid of Internal-Combustion Engines," by Dr. Dugald Clerk, F.R.S., before the Junior Institution of Engineers, has been published by the Institution, and is obtainable from Messrs. Percival Marshall & Co., 66, Farringdon Street, London, E.C. Price 1s. 2d. post free.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXX, No. 6. June 1st, 1913. Santiago, Chile: The Society.

"*Journal* of the United States Artillery." Vol. XL, No. 1. July-August, 1913. Fort Monroe, Va: The Coast Artillery School Press.

"*Journal* of the American Society of Mechanical Engineers." August, 1913. New York: The Society. Price 35 cents.

"*Boletin* de Ingenieros." Vol. III, No. 10. Mexico: Departmento de Ingenieros de la Secretaria de Guerra.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX, June, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spèciales." February, March and May, 1613. Liége: Lahaye & Co. Price 15 cents each.

"Herzogliche Technische Hochschule Carola-Wilhelmina zu Braunschweig." Programm fur das Studiejahr 1913-14. Brunswick: Vieweg & Sohn.

"Action of the Salts in Alkali Water and Sea Water on Cements." By P. H. Bates, A. J. Phillips and R. J. Wig. "The Evaporation Test for Mineral Lubricating and Transformer Oils." By C. E. Waters. "*Bulletin* of the Bureau of Standards." Vol. VIII, No. 4. Vol. IX, No. 1. March 1st and 15th, 1913. Washington: Government Printing Office.

"Science Abstracts." Vol. XVI, Part 7. July 28th, 1913. Sections A and B. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"The Practical Metallography of Iron and Steel." By J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 3s. net.

Patent Restorations.—An order has been made restoring patent No. 15,801 of 1901, for "Improvements in Holders for Electric Incandescent Lamps," granted to Harvey Hubbell.

Application has been made by Harry Wilkins for restoration of patent No. 14,733 of 1905 for "A new alloy."

Trade Announcements.—The Carlisle Electricity Department announces the following altered telephone numbers:—Offices, No. 67; works, No. 220.

Messrs. Wallis & Watson, electrical engineers and contractors, have removed their offices and showrooms to 26, Park Row, Leeds. The showrooms contain a display of electric light fittings and heating and cooking apparatus, &c., and a department of automobile accessories has been added.

Messrs. Thermit, Ltd., have removed into larger and more convenient works at 675, Commercial Road, London, E., to which all goods should in future be addressed. All communications should be sent to 27, Martin's Lane, Cannon Street, E.C., as before. New telephone number, "4292, City" (two lines).

Catalogues and Lists.—Messrs. H. W. Butler and Co., Craven House, Kingsway, London, W.C.—Forty-four-page illustrated catalogue of portable electric tools. Particulars are given in English, French and German of a range of electric drills for metals, also special drills for marble, and buffing, polishing and grinding machines. These machines are built with motors for D.C. up to 250 volts, and can also be supplied with motors suitable for single, two and three-phase A.C.

Gesellschaft m.b.H. Classen & Co., Barbarosstrasse 16, Berlin.—Price list of Fludor solder.

The Pulsometer Engineering Co., Ltd., Nine Elms Ironworks, Reading.—Twenty-four-page catalogue containing full details of the construction, performance, output, method of drive, &c., of their Pulsometer turbine centrifugal pump. Tabulated data respecting head due to friction of water, water discharged from pipes at different velocities, dimensions of pumps, belt pulleys, and flanges, shipping weights, also a private code and price list of fittings, are included.

The Wright Electrical Sales Co., Ltd., 94, Albion Street, Leeds.—Illustrated leaflet describing the "Wescoscope" home electric cinematograph.

The London Electric Warehouse Co., Manners Street, York Road, London, S.E.—Stock list, with prices, of D.C. motors, shunt wound, protected type, also a batch of other price lists of rubber-insulated cables, "Metallum" lamps, Benjamin reflector fittings, Primax interphones, Holophane glassware and fittings, and Brush arc lamps. Also a 90-page illustrated catalogue, with particulars and prices of a large variety of c.i. watertight fittings, cluster light fittings, street lighting lanterns and fittings, hand lamps, shop and ship fittings, bulkhead and deck fittings, and sundries belonging to the same class.

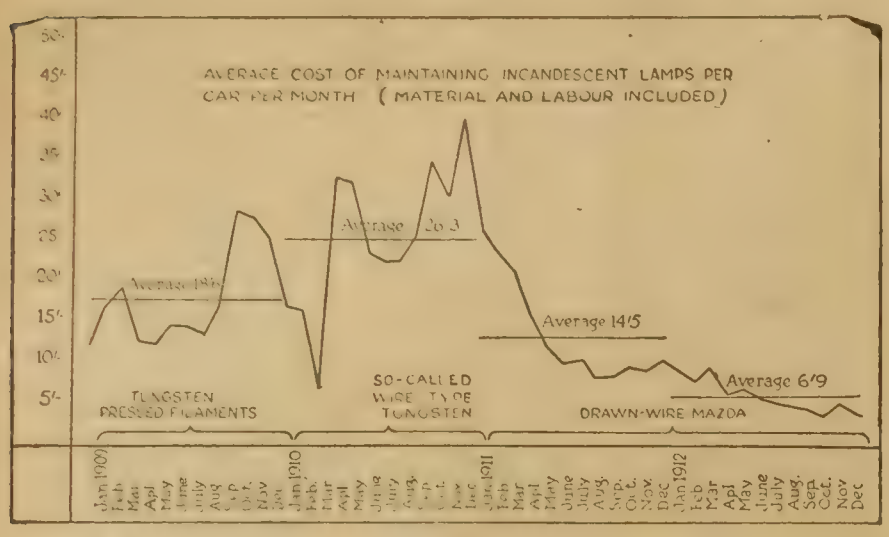
Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, London, S.W.—Illustrated price leaflet concerning their new type electric blower for hair-drying and other purposes.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Pamphlet VL1, just issued, contains particulars and prices of the "Wotan" Verico lamp, giving daylight illumination, at a current consumption of 1·5 watts per C.P. It is intended for

drapers, storekeepers, colour printers, &c., who require an illumination in which colours can be matched as safely as with daylight.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 100-106, Cannon Street, London, E.C.—List No. 11 (eight pages) containing tabulated prices of "Silvertown" Balata belting, from 3 to 10 ply and from 1 to 24 in. width.

Mazda Lamps in Railway Service.—The accompanying diagram translates the improved strength of the Mazda lamps into the pounds, shillings and pence of reduced maintenance costs. The curve was prepared by the Chicago Rock Island Railway of America, and shows the average maintenance costs per car per month for lamps, renewals and labour over a period of four years.



In the first year the ordinary "pressed" filament tungsten lamps were used, and the average monthly cost per car was 18s. 6d. In the second year so-called "wire" lamps were used, and the maintenance cost was 26s. 3d. Mazda drawn wire lamps were employed in the third and fourth years, and the average monthly maintenance cost per car was 14s. 5d. and 6s. 9d. respectively. The lower figure in 1912 was due to the improved strength of the Mazda lamps used in that year.

The Anchor Hospital and Distress Fund.—The third annual general meeting of members of this fund in operation at the Anchor Cable Works, Leigh, was held on Friday evening, August 1st. The objects of the Fund are:—(*a*) The granting of annual sums to hospitals and convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness, and (*b*) the granting of temporary relief to members in exceptional distressed circumstances, so that shop collections may be discontinued. The hon. secretary (Mr. A. Crooke) reported that every one of the employés at Leigh, including the staff, were members; each member paying 1d. per week. He pointed out the useful work which had been done by the Fund. Members have been sent to convalescent homes, and to sanatoria, in addition to recommendations having been issued to members requiring attention at various institutions. Moreover, members in exceptional distressed circumstances have been assisted in many ways. During the year an ambulance corps has been formed at the works, and its usefulness proved by the promptitude with which the members attended a serious accident at McGregor Bros.' works. There was a balance in hand of £81, out of which £49 was voted by way of grants to a number of hospitals, infirmaries, &c. The following officers were reappointed:—President, Mr. James O. Callender; trustees, Mr. J. Bowyer and Mr. C. Hulme; hon. secretary and treasurer, Mr. A. Crooke; hon. auditors, Messrs. W. Mort and W. Webster; together with a Committee of 10 others.

Copper.—The course of copper prices has fully borne out the hints conveyed in these columns during recent weeks, and even although the price has appreciated very considerably, it would be rash to assume that the top points have yet been seen. The exercise of caution is, however, a conspicuous virtue, when there has been so considerable an advance. The long expected American statistics when they did make their appearance showed an increase in the American stocks of refined material of 308 tons, at 23,926 tons, compared with 23,618 tons at the end of June Market anticipations varied a good deal as to the result which would be shown, but the result must be considered as quite satisfactory when the production is considered. This was over 7,200 tons up on the month at 61,640 tons against 54,402 tons in June, the increase arising from the renewal of operations at the Nichols smelter, which had been partially stopped in June owing to a strike there. The serious disturbances in the Lake Superior region have not been reflected in the July returns, but they were not expected to be. It is the impression that the August figures will show the interference with the operations in this area, and if this proves to be the case, the next returns may be pretty well as good as those of June, though, at the same time, it must not be forgotten that the world's reserve stocks are too small for any very great reduction to be possible from the present level. There has been an enormous volume of business done within the past couple of weeks both in America and Europe, and even yet the demand persists, while it is doubtful whether consumers have at all anticipated needs. Most of them, indeed, seem to have been merely buying for the satisfaction of their needs in connection with work on hand, and there are no stocks in second hands or in the yards of users. The wave of optimism fairly caught consumers napping, but the situation was quickly recognised, and at once prices were advanced, and a very sustained upward movement has been witnessed. It is probable that consumers got very little copper at or near the bottom prices asked, for during June there was but little inquiry, everyone being obsessed with the idea that prices were going to collapse, hence there were crowded into the July buying movement orders which under normal conditions would have been spread over a period of two or three months. In the United States the wire mills have been actively replenishing their depleted stocks, and there has been considerable business booked for September and October, with some inquiry for November, though for the last-named month no important tonnage of metal was booked. Demands were particularly heavy for wire bars, the electrical people reporting a big demand for wire, and the mills are running at full pressure.

Lead.—Mail advices from Mexico recently received in London give some details regarding the interruption of operations at the smelting plants and mines there, from which it would appear that the position has not been at all exaggerated in its gravity. It is asserted that every smelting plant without exception in the Northern States is closed, those at Mapimi, Torreon, Asarco, Aguascalientes, San Luis Potosi, Monterey, and Matahuela, having been out of commission for periods ranging from 60 to 120 days, and it is added that the early resumption of operations is unlikely. It is impossible to get particulars of the state of affairs in the Southern districts of Chihuahua, and in the States of Durango, Sinaloa, Coahuila, Zacatecas, and Aguascilientes, owing to the cutting of railway and telegraphic communication. It is believed, however, that very few mines are operating. This applies alike to the lead and to the copper properties. The lead market is accordingly feeling the effects of the continued restriction of supplies from the country responsible under normal conditions for a matter of 10 per cent. of the world's output. There are occasions when the market wears an easy appearance, because somebody wants to sell a little near stuff, and dealers try to get it cheap, but the fundamental circumstances remain quite undisturbed, and it is useless to anticipate any material alteration until the general position in Mexico is vastly different from what it is to-day. Even under the most favourable conditions it would take months for conditions to assume their pre-revolution appearance. The stoppage of railway communication is a most serious matter. The North-Western Railway is practically at a standstill, and is passing its dividend on the preferred shares, the National Railway has sustained enormous losses, while the Southern Pacific are only operating 150 miles out of their 1,000 miles of track. This means that even when the actual fighting and brigandage are suppressed, time will be required before industrial operations can be resumed, because the mines cannot work without supplies, and these are all exhausted, and fresh material will have to be hauled from the coast. Altogether, therefore, the outlook is the reverse of rosy. Trade demands for lead continue on a moderate scale, the best support coming from the cable people and electrical industry generally, which, taken altogether, seems to have lately been taking a few fair contracts. At all events, these interests have bought more freely of both copper and lead, and, as is well known, the more important firms only buy their raw material against actual bookings of finished goods.

LIGHTING and POWER NOTES.

Australia. — According to the *Australian Mining Standard*, the N.S.W. Railway Commissioners have decided to illuminate the whole of the stations from Sydney to Parramatta by electricity. The section from Sydney to Strathfield will be supplied from the Pyrmont power house, and a new generating station will be erected at Clyde to supply the remainder of the stations.

Argentina.—The Rosario City Council has rejected all the tenders received for the public lighting of the city and the *Review of the River Plate* suggests that the object is to secure the establishment of a second electric supply company in the city, although it considers it doubtful whether any serious concern would have anything to do with the Corporation after what has taken place.

Algeria.—The municipal authorities of Zemmora (Oran) have decided on the establishment of a central station in the town for electric lighting and power purposes.

Batley.—The T.C. has decided that from October 1st next the prices for electric supply shall be advanced, particularly for shop lighting, and has also resolved to apply to the L.G.B. for powers to borrow £8,206 for expenditure on mains, arc lighting, meters and services, and £1,550 for a proposed new feeder, distributors and services.

Boston.—Prov. Order.—The T.C. has been notified of the intention of Messrs. Crompton & Co., Ltd., to apply in the next session of Parliament to the B. of T. for a provisional order for electricity supply in the borough.

Bury.—Proposed Heywood Supply.—The Corporation has decided to enter into a provisional agreement with the Heywood Corporation for the supply of electricity in bulk, and application is to be made to the Lancashire Electric Power Co. for its consent to the proposed supply. Failing such consent, application is to be made to the B. of T. for an order dispensing with the consent of the Power Co. According to a Heywood newspaper, it is understood that the Bury Corporation will supply the current in bulk at cost price, and that the agreement will be for a term of 10 years, with an option of continuing for a further period of five years.

Generating Plant Extension.—The T.C. has decided on August 7th to make application to the L.G.B. for borrowing powers for £55,000 for electricity purposes. The amount required is divided up as follows:—Excess expenditure on buildings, £1,656; two rotary converters, £2,100; acquisition of land, £2,088; third turbine plant, Chamber Hall power station, £13,500; extension of Chamber Hall power station, £14,000; extension of E.H.T. mains, £10,000; additional transformers, £4,000; extension of L.T. mains, £5,000; and contingencies, 5 per cent., £2,656.

Crewe.—Having made inquiries respecting the provision of a coal bunker and coal-handling plant, the electrical engineer, Mr. Denton, has reported that the capital expenditure would be heavy, and the Electric Lighting Committee has approved his suggestion that it would be well to defer the question for the present.

The returns for the quarter show that 101,840 units have been sold to private consumers, and 48,062 units have been supplied for public lighting, increases of 20,559 units and 6,085 units respectively over the figures for the same period last year.

Cromer.—Regarding the recent B. of T. inquiry as to the proposed transfer of the electric light undertaking to Messrs. Edmundsons, the B. of T. has intimated to the U.D.C. that, "in the event of the transfer being allowed," it will be necessary for the Board to obtain the assistance of counsel in settling the draft deed, entailing extra cost. This is viewed as being in favour of the transfer.

Doncaster.—A new water-tube boiler is to be installed at the electricity works. This, together with the necessary foundations and steam pipes, is estimated to cost £1,800. Application is to be made to the L.G.B. to borrow this sum.

Farnworth.—Under the auspices of the electricity department, and by the arrangement with Messrs. Gillespie and Beales, a series of lectures and demonstrations on electric cooking have recently been given in the Moor Hall, by Mr. F. S. Grogan, of the British Electric Transformer Co.

Felixstowe.—L.G.B. Inquiry.—An inquiry was held on August 6th relative to the application of the U.D.C. for a loan of £4,729 for plant extensions at the Electricity Works, it being proposed to add another 150 kw. Diesel set, and a balancing set with switchgear. After some discussion the application was amended as follows, with an application for a total loan of £2,800:—Diesel engine set, £3,396, less £800 outstanding debt on the existing gas engines, and £340 on the existing Diesel generator; £110 for cables and foundations; £174 for engineers' fees and contingencies, and the balance for buildings, &c.

Fife.—In regard to the breakdown which recently occurred at the Fife Power Co.'s station, we understand that on Monday, 4th inst., owing to a breakdown of one of the large turbines, it was found necessary to curtail the tramway service, the other supply being fully maintained. On Thursday morning a reciprocating engine broke down which necessitated cutting off the supply to a few consumers including two collieries; the engine was repaired, and the supply restored by mid-day. It was also expected to have the full tramway service running on Wednesday last.

Fordwich (Kent).—The P.C. having decided to offer no objection to an electric light scheme proposed for the district, the Bridge R.D.C. has informed the promoters that it will offer no opposition.

Hereford.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for a loan of £1,000 for services, and for £334 expended for mechanical stokers at the electricity works.

India.—A dispatch from Simla states that Elysium Hill and other points there are now lighted by electricity. The demand for wiring is so great that it looks as if the plant would have to be extended in the near future, especially as power may be needed to light Jutogh, Mashobra and Mahasu. The municipal authorities do not expect the scheme to pay for at least three years. Some of the Indian newspapers wax sarcastic over the fact that whilst Simla and other places are lighted by electricity, Bombay streets are still innocent of it. The Fort, Bombay, is electrically lighted, but the main streets are in a state of Cimmerian darkness.

Japan.—The plant of the Nippon Electric Light Co., in Tokio, has now been completed and passed by the Government inspectors. The Asakusa ward of the city is the first to be supplied with current.

Kingstown.—The Parliamentary wrangle in regard to the proposed Kingstown electric lighting scheme, which latter was opposed by the Irish Party, has resulted in the Kingstown order being suspended until next session. This procedure will avoid further expenditure on promotion of the scheme next year.

Lytham.—Supply from St. Anne's.—The Council having approached the St. Anne's U.D.C. with a view to obtaining a supply of electricity in bulk, the latter has indicated its willingness to give a supply, provided satisfactory arrangements can be made as to terms.

Macclesfield.—The T.C. was informed on August 6th that the B. of T. had consented to the erection of a generating station in Pickford Street, by the New Electricty Co., of Macclesfield.

Middleton (Lancs.).—At a meeting of the T.C. on August 6th, Councillor Grundy inquired if it was true that a local firm had applied to the Electricity Committee for a supply to the extent of 600 H.P., that the Committee could not supply it, and that the firm was going to be supplied from a source outside the borough. Councillor Wiggins replied that it was true that a firm had applied for power, and that the Committee could not supply it. They could only give the supply by a capital expenditure of at least £40,000, and therefore they were allowing the Lancashire Electric Power Co. to serve this particular firm under a particular agreement, which did not give the company any other rights.

Oulton Broad.—Street Lighting.—The U.D.C. has accepted the tender of the Oulton Broad Electricity Co., Ltd., for public lighting for one year at £2 3s. 6d. per lamp. The tender for gas lighting was £2 6s. 6d.

The Council on August 5th received from the Electricity Co. an intimation that it intended applying to the B. of T. for a prov. order for electric supply throughout the district.

Ramsbottom.—Street Lighting.—The Lighting Committee of the Council has recommended that further consideration be given to the offer of the Lancashire Electric Power Co. and the Ramsbottom Gas Co. for the lighting of the railless traction route, and a sub-committee has been appointed to inspect lighting arrangements in other districts.

Having considered an amended quotation from the Lancashire Electric Power Co. for street lighting by electricity at Summerseat, a deputation has been appointed to wait on Mr. Taite (of the company) with regard to the proposals.

Reading.—Street Lighting.—The T.C. has decided to compare public lighting by electricity and inverted incandescent gas burners, and has given notice to terminate the present contracts on March 31st next, when a decision will be arrived at.

Rochdale.—The Littleborough and Whitworth Councils have asked the Rochdale Corporation to continue to supply them with electricity in bulk, and it has been agreed to do so.

Three of the largest firms in Rochdale have come to terms with the Corporation for a supply of electricity.

The L.G.B. has sanctioned the borrowing by the Corporation of sums of £5,600 and £24,400 for extensions in connection with the electricity undertaking.

Sheffield.—The Electric Supply Sub-Committee has further considered the question of the future working of the Installation and Motor Department, lately known as the Wiring and Fittings Department, and recommends:—(1) That a showroom be maintained for the exhibition of electrical fittings, including such electric lighting fittings as the Corporation can only sell through a contractor carrying on the business independently of the Corporation. (2) That the following be the method of selling such electric light fittings:—(*a*) A list of such electrical contractors as are willing to agree with the Corporation to sell electric light fittings on agreed terms, be prepared and maintained; (*b*) that the Corporation canvassers and showroom attendants be supplied with this list, and authorised to inform customers that the Corporation will sell to them, through any of such electrical contractors, such electric light fittings as they may require, and to request the customer to arrange accordingly; (*c*) that all such electrical contractors and their customers be allowed access to the Corporation's showroom for the purpose of inspecting and selecting electric light fittings, and arranging between themselves for the sale and purchase thereof. (3) That an invitation be given to all electrical contractors in the city to place their names upon the list of contractors.

An application has been received from a firm with works at Beeley Wood, for a supply of energy. As the Yorkshire Electric Power Co. (within whose area of supply the premises are situated) has consented to the Corporation supplying the firm with electricity, application is to be made to the B. of T. for an order authorising the supply.

Stockton-on-Tees.—Power Co.'s Supply.—The T.C. has accepted the offer of the Cleveland and Durham Electric Power Co. for a further supply of current within the borough, subject to a formal agreement being entered into.

St. Helens.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £1,560, being the excess expenditure on a loan of £10,800 sanctioned in August, 1911, for electricity purposes, and to a further loan of £2,000 for converting plant.

Swanage.—The B. of T. has granted the application of the new electric light company for permission to erect a generating station on a site at Courthill. It will be remembered, as stated at the time in the Electrical Review, that there was opposition to the project, on the ground that the station would prove a nuisance to the neighbourhood, an allegation that was refuted by the promoters of the scheme, and unsupported by the B. of T. inspector, who held a local inquiry.

Walsall.—An inquiry has been held as to the terms upon which the Corporation would extend its mains and give a supply of energy to the premises of the Joint Committee of the Walsall and West Bromwich Unions, Great Barr Estate, but having regard to the heavy cost which would be entailed, the proposal could not be entertained.

South Shields.—At a meeting of the T.C. on the 6th inst., Alderman Rennoldson, in moving the adoption of the Electricity Committee's report, details of which have already been published, said that despite the fact that their coal had cost them £1,500 more than in the previous year, they had made a profit of £3,163. Another feature was that they had overtaken the drop which had occurred in the private lighting for five years. In 1908 they reached their maximum with a revenue of £14,360. During the next few years it decreased until it reached £12,400, but it had risen until last year it was £7 more than it ever had been, so that they had wiped out the loss occasioned through the introduction of the metal-filament lamp. The Committee recommended that the salary of the electrical engineer (Mr. H. S. Ellis) be increased from £400 to £500, but after some discussion it was advanced from £400 to £450. Alderman Wylie, in bringing forward the report of the Tramways Committee, said it had been shown clearly that they must have more cars. The report was adopted.

Wallsend-on-Tyne.—At a meeting of the T.C. on the 5th inst., the Sanitary Committee reported upon correspondence that had taken place between the Council and the Newcastle-on-Tyne Electric Supply Co. in regard to an alleged nuisance caused by the escape of grit from the chimney of the Carville power station. The Committee recommended that the town clerk should be instructed to obtain the assent of the Attorney-General to take the necessary legal steps to have it abated immediately.

Wimbledon.—Annual Accounts.—There was a net profit of £2,097 on the working of the electricity undertaking during the year ended March 31st last. The total expenditure during the 12 months amounted to £16,702 or 1·38d. per unit sold, as against 1·261d. in the preceding year. Against this expenditure was an income of £34,718 of which, after writing off bad debts and allowances, £34,240 was derived from the sale of current. Public lighting accounted for £5,568; the gross profit for the year was £18,015. Adding to the net profit the balance brought forward from last year there remains £7,474 to the credit of the suspense account, and of this, a balance of £6,791 is carried forward to next year's account. The total number of units sold during the year under review amounted to 2,903,831 from which an average price of 2·826d. was obtained. Of this total 1,463,330 went to private consumers for lighting purposes at an average price of 4·099d. per unit; 918,691 to private consumers for heating at an average price of ·961d. and 521,810 for public lighting from which the average price obtained was 2·561d.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—The revenue of the Corporation tramways for the year ending May 31st was £80,166, an increase of £2,985 over the previous year. The working expenses were £43,206, an increase of £2,236, which is due to rising wages, extra cost of materials, and also to the 95,000 additional miles run during the year. The increase in the profit over the previous year was £1,366. Last year the department started a reserve account by a contribution of £4,396, and this year the whole of the profits will go the reserve fund. Parliamentary powers are to be asked to utilise one-third of these profits either for the relief of rates or a contribution to the common good. The Council has agreed to extend the length of the ½d. fare sections.

Australia.—According to *Tenders*, the Townsville Electric Tramway Co., Ltd., has been formed with a nominal capital of £60,000, in 120,000 shares of 10s. each; 80,000 shares were last month offered to the public. The object of the company is to construct electric tramways in Townsville (Q.) and suburbs.

Ashton.—As a result of an application for increased wages and extended holidays of the 400 employés of the Ashton Corporation Tramways, the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board, and the Oldham, Ashton and Hyde Tramways Co., a conference has been held of the three tramway authorities and employés' representatives, an offer being made to the employés which is to be submitted to the men. The men had refused arbitration and voted almost unanimously in favour of withdrawing their labour.

Ayr.—Year's Working.—The financial statement for the Ayr Tramways for the year ended May 15th last shows that the total income for the tramways from all sources amounted to the record sum of £16,295, an increase of £533 compared with the previous year. After providing for the sinking and the reserve funds, interest and repayment of loans, and placing £2,040 to depreciation and renewal fund, there remained a balance of £1,337, which is transferred to the burgh general assessment.

The newly-completed extension of the Corporation electric tramways to the racecourse was inspected last week by Colonel Druitt, who expressed himself satisfied with the new line. The new portion extends to 1,500 yards.

Birkenhead.—The Tramways Committee has under consideration the question of utilising motor-'buses to provide cross-town facilities and link up the various routes in the borough.

Bacup.—The town clerk has reported that the Rawtenstall Corporation has refused to accept the construction of the draft lease with respect to the schedule of fares, and that the two Corporations were submitting their respective contentions to Mr. C. C. Hutchinson, K.C., for decision.

Blackburn.—The quarterly report of Corporation tramways shows the revenue for the three months to be £18,991 against £17,854 last year. The traffic receipts were up on all sections. A total of 3,389,776 passengers were carried and the mileage run came to 302,296. There is a balance profit of £1,921, or exactly £200 more than the profit shown for the corresponding period last year.

Crewe.—Motor-'Buses.—Application is to be made to Parliament for powers to provide and run motor-'buses within the borough and also between the neighbouring towns of Nantwich, Sandbach, Willaston and Haslington.

Dartford.—The U.D.C. has decided to offer no objection to the application of the lessees of the tramways for the extension of time until August 18th, 1915, for the completion of the extension of the tramways to the Gravesend system. It has, however, reminded Messrs. Balfour, Beatty & Co. of their promise to construct and work the extension immediately they obtain the powers to do so.

Doncaster.—Proposed Loans.—The T.C. has decided to purchase at an estimated cost of £5,000 six additional tramcars similar to those now in use, and to extend the tramcar shed in Grey Friars Road at an estimated cost of £750. Application is to be made to the L.G.B. for the necessary borrowing powers.

A proposal to obtain six or eight motor-'buses as an experiment to run between Doncaster and Bradsworth, and Adwick-le-Street and Balby-with-Hexthorpe has been referred to the Council in committee.

Dundee.—Annual Report.—During the year ended May 15th the receipts on the Corporation cars amounted to £65,004, and the working expenses, including the maintenance of lines, to £39,421, leaving a balance of revenue over working expenses of £25,623. This sum has been apportioned in meeting interest, sinking fund, and depreciation; £7,400 has been allocated to the fund for renewals; a contribution of £1,500 has been made to the common good, leaving a surplus of £9 to be carried to reserve. The receipts exceeded the estimates by £4,464. The number of passengers carried was 17,734,162 while the cars covered 1,359,821 miles. The gross capital expenditure on the undertaking from the beginning has been £352,663 and the amount that has been applied in the reduction of debt up to the end of the year is £83,412. For the current year it is estimated that the revenue and expenditure will balance at £64,900. About £750 more is allowed for traffic expenses, the increase being largely due to a bigger wages bill.

Glasgow.—There has been under the consideration of the Tramways Committee, Sec. 49 of the Glasgow Corporation (Tramways Consolidation) Order, 1905, under which the Corporation is empowered to provide and run a service of omnibuses in prolongation of existing tramway routes, or for testing the amount of traffic along any route, subject to the consent of the local authority. The Committee was of opinion that it was desirable that the Corporation should make application to Parliament for powers to provide and run omnibuses in the city, and generally in the districts adjoining the city, and decided that such powers be asked for in the first provisional order.

At the above meeting the general manager (Mr. Dalrymple) reported upon the frequent and serious interruptions to tramway traffic by obstructions on the track caused by vehicles out of repair or overloaded breaking down, and the Committee agreed to recommend that powers be sought under the next provisional order to deal with this matter.

The T.C. proposes promoting a provisional order at the end of the year for the extension of several of the powers conferred upon it by previous legislation. In the new Bill the tramways department figures conspicuously. All the proposed extensions of the present system—reported some time ago in the Review—being included, with one exception, namely, a short line from Garngad to Provanmill. An important arrangement has been come to, subject to the T.C.'s approval, between the Tramways Committee and the representatives of the Airdrie and Coatbridge Tramways Committee. The meeting took place in connection with the extension of the Glasgow system from Bailliestow to Coatbridge, and the company has now agreed to grant the T.C. running powers over the portion of its lines from Langloan to Coatbridge, a distance of about a mile, on conditions somewhat similar to those made between the T.C. and the Paisley District Tramways Co. for the running of the Glasgow cars over the portion of that company's lines from Hawkhead to Paisley Cross.

Halifax.—Year's Working.—Some interesting figures are contained in the annual report of the working of the Halifax tramways department during the year ended March 31st last. Deducting the mortgage debt on the undertaking (£299,480) from the amount expended on capital account during the 12 months, there was left a net profit of £12,680, as compared with £18,020 in 1912, and £11,514 in 1911. The revenue totalled to £105,973, as against £101,893 in 1912, and the working expenses were £69,661 as against £62,890 a year ago. The tramways comprised nearly 55 miles of single track, and the number of passengers

carried on the tramways during the year was 19,456,923. Transfer tickets showed an increase of £316 on last year, and the cost of allowing blind persons to travel on the cars free of charge represented a sum of £37. It was stated in the report that the track all over the system was in a very bad state, and this was one of the primary causes of an increase in the number of broken axles and truck side frames.

Leeds.—Some feeling has been aroused amongst tramwaymen by the dismissal of a conductor named O'Leary for quarrelling with the driver of his car and using abusive language. O'Leary states that the reason of his dismissal was that he went to a public house, after informing an inspector of his intention, to convert a quantity of copper into silver and gold, this being against the regulations. The general manager (Mr. J. B. Hamilton), however, states that that was not the cause of O'Leary having to leave the service, for he was only cautioned for this offence, and the real reason for his dismissal was for quarrelling and using abusive language to the driver of his car. The men do not appear to wish for the reinstatement of O'Leary, but rather that similar punishment should be meted out to the driver concerned in the quarrel.

London.—Supply to Proposed P.O. Tube Line.—In connection with the examination of the Post Office tube scheme by the House of Lords' Committee, the question of the supply of electricity to this line, and the five district post offices on the route, was considered. Evidence was given by Mr. Slingo, P.O. Engineer-in-Chief, and his assistant, Mr. Gunton, to the effect that the department's own supply of energy cost it 1·077d. per unit for generation and delivery; the cost of generation, all charges included, of the Blackfriars and Mount Pleasant generating stations was given as ·627d. per unit. The cost of energy supplied by public suppliers was stated to average 2·16d. per unit, comparable with the 1·077d. mentioned above. Great importance was attached to the Postmaster-General having control of the supply—which, for the railway, is estimated at 490,000 units per annum. Evidence was given on behalf of the companies, who opposed the Post Office supplying its own requirements, it being stated that the London Electric Supply Corporation was supplying the Brighton Railway Co.'s line under a 17 years' agreement, with energy on a graduated scale, ranging from ¾d. to ½d. per unit. On behalf of the City of London and the Charing Cross companies, it was stated that they would be prepared to supply at ½d. per unit. The Committee, which approved of the construction of the line, decided that the Post Office should not itself supply the electrical energy required for its working. Subsequently, on behalf of the Government, a new sub-section was proposed, and after amendment accepted, which provides that the Postmaster-General should invite tenders for the supply of power to the railway, and if an appreciable saving would result, should purchase power from an outside source.

The Bill was read a third time and passed.

Proposed Crystal Palace Railway.—A scheme is being proposed, which we gather is to result in a Bill, to be presented in Parliamentary Session of 1914, to obtain the necessary powers for the construction of a Kearney high-speed electric railway from the Strand to the Crystal Palace with four intermediate stations. The time to be occupied in the journey is given as 10 minutes, an average speed of 40 miles an hour, including stops, being proposed. The estimated capital expenditure involved is £2,400,000.

According to the *Globe*, it is also proposed to reintroduce the proposal for a mono-railway between London and Brighton, which failed to obtain Parliamentary sanction five years ago.

Manchester.—Motor-'buses.—The Tramways Committee of the Corporation has decided to order four additional motor-omnibuses from the Daimler Co. The price is £870 each.

A petition in regard to the running of first-class cars on the Palatine Road route has been presented to the Tramways Committee, and referred to the Traffic Sub-Committee.

Mexico.—The Mexico Tramways Co. has now 200 miles of tramway track in operation in Mexico, all except 15 miles of which is electrically operated.

New Zealand.—Some details of the Gisborne battery cars, which have appeared in an Australian contemporary, indicate that they weigh 4½ tons each, and are equipped with two 10-H.P. motors and a 100-cell Edison battery, storing sufficient energy for 85 miles running. The cars each seat 26 passengers, and are said to cost 2d. per mile to run; the initial track is, however, only a mile in length, and obviously more reliable results will be available when the complete line, extending 7 miles, is in working order.

Ripley.—The Notts. and Derbyshire Tramway Co.'s line from Ripley to Nottingham is now rapidly approaching completion, and a trial run has been made from Langley Mill to Cinder Hill. From the latter point into the city the line has not yet been laid, and between Codnor and Ripley it is still unfinished.

Rotherham.—The T.C. has decided in favour of the tramway track in Fitzwilliam Road being relaid with a double instead of a single line, as recommended by the Committee.

Walthamstow.—Annual Report.—The accounts of the tramways undertaking for the year ended March 31st last, show that the expenditure amounted to £41,051, as compared with £37,399 for the previous year. After meeting interest on loan repayments amounting to £8,782, the year's working resulted in a deficit of £2,865. A comparison with the previous year, when there was a surplus of £1,800, shows that the expenditure has increased by £3,651, and the income decreased by £1,014, resulting in an adverse difference of £4,666 on the working for the year under review. The deficit of £2,865 will be made up from the reserve fund account, but having regard to the amount that will have to be provided for superseded work in connection with the alterations to the permanent way, the reserve fund will be wholly depleted, and any deficiency in the year ending March next will become a charge upon the rate. The amount of the reserve fund at the commencement of the year was £2,757, and the sum of £1,800, the surplus of the previous year, together with the interest earned, amounting to £129, increases the reserve fund at the end of the year to £4,687. The tramways manager, in his annual report, say "for the first time since the inauguration of our tramway system, eight years ago, I have to report a retrogression in the affairs of the department. In common with all similar undertakings in the Metropolitan area, during the past year we have had to meet severe motor-'bus competition, and this—combined with an exceptionally poor summer—decreased our receipts and increased our expenditure, so that the year's working showed a net loss of £2,800. Up to the end of May, 1912, our receipts were in advance of the previous year by over £400, but during the summer months they dropped over £1,300. Allowances must be made for the Easter holidays falling in March this year, but even then it is evident that during the winter months the greater size of our cars, as compared with the 'buses, has given us a marked advantage over the latter." During this year a charge of 1⅛d. per unit was made for traction energy, and the manager considers that 1d. per unit would be a fair and reasonable price, and this difference in price would mean a saving of £2,229. 11,807,549 passengers were carried, as against 12,049,323 in the previous year, a drop of 241,744. The car-miles run amounted to 1,151,029, as against 1,004,872 in 1912, an increase of 146,157. The average receipts per car-mile were 7·90d., as against 9·31d. during the previous year, a drop of 1·41d. per mile.

Walsall.—The Corporation Tramways Committee proposes to construct a tramway siding in St. Paul's Street and Darwell Street, at a cost of £500, to alter and extend the tramway offices on the Bridge, at a cost of £1,250, and to provide a tramway shelter on the Bridge, at a cost of £300, all three items to be charged to revenue account.

Whitby.—The U.D.C. has confirmed a proposal to apply to the L.G.B. for a provisional order, authorising, among other works, the provision of a cliff tramway.

TELEGRAPH and TELEPHONE NOTES.

Norwegian Marconi Station at Stavanger. — It is reported from Norway that a large number of men are now employed in connection with the construction of the Marconi station at Stavanger. The masts are to be supplied by an English firm, and will be 10 in number. For the foundations about 3,000 cb. metres of concrete will be used. The work of erection of the telegraph and telephone lines, which are to be connected with the station, is also in full swing.

Argentina. — According to the *Review of the River Plate*, in order to commemorate the National anniversary, the National Telegraph Department, on July 9th inst., effected direct duplex communication between Jujuy and Puerto Rio Gallegos (Santa Cruz) which passed through the 14 provinces and the territories of the Chaco, Rio Negro, Chubut and Santa Cruz, a distance of 8,747 kilometres. Duplex instruments of the Argentine model were used: 18 translation stations intervened.

Cable Rates.—The Postmaster-General has sent a letter to the British Empire League, in which, according to the *Financial News*, he says:—"Arrangements are being made to secure Government control over the rates charged by the cable companies, through their licences to land cables. The proposal is that, whenever such a course appears necessary, the rates should be fixed by the Government at whatever amount appears reasonable with reference to the company's receipts and expenditure, and that in the event of difference, the matter should be referred to arbitration." Our contemporary, commenting on the matter, says:—"It is quite in accordance with Socialistic practice to seize a prosperous company by the throat, but for the Government officials to be endowed with power to examine cable companies' books, and determine whether too great a profit is being earned, while the only remedy a company has is to agree to arbitration, seems to us to be preposterous, and absolutely unjustifiable. Investors in cable companies have worries enough now, seeing that they have the nightmare of wireless constantly before them; but that the fruits of their enterprise should be at the mercy of a Government interested in a competitive system surely requires explanation. If a cable company can effect economies, and thereby render the use of its capital more profitable, it is to be unwarrantably penalised."

The *Financial Times*, commenting upon the matter, remarks that the Stock Exchange "has accepted with perfect equanimity the statement made by the Postmaster-General." "It is believed in expert circles that the object Mr. Samuel has in view is to obtain some sort of control over those enterprises which are entering into alliances with foreign undertakings, the effect of this policy being to reduce the amount of genuine competition, and is regarded with disfavour by the Post Office; for this view there is

a good deal to be said. In the event, therefore, of these tactics being continued, a strict watch will be kept on the situation by the British authorities with a view to seeing that the interests of the public are not prejudiced. That we are on the eve of a further cutting down of cable charges is generally believed, but this would have occurred without any action on the part of the Postmaster-General. The result of his statement of policy will probably be, however, to bring into the list of companies adopting this policy some which might otherwise not have appeared there, while any schemes now on foot for a consolidation of interests between competing companies, with a view to maintaining tariffs, will probably be postponed."

London Clocks.—It appears that of the 100 private clocks fixed above streets in the City, 42, an increase of seven during the year, are electrically synchronised. Not one of the 29 church clocks is synchronised.

Spain.—The Compania Nacional de Telegrafia sin Hilos has made application to the Minister of Public Works, for a grant of land at El Patero, Malaga, for the erection of a wireless station.—*Electron.*

Telephone Finance.—A Government return dealing with the development of the telephone system, shows that, including £3,000,000 estimated expenditure for 1914, the total sum expended on the telephones since 1893 is £17,085,520, and this statement is exclusive of the purchase money for the plant, &c., of the National Telephone Co.—some £12,000,000.

In reply to a question in the House of Commons, the Postmaster-General said that a new £10,000,000 loan was intended for capital expenditure on new plant for extension and development of the service, and no part is to be employed for reduction of telephone subscriptions. The Bill providing for the issue out of the Consolidated Fund was introduced by Mr. Samuel last week. It provides for borrowing by means of terminable annuities for a term not exceeding 20 years, or by the issue of Exchequer Bonds.

Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

PERTH.—October 8th. Bolts for the P.M.G. See "Official Notices" to-day.

The *Australasian Record* announces the following open contracts:—

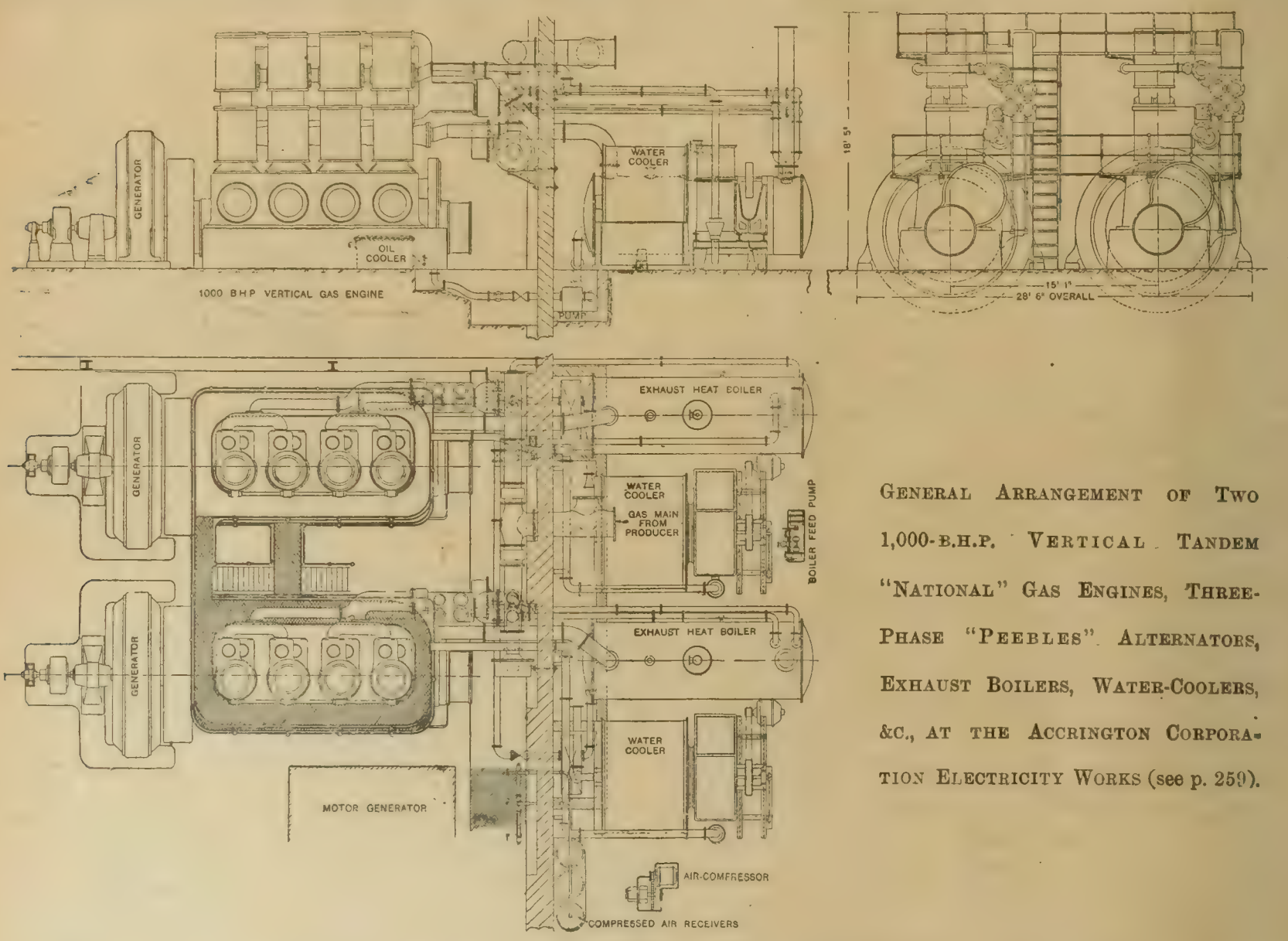
SYDNEY.—August 27th. Supply of telephones, lamps, electric, incandescent, and switchboards.

MELBOURNE.—October 14th. Supply of common-battery switchboard.

October 7th. Postmaster-General's Department. S. and I. of electrically-driven machinery for operating pneumatic tube services, Central Telegraph Office; Schedule No. 900.

MELBOURNE SUBURBS.—November 4th. Supply of eight automatic telephone switchboards.

Bacup.—The Electricity and Tramways Committee has decided to obtain tenders from cable manufacturers for supplying alternatively '05 size, '075 size or '1 size H.T. cable. The manufacturers are to be asked to quote a separate price for the laying, jointing and other work of connecting up the mains, and for this latter work the Rawtenstall Corporation is also to be asked to quote.



GENERAL ARRANGEMENT OF TWO 1,000-B.H.P. VERTICAL TANDEM "NATIONAL" GAS ENGINES, THREE-PHASE "PEEBLES" ALTERNATORS, EXHAUST BOILERS, WATER-COOLERS, &C., AT THE ACCRINGTON CORPORATION ELECTRICITY WORKS (see p. 259).

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — BRISBANE.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" to-day.

CANBERRA.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary,

Belgium.—August 19th. The municipal authorities of Schaerbeek, near Brussels, are inviting tenders for the contract for the supply of high-tension current. Particulars may be obtained from the Service de l'Electricité, 30, Rue de la Ruche, Schaerbeek.

The municipal authorities of Glain, a small town in the Province of Liége, have just invited tenders for the concession for the supply of electrical energy for private and public lighting and power purposes.

BRUSSELS.—August 22nd. The municipal authorities are inviting tenders for the supply of circuit-breakers. Deposit 1,000 fr. Cahier des Charges, 0 fr. 50 c.

Bournemouth.—August 27th. Reconstruction of 3 miles (single track) of permanent way for the Corporation Tramways Department. Mr. I. Bulfin, tramway manager. Deposit for specifications, £2.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" August 8th.

Bury. — August 25th. One 2,000/3,000-KW. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" August 1st.

(*Continued on page* 264.)

GAS-ELECTRIC AND BY-PRODUCTS RECOVERY PLANT AT THE ACCRINGTON ELECTRICITY WORKS.

Although some years have now elapsed since Messrs. Andrews and Porter brought forward so strikingly the possibilities of the large gas engine, working in conjunction with producer and by-product recovery plant, for generating electricity,* we have not noticed any pronounced movement in favour of their adoption by British central station engineers. But at least one borough electrical engineer—Mr. Harold Gray, of Accrington—has boldly left the beaten track, and launched out on a gas engine scheme of some magnitude, and judging by his experience of its working, he is to be congratulated on his choice of plant.

Speaking generally, the suitability or otherwise of gas-engine plant depends entirely on the working conditions which will have to be met; under steady and continuous load conditions—such as exist in the case of the Accrington gas engines—such plant working in conjunction with producers and ammonia and tar recovery plant, enables exceptionally low generating costs to be secured, the cost of fuel being either negligible or comparatively small.

At Accrington the producer and recovery plant is installed on land lying 100 yards or so behind the present steam generating and destructor station, and if the two 1,250-I.H.P. producers and auxiliaries are regarded as a unit, six such units could be accommodated on the space available, while sufficient ground remains to extend the present engine room to accommodate suitable engine power.

The lay-out of the gas plant—which was supplied by the Power Gas Corporation, Ltd., of Stockton-on-Tees—is shown diagrammatically on page 263; the producers, which are run on local bituminous coal, costing 13s. 6d. per ton, are of the Mond pressure type, provided with water bottoms, and fitted with wide fire-bars of the standard Mond pattern.

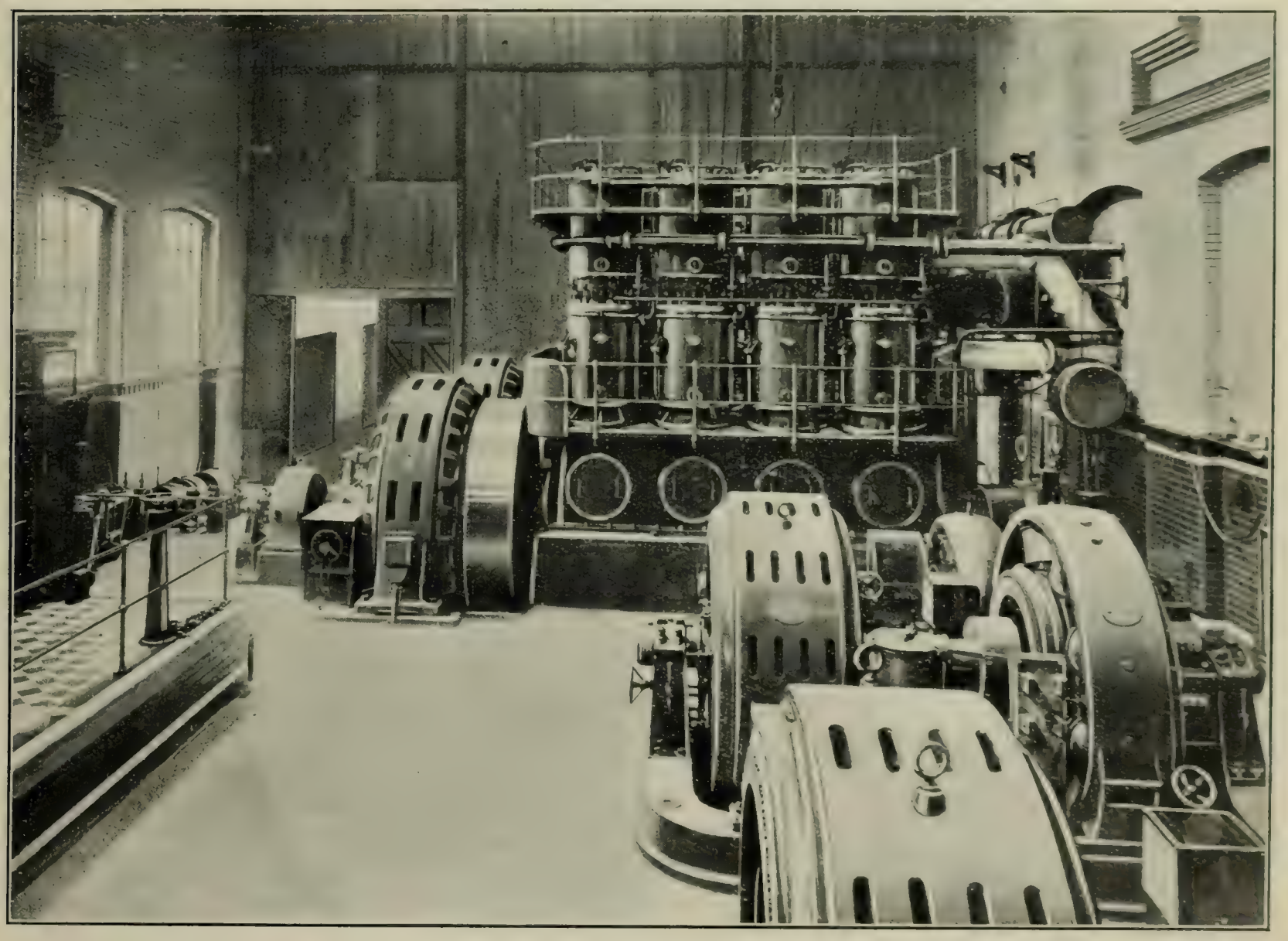
Coal is delivered to a hopper below the road level, and lifted to the top of the bunkers by means of a bucket elevator, which delivers on to a distributing conveyor running over the bunkers. From the latter the coal falls into 4½-cwt. measuring hoppers, which discharge into the producer bells.

The gas from each producer is led through a tubular superheater to a common collecting main; in passing through the superheaters the hot gas raises the temperature of the steam and air supply to the producers to 225° C.; the lower ends of the superheaters form dust-catchers, where the fine dust carried over with the gas is discharged at intervals.

From the collecting main the gas, at a temperature of 400° C., passes through a washer, the interior of which is filled with fine water-spray produced by two revolving dashers, and the sooty matter deposited is removed through lutes at the side; the gas, reduced in temperature to 80° C., then passes through a spray arrester fitted with baffles, to an ammonia absorber, also containing two revolving dashers which, in this instance, produce spray from a liquid consisting of a solution of ammonium sulphate with about 2 per cent. of free sulphuric acid.

The acid in this solution combines with the ammonia in the gas to produce sulphate of ammonia. The process is continuous, and hence, as the liquor becomes augmented in strength, a certain portion is, from time to time, drawn off to a stock tank, and the remainder in the absorber made up to the required volume with added water.

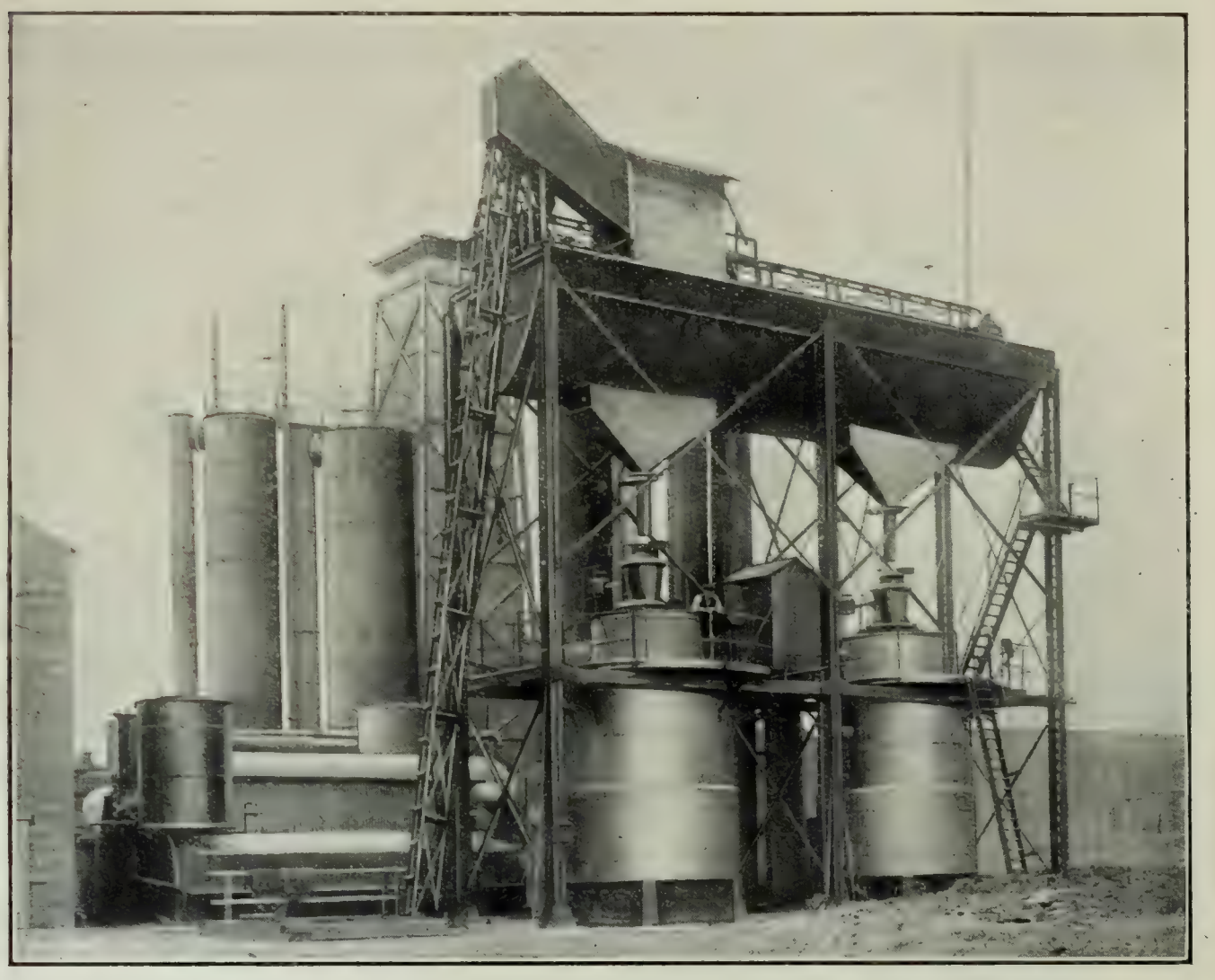
From the absorber the gas passes through a second spray



1,000-B.H.P. Vertical Gas Engines at the Accrington Electricity Works; Motor-Generators in Foreground.

* I.E.E. paper. See Elec. Rev., February 19th, 26th, March 5th, 1909.

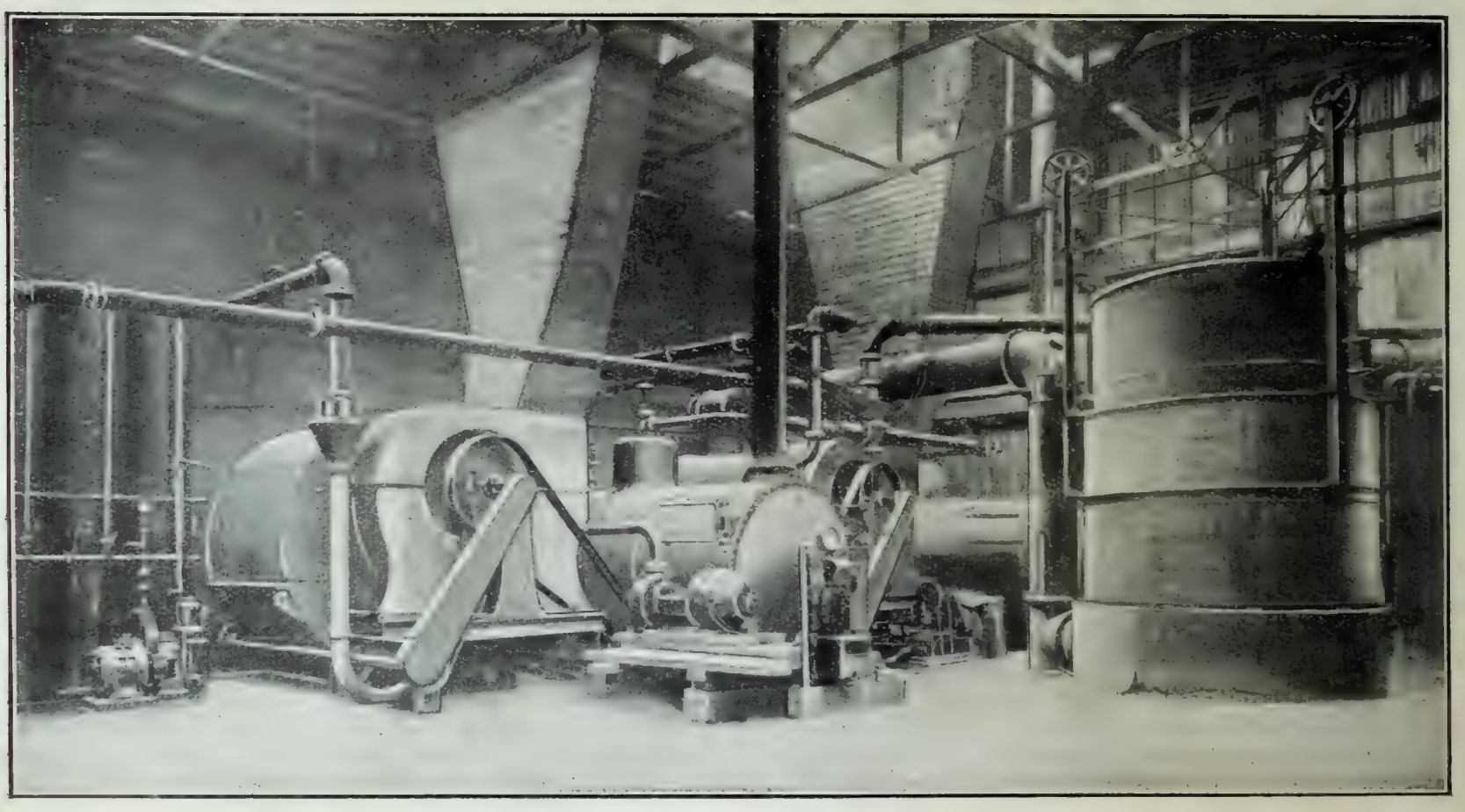
arrester and two vertical coolers—in which it meets cold water sprays and deposits the bulk of its tar—to a gas governor consisting of a small sensitive gas holder, the rise and fall of which—depending on the rate at which gas is being used—controls the supply of pressure-air to the producers through the medium of a butterfly valve, which allows more or less of this air to be discharged to atmosphere.



Mond Gas Plant, with 1,250-h.p. Producers in Foreground; Accrington Electricity Works.

The gas next passes through two centrifugal cleaners and a sawdust scrubber to the 18-in. gas main running to the engine house, prior to entering which, however, it is metered in a rotary meter and passed through an anti-pulsator—another small gas holder similar to that already mentioned. The centrifugal cleaners which run at 1,400 r.p.m., perform a triple function, as, in addition to removing all but a trace of the remaining tar (the trace being removed in the scrubber), they also cool the gas further and raise its pressure sufficiently to give a small reserve for working the anti-pulsator. The tar from centrifugal cleaners, as also that from the coolers, passes out through water-sealed pipes to settling tanks, and is finally collected, steam heated in a boiler to get rid of excess water and sold at about 10s. per ton to neighbouring chemical works.

The air blast for the producers is obtained from two No. 3 Roots blowers coupled to high-speed steam engines, and shown in one of our views; the air at 45 cm. water pressure is passed through an air-heating tower, where it meets jets of the hot water which has been returned from the first gas cooling tower, taking up a proportion of water vapour and being raised in temperature. A considerable quantity of steam is also introduced into the blast (roughly $2\frac{1}{2}$ tons, which includes $\frac{3}{4}$ ton from the air tower per ton of fuel gasified) prior to its being superheated to about 225° C. and entering the producers. The steam limits the temperature of the producer, preventing the formation of clinker and destruction of the ammonia.



Exhaust Boilers, Heenan Cylinder-Water Coolers, Anti-Pulsator, &c.; for Two 1,000-b.h.p. Gas Engines.

The blower house also contains four small motor-driven centrifugal pumps, for circulating the water through the two gas-cooling towers, the water-cooling tower, which works in conjunction with them, and the air-heating tower; a gauge board is also provided here, containing nine water

gauges connected to various portions of the plant, the indications of which are logged at regular intervals, and show how the plant is working.

The ammonia liquor from the stock tank is lifted by means of an ejector to a feed tank in the sulphate house, being drawn off and boiled in a vacuum evaporator until it begins to crystalise; these crystals are subsequently withdrawn and dried in a hydro-extractor, the product known as grey sulphate being sold for about £12 10s. per ton. At the present time about 85 tons of coal per week is being gasified and as by-products, $3\frac{3}{4}$ tons of sulphate and 10 tons of tar are obtained. The clean gas is delivered to the engines at 7 cm. water pressure and 25° C. temperature.

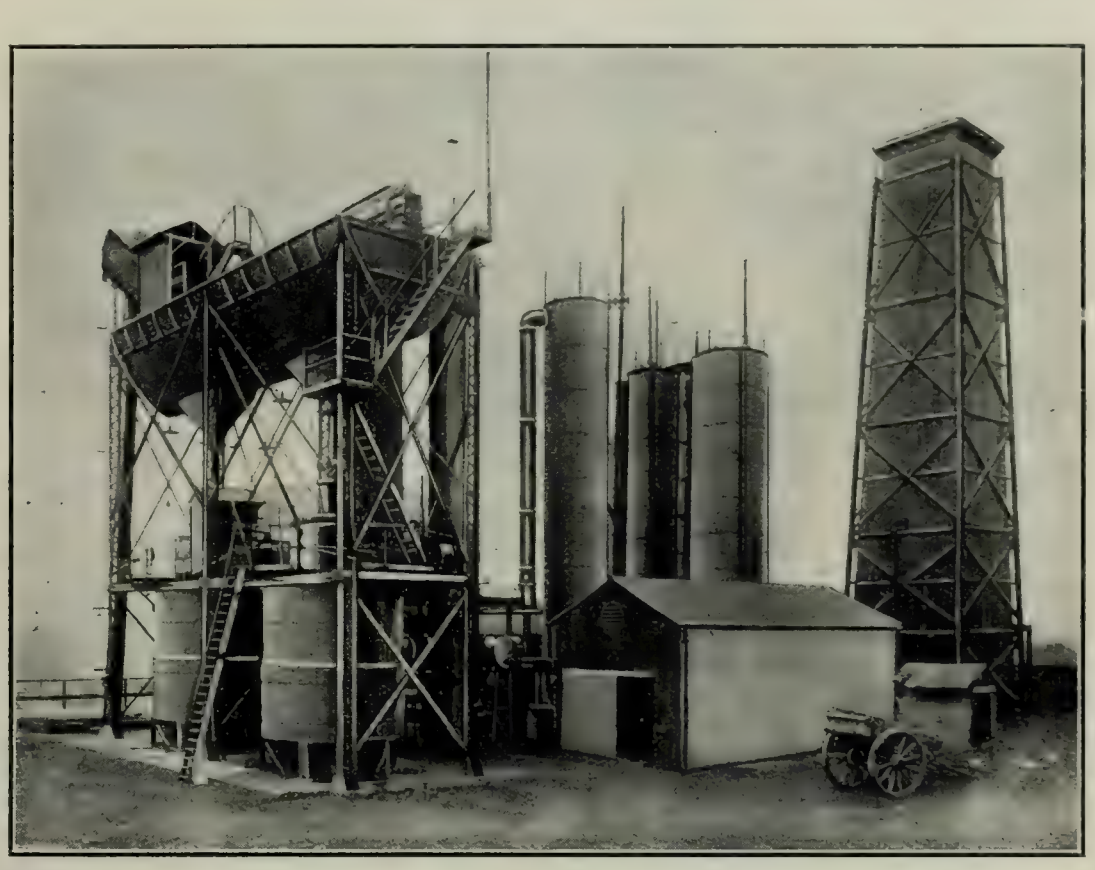
The gas plant is worked in conjunction with a fully equipped chemical laboratory where daily tests of the fuel, gas, and by-products are carried out. Turning to the engine house, there are installed two 1,000-B.H.P. National gas engines, direct-coupled to 938-K.V.A. Bruce Peebles alternators, and 12-KW. exciters, running at a speed of 200 R.P.M. The alternator windings were specially impregnated and large creeping surfaces provided on account of gas fumes. The engines, as shown in our views, are of the four-crank vertical enclosed pattern, each having eight cylinders arranged in tandem pairs, the lower ones 22 in. diameter, and the upper ones 23 in. diameter, to allow of the lower pistons being easily withdrawn.

Two low-tension Bosch magnetos are provided to each engine supplying independent sparking plugs on each cylinder.

The air for the engines is drawn in through admitters in the engine room, which are silent in action, and is mixed with the gas at the cylinder head.



Roots Blowers for the Mond Producer Plant.



General View of the Accrington Producer Plant, with Blower House in Foreground.

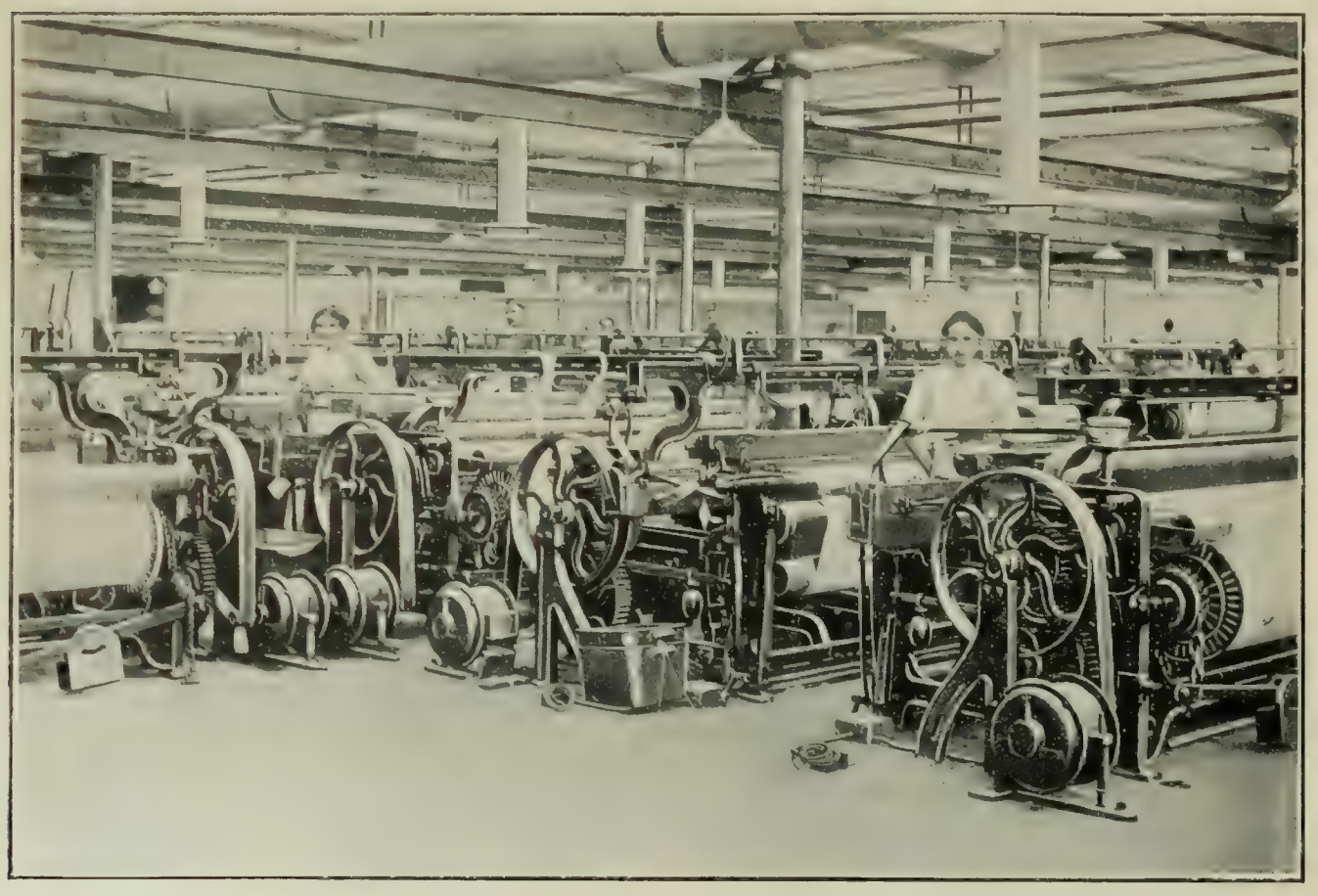
The exhaust from each engine is passed through a special loco.-type boiler, which generates steam at about 100 lb. pressure, for supplying the needs of the producer plant, and effectively silences the escaping gases; the cylinder cooling water from each engine is circulated through a Heenan cooler—an ingenious apparatus consisting practically of a large plate coiled in the form of a watch spring, which in revolving slowly abstracts the heat from the water, and is in turn cooled by means of air blown on to it.

The boilers and coolers are situated in the original boiler house, together with the anti-pulsator and three compressed-air starting tanks for the gas engines; a small motor-driven compressor charges up the starting tanks to a pressure of 300 lb. per sq. in., and together with the other apparatus is shown in our views on pages 258 and 260. The Accrington gas engines have now been running about nine months, and supplying a very large proportion of the load on the station, which is rapidly growing during the day owing to the number of textile and machine works which have taken up electric driving; one of the engines runs throughout the 24 hours of the day, while the other runs during factory hours, *i.e.*, 6 a.m. to 5.30 p.m., and together they generate about 120,000 units per week at the present time. The fuel consumption under these conditions is rather more than $1\frac{1}{2}$ lb. per unit, costing about ·125d., and against this there is to be credited from the sale of by-products about ·07d. per unit, leaving a fuel cost of some ·05d. per unit generated. The gas engine plant generates three-phase 50-cycle



Centrifugal Cleaners and Gas Cooling Towers behind, Governor, Ammonia Absorber, &c. (Left to Right.)

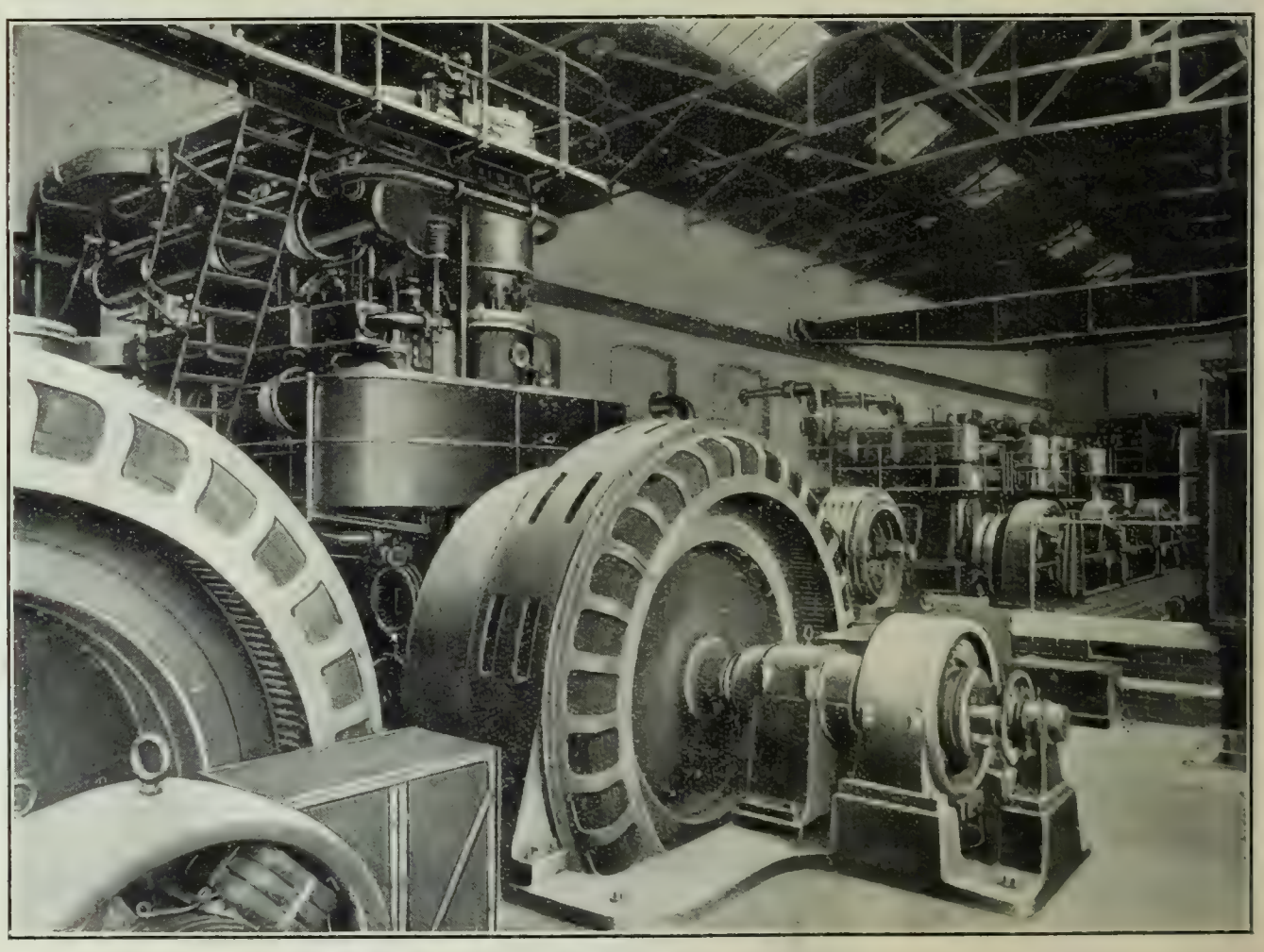
current at 6,000-6,600 volts, and is linked up to the older high-speed direct-current steam generating plant through one 270-H.P. and two 570-H.P. G.E.C. motor-generators, an arrangement which allows for the economical distribution of the load between the steam and gas plant. The 6,600-volt feeder system extends about 2 miles in a northerly direction to Clayton-le-Moors, where there is a static sub-station containing three 250-KW. transformers for supplying a three-phase four-wire network at 230 and 400 volts; negotiations have been practically completed for extending the E.H.T. supply to Great Harwood, about $1\frac{1}{2}$ miles beyond Clayton, where it is proposed to give a supply in bulk. The Clayton feeder is looped into a 300-KW. static sub-station at a local brickworks, where a 260-H.P. motor is in use for running a brick-making plant. Duplicate E.H.T. feeders also extend some $5\frac{1}{2}$ miles south to Haslingden, where a bulk supply is given to the local council through a static sub-station containing two 250-KW. transformers; *en route* these feeders supply a 450-KW. sub-station at Messrs. Howard & Bullough's machine works, also static sub-stations at the Albert Mill (120 KW.) and Messrs. Higham's mill (250 KW.); both feeders also pass through a rotary sub-station at Oak Hill, containing two 250-KW. induction motor-generators for supplying in the locality, which, in common with the rest of the Accrington area, is supplied through a direct-current three-wire network.



A Corner of Messrs. Higham's Weaving Shed Equipped with Individual Drive and Supplied from the Accrington E.H.T. Mains.

Through the kindness of Mr. T. E. Higham—whose close connection with the Accrington Electricity Committee in his capacity of chairman, would appear to be a matter for congratulation—we were able to inspect the fine individual drive installation which that gentleman has introduced in connection with the weaving and allied departments of his mill.

Some 400 heavy sheeting looms are installed, each driven by its own three-phase 200-volt motor, of $\frac{2}{3}$ to 1 B.H.P., and about 970 R.P.M. speed. The motors are of the Schorch type, fitted with ball bearings and $2\frac{3}{4}$ in. pulleys, with belt drives on to 24-in. pulleys on the looms, an arrangement which gives both satisfactory starting and running. The Schorch Co. carried out the whole of the electrical equipment, which included a sub-station (originally the engine room), and the whole of the wiring, as well as the motors, &c. From the sub-station a central rubber-covered feeder runs in steel piping under the concrete floor of the shed; at intervals there are 11 distribution boxes where distributors, also in pipes under the floor, branch off on either side. A series of sub-distribution boxes, in fact, one to each four loom motors, is provided in each of the side distributors, the motor leads passing out through Zed fuses and small



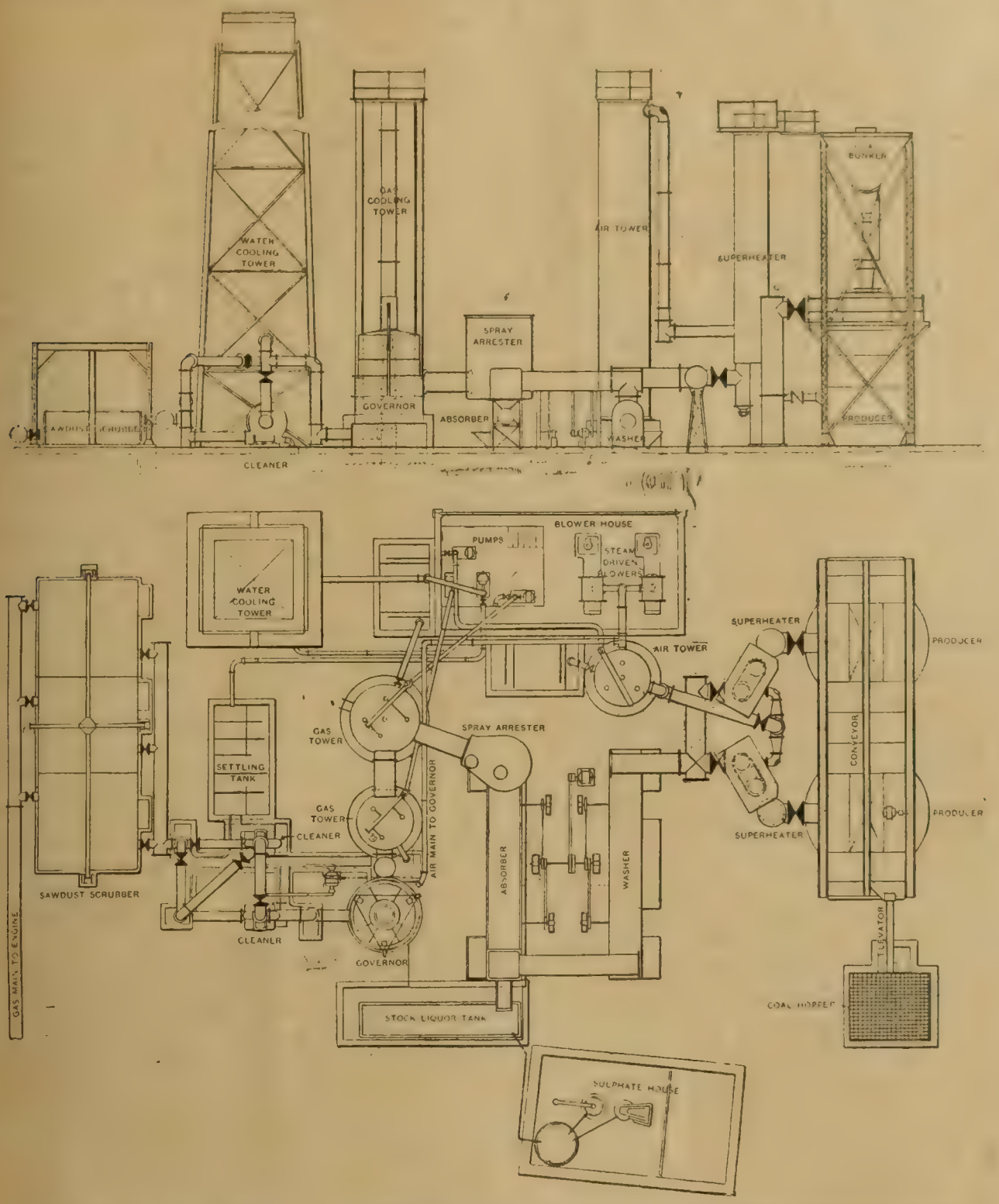
Accrington Electricity Works; Gas Engine Driven Alternators on the Left and Steam Plant in the Distance.

pipes to above floor level. Our view shows a corner of the shed with loom motors in the foreground; the ventilating ducts in the roof connect to an electrically-driven humidifying plant.

The installation ought to be an object lesson to local mill owners, as we believe it is to the employés, for whom Mr. Higham has introduced electrical heating and water-boiling apparatus.

During the year ending March 31st last, the Accrington electricity department sold about 4,840,000 units, of which 3,084,000 were sold for power purposes, showing an increase of 1,350,000 units during the 12 months, and the indications are that this year's working will show equally favourable progress.

In conclusion, we are indebted to Mr. Harold Gray, for enabling us to place on record some particulars of a most interesting municipal development.



Plan and Elevation of the Mónd Gas and By-Product Recovery Plant at the Accrington Corporation Electricity Works.

The Half-watt Lamp in America.—According to the *Electrical World*, as a result of investigations made in the research laboratory of the General Electric Co. at Schenectady, N.Y., for the past few years, there has been produced a metallic-filament lamp which operates at the low specific consumption of 0·5 watt per candle, the efficiency being about twice that of the best incandescent lamps heretofore available. The new lamp contains a specially shaped tungsten filament, and is filled with an inert gas, such as nitrogen, at a pressure of about an atmosphere. The types which it is expected to develop first are adapted to comparatively high current consumption—6 amperes—and above. The new lamps promise to be of particular value in a field not heretofore covered by incandescent lamps, and should greatly broaden the applications in which they can be used advantageously, particularly in the direction of very large candle-power units.

SOME RESULTS OF OVER-PRODUCTION.

[An Essay in Political Economy.]

[communicated.]

At a time when nearly every industry in the country is thriving, when orders have to be executed abroad because there are no hands free to do the work at home, it is not unprofitable to consider some of the aspects of excessive production from the point of view of political economy. "Take no thought for the morrow," is a precept familiar to us all; but like many another utterance from Holy Writ, it must not be too literally interpreted.

In no industry is the study of the phenomena of over-production more necessary than in that with which this journal is primarily concerned. Ours is an industry of modern conception and rapid growth. So rapid is that growth, so fertile the mind of the electrician in devising improvements, that the life even of the most modern types of machinery is by no means long. We do not mean that modern machinery is of necessity soon worn out. Say rather that it rusts out. Being supplanted and superseded, it is of necessity consigned to the scrap-heap.

It is to the scrap-heap in its larger sense that he who desires to consider the phenomena of over-production should turn. His investigations will prove interesting. It is said of an American who was invited to inspect a large engineering works in this country, that his first request on entering the premises was "Show me the scrap-heap." And he found so much to interest him at that corner of the premises, that he found no time to extend his visit to any other department!

That over-production is a normal incident in nearly every industry was early recognised by the political economists. As John Stuart Mill wrote in his "Principles of Political Economy" (Bk. III, Cap. XIV, Sec. 1), "Dearth, or scarcity on the one hand, and over-supply, or, in mercantile language, glut, on the other, are incident to all commodities. In the first case, the commodity affords to the producers or sellers, while the deficiency lasts, an unusually high rate of profit; in the second, the supply being in excess of that for which a demand exists at such a value as will afford the ordinary profit, the sellers must be content with less, and must, in extreme cases, submit to a loss."

The phenomenon of over-production is so well recognised that some political economists have recommended the adoption of certain remedies. Thus, Dr. Chalmers has suggested the practice of a moral restraint in reference to the pursuit of gain; while Sismondi deprecated the use of machinery and the various inventions which increase productive power. These two *savants* have urged that accumulation of capital may proceed too fast, not merely for the moral, but for the material interests of those who produce and accumulate; and they enjoin the rich to guard against this evil by an ample unproductive consumption.

It is well to observe, however, that John Stuart Mill took a very cheerful view of the accumulation of capital. He wrote: "Until the working classes have reached the point of satiety there will be no want of demand for the produce of capital, however rapidly it may accumulate; since, if there is nothing else for it to do, it can always find employment in producing the necessaries or luxuries of the labouring class. And when they, too, have no further desire for necessaries or luxuries, they would take the benefit of any further increase of wages by diminishing their work; so that the over-production which then for the first time would be possible in idea, could not even then take place for want of labourers." "Thus," concludes Mr. Mill, "in whatever manner the question is looked at, even though we go to the extreme verge of possibility to invent a supposition favourable to it, the theory of general over-production implies an absurdity.

"The true interpretation of the modern, or present, state of industrial economy, is that there is hardly any amount of business which may not be done, if people will be content to do it on small profits . . . . but even those who comply with the necessities of their time, grumble at what they comply with and wish that there were less capital, or, as they express it, less competition in order that there might be greater profits."

Your modern electrical engineer, who is concerned with the severely practical side of electrical industry, will scarcely adopt the means suggested for stopping over-production. Let him abandon labour-saving machinery, and he will be in a welter of labour troubles. Let the rich be enjoined to indulge in ample unproductive consumption: bankruptcy would then stare the electrical, as well as many other industries in the country, fairly in the face.

CONTRACTS OPEN.

(*Continued from page* 258.)

Doncaster.—The Tramways Committee has recommended the purchase of 200 tons of tramway rails.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe-work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" August 1st.

August 26th.—Supply of A.C. meters, single-phase and three-phase, for two years, for the Corporation. See "Official Notices" to-day.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour. See our last issue for particulars.

France.—PARIS.—August 18th. The State Railways Administration (2e division, 43, Rue de Rome) invites tenders for the supply of electrical material for the traction sub-station at Porchefontaine, in two lots.

Germany.—September 22nd. The Hafenbauamt at Bremen is inviting tenders for the supply of 22 electrically operated cranes of 2½ tons capacity each.

Halifax.—August 19th. 200 tons tram rails, for the Corporation Tramways Committee. Borough Engineer.

Hungary.—Tenders have just been invited by the municipal authorities of Gyoma for the establishment of a central station in the town for electric lighting and power purposes.

Hyde.—August 21st. Corporation. Electric light fittings, electric ventilating fans, &c., for the Corporation Baths extension. Architect, Mr. J. H. Fletcher, 45, Clarendon Place, Hyde. Tenders to Mr. Thomas Brownson, Town Clerk.

London.—GENERAL POST OFFICE.—September 1st. Stores Department. (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. Mr. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

L.C.C.—August 25th. Electrical installation, 320 lighting points, for Middle Row School, Kensal Road, N.W. See "Official Notices" August 8th.

September 1st.—Electrical installation (100 lighting points), for the L.C.C., at Royal Hill Central Elementary School, Greenwich, S.E. See "Official Notices to-day.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Malvern.—The U.D.C. has decided to invite tenders for a year's supply of coal to the electricity works.

Manchester.—August 18th. Cables for the Electricity Committee. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Rochdale.—August 27th. The Electricity Department invites tenders for steam coal, cartage of coal and removal of ashes, supply and erection of wet-air filter, and circulating water screens. Specifications, &c., from Mr. C. C. Atchison, engineer and manager, Dane Street, Rochdale, £1 1s.

Servia.—August 23rd. The Servian Post and Telegraph authorities in Belgrade are inviting tenders for the supply of 100 tons of iron wire, 46 tons of siliceous bronze wire, and a quantity of telephone cable.

Shanghai.—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

South Africa.—August 26th. 36,000 metal-filament lamps, for the S.A. Railways Administration.

Spain.—August 29th. Tenders are being invited by the municipal authorities of Cuevas de San Marcos (Province of Malaga) for the concession for the electric lighting of the town during a period of 20 years.

September 11th.—The municipal authorities of Castellon de la Piana are inviting tenders for the installation of a generating station.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" August 1st.

Wimbledon.—September 1st. One 1,500-KW. turbine alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" August 8th.

York.—August 25th. Coal for a year from September 30th, for the Corporation electricity works (about 10,000 tons, either unscreened beans, pea slack, rough slack or small peas). Mr. J. W. Hame, engineer and manager, Clifford Street.

CLOSED.

Atherton.—The U.D.C. has accepted the tender of the Callender's Cable and Construction Co. for extra-high-tension cables.

Australia.—The placing of the following contracts is announced by the *Australian Mining Standard and Electrical Record*:—

West Australia, Railways Department—
W.E. magnetos, induction coils, &c., Unbehaun & Johnstone.

Melbourne Harbour Trust Commissioners—
E.L. installation for dredging and transport service, £512, Clayton, Joel & Co.

N.S.W. Public Works Department, Harbour Works—
Three 82-K.V.A. motors for Newcastle workshops, £1,059, Australian General Electric Co.

Victorian Railways—
30-KW. A.C. transformers, £61, Australian G.E. Co.

P.M.G., Western Australia—
Three miles paper-insulated lead-covered telephone cable, £214 per mile, W. T. Henley's Telegraph Works Co.
Distributing boxes (330), 17s. 3d. and 19s. 6d. each, James & Co., Ltd.
" " (330), 14s. 10d. and 29s. 8d. each, G. Stirzacker.
"Hargis" cable-jointing boxes, G. Kent, Ltd.

City of Melbourne—
Reactance coils for 4,400-KW. turbines, £963, c.i.f. Melbourne, Siemens Bros. Dynamo Works, Ltd.

Municipal Council of Sydney—
Rubber-insulated cable, £551, with an allowance of 0·175 per cent. in the price up or down for every £1 per ton rise or fall in the market price of copper, and 1·05 per cent. in the price for every 1d. per lb. rise or fall in the market price of rubber between July 23rd and the date of receipt of notification of the acceptance of the tender, Noyes Bros.

Belgium.—The Belgian military authorities in Liége recently invited tenders for the supply and laying of a series of electricity mains at 12 forts in the Liége district and nine in the Namur area. Three firms tendered for the order, the lowest offer being that of Messrs. Dehousse & Co., of Saint-Josse-ten-Noode. A contract for 42 dynamos and 21 switchboards for the forts in the Meuse district fell to La Société Belge d'Appareillage Electrique Goerdy, of Mons, and one for 37 electric motors to La Société Electrique la Campine, of Brussels.

One French and four German concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for

the supply of two telephone cables between the Belgian capital and Antwerp, the lowest offer being that of the Rheydt Kabelwerk Gesellschaft, of Rheydt, Westphalia. The same concern also sent in the lowest tender for two telephone cables between Ans and Verviers.

Blackburn.—The T.C., on August 7th, ordered its seal to be affixed to a contract between the Electric Construction Co., Ltd., and the Corporation, for the supply of electric motors for the electricity department.

Cape Colony.—Wellington, Cape Province.—The Municipal Council held on July 15th considered the report of the consulting engineer (Mr. Chas. G. Trevett) on the tenders received for the electric lighting scheme. The tender of the British General Electric Co., Ltd., for the complete installation, was accepted, subject to the approval of the Administrator. The amount of the tender, which includes the erection of Hornsby suction gas plant, is £7,486, exclusive of buildings.

Stellenbosch, Cape Province.—The tender of the A.E.G. Co., Ltd., of Johannesburg, for the electric lighting scheme, has been accepted by the Municipal Council.

Fleetwood.—Mr. R. Banon has secured the contract for the new installation and re-wiring at the extensive works of the Fleetwood Fish Meal Co. on Wyre Dock.

France.—Paris.—July 31st. Chemins de Fer de l'Etat. The following tenders were submitted for the supply of vulcanised india-rubber articles :—Colonial Rubber Co., 76,954·25 fr.; Hutchinson, 78,618 fr.; Kalker, 98,271·50 fr.; Manufacture Parisienne du Caoutchouc, 71,829 fr.; Casassa, 64,236·40 fr.; India-Rubber and Gutta-Percha Co., 95,939·90 fr.; Société Industrielle des Téléphones, 71,910·19 fr.; Torilhon, 66,718·60 fr.; and François et Cie. (successful), 61,500·25 fr.

Germany.—Messrs. De Fries & Co., of Dusseldorf, have secured a contract from the Prussian State Railway authorities at Munster, Westphalia, for the supply and erection of four electrically-operated 5-ton cranes.

Glasgow.—The Electricity Committee recommended acceptance of the offer of the British Thomson-Houston Company (£476), for H.T. gear to be erected at Partick Electricity Station.

The offer by the Midland Electric Wire Co., Ltd., for D.C.C. wire has been accepted by the Tramways Committee.

Hereford.—The T.C. has accepted the tender of Messrs. Reyrolle & Co. for three starting switches for the electric pumps at the waterworks, at £76.

Italy.—The India-Rubber, Gutta-Percha and Telegraph Works, Ltd., of Silvertown, E., have secured a contract from the Italian telegraph authorities in Rome for the supply of 1,300 m. of submarine 13 conductor cable.

Llandudno.—The U.D.C. has accepted the tender of Messrs. Thomas Parry & Co., of Mold, for 5,000 tons of slack coal for the electricity works, at 10s. 10d. per ton.

London.—For installing the electric light at the Convent of Marie Auxiliatrice, 26, Bow Road, the tender of Mr. W. Morgan, Leytonstone, has been accepted.

Loughborough.—The T.C. has accepted the tender of Messrs. Clarke, Chapman & Co., at £1,774, for boiler and superheater at the generating station.

Manchester.—The Education Committee has accepted the tender of Messrs. W. P. Theermann & Co., Ltd., for electric lighting installation at Grange Street Municipal School.

The Corporation Electricity Committee has accepted the tenders of the B.I. & H. Cables, Ltd., and W. T. Glover & Co., Ltd., for rubber and aerial cable respectively.

The Corporation Tramways Committee has accepted tenders from the following :—

Tramcar trucks.—Brush Electrical and Engineering Co., Ltd.
Tramcar wheel centres.—Edgar Allen & Co., Ltd.
Block tin.—Stedman, Crowther, Ltd.

The Electricity Committee has accepted the tenders of Messrs. Johnson & Phillips, Ltd., and the Electrical Engineering and Equipment Co., Ltd., for paper cable. The following tenders for the supply of stores required during the ensuing 12 months have also been accepted :—

Asbestos goods.—Witty & Wyatt, Ltd.
Canvas or Hessian.—L. Andrew & Co.
Commercial hydro-acid.—Joseph Brooks & Co., Ltd.
Sulphuric acid.—H. N. Morris & Co., Ltd.
Boiler tubes (land type).—Babcock & Wilcox, Ltd.
" " (marine type).—British Mannesmann Tube Co., Ltd.
Brass and copper work.—Till & Whitehead, Ltd.
Buxton lime.—Buxton Lime Firms Co., Ltd.
Service cables.—Rubber insulated: Henley's Telegraph Works Co., Ltd.
Lead-covered paper.—Union Cable Co., Ltd.
Carbons.—Sloan Electrical Co., Ltd.
Cement.—Warrington Slate Co., Ltd.
Cotton waste and rags.—W. C. Jones, Ltd.
Dynamo Brushes.—George Christie, Ltd.
Carbon brushes.—Le Carbone and the Morgan Crucible Co., Ltd.
Earthenware bridges.—Doulton & Co., Ltd.
" pipes, &c.—[illegible]: Isherwood Bros., Ltd.
Pipes and bends: Doulton & Co., Ltd.
Fire-bricks and clay.—[illegible] Fireclay Co., Ltd.
Gauge glasses.—[illegible] & Bellenberg, Ltd.
India-rubber goods.—L. Andrew & Co.; George Macmillan & Co.; North British Rubber Co., Ltd.; F. Reddaway & Co., Ltd.
Insulators.—Doulton & Co., Ltd.; Sloan Electrical Co., Ltd.; Bullers, Ltd.
Iron and steel.—Hall & Pickles.
Leather belting.—Peter Hawcroft & Co., Ltd.
Manhole fittings and covers.—J. Gent & Co.
Metal polish.—Matchless Metal Polish Co., Ltd.
Engine paste.—G. Maclaren & Co.
Pitch and pitch oil.—Hardman & Holden, Ltd.
Recorder paper.—Elco Recording Press.
Rubber tape.—Jas. Nortie, Hart & Son; W. T. Henley's Telegraph Works Co., Ltd.; Geo. Hattersley & Sons, Ltd.; Chas. Macintosh & Co., Ltd.; L. Andrew & Co.; I.R., G.P. & Telegraph Work Co., Ltd.
Steam and gas fittings.—John Russell & Co., Ltd.
Wiring cables.—British Thomson-Houston Co., Ltd.
Electrical accessories.—British Thomson-Houston Co., Ltd.; Sloan Electrical Co., Ltd.; General Electric Co., Ltd.
Creosote and common tar.—Hardman & Holden, Ltd.
Paints, &c.—J. E. Williams & Co.
Crucibles.—Morgan Crucible Co.
Anti-sulphuric enamels.—Griffiths Bros. & Co.
Nickel-chrome wire and strip.—Wiggins & Sons.
Tinned steel and armature wire.—W. N. Brunton & Son.
D.C.C. silk-covered and Eureka wires.—London Electric Wire Co. and Smith's, Ltd.
Enamelled wire.—Connolly Bros., Ltd.
Box compounds and Bittite tape.—Callender's Cable and Construction Co., Ltd.
Blackley tape.—Connolly Bros., Ltd.
Pipe compound.—W. H. Mitchell & Co., Ltd.
Wood troughing and covers.—Alex. Bruce & Co.
Tubing and accessories.—Brotherton Tubes & Conduits, Ltd.
Tubing.—Eureka Conduits and Fittings Co.
Dry cells.—A. H. Hunt; General Electric Co., Ltd.
Soldering paste.—W. P. Burnley & Co.
Varnish.—Pinchin, Johnson & Co., Ltd.
Evertite jointing.—R. L. Ross & Co., Ltd.

Meter Contracts.—The following contracts have been secured by the Electrical Co., Ltd. :—

Burnley Corporation.—Seventy type St tramcar watt-hour meters, mounted on special spring frame to take up the vibration.
Hammersmith Borough Council.—Hour meters for 12 months.
Falkirk Borough Council.—Polyphase meters, with and without maximum demand indicators, for 12 months.

Newport (Mon.).—The T.C. has accepted the tender of Mr. R. W. Moor for the erection of an extra-high-tension switch house and motor house, at £599; and that of Mr. Bertram Thomas for additional extra-high-tension switchgear, at £168.

Rotherham.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for meters of 10 amperes capacity and upwards.

St. Marychurch.—For installing the electric light at the Parish Church, the tender of Messrs. Drury & Chaffe has been accepted. The cost will be over £150.

Sheffield.—The City Council has accepted the following tenders :—

Vickers, Ltd.—125 tramcar tires.
Brush Electrical Engineering Co., Ltd.—25 double-deck top-covered extended-canopy cars, £640 per car (plus 5 per cent. for contingencies).
Lea Recorder Co., Ltd.—One combined indicating and recording water meter, including steel notch tank and float chamber, £118.
Longbottom & Co.—Annual supply of coal to the generating stations, 9s. 11 per ton.

Stockport.—The Tramways Committee has accepted the following :—

Welding Hazel Grove tramway track.—Tudor Accumulator Co., Ltd.
24 semi-elliptic steel springs (eight laps).—Smith Bros. & Hill, 9s. 6d. each.
Three pressed-steel gear cases.—Watlington & Co., £2 17s. 6d. each.
Set of spare wheels for trackless trolley vehicles.—Atlas Resilient Road Wheel Co., Ltd., £80 10s.

The Corporation Electricity Committee has accepted the following tenders :—

15 tons of copper to be made into cable during two years.—W. T. Glover and Co., Ltd.
Circulating pipes for turbo-condenser.—Engineering Supply Co., £65.
Twin strainer for removing foreign matter from water supply.—Royle's (Irlam), £75, less 5 per cent.
Grease-eliminating and water-softening plant.—Messrs. Bell Bros., £260.

Walsall.—The following tenders have been accepted by the T.C. :—

Callender's Cable and Construction Co., Ltd.—Laying A.C. mains from Bath Street to Sandwell Street, £179.
H. Gough & Son.—Foundation work for new boiler house and economiser house.
W. S. Laycock, Ltd.—Rollers and blinds for cars now being fitted with vestibules, £72.

Warrington.—The offer of the Monovel Governor Co. to install a 12-in. Chorlton Whitehead governor to the 300-KW. Westinghouse turbine, at a cost of £41, has been accepted by the Council, which, however, reserves the right to reject the apparatus during the first month's use.

Wigan.—The E.L. Committee has accepted the following tenders for fuel for the electricity works for 12 months :—

Pearson & Knowles.—3,500 tons.
Ackers, Whitley & Co.—1,000 tons.
William Reay & Co.—1,000 tons.
Wigan Coal and Iron Co.—4,000 tons.
F. E. Moss.—2,000 tons.
Worsley Mesnes Colliery Co.—500 tons.

NOTES.

Foreign Trade in July.—The official trade returns for last month show advances of 5·9 per cent. in imports, 12·3 per cent. in exports, and 17·7 per cent. in re-exports, as compared with the corresponding month of 1912, the increases being £3,487,253, £5,177,848, and £1,217,674 respectively. In the exports section the higher prices of coal and cotton are responsible for a large proportion of the advance. The following figures relate to the electrical and machinery trade :—

	Month of July.	*Increase or decrease.*	*Seven months, 1913.*	*Increase or decrease.*
IMPORTS.				
Electrical goods and apparatus, excluding machinery and insulated wire ...	£122,688	+ 26,029	£868,817	+ £50,337
Machinery ...	£633,944	+ 80,133	£4,391,682	+ £410,496
EXPORTS.				
Electrical goods and apparatus, excluding machinery and insulated wire ...	£509,083	+215,670	£3,191,894	+ £832,148
Machinery ...	£3,131,686	+373,181	£21,556,229	+£3,108,538

Municipal Wages at Nelson.—Nelson Electricity Committee have considered applications from the Municipal Employés' Association respecting several classes of men. It was resolved (1) that the commencing wages of firemen be increased from 25s. to 27s. per week ; (2) that the minimum and maximum wages of charge engineers be increased from 28s. to 30s. and 35s. to 37s. 6d. per week respectively. It was resolved that 10 minutes per shift be allowed to drivers and conductors for coming on and going off duty.

A Model Gas-Engine Plant in Japan.—In the article on the above which appeared on p. 141, the Power Gas Corporation, Ltd., point out that fig. 1 shows diagrammatically an atmospherically-cooled plant, whereas the Kawasaki producer plant, which is described (and illustrated in fig. 2) is of the Mond pressure type, and utilises water cooling—a point which was plainly stated in the article.

The Private Installation.—The last sentence in the first paragraph of the above article on page 207 of our last issue was incomplete, the following words being accidentally omitted after the word "premises"—"may want to supply his neighbour. Can he do so ?"

Engineers and National Agreement.—The *Times* states that the working agreement between employers and workers in the engineering industry throughout the United Kingdom is threatened as the result of a decision by the Executive Council of the Amalgamated Society of Engineers. A circular was issued to the branches on 11th inst., asking the men to vote for and against ending the agreement, and also for and against continuing the premium bonus system. "It is regarded as a foregone conclusion that the ballot will go against both the agreement and the premium bonus system, and in that case the executive say they will serve the necessary three months' notice on the employers without delay."

Parliamentary.—VARIOUS BILLS.—In the House of Lords on August 6th the Metropolitan Electric Tramways (Railless Traction) Bill passed its third reading, and in the House of Commons, on Tuesday, the City and South London Railway Bill was read a third time.

Calcium Cyanamide Statistics.—While the world's production of cyanamide of calcium in 1910 totalled 110,000 tons, and in 1912 153 000 tons, on June 1st of the current year it had risen to 260,000 tons. The increase is due principally to two new producers in Sweden (12,000 and 15,000 tons) ; and one American (24,000 tons) ; also to increased outputs from existing German (30,000 tons), Norwegian (28,000 tons), and Swiss works (4,000 tons).—*Chemiker Zeitung.*

Fatalities.—An inquest was held last week into the death of a child aged five years, who was found dead across the live rail of the North-Eastern Railway at Percy Main. The father complained that the line was not properly fenced, but it was stated that the child would have to climb two walls in order to get on to the line.

At an inquest held into the death of Tom Roxborough (34), steam motor-lorry driver, in the employ of Messrs. W. & R. K. Lee, doublers and spinners, Sowerby Bridge (see ELECTRICAL REVIEW, August 1st, page 186), the jury brought in a verdict of "Accidental death caused by electric shock." Roxborough was engaged repairing a steam motor-lorry, and he was found on his knees on the footplate between the boiler and the coal bunker, with his head thrown backwards and his hands hanging down. He was groaning, and behind his ears and neck the skin was blue. An electric lamp wire was resting on his left shoulder. The foreman mechanic, in giving evidence, said that he resorted to artificial respiration for a quarter of an hour, when two doctors arrived on the scene. Afterwards he found the electric lamp produced, detached from the broken wire, on the lorry. The conclusion he came to was that by treading on a wire he pulled it out of the lamp, and the live wire then touched his sleeve or his arm, and he received an electric shock. Deceased had been shovelling small coal dust from underneath the footplate, the board covering which having been removed immediately before the accident happened. From what witness had heard, deceased had asked for the lamp he was using, and it had been lent to him. The wire was insulated, and the voltage was 230.

On Wednesday an inquest was held at Manchester into the death of Henry Hill (25), Peacock Street, Gorton, an electric wireman employed by Messrs. Beyer, Peacock & Co., Gorton. The evidence was to the effect that on Monday the deceased was working on a ladder, which was propped against a beam carrying live cables. He was seen to fall, and his head struck an iron block at the foot of the ladder. He died in the infirmary, and his left hand was burnt in such a way as to suggest that he had had an electric shock. A foreman in the electricity department of the works said the cables were about 8 in. above Hill's head as he was at work on the ladder, and he would have no need to touch them. Even if he had touched them, witness did not think he would have received a shock, as the cables were thickly coated with oxide. Witness had tried the cables and had not received a shock. Dr. Buck, of the Infirmary, said the cause of death was a fracture of the skull. The left hand was shrivelled as though a strong electric shock had been received. He knew of nothing which would cause such an injury, except a shock. The Coroner said he did not see how they could get away from the fact that Hill touched the cable and received a shock. It might be another case of familiarity breeding contempt. There was nothing to suggest that there was any fault to be found with the installation. A verdict of "Accidental Death" was returned.

The *Times* states that Indian papers just received report the death of Mr. A. Kinghorn, manager of the Burma Development Syndicate, Ltd. "On receiving information that the main transmission wire had broken between Victoria Point and Maliwun he went to the spot with his electrician and a coolie. Finding a wire lying across the path Mr. Kinghorn pushed it to one side with his umbrella and kicked it with his wet boots. Death was instantaneous."

How Germany Secures Trade.—In connection with the pending renewal of the Treaty of Commerce between Russia and Germany, the German Minister of Commerce has circularised a number of Chambers of Commerce with the inquiry as to how Germany has won its present prominent position in the Russian market. One Chamber only—that of Moscow—has made reply as follows :—"During the last 10 years the number of German commercial travellers in ironware and kindred products has remarkably increased, and more especially in the branches of machinery, electrical material and patented articles. The German traveller possesses a fundamental knowledge of the goods which he offers ; he knows every detail of its production, and to which qualities he must draw attention, and those which most interest the purchaser. He is always well informed as to the current prices and the stocks at the moment on the market. . . . To increase sales, German firms make liberal and frequent dispatches of samples gratis, and beg the receiver to give the goods a trial and make report. Then follows a traveller. German firms are prompt in the execution of orders, and take the greatest care with the details of packing. Many German firms have appointed agents in Russia, or opened branch houses, in order to get into closer touch with the market. . . ." This laudatory epistle, which seems to show that German firms and their representatives come very near perfection in their business arrangements, explains the preponderating position which the German Empire now occupies in Russian trade ; it also implies that other competitors in the Russian market, including ourselves, are more or less deficient in those qualities which have conduced to the German success.

Determining the True Temperature of Incandescent Lamp Filaments.—The great differences in the energy consumption of different types of lamp have been partly accounted for by the influence of increased temperatures or differences in selectivity. Coblentz has even established some laws supposed to govern the selective emission of tantalum, osmium and tungsten, which, however, eventually proved incorrect.

In a paper read at a recent meeting of the German Society of Illuminating Engineers, Dr. Lummer discussed the question how the true temperature of the luminous substances used in our sources of light could be ascertained. What temperature will be assumed by a body into which a given number of joules is thrown ? The energy absorbed is given out by conduction and radiation. If conduction be eliminated, only the laws of radiation ought to be known. For one kind of body, viz., for what is called the black body, the law of radiation is actually known, the whole energy of radiation being proportional to the fourth power of absolute temperature. The number of joules being known and the surface being calculated from the thickness and length of the body, there only remains a constant to be determined for each substance in order to have all the data for calculating the temperature. It is true that the laws of black radiation do not apply to carbon. For one substance, viz., platinum, the law of radiation is known, the Joule heat being equal to a constant multiplied by the surface and the fifth power of temperature, which allows the temperature of platinum filament-lamps to be calculated. On the other hand, the same temperatures can be ascertained by actual observation from the radiation of platinum. In fact Kurlbaum's electrically-heated platinum box allows these temperatures to be measured most accurately. If the same platinum box be coated with the metal of each lamp to be examined, the filament temperatures of all substances used in actual practice could be ascertained. Experiments of this kind would allow the causes of existing differences in the efficiency of lamps to be ascertained.

Strike.—A strike of moulders is in progress at Sheffield. Masters and men were to meet on Wednesday. The former had issued summonses against the strikers for leaving work without giving notice. The men would not resume work until these summonses were withdrawn, and to this demand the employers declined to accede.

Accident.—An accident occurred in part of the conduit warehouse of Messrs. Accles & Pollock, Ltd., at their works at Oldbury. Shortly after work was resumed after the holidays on Thursday, last week, while stocktaking was proceeding, the racks suddenly gave way, with the result that two of the men were imprisoned beneath a mass of 70 tons of tubes. For a couple of hours every available employé worked with a will until the men were released little the worse for their experience. Their miraculous escape was due to the tubes having formed an arch over them. Naturally, the greatest care had to be taken in removing the tubes.

Annual Outings.—On Saturday, August 2nd, over 300 of Messrs. A. Reyrolle & Co.'s employés travelled by special train to Edinburgh, where a most enjoyable day was spent in general sight seeing, the section of the National Museum allotted to working models proving an irresistible attraction to many members. Tea was served at the Edinburgh Café Co.'s premises, where speeches were made by various members of the staff, in which the rapid expansion of the firm was the main theme.

The staff of the Faraday Electrical Co., Ltd., of Wandsworth, went for their annual outing on Saturday, August 9th. The company journeyed by train to Eastbourne, and after a morning ramble to Beachy Head and Lighthouse, dinner was served at Randolph House, on the Royal Parade. The weather was favourable, and a good time was spent.

Inquiry.—Makers of the "Gibbs" electric fan are asked for.

Association of Electrical (Station) Engineers.—A general meeting was held last week at the Y.M.C.A., Newcastle-on-Tyne (Mr. J. W. Lanham, chairman). The general policy of the Association was well discussed, severe criticism being passed upon the "wait and see" community in this district, who it was stated would join the Association after all the uphill work had been done. It was proposed to hold a social and musical evening during the coming month, particulars of which will be duly announced. During last month meetings have been held at Grimsby and Manchester to receive the delegate's report of the conference. Mr. P. B. Roberts, of the Grimsby Branch, has promised to read a paper at the next meeting, September 11th, entitled "Running a Steam Turbine."

The information bureau of the Association, though not yet in proper working order, has been able to warn members off a number of stations where conditions were very bad, and in a few cases the undertakings concerned have had to increase the salaries offered for vacant positions, and shorten the number of working hours, before they could obtain men. Successful efforts have also been made to find better paid positions for a number of "15s. and 20s., shift engineers," and, in some cases, with over 100 per cent. increase in salary, and some of the undertakings which are notoriously "bad payers" have lately slightly increased the salaries offered (as per recent advertisements), owing to the difficulty in obtaining and retaining engineers to run their stations.

Continued efforts are to be made on these lines, and it is hoped to obtain the co-operation of those engineers who are at present in receipt of fair salaries, and to whom it must be pointed out that before they can improve their own conditions they must organise themselves, and in the first place raise the status of the profession generally by assisting their underpaid colleagues throughout the country to better conditions. Without this effort the status must decline and with it of course the salaries paid.

The Electrical Plant at the Cockerill Steel Works at Seraing, Belgium.—In connection with the forthcoming meeting of the British Iron and Steel Institute in Belgium, when visits to a number of the leading iron and steel works in the country will be included in the programme, the following particulars and the electrical plant at the well-known iron and steel works of the Cockerill Co., at Seraing, near Liége, will be of interest.

The company was among the first to take up the question of the utilisation of the waste gases from blast furnaces and coke ovens, and the designing of special internal combustion engines to work with the same, and the fact that the electricity-generating plant at the Seraing works has now a capacity of no less than 12,300 H.P., all the engines utilising these waste gases, gives an excellent idea of the progress that has been made.

Current is generated by two distinct plants; the first, which, working with blast furnace gas, dates from 1901; it has a capacity of 7,500 KW., and comprises two engines of 900 H.P. and six of 1,400 H.P. The second station, where coke oven gas is utilised, is equipped with two 550-H.P. engines and one of 1,000 H.P., the capacity being 1,600 KW. Continuous current is generated; the two stations are about three-quarter mile from each other and work in parallel.

Current is supplied to 950 electric motors for power purposes, and to 8,000 incandescent and 1,500 arc lamps, the annual output of the two stations being about 35,000,000 KW.-hours. The distribution for the motors is at 250 volts pressure, and for lighting at 125 volts. A 500-KW. motor-generator is also provided for converting the continuous current to alternating at 2,000 volts for use at the mines, and two three-phase sets for operating crushing mills at the cement works.

The mains are of the overhead type, a separate network being provided for each section of the works. The company states that by utilising the waste gases the cost of the current is very low, and much lower than is possible even with the most modern steam-operated plant.

Each year witnesses a further development in the utilisation of electrical energy at the Cockerill Works. All the travelling and fixed cranes—110 in number—are now fitted with electric motors, most of the shafting is now electrically-driven, as also is the majority of the pumps, crushing mills, ventilation and rolling mill plants.

International Engineering Congress, 1915.—The Committee of Management of the International Engineering Congress, 1915, asks us to announce that Col. Geo. W. Goethals, chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal, has consented to accept the honorary presidency of the Congress, and will preside in person over the general sessions to be held in San Francisco, September 20th-25th, 1915.

Educational Notes.—The South-Western Polytechnic Institute, Manresa Road, Chelsea, will re-open on September 29th for day classes and on September 22nd for evening classes. The engineering courses include lectures in electrical and mechanical engineering, physics, chemistry and mathematics and practical instruction in the fully-equipped laboratories of the institute. The laboratories and workshops of the institute may be inspected by intending students. In the electrical wiring department a new advanced course will be commenced this session suitable for preparation of candidates for the final wiremen's examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the institute has been able to fill with its students. The prospectus may be obtained from the Secretary, price 1d., or by post 3½d.

The new course at the Crystal Palace School of Practical Engineering will commence on September 10th as announced in our advt. pages to-day.

University of London, University College, Gower Street, W.C.—We have received a copy of the Hand-book of the Faculty of Engineering at this College for the forthcoming session, which commences on September 30th. It contains particulars of entrance scholarships and exhibitions, and information respecting the mechanical, electrical, civil and municipal courses.

Legal.—British Vacuum Cleaner Co., Ltd., *v.* Jas. Robertshaw & Sons, Ltd.—Application was made to Mr. Justice Astbury, sitting as Vacation Judge, by the defendants in their patent action for a stay of execution. It was explained that the Sheriff was in possession for the costs, though the inquiry as to damages and delivery up of the alleged infringing articles had been stayed pending an appeal. His Lordship felt a difficulty in dealing with the matter, as he had advised on the case while at the Bar. After some discussion it was arranged that the application should be dealt with by the succeeding Vacation Judge in September, and in the meantime the Sheriff should be withdrawn, the defendants paying his costs and paying the amount of the debt into Court.

National Physical Laboratory.—A daily paper states that on account of the buildings recently erected, the assessment of the National Physical Laboratory at Teddington has been increased from £1,000 to £1,960.

The Lighting of Foundries.—In the course of a special report on the "Artificial Lighting of Iron Foundries," by D. R. Wilson, included in the Report of the Inspector and Factories and Workshops, it is stated that in connection with the inquiry, 40 iron foundries in different parts of the kingdom were visited in order to ascertain the efficiency of the artificial illumination. For efficient lighting the illumination in iron foundries should be high compared with other rooms.

It would appear that the most satisfactory method of lighting is by means of powerful units, fixed as high as possible above the floor and spaced comparatively close together. This method is adopted in most of the foundries classified as well lighted.

All the observations have reference to a horizontal plane 1 ft. above the floor level, and were made by means of a holophane lumeter with a range of 0·01 to 1,000 ft.-candles. The results of observation show that a sharp distinction may be drawn between well and badly lighted foundries. In some of the former the very high minimum value of 1·5 ft.-candles is attained and even exceeded, and the lighting may be considered good if the illumination does not fall below 0·5 ft.-candle. In the badly lighted foundries in almost all instances the system of lighting consists of ordinary flat-flame gas burners. The actual data indicate the extremely bad lighting that exists in some of these foundries, measurements as low as one-sixtieth of a ft.-candle being recorded, the lighting cannot be deemed to be adequate unless the illumination received on a horizontal plane 1 ft. above the floor level is not less than one-third of a ft.-candle over any part in which work is being carried on or over which any person is liable to pass.

Two tables accompanying the report, giving particulars of the illumination of well-lighted and badly-lighted foundries respectively. In the former, out of 24 examples, ten are classed as "excellent"; these are all lighted with flame arcs, inverted arcs, or ordinary arc lamps, sometimes supplemented with metallic-

filament lamps. In one very large foundry (126,600 sq. ft.) there are 91 flame arcs in seven rows, 17-22 ft. high and 43 ft. apart, with 64½ ft. between rows. The illumination ranges from 2·8 to 1·8 ft.-candles, and is described as very uniform. Another (51,200 sq. ft.) is lighted with 32 arcs 40 ft. apart, in four rows 40 ft. apart, at a height of 14 ft. The illumination varies from 3·9 to 1·5 ft.-candles, and is classed as "uniform and very good." Very often, however, a single row of arcs down the centre, from 12 to 30 ft. high, and from 22 to 30 ft. apart, give excellent results. In five foundries the illumination with arc lamps is described as good. Metallic-filament lamps are used alone in three cases, one of which is "good" (1·8 to 0·88 ft.-candles) and two "fair" (3·2-0·4 and 2·2-0·38 ft.-candles). One foundry lighted with inverted gas mantles is described as "very good" (1·8 to 0·7 ft.-candles), another as "fair" (1·8-0·35 ft.-candles), and a third with high-pressure gas is "good" (1·4 to 0·88 ft.-candles).

All the "badly-lighted" foundries were equipped with gas-jets except two, in which incandescent gas was used. The maximum illumination observed in any of them was 1 ft.-candle.

Some New Forms of Recording Instruments.—The word "radical" at the top of the second column, page 246, should read "radial"; also the "resonance," second paragraph, page 247, should read "remanence."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The South Shields T.C. has increased the salary of MR. H. F. ELLIS, electrical engineer, from £400 to £450 per annum.

The staff and employés of the Stratford-on-Avon Electricity Co. have presented a silver cigarette case to MR. J. E. WOODS, who is leaving to take up a position at Nuneaton in the engineering department of the G.P.O.

The Bury T.C. has increased the salary of MR. J. G. POTTS, works superintendent at the Chamber Hall power station, from £156 to £170, with a further increase to £180 in a year hence.

MR. W. J. FERGUSON, on retiring from the position of works manager of the Redditch electricity undertaking, was presented by the officials of the Council with a gold lever watch. Mr. Ferguson had been at Redditch 14 years. The staff and employés presented him with a pair of bronze figures, and Councillor Dolphin gave a pocket wallet.

Tramway Officials.—MR. JAMES DALRYMPLE, general manager of the Glasgow T.C.'s tramways, and MR. THOMAS NISBET, master of works, left Glasgow on Saturday on board the *Cameronia* for the United States, in order to inspect cross-river bridges with particular reference to tramways work. Within the next week or two, Bailie W. B. Smith, convener of the Electricity Committee, and Mr. W. W. Lackie, the chief electrical engineer, will depart for the States and Canada, as already reported, to inspect the largest electrical installations there in connection with the erection of a new power station in the Dalmarnock district of Glasgow.

General.—The *Times*, in alluding to the strong feeling that exists among many scientific men that an effort should be made to secure that the invaluable work of the late Prof. Milne, the seismologist, should be continued, quotes an eminent scientific authority to the effect that the late Prof. Milne used to spend £400 or £500 a year out of his own pocket in keeping up his scientific enterprise. There was a small grant of less than £100 a year from the British Association, and the matter will be discussed at next month's meeting of that Association. Everything, however, depends upon finding generous contributors to provide a fund for endowment. "Mr. Matthew H. Gray, F.G.S., F.R.G.S., a close friend of Prof. Milne, has set a noble example by giving some time ago £1,000 towards this object, and this is known as the Gray Fund, Prof. Milne having refused to receive it for himself."

MR. J. H. HOWE, secretary to Messrs. Richardsons, Westgarth and Co., Ltd., of Middlesbrough, who is leaving to take up an appointment at Belfast, has been presented by the staff with a gold albert with medallion, and a gold bracelet for Mrs. Howe.

The *Indian Textile Journal* states that MR. CARDEW, electrical inspector to the Madras Government, has been appointed chief electrical engineer to the North-Western Railway, Lahore.

We regret to read in the *Times* that SIR WILLIAM PREECE is lying ill at his residence at Carnarvon. "Sir William, who is 79 years of age, has been confined to his room for a fortnight, and his friends are afraid that it will be impossible for him to be moved to a warmer climate." He has been suffering from a severe attack of bronchitis. We desire to tender our deep sympathy with Sir William in his illness, and to express a hope that he will soon improve in health.

MR. C. H. AVERY, B.Sc., of University College, London, and MR. F. A. EUSTACE, of the City and Guilds Technical College, Finsbury, have been appointed to the Heating and Ventilating Scholarships awarded by the Institution of Heating and Ventilating Engineers, tenable at University College.

At St. Matthew's, Chapel Allerton, Leeds, on August 9th, MR. ARTHUR W. FITHIAN, M.I.E.E., only son of Sir Edward W. Fithian, J.P., of London, was married to Mary Teresa, only daughter of the late George Jaques, of Leeds.

The Malvern U.D.C. has received with regret the resignation of MR. W. J. RENDELL BAKER, gas and electricity engineer, who has been appointed gas and water engineer by the Mansfield T.C. A successor at a salary of £350, rising to £400, was advertised for last week.

Obituary.—MR. FREDERICK BROWN.—We learn with deep regret of the death of Mr. Frederick Brown, of Walsall, at the age of 65 years, after an illness extending over nine months. Mr. Brown was manager of the Wednesbury and Wolverhampton district of the National Telephone Co. until 1884, when he turned his attention to the establishment of the Walsall Electrical Co. In July, 1892, the business was converted into a limited liability company, with the deceased gentleman as managing director. The *Walsall Observer* remarks that it was largely owing to Mr. Brown's undoubted business acumen, tempered with a strong sense of justice and a generous nature, that the firm has made such satisfactory progress. As consulting electrical engineer to the Walsall Corporation many years ago, Mr. Brown reported on electric traction systems in the United States, and it was upon his advice that the overhead trolley system now in use was adopted. For very many years he took a leading part in the affairs of the local Chamber of Commerce.

NEW COMPANIES REGISTERED.

Western Engineering Co., Ltd. (130,527).—This company was registered on August 6th, with a capital of £2,000 in £1 shares, to take over the business of an electrical and general engineer carried on by C. E. Isaac, at 24, Frogmore Street, Bristol, as the Central Engineering Co. The subscribers (with one share each) are:—Mrs. M. R. Isaac, 10, West Shrubbery, Bristol; C. W. Isaac, 24, Frogmore Street, Bristol. Private company. The number of directors is not to be more than three; C. W. Isaac is first permanent director; qualification, £50; remuneration as fixed by the company. Registered office, 24, Frogmore Street, Bristol.

Mossay & Co., Ltd. (130,519).—This company was registered on August 6th, with a capital of £2,000 in £1 shares, to carry on the business of railway, motor, mechanical, electrical and general consulting engineers and manufacturers, founders, tool-makers, car, coach, carriage and van builders, woodworkers, manufacturers of and dealers in machinery, vehicles, boats, diving and flying machines, &c., and to enter into a contract with P. A. Mossay. The subscribers (with one share each) are:—P. A. Mossay, 4, Abbots Road, Hampstead, N.W., civil and consulting engineer; A. J. Makower, 37, Maresfield Gardens, Hampstead, N.W., electrical engineer. Private company. P. A. Mossay is first managing director, with power to appoint others; qualification, £250 shares. Registered office, 45, Horseferry Road, Westminster.

J. T. Pickering Hoist and Engineering Co., Ltd. (130,544).—This company was registered on August 7th, with a capital of £1,000 in £1 shares, to carry on the business of general mechanical engineers, manufacturers of hoists and lifts, motors, and electrical and other appliances, &c., and to adopt an agreement with J. T. Pickering. The subscribers (with one share each) are:—J. T. Pickering, 41, Evington Road, Leicester, engineer; J. B. Smith, 308, Aylestone Road, Leicester. Private company. The number of directors is not to be less than two or more than three; the first are J. T. Pickering and J. B. Smith; qualification, £1; remuneration as fixed by the company. Registered by J. T. Pickering, 41, Evington Road, Leicester.

W. Parsons & Co., Ltd. (130,508).—This company was registered on August 5th, with a capital of £2,000 in £1 shares, to take over the business of an electrical, mechanical and general engineer and contractor, by W. Parsons at Regent Street, Leamington, Warwick, as "Parsons & Co." The subscribers (with one share each) are:—W. Parsons, Regent Street, Leamington, electrical engineer; G. Williams, 156, Edmund Street, Birmingham, solicitor. Private company. The number of directors is not to be more than five; W. Parsons is sole director. Solicitor, G. Williams, Bank Buildings, Cradley Heath. Registered office, Regent Street, Leamington, Warwick.

Edison Accumulators, Ltd. (130,495).—This company was registered on August 5th, with a capital of £150,000 in 135,000 7 per cent. participating preference shares of £1 each, and 300,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of, and dealers in, electric storage batteries of all kinds, and apparatus and things used in connection with the generation, distribution, supply, accumulation and employment of electricity, electrical and general engineers, proprietors of motors, carriages, omnibuses and other conveyances, motor garage proprietors, marine engineers, &c., and to adopt an agreement with J. F. Monnot. The signatories (with one preference share each) are:—A. E. Lambert, 33, Loxley Road, Wandsworth Common, S.W., solicitor; J. M. Burchell, 56, Hurlingham Court, Fulham, S.W., solicitor; C. Vince, Croydon, Elm Park Gardens, Barnes, S.W., clerk; W. A. French, 171, Carlingford Road, West Green, Tottenham, N., cashier; C. Hendy, 5, Marney Road, Clapham Common, S.W., clerk; C. Giggs, 65, Arlingford Road, Tulse Hill, S.W., clerk; J. A. Braik, 20, Cambridge Road, Wimbledon, S.W., accountant. Minimum cash subscription, £25,000. The first directors (to number not less than three or more than eight) are Lord Montague of Beaulieu, 62, Pall Mall, S.W., Col. H. C. L. Holden, C.B., F.R.S., M.I.E.E., Gifford House, Blackheath, A. L. Pearse, Worcester House, Walbrook, E.C., and J. F. Monnott, 49, Old Broad Street, E.C.; qualification (except first directors), £250; remuneration (except managing director), £200 per annum (chairman, £300). Registered office, 49, Old Bond Street, W.

Opel Motors, Ltd. (130,548).—This company was registered on August 7th, with a capital of £15,000 in £1 shares, to acquire the business carried on by the British Electromobile Co., Ltd., at 5 and 6, Halkin Street, Hyde Park Corner, and elsewhere, to carry on the business of agents for the sale, hire or exchange of Opel and other motor-cars and vehicles (complete with body or chassis only) and accessories, body and frame builders, tire manufacturers and dealers, suppliers of electricity, petrol or other power, &c., to adopt agreement with the said company and R. B. Tyler, C. F. G. R. Schwerdt and D. Watson, and to acquire the benefit of an agency agreement between Adam Opel and the said C. F. G. R. Schwerdt and D. Watson. The subscribers (with one share each) are:—F. R. While, 18, Holmewood Road, South Norwood, S.E., clerk; J. T. R. H. Dormer, Oak Farm, Billericay, Essex, clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. F. G. R. Schwerdt, D. Watson and A. W. S. Pocklington; remuneration as fixed by the company. Registered office, 1, Queen Victoria Street, E.C.

Tempo Electric Supply Co., Ltd. (4,018).—This company was registered in Dublin on August 1st, with a capital of £500 in £1 shares, to carry on the business of electricians, engineers, dealers in electricity, motive power and light, &c. The subscribers (with five shares each) are:—Rev. J. Wilson, The Rectory, Tempo, Co. Fermanagh; Rev. P. S. O'Neill, Tempo; C. Grady, Tempo, national teacher; S. R. Gibson, J.P., Tempo; J. McKigney, Tempo, farmer; B. Breen, Tempo, merchant; P. Maguire, Tempo, merchant; E. McCaffrey, J.P., Tempo; E. Rogers, Tempo, national teacher; Rev. J. Wilson, Tempo. Private company. The number of directors is not to be les

than three or more than 10; the first are the Rev. J. Wilson, Rev. P. S. O'Neill, C. Brady, S. R. Gibson, J. McKigney, P. Maguire, B. Breen, E. McCaffrey, J.P., E. Rodgers and Rev. J. Wilson (hon. secretary). Registered office, Tempo, Co. Fermanagh.

Leyburn Electric Supply Co., Ltd. (130,488).—This company was registered on August 2nd, with a capital of £1,200 in £1 shares, to carry on the business of an electric light company at Leyburn, Yorks., and elsewhere. The subscribers (with one share each) are:—F. Wilson, Leyburn, draper; P. Dobson, Leyburn, postmaster; J. Watmough, Leyburn, farmer; R. May, Leyburn, plumber; C. W. Sanderson, Leyburn, joiner; C. W. Plews, Leyburn, printer; Mrs. K. Dobson, P.O., Leyburn. Minimum cash subscription, £700. The number of directors is not to be less than four or more than six; the first are F. Wilson, P. Dobson, J. Watmough and R. May; qualification, £50. Solicitors, Chapman & Wilkinson, Leyburn, Yorks. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Westinghouse Electric and Manufacturing Co., Ltd. (62,414).—Return dated May 19th, 1913. Capital, £1,875,000 in 500,000 pref. shares of £3 each, and 75,000 ord. shares of £5 each. All shares taken up. £1,500,000 paid on the pref. £375,000 considered as paid on the ord. Mortgages and charges: £1,462,553.

British Thomson-Houston Co., Ltd. (47,982).—Return dated July 11th, 1913. Capital, £800,000 in £10 shares (40,000 ord. and 40,000 pref.). All shares taken up. £10 per share called up on 32,531 ord. and 40,000 pref. £725,310 paid. £74,690 considered as paid on 7,469 ord. shares. Mortgages and charges: £245,715.

Hewson Manufacturing Co., Ltd.—Particulars of £1,000 debentures, created April 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electrical Power Storage Co., Ltd.—Issue on July 30th, 1913, of £5,000 debentures, part of a series of which particulars have already been filed.

Renton, Holdsworth & Co., Ltd. (102,086).—Return dated June 17th, 1913. Capital, £10,000 in £1 shares: 6,652 shares taken up; £1 called up on 6,052; £6,052 paid; £600 considered as paid on remainder. Mortgages and charges: Nil.

Perth Electric Tramways, Ltd.—A memorandum of satisfaction in full of debenture stock and debentures issued under trust deeds dated August 19th, 1901, and December 30th, 1903, securing £100,000 has been filed.

CITY NOTES.

Tyneside Tramways and Tramroads Co.

In their half-yearly report the directors state that the surplus of receipts over expenditure is £5,446, plus £427, making a total to the credit of profit and loss account of £5,873, and after deducting interest on debentures, loans, &c., amounting to £1,009, there remains an available balance of £4,864. The directors propose to pay a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; a dividend on the ordinary shares at the rate of 3 per cent. per annum (less income-tax), £2,008; putting to the credit of reserve for renewals, depreciation and other contingencies, £1,200, which is now £14,538; setting aside for the reduction of registration and formation expenses, &c., £330, leaving to be carried forward £724.

The half-yearly meeting was held at Newcastle-on-Tyne on 11th inst., Dr. J. T. Merz (chairman) presiding.

The Chairman, in proposing the adoption of the above report, said the accounts did not show much difference compared with last year. There was, nevertheless, an appreciable increase in the revenue, and, as a consequence, in the dividend proposed. The revenue was £1,049 more than the corresponding half of last year, which was a record. The increase on the ordinary traffic was £579, on workmen's traffic £59, and on holiday traffic £411. It was especially satisfactory to note that the ordinary traffic was gradually increasing, for this furnished the most important part of the company's income. The holiday and workmen's traffic was always subject to such contingencies as the weather and the state of trade in the district. The number of passengers had increased by 214,503, which was not quite so large an increase as was reported a year ago—240,000. The revenue per car-mile had been 9·498d.; a satisfactory figure. Last year it was 9·28d., in 1911 it was 8·8d., and a year before that it was 8·2d. Meanwhile, the expenses per car-mile were 6·27d., compared with 6·01d. in the corresponding half of last year, the increase being due, to a large extent, to the expenses for maintenance, which were now defrayed entirely out of revenue. If maintenance became more expensive they would, of course, have to draw upon the reserve fund, which was created for that purpose. The increase of available profit for the half-year it was proposed to deal with by paying a dividend at the rate of ½ per cent. more, absorbing £335; by putting to the reserve fund £1,200 instead of £1,000, as was the case last year, and by increasing the investments in Consols £87. They had reduced their loans by £160. Their reserve now stood at £14,538, as against £11,750 a year ago. He was pleased to state that there was a slow but steady improvement in the affairs of the company. The directors might have proposed to pay a larger dividend, but their policy had always been first to strengthen the reserve fund, and, secondly, to give only such an increase as they could reasonably expect to maintain. They hoped in the next half-year to be in a position to increase the dividend in a similar manner.

Mr. G. E. Henderson seconded the report, which was carried unanimously.

Fairbairn, Lawson, Combe, Barbour, Ltd.—The directors have declared an interim dividend on the preference and ordinary shares at the rate of 5 per cent. per annum for the half-year ended June 30th.

Japan.—The *Indian Textile Journal* for July quotes the *Osaka Asahi* as follows:—

"The profits of the electric tramways in the neighbourhood of Osaka, Japan, for the half-year ending March 31st—with the exception of the Keihan Electric Tramway—have shown a heavy decrease as compared with the figures for the preceding period. The various companies are experiencing great difficulty in arranging their rates of dividend for the period just closed; but, owing to various circumstances, some cannot reduce their dividends, and these have determined to pay the same dividend as hitherto declared. It is said that 13 per cent. for the Hanshin, 9 per cent. for the Nankai, and 7 per cent. for the Mino-Arima are foregone conclusions, while 6 per cent. for the Hankai and 5 per cent. for the Koya Tozan and the Osaka Tramway are almost equally certain. The directors of the Keihan are inclined to recommend a dividend of 6½ per cent., but the large shareholders are demanding an increase to 7 per cent. The Kyoto Electric Tramways has suffered the heaviest decrease of profit, and opinion is divided among the directors as to whether 3 or 4 per cent. should be declared."

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books, &c., will be closed from August 18th to 30th (both days inclusive), for preparation of warrants for interim dividends payable 31st inst.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum on the issued share capital in respect of the half-year ending July 31st, payable, less income-tax, on August 31st.

Harper Electric Piano (1910) Co., Ltd.—The directors have declared a dividend at the rate of 2½ per cent. on the participating ordinary shares for the half-year ended June 1st, making 3¾ per cent. for the year.

Reduction of Capital.—Otis Elevator Co., Ltd.—A petition for reducing the capital from £200,000 to £68,190 is now pending. The list of creditors is to be made out as from September 13th.

Continental.—Belgium.—La Société d'Installations et d'Exploitations Electriques is the name of a new company which has just been formed in Brussels (46, Rue de l'Association) with a capital of £1,200.

Germany.—The Körting Electricitätswerke Gesellschaft, of Berlin, reports a net profit of £15,522 for the last financial year, as compared with £15,517 in the preceding twelve months. A dividend of 8 per cent. is being maintained.

Hadfield's Steel Foundry Co., Ltd.—The directors have declared an interim dividend of 5 per cent. (1s. per share), free of income-tax, on the ordinary shares for the half-year to December 31st.

Oxford Electric Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum on the ordinary shares for the half-year ended June 30th.

John Spencer & Sons, Ltd.—The directors recommend a dividend on the ordinary shares of 3½ per cent., making, with 2½ per cent. already paid, 6 per cent. for the year ended June 30th.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets as a whole show a good deal of strength. There is not a lot of business going on; but, notwithstanding this, the various markets are well maintained, and the reluctant peace to which Bulgaria has been forced is accepted as likely to last—at all events for some time. The countries which have been engaged in the Balkans trouble require time during which to put their finances in order; and it is hoped that for some months at least peace may be preserved.

The Home Railway market continues to improve. Big rises in many stocks took place to-day (Tuesday). The Undergrounds have shaken off much of their recent weakness, and Metropolitan Consolidated in particular has shown considerable strength. The price rose 3¼ to 48¼. Districts are 2 higher. Central London is hardened as regards the assented stocks. Underground Electric Railways further advanced, upon expectations of the current year providing a possible dividend on the ordinary shares, and possibly the "A" shares as well. Those £10 paid, after their rise of 7s. 6d. last week, have gained a further half-a-crown, and the 1s. shares at 11s. 3d. are better. A spurt of 3 points raised the Income bonds to 94½.

London United Tramways Debenture maintained its substantial recovery, but the London and Suburban issues remained weak, and British Electric Traction 6 per cent. Preferred stock is ½ down at 8½. On the other hand, B.E.T. 7 per cent. Preferred stock gained a point.

The metropolitan electric lighting shares are mostly firm. City of London Ordinary rose 10s., and Counties have further improved, there being a fair amount of demand for both. Westminsters are ⅛ better. The inquiry has extended to other shares in the London

group, and the market shows a good deal of strength. Brompton and Kensington reacted a trifle after their recent improvement.

One of the disquieting features which have upset markets during the past few days has been the diplomatic friction engendered between the United States and Mexico. Fears were immediately revived that the incident might lead to an outbreak on the part of the Mexican mob, and declines took place in most of the securities connected with the country. A swift recovery followed upon the more pacific news of the early part of this week. The shares and bonds of the utility companies exhibit quite big rises on balance. Mexican Light and Power Common and Preferred advanced 1, but Mexico Trams are 6 points higher at 96½, and both classes of the company's bonds are better. At the same time, Rio and Sao Paulo bonds rallied. Brazil Tractions soared to the extent of 5½ points, "bears" being nearly caught napping. Manaos Trams have gone ahead on a very unexpectedly good report. The Argentine group is a little irregular.

Telegraph descriptions continue firm, and most of the changes in the list show improvements. The Eastern group is good, with Eastern Extensions ⅜ up, to 12⅝, Eastern Telegraph Ordinary stock keeping firm at 128½. West India and Panama shares came into demand upon the buoyancy exhibited by the American market; they are 5s. to the good. Western Telegraph rose to 13, and the Anglo-American group shows pronounced steadiness. Globe Telegraphs are firm, and most of the Debenture stocks in this section are more difficult to buy than they are to sell. Reuters are beginning to throw off the weakness which they have endured for so long, and the price this week shows a 10s. improvement at 9¾. National Telephone Deferred rose to 7½, to react later to 6½. The Marconi group, after being good, went back a little, the parent company's Ordinary and Preference shares exhibiting small net rises on the week, but both have been better than the present quotations. Canadians remained about 8s. 6d.; Americans touched 18s. 3d., reacting later to 17s.

Mackay Common rose 3, with Yankee Rails. American Telephone capital stock is rather higher.

Most of the stocks and shares connected with the Manufacturing group are steady to good. The feature is the strength of India-Rubber shares, which have risen no less than 25s., a small demand sufficing to show the limited number of shares on supply. Henley's put on 5s. Babcock & Wilcox are ⅛ up, the Iron and Steel share market being a good one just now. British Thomson-Houston Debenture fell back to 96½. British Westinghouse Preference are 1/16 higher at 15s.

The Rubber share market has advanced sharply again, and at the Stock Exchange settlement this week it became obvious that the Bear account was still a large one. At the auction sales in Mincing Lane no fresh feature developed of special interest, but the prices obtained were rather better than those which have been ruling of late. It is expected that the Committee, which is sitting to investigate the conditions under which the produce is sold, will be evolving before long some scheme whereby better prices can be obtained, and it is upon the strength of this that hopes of a further rise in prices are built. The market for copper, the metal, has been a little less firm, which to the outsider seems natural enough, in view of the exceedingly sharp rise which it has recently enjoyed. Still, every reaction seems to be followed by further recovery, and the price at the time of writing is close to £70 per ton.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Bath	July 30	4,994	+ 782	31	28,384	+ 1,356	..	..
Blackpool-Fleetw'd	Aug. 2	7,458	+ 674	4	07,458	+ 674	8	..
Bristol	„ 1	36,872	+ 6,098	..	239,316	+ 31,384	30·5	..
‡Brit. Elec. Trac. Co.	„ 1	108,910	+ 6,396	..	789,579	+ 47,717	..	..
Chatham and Dist.	July 31	8,906	+ 119	30	27,040	+ 1,208	14·98	..
Cork	„ 31	2,305	+ 141	30	14,905	+ 11	9·89	..
Dublin	Aug. 1	26,057	+ 1,096	..	181,848	+ 4,178	54·25	..
Hastings	July 31	4,943	+ 114	..	..	+ 1,387	19·3	..
Lancashire United	„ 30	6,567	+ 645	30	44,917	+ 4,464	39	..
Llandudno-Col. Bay	Aug. 1	2,446	+ 239	35	9,807	+ 976	6·5	..
London United	„ 1	27,875	— 652	..	189,578	— 1,065	..	..
Tyneside	July 30	2,203	+ 89	5	2,325	33	11	..
Anglo-Argentine	July 29	218,982	+ 24,955	..	1,670,765	+ 145,594	..	..
Auckland	..	..	..	..	..	..	24·36	1·05
Bombay (B.E.T.)	Aug. 1	12,050	+ 482	28	87,025	+ 3,318	..	..
Brisbane	July	26,205	+ 3,145	..	177,208	+ 46,494	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 2	17,366	+ 1,080	..	..	+ 6,112	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A.	June	2,854	..	..	17,226	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
‡Madras	July 31	3,720	+ 436	..	25,005	+ 1,870	15·25	1
Montevideo	July	29,189	+ 3,754	..	287,602	+ 23,745	..	..
Cen. London Rly.	Aug. 2	17,474	+ 625	31	115,494	13,313	6·78	·4
City & S. Lon. Rly.	„ 2	10,986	— 359	31	87,919	— 8,110	7·26	..
‡Dublin-Lucan Rly.	„ 1	845	+ 98	..	..	..	7	..
G.N. and City Rly.	..	..	..	..	..	..	3·5	..
L'pool Overh'd Rly.	Aug. 3	7,906	+ 1,154	..	52,500	+ 4,107	6·6	..
London Elec. Ry. Co.	„ 1	50,775	+ 1,970	31	433,740	+ 5,510	21·25	..
Mersey Railway	„ 2	9,025	+ 685	31	69,271	+ 4,670	4·5	..
Metropolitan Rly.	„ 3	68,629	+ 857	31	521,315	+ 3,479	25·75	..
Met. District Rly.	Aug. 2	51,011	+ 2,423	31	407,187	+ 16,507	25	..

‡ 4½ weeks.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21 10	..
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£3 6	..
a Sodium Bichromate, casks	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	⅛d. inc.
c „ Tube (brazed)	„	10d.	inc.
c „ „ (solid drawn)	„	8¾d.	inc.
c „ Wire, basis	„	8d.	⅛ inc.
c Copper Tubes (brazed)	„	11½d.	inc.
c „ „ (solid drawn)	„	10⅝d.	inc.
g „ Bars (best selected)	per ton	£85	£1 inc.
g „ Sheet	„	£85	£1 inc.
g „ Rod	„	£85	£1 inc.
d „ (Electrolytic) Bars	„	£73	£6 10s. inc.
d „ „ Sheets	„	£91	£6 10s. inc.
d „ „ Rods	„	£78 10	£6 10s. inc.
d „ „ H.C. Wire	per lb.	9½d.	1d. inc.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	3/10	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	54/11	4d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£21 5 to £21 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£193 to £194	£9 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	1d. inc.
p White Anti-friction Metals	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 5	5s. inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

International Light and Power Co., Ltd.—$1,000,000 six per cent. cumulative preferred stock.

To appoint a special settling day in—

International Light and Power Co., Ltd.—$2,500,000 common stock.

Marconi's Wireless Telegraph Co., Ltd.—The directors' report, published yesterday morning, shows that during the year ended December, 1912, the gross profit was £537,243, as compared with £214,407 for 1911. The net profit is £413,295, as compared with £141,717 for 1911. Dividends of 17 per cent. on the preference shares and 20 per cent. on the ordinary for the year, require £42,500 and £149,921 respectively. A reserve fund is started with £100,000, and £146,726 is carried forward. We shall deal with the report more fully in our next issue.

Tyneside Electrical Development Co., Ltd.—An interim dividend of 5 per cent. is declared.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	£10	5½	6	9½ — 10½	..	5 14 3
Do. 4½ % Pref.	£10	4½	4½	8½ — 9½	..	4 12 4
Do. Second 6 % Pref. ..	£10	6	6	10⅛ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 96	+1½	4 11 10
Brompton & Kensington, Ord...	£5	10	10	8½ — 9	— ⅛	5 11 1
Do. 7 % Cum. Pref.	£5	7	7	8½ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	£100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	£5	5	5†	4⅛ — 4⅜	..	5 5 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	£5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb... ..	£100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	£5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	£10	8	9	15 — 16½	+ ½	5 9 1
Do. 6 % Cum. Pref.	£10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	£100	4½	4½	98 —100	..	4 10 0
County of London, Ord... ..	£10	6	6	11 — 11½	+ ¼	5 4 4
Do. 6 % Pref.	£10	6	6	11½ — 12	+ ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	+ ½	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	£5	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	£5	..	..	1⅝ — 2	— ⅛	..
Do. 4½ % First Mort. Deb. ..	£100	4½	4½	79 — 82	..	5 9 9
Folkestone	£5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	£5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	£100	4½	4½	88 — 90 xd	..	5 0 0
Hove	£5	9	9†	7¾ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	£5	9	8†	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	88 — 91 xd	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	£8	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	£5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	£5	4	4†	3½ — 3¾	..	5 6 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 4⅜	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	£100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	£10	6	6	9½ — 10½	..	5 14 3
Oxford	£5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	£5	10	10†	8½ — 8¾ xd	..	5 14 3
Do. 7 % Pref.	£5	7	7	6½ — 7 xd	..	5 0 0
Do. 3½ % Deb.	£100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	£4	5	5½	2¾ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	£100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref...	£1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	£100	4½	4½	96 — 99	..	4 10 6
Urban, Ord...	£8	Nil	Nil	½ — ¾	..	..
Do. 5 % Cum. Pref.	£5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	£100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	£5	10	10	8½ — 8¾	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅞ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	£5	6	6	5 — 5¼	..	5 14 8
Calcutta, Ord.	£5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	£5	5	5	5 — 5¼	— 1/16	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90 — 92	..	5 8 8
Canadian Gen. El. Com. ..	$100	7	7	108 —112	..	6 5 0
Do. 7 % Pref.	$100	7	7	119 —124	+1	5 12 11
Cordoba Lt., Power and T., Ord.	£1	8	5	5/8 — 11/16	..	6 8 1
Do. 5 % Deb.	£100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	£100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	£100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	— ½	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — 5/32	..	Nil
Do. 6 % Pref.	£1	6	6	7/16 — 5/8	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	+1	4 17 1
Madras, Ord.	£5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	£100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	62 — 64	+1	6 5 0
Do. 7 % Cum. Pref.	$100	7	7	93 — 98	+1	7 2 10
Do. 5 % 1st Mort. Gold Bds.		5	5	85 — 88 xd	..	5 13 8
Do. 5 % 2nd Mort. Bonds ..	£100	5	5	74 — 77	..	6 9 10
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	£100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	207 —217 xd	..	4 2 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	£100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	126 —130	+2	4 4 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	+ ⅛	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	£100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	£1	11¼d.	17½d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	£100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	130½ —133½	+ ½	5 19 10
Do. Collat. Trust	$1000	4	4	90½ — 92½	..	4 6 6
Anglo-American Telegraph ..	Stock	8	8	60 — 63	..	4 15 3
Do. 6 % Pref.	Do.	6	6	108 —109	..	5 10 1
Do. Def.	Do.	80/-	80/-	23⅜ — 23⅝	..	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	£100	5	5	104 —106	..	4 15 3
Chili Telephone	£5	7	8	7 5/16 — 7 9/16 xd	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	£10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	£10	10	10	15⅝ — 16⅝	..	5 19 4
Direct Spanish Telegraph, Ord.	£5	4	4†	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	£5	10	10	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	£10	5	4	6¾ — 7¼ xd	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	£100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	75½ — 77½	..	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	+1⅛	4 2 11
Eastern Extension	£10	7	7	12⅜ — 12⅝	+ ⅜	5 8 9
Do. 4 % Deb.	Stock	4	4	92 — 94 xd	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	£25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	£10	6	6†	10⅜ — 11¼	..	5 6 8
Do. 6 % Pref.	£10	6	6	12 — 12⅝	+ ⅛	4 16 0
Great Northern Telegraph ..	£10	18	20	30 — 32	+ ½	6 13 0
Indo-European Telegraph ..	£25	18	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	82 — 84	+3	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	£1	20	..	8⅝ — 8¾	+ 1/16	5 6 8
Do. 7 % Cum. Partic. Pref.	£1	17	..	3 — 8¼	+ ⅛	5 4 7
Monte Video Telephone, Ord. ..	£1	6	6†	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	£1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	£100	4½	4½	99¼ — 100¼	+ ¼	4 9 9
Oriental Telep. and Elec. ..	£1	8	10	1 3/32 — 1 7/32	..	5 8 6
Do. 6 % Cum. Pref.	£1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	£10	10	10	9½ — 10	+ ½	10 0 0
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	£5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	£5	5	5	5 — 5½	..	4 11 0
West Coast of America	£2½	2½	..	1 3/16 — 1 1/4	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	£100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	£10	1½	1½	2 9/16 — 2 13/16	+ 3/16	4 8 10
Do. 6 % Cum. 1st Pref. ..	£10	6	6	9⅜ — 10⅜	+ ⅛	5 18 5
Do. 6 % Cum. 2nd Pref. ..	£10	6	6	9⅜ — 9⅞	..	6 1 6
Do. 5 % Debs.	£100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	£10	7	7†	12¾ — 13¼	+ ⅛	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 12th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	7½ — 9½	— ½	..
Do. Do. Deferred ..	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	+1	7 6 4
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	72 — 76	..	5 18 5
Central London Railway, Ord.	100	3	3	73 — 75 xd	..	4 0 0
Do. Gtd. Assented	100	..	..	81 — 83	+1	4 16 5
Do. Pref.	100	4	4	73 — 80 xd	..	5 0 0
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	79 — 81	+1	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100 xd	—1	5 0 0
Do. Do. 1896	100	5	5	98 —100 xd	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99 xd	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99 xd	+1	5 1 9
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2⅝	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	¼ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	9/16 — 11/16	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	+1	6 5 0
Metropolitan Railway Consol. ..	100	1⅞	1⅝	48 — 48½	+3¼	3 7 0
Do. Surplus Lands	100	2⅞	2⅝	59 — 61 xd	..	4 10 2
Do. 8½ % Deb.	100	8½	8½	83 — 85 xd	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	81 — 83 xd	..	4 4 4
Do. 8½ % Con. Pref.	100	8½	8½	77 — 79 xd	..	4 8 7
Metropolitan District Ord. ..	100	Nil	Nil	35 — 35½	+ 2	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	81 — 83 xd	..	5 8 3
Do. 8½ % Gtd.	100	8½	8½	74 — 76 xd	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91 — 94	— ½	5 6 5
Potteries, Ord.	1	4½	3½	9/32 — 13/32	..	..
Do. 5 % Pref.	1	6	5	7/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — ¾	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3⅞ — 4⅛	+ ⅛	Nil
Do. "A"	1/-	4½	..	½ — 5/8	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	111 —113	+1	5 6 2
Do. 4½ % Bonds	100	Nil	4½	99 —101	+1	4 9 1
Do. 6 % Income	100	3	6 †	94 — 95	+3	6 6 4
Yorkshire (West Riding), Ord.	5	..	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	..	3†	3⅞ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 5 15/16	— 1/16	5 11 4
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	+ ⅛	6 0 7
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	— ⅛	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	92½ — 94½	+5½	6 7 0
Brisbane Trams Invt., Ord. ..	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	124 —129	+1	6 4 0
Do. Pref. Ord.	100	6	6	109 —114 xd	..	5 5 3
Do. 5 % Pref.	100	5	5	102½ —105½ xd	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102 xd	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	+ 1/16	4 17 7
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5⅜ — 5⅞	+ 1/16	4 8 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 85	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	29/32 — 1 1/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	4½d.	1 3/32 — 1 11/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	5	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	86½ — 89½	..	5 11 9
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99 — 101	..	4 19 0
Mexico Trams Com.	$100	7	7†	95 — 98	+6	7 2 10
Do. Gen. Con. 5 % Bonds ..	..	5	5	88 — 91	+1	5 9 11
Do. 6 % Bonds	100	6	6	87 — 90	+1	6 13 4
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6⅛ — 6½	..	7 13 10
Do. 6 % Pref.	5	5	6	4¾ — 5⅛	+ ⅛	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	+ ½	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 5 % Bonds	..	5	5	100 —102	+1½	4 18 0
Do. 5 % Mort. Bonds ..	100	5	5	95 — 97	+2	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101 — 103	+1	4 17 1
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Un. Elec. Trams Monte Video ..	5	7	7	4½ — 5	+ ⅛	7 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —102	+ ½	4 8 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	25/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	28	16	3 — 3⅛	+ ⅛	5 2 5
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord. ..	1	Nil	..	7/8 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	¾ — ⅞	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	..	5 17 8
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5¾ — 6½ xd	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	95 — 98	—1½	4 11 10
British Westinghouse, Pref. ..	8	Nil	Nil	⅝ — ⅞	+ 1/16	Nil
Do. Deb...	100	4	4	62 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —8/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅝ — 11⅜	..	6 11 10
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3 1/16 — 3 1/16	..	5 4 11
Do. Deb...	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/16 — 9/16	..	..
Do. Pref.	1	6	6	31/32 — 1 3/32	..	7 13 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1 3/4	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1 — 1½ xd	..	8 0 0
Do. Pref.	2	7	7	1 3/16 — 2 1/16 xd	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7⅛ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	6	9¾ — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12½ — 13	+ ½	5 15 5
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb...	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	12¾ — 13¾	+1½	5 9 1
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction.. ..	12	17½	20	35 — 37	..	6 7 2
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

THE BILLITER-SIEMENS ELECTROLYTIC ALKALI CELL AND PROCESS.

By JOHN B. C. KERSHAW.

The Billiter-Siemens cell is protected by English patent No. 7,757 of 1907, and is the invention of Dr. Jean Billiter, of Vienna. Since the patent was granted the cell has been thoroughly tested on a practical industrial scale at the Kaliwerke Aschersleben in Germany, and at two small installations of a similar character in Austria, and the patent rights for Europe have passed into the hands of Messrs. Siemens and Halske, of Berlin, while the Kaliwerke Aschersleben control the American and Colonial rights. At the present date there are five works in operation where the Billiter-Siemens cell and process are employed, the most important

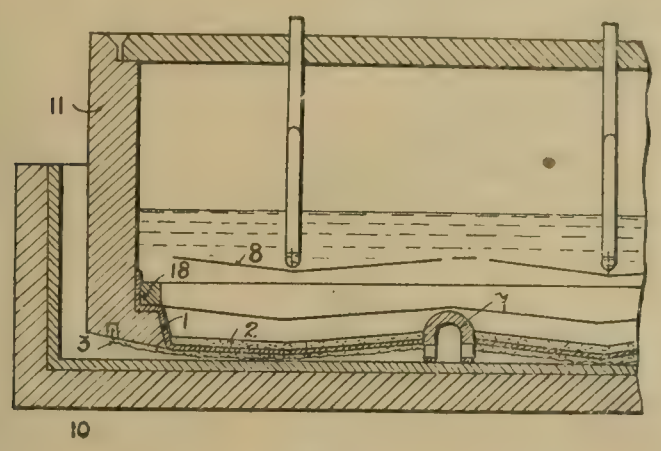


Fig. 1.

of these being the installation at the works of the Niagara Alkali Co., successors to the old Roberts Chemical Co. Details of these five installations of the Billiter-Siemens cell and process are given in Table I, and it may be remarked that the Niagara plant is at present being enlarged to three times its original size, and that 3,000 kw. will be ultimately required for operating the cells at this factory.

Description of Cell and Cell Process.

The Billiter-Siemens cell is a combination of the "bell" type of gravity cell and a horizontal diaphragm, by means of which the known disadvantages of this type of cell are minimised. These disadvantages were fully demonstrated during the trials of the Richardson & Holland bell-type of

TABLE I.—Locality and Capacity of Works employing the Billiter-Siemens Diaphragm Cell.

Title of firm and locality of works.	No. of cells.	Capacity of cells.	kw. utilised.
Kaliwerke Aschersleben Akt. Gesell. (Aschersleben, Saxony)	10	2,000 amps.	100
Bosnische Elektricitäts Akt. Gesellchaft (Brückl, Austria)	64	2,500 amps.	650
Ignaz Spiro & Sohne (Krummauer, Bohemia)	32	500 amps.	65
Farb-Werke Höchst (Höchst, Germany)	?	?	?
Niagara Alkali Co. (Niagara Falls)	50	3,000 amps.	1,000

cell, by the Electrochemical Co. at St. Helens, in the years 1895-1900, and the disappointing results that followed the erection and equipment of this works have handicapped the development of electrolytic alkali processes in this country, even down to the present date. A second attempt to work this type of cell was made in 1899, at Aussig, in Austria, by the Oest Verein fur Chemische Production, and here greater success was achieved. A low concentration of sodium hydrate is, however, only possible with the open gravity type of cell, and according to Allmand* not more than 6,000 h.p. is utilised at the present moment in the Aussig and other works using this cell and process. The Billiter-Siemens cell, one of the latest developments of the bell-type of cell, is shown diagrammatically in figs. 1 and 2. Fig. 1 is

* "The Principles of Applied Electrochemistry," Arnold, 1912.

portion of a longitudinal section of the cell; while fig. 2 is a cross-section of the whole cell, drawn on a reduced scale, as compared with fig. 1.

As described in the patent specification, the cell consists of a bell (11) which is closed at the bottom by a diaphragm (2). The latter rests on an iron or nickel wire net (3) which serves as the negative electrode. The bell stands in a vessel (10). In the inside of the bell is the anode (8), made of platinum or carbon—this is placed parallel to and at a short distance from the cathode wire net (3).

In order to permit of a complete separation of the products of electrolysis (soda-lye and chlorine), the cell is operated as follows:—The bell is filled with the electrolyte to a pre-determined height, whilst the outer vessel (10) remains at first empty. Since the diaphragm is pervious to liquids, the common salt solution works through to the cathode, and forms there soda-lye. The outlet (13) for the lye is in such a position, and of such dimensions, that the liquid in the outer vessel just washes the cathode wire net. In order to allow easy exit for the hydrogen bubbles evolved during electrolysis, the cathode wire net (fig. 1) may be curved, and may be allowed to abut against impervious channels (7) having openings allowing the hydrogen to escape easily; or the straight or corrugated cathode wire net is fixed with a slightly upward slope—a slope of $\frac{1}{20}$ is quite sufficient for the purpose. In order to raise its conductivity, the electrolyte may be warmed by a heating pipe, not shown in the drawing, and the apparatus only works well when suitable diaphragms are used. Diaphragms must be provided therefore, the permeability of which may be adjusted according to the liquid used, without opposing a high resistance to the current; these diaphragms must also be capable of being made to conform to the shape of the cathode. All solid diaphragms, such as corrundum compositions—cement, asbestos board, &c.—have been found to be unsuitable for this reason; and powder diaphragms are also inadmissible, since they cannot be moulded and are not permanent. The ordinary powder diaphragms cannot be used on sloping surfaces, because the powder soon slips off; moreover, they pack together and soon become impervious. For the same reason they cannot be used in combination with solid ribs. The desired result has been obtained in the Billiter cell by covering the wire net cathode with ordinary commercial asbestos cloth (1 in fig. 1), on which is spread a special powder diaphragm (2 in fig. 1).

According to the invention, the diaphragm composition is produced from a mixture of barium sulphate or alumina, with asbestos wool, and this is made into a plastic but tenacious and consistent mass, with a solution of common salt. Such mixtures of suitable powders with asbestos wool, can be made extremely quickly and easily. Whereas, for example, barium sulphate takes several hours to settle in the form of mud, a suspended mixture of barium sulphate powder with asbestos wool will settle in a few minutes, in a solution of common salt of 20 per cent. strength. This

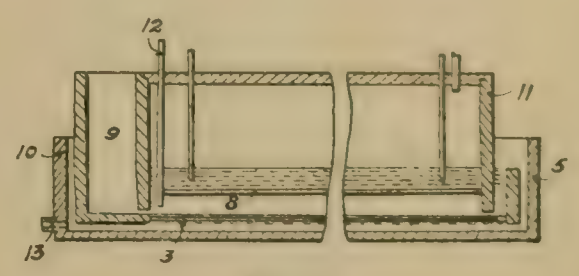


Fig. 2.

deposit, which has at first the consistency of a tenacious mud, can be easily dried, and can take any desired shape, which it retains during use, even when kept for a long time in liquids. According to Muhlhaus, the $BaSO_4$ is best precipitated hot, no change in the size or shape of the grains then occurs in the cell.

These diaphragms are stated to be extremely resistant, they will keep for months or years, and can be quickly and easily changed or renewed, as compared with the ordinary powder diaphragms. It is only necessary to remove the layer of mixed asbestos wool and powder, and to substitute a new layer, which can be done in a few minutes. As an alternative, the asbestos cloth may be taken out, a new one put in, and the diaphragm made up again.

In air, these diaphragms after a short time, dry completely, and become hard; they recover their original pliability and permeability on being placed for a short time in water or in a salt solution.

By altering the proportions of the mixture of asbestos wool and barium sulphate powder or alumina, and also by altering the thickness thereof, the permeability of the diaphragm can be graduated as desired. As a rule in the production of lyes of 8 to 13 per cent. strength, 190 grammes of $BaSO_4$ with

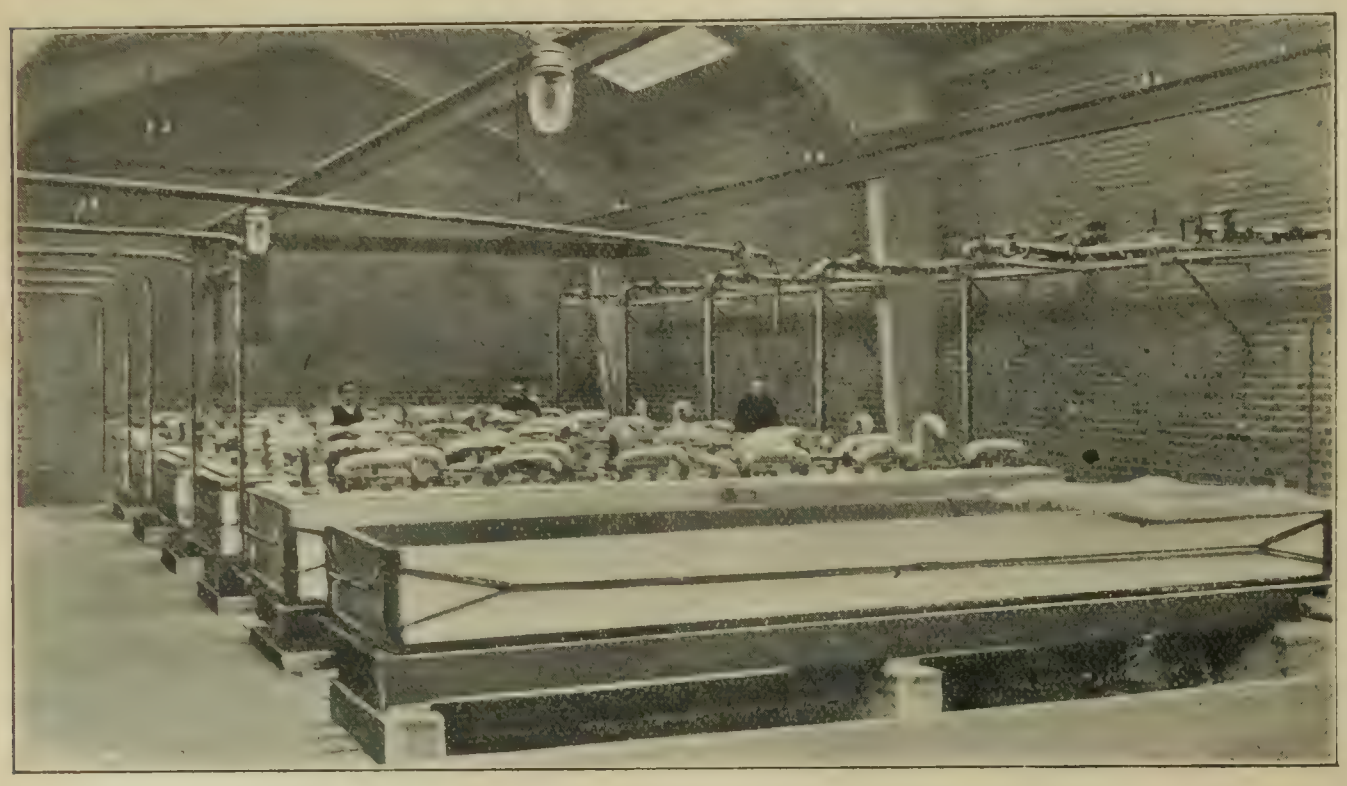


Fig. 3.—Alkali Cells at the Kaliwerke Aschersleben, Saxony.

3 to 6 grammes of asbestos wool are used on 100 sq. cm. surface; for the production of 13 to 18 per cent. lyes, 275 grammes of $BaSO_4$, with 8 to 10 grammes of asbestos wool; and for the production of still more concentrated lye, 350 grammes of $BaSO_4$, with 15 grammes of asbestos wool, are employed.

During the electrolysis, soda lye is formed in the vessel (10), while chlorine ions pass to the anode, are there collected and evolved as gaseous chlorine. Fresh solution is added through the pipe (12), which extends down almost to the diaphragm. During the electrolysis, therefore, the upper part of the solution becomes poor in salt, and the lower part increases in specific gravity; as a result of this difference in specific gravity, a very sharply defined layer is formed directly above the diaphragm. To further facilitate the formation of the layers, a chamber or pocket (9), fig. 2, of impervious material may be fixed to the bell and charged with solid common salt, in order to keep the layer next the diaphragm constantly saturated, and so make it specifically still heavier. This is especially advisable when the feeding is purposely made very slow, in order to obtain highly concentrated lyes; otherwise the solution may readily become impoverished in salt.

The solution arrives at the cathode, not only through the diaphragm but also by being forced over a dam (5), fig. 2, so as to wash the underside of the cathode as well. The cathode net, therefore, is continually washed on its upper and lower sides by the overflow from the dam and by the passage of the solution through the diaphragm. In fig. 2 the intervening space between (5) and (11) is made much larger than it really should be, for clearness sake. In practice, this space is made as narrow as possible to prevent diffusion.

The cells may be made of various materials—such as glass, wire-glass or stoneware plates bedded in cement or asphalte, as shown in fig. 1; they can also be made of armoured concrete or of stone slabs. In small cells (up to 100 amperes) it is advisable to fix the asbestos cloth to the bell. The whole bell with the diaphragm can then be placed on a corrugated wire net, shaped to the form of the outer vessel. The bottom of this outer vessel (10) is advantageously made of sheet-iron, and it then forms a direct conductor for the current to the cathode net. In larger cells (above 100 amperes) this plan is scarcely practicable; and in such cells it is advisable to fix the cathode wire net to the bell. In order easily to renew the diaphragm, if required, without having to take out the bell, the lid of the latter is made readily removable. The asbestos cloth is not fixed to the bell, but is clamped to it by means of a framework of stone or of some other suitable material, with the help of wedges. A more effective joint can be made here if required, by means of an insoluble powder, this asbestos powder mixture being piled upon the diaphragm. In order to renew the diaphragm, it is only necessary to remove the lid, and to lift out the partition and the frame; after this has been done the diaphragm can be removed in a few minutes.

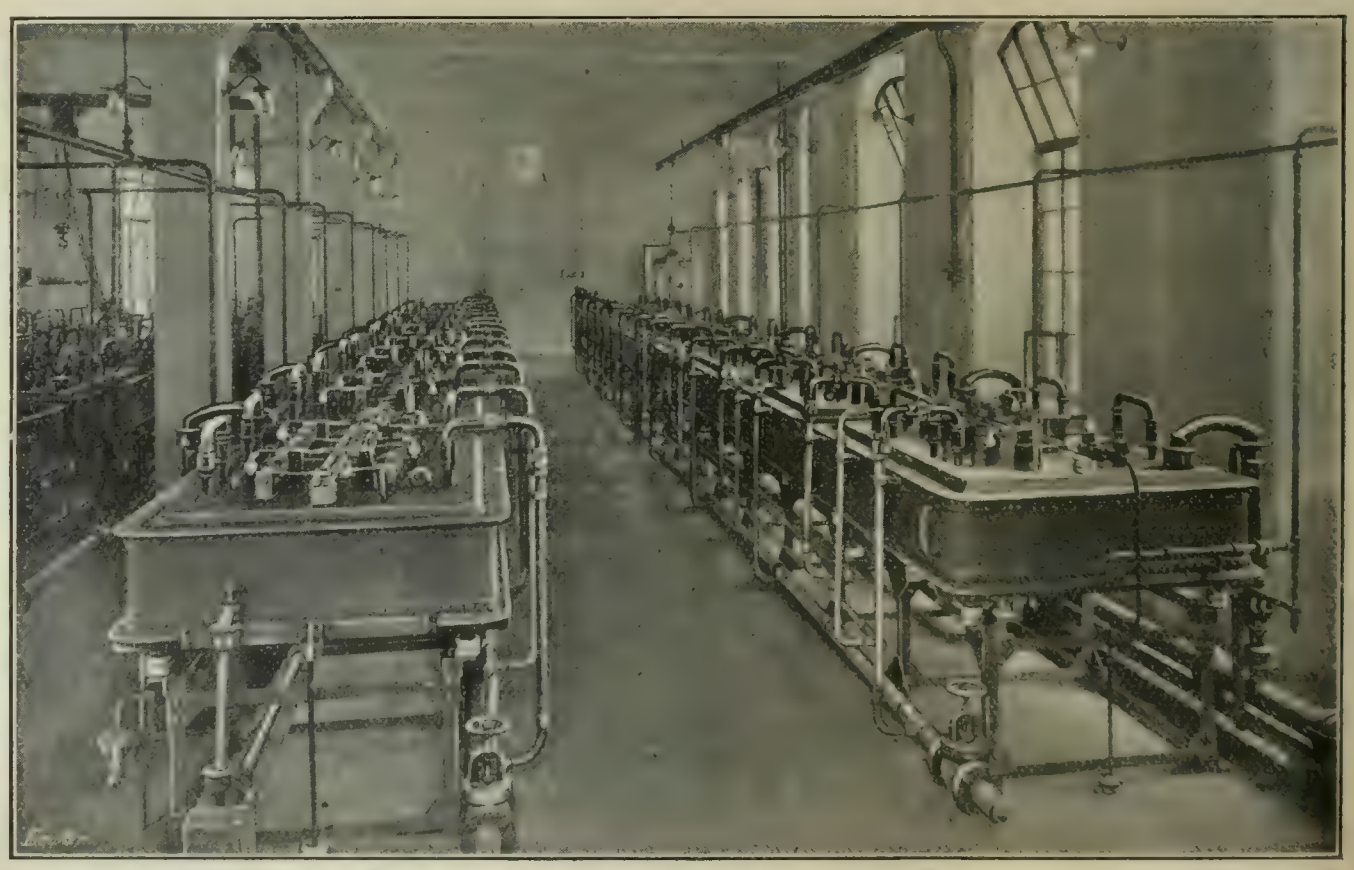


Fig. 4.—Billiter-Siemens Cells at a Bohemian Paper Works.

The experimental trials with this cell, gave a current efficiency of from 85 to 95 per cent., with a concentration

of soda lye of 12 per cent., and chlorine gas of 99 per cent. purity. In the patent specification, the inventor states that concentrations up to 15 per cent. NaOH can be obtained, and that a cell with a cathode surface of 1 sq. metre, when worked at 60° C., will take a current of 600 amperes, with an E.M.F. of only 4 to 4½ volts. According to Allmand, the heating of the cell is effected by means of earthenware pipes immersed in the brine at the top of the bell jars, through which hot water or hot brine is conducted. The anodes in practice are made of graphite or of fused magnetite ($Fe_3 O_4$) and are arranged horizontally over the diaphragm. The maximum capacity of each bell jar is 500 amperes, and six of these must therefore be grouped in one cell to give a unit of 3,000 amperes. Allmand also states that the brine must be purified before use, in order to remove iron and magnesium salts. This is a disadvantage, however, which the Billiter-Siemens cell and process suffers from in common with other cells of the gravity diaphragm type, such as the Finlay and Townsend cells.

The claims made for the Billiter-Siemens cell and process are :—(1) That it combines the advantage of the earlier diaphragm processes with those of the "bell" gravity cell, and that it overcomes the chief defects of both. (2) That the causes of low efficiencies in the open type of bell cell are checked ; (*a*) by the presence of the diaphragm ; (*b*) by the stratification of the liquors in the cell, and (*c*) by the direction of the flow of the electrolyte through the cell. These three conditions enable one to obtain a comparatively high current efficiency (for the type of cell) with a fairly concentrated solution of sodium hydrate at the cathode. The fact that the diaphragm is immersed in sodium hydrate solution, also contributes to its long life, and reduces the running costs of the process.

II.—Description of the Two Plants Illustrated.

The Kaliwerke Aschersleben A.G., at Aschersleben, in Saxony.—This plant is designed for the production of caustic soda or potash, and of chlorine gas, by the decomposition of sodium or potassium chlorine. Fig. 3 shows an internal view of the cell-room at this works, with six of the cells installed. The cells are long and narrow troughs constructed with granite side-walls, held together by corner anchor blocks and long iron rods, and are designed to utilise a current of 2,000-2,500 amperes. Each cell is provided with an iron bottom, and rests upon iron girders, which are insulated from the ground. The wire gauze-cathodes rest upon this iron bottom inside the cell, and in this way make contact with the current leads. The covers of each cell are made of earthenware, and are provided with the necessary openings for the anodes and for the pipes which carry away the chlorine gas, and also for the salt and the heating solutions.

The main supply pipes for the brine and heating solutions are placed underneath the baths in a wide channel in the floor of the cell room ; vertical branches lead from these to the cells. At Aschersleben the chlorine gas is employed in the chemical works, but for what purpose is not known. The caustic alkali solution is collected from the cells by a pipe running in a floor channel underneath the cells, and is led to a collecting chamber, from whence it is pumped into the concentrating pans, and is sold either as strong caustic liquid or as solid caustic. The hydrogen gas, which is liberated in the cathode compartment of the cells, is not used at the Aschersleben Works at present, but arrangements exist for its collection and storage, and it is probable that it will either be compressed and sold for balloon purposes, or utilised for the manufacture of ammonia by the synthetic process. In this connection it is interesting to note that several of the electrolytic alkali works are turning their attention to the utilisation of their hitherto wasted hydrogen for this new manufacture.

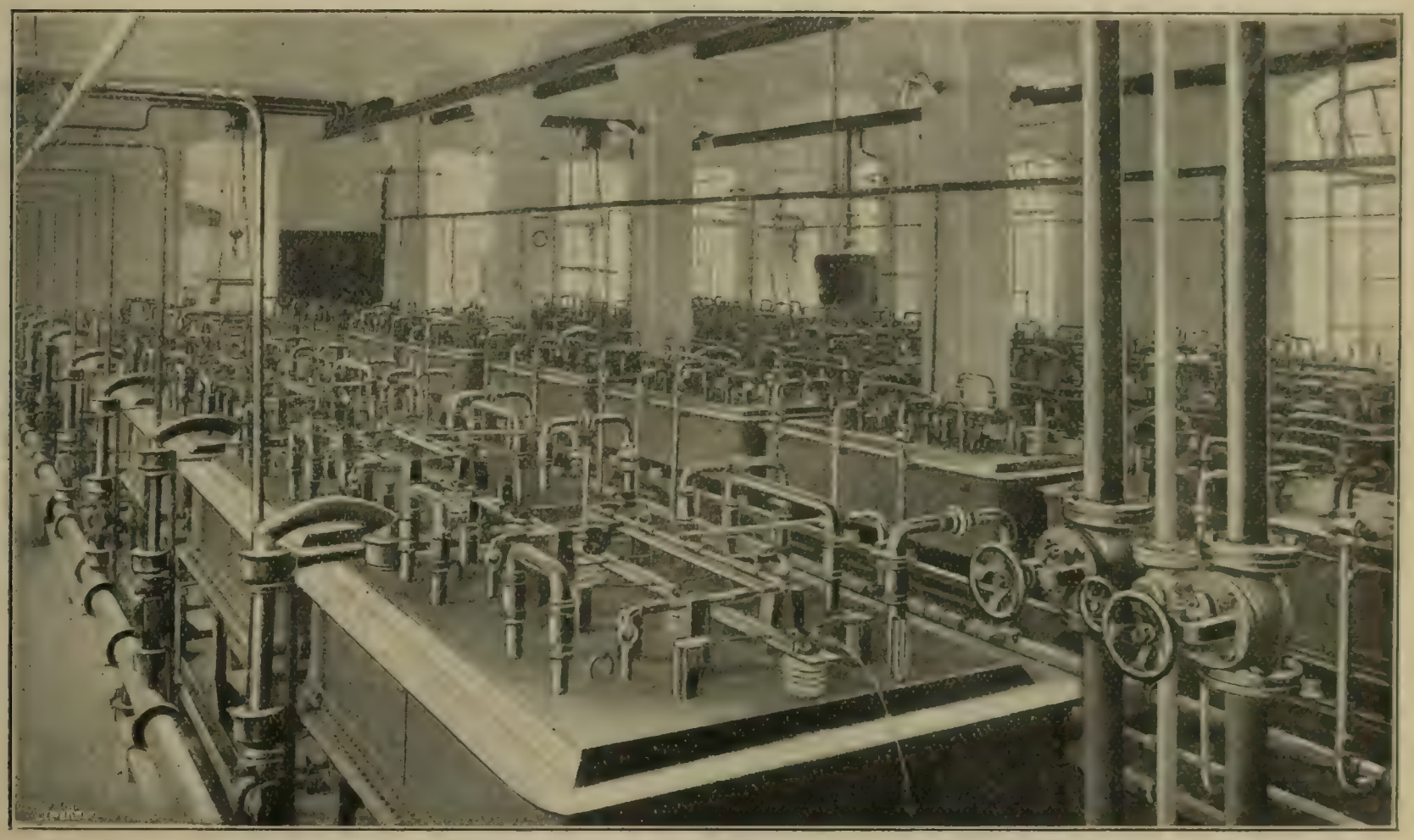


Fig. 5.—Electrolytic Cells at the Bohemian Paper Works of Spiro & Sohne.

An overhead travelling crane is provided in the cell room, and by its means the cover of each cell, with its complement of connecting pipes and graphite anodes, can be quickly lifted clear of the cell, and any work required in the interior of the cell can then be carried out with a minimum of trouble and loss of time.

The electric current is conveyed to the cells by bare copper conductors laid on insulating blocks, and the cells are run in series with an E.M.F. of between 3·5 and 4·2 volts per cell, and a mean current intensity of 2,000 amperes. The connecting leads between the cells are so arranged that any cell can be cut out without disturbing the work of the remainder. At a trial run of this plant made in April, 1909, the following results were obtained :—Current intensity, 2,000 amperes ; voltage, 3·66 per cell ; current efficiency, 94·7 per cent. ; concentration of cathode liquor, 130 grammes NaOH per litre ; chlorine gas contained 1·17 per cent. CO_2 ; duration of test, 4 weeks.

The consumption of salt required with the Billiter cell is only a little above that required by theory, since the salt that remains undecomposed is fished out during the concentration of the caustic liquors, and is returned to the elec-

trolytic cells, with the fresh brine. Messrs. Siemens & Halske state, in fact, that 1 kg. of active chlorine can be obtained by this process, with an expenditure of electrical power of between 3-4 and 4 KW.-hours, with a consumption of only 1·8 kg. salt. The theoretical figures for 100 per cent. efficiency are 1·7 KW.-hours and 1·6 kg. salt.

Plant at the Paper Works of Spiro & Sohne, at Krummau. a-d. Moldau, Bohemia.—This firm produces sulphite cellulose for paper manufacture, and the electrolytic plant (which was erected in 1910) comprises 32 Billiter-Siemens cells, utilising a current of 500 amperes at 115 volts, and producing chlorine equivalent to 1,000 kg. bleach per day of 24 hours.

The general appearance of the cell-room at this works is shown in figs. 4 and 5. As will be seen from these views, the chief distinction between these cells and the earlier cells erected at Aschersleben, is in the form and construction of the cells. These are reduced considerably in size, and are now constructed of boiler-plate, provided along the four sides of the cell with a thick lining of cement, in order to confine the current to the iron bottom. This bottom is in contact (as before) with the negative wire-gauze electrodes.

Each cell contains 12 graphite anodes, the method of connecting these to the current leads is seen plainly in fig. 5. The 12 anodes in each cell are connected in parallel —the cells themselves are connected in series. The other details of the plant are as already described. The travelling cranes with their lifting frames for the cell covers, are seen plainly in the background of fig. 5. The chlorine produced at this plant is absorbed by milk of lime, and is used as calcium hypochlorite for bleaching purposes in the other departments of the works.

It is noteworthy that Messrs. Siemens & Halske have now convinced themselves, *by actual trials*, that this system of using the chlorine produced by the electrolysis of chlorides, is more efficient and economical than its use for the production of hypochlorites in the Kellner or any other type of hypochlorite cells. The disposal of the caustic liquors obtained as a by-product, is, however, a difficult matter for those industries in which no use can be found for these liquors.

Yields and Costs.—As regards the yields and costs of the Billiter-Siemens cell and process, the most reliable figures available are those given in a lengthy article upon "Die Betriebskosten der Chloralkalielektrolyse," contributed by Dr. V. Engelhardt to the *Chemiker Zeitung* in 1911. From this article the following figures are taken. These estimates, it may be explained, are based on the supposition :—(1) That both the chlorine and caustic alkali produced in the cell are worked up into solid form, and sold as 35 per cent. bleach and 73 per cent. caustic soda ; and (2) that the plant is of large size, and is fully equipped with all the necessary accessory plant for carrying on the process. The first estimate is based on the provision of electric power at a cost of ·235d. per KW.-hour, the second at a cost of ·587d.

Details of Power Requirements.—1,200 KW. for electrolytic cells ; 30 KW. for the bleaching powder plant ; 30 KW. for the caustic concentrating plant ; 20 KW. for pumps and fans ; 70 KW. for lighting and miscellaneous purposes ; total 1,350 KW.

Output of Finished Products.—Caustic soda 73 per cent., 3,560 ton per annum ; bleaching powder 35 per cent., 8,690 tons per annum.

Capital Required.—Electrolytic cells, £25,000 ; chemical plant, £27,000 ; buildings, &c., £23,500 ; working capital, £7,500 ; total, £83,000.

It may be noted that this estimated production of 8,690 tons of bleach (in the author's opinion) is too high, and a ratio of 2·1 tons, 35 per cent. bleach, to 1·0 ton of 73 per cent. caustic soda would have been more correct. The annual production of bleach by this plant would then be 7,476 tons, or 14 per cent. less than Engelhardt's total. The conversion of costs is based upon the ratio 20 M. (German) equals 19s. 6d. (English).

It will be noticed that the capital account does not include cost of land, and that the running costs do not allow anything for royalty on the process used.

TABLE II.—Summary of Costs for a Billiter-Siemens Electrolytic Plant Producing 3,560 Tons 73 per cent. Caustic Soda and 8,690 Tons 35 per cent. Bleach per Year.

No. 1 Estimate, with power at 2 pfg., or ·235d. per KW.-hour.
No. 2 Estimate, with power at 5 pfg., or ·587d. per KW.-hour.

	No. 1.	No. 2.
Raw materials	£13,826	£13,826
Power	10,530	26,325
Maintenance and repairs ...	6,825	6,825
Packages, &c.	5,265	5,265
Wages	4,875	4,875
General expenses...	2,292	2,292
Oil, waste, &c.	1,170	1,170
Depreciation charges	5,558	5,558
Interest charges	4,144	4,144
Totals	£54,485	£70,280

Taking the prices of 73 per cent. caustic soda and bleaching powder at the makers' works in West Lancashire on March 15th, 1913, at £9 15s. and £5 7s. 6d. per ton respectively, the value of the output of this plant would be as follows :—

Caustic soda, 3,560 tons at £9 15s.	£34,710
Bleaching powder, 8,690 tons at £5 7s. 6d. ...	46,708
Total	£81,418

Assuming that Engelhardt's estimate of the yield of bleaching powder for this plant is too high, and that the ratio of bleach to caustic soda is only 2·1 to 1·0, the total receipts from sales would be as follows :—

Caustic soda, 3,560 tons at £9 15s. 0d.	£34,710
Bleaching powder, 7,476 tons at £5 7s. 6d. ...	£40,183
Total	£74,893

If these estimates be accepted as correct, the profits that can be earned by the Billiter-Siemens diaphragm cell, or by any other type of diaphragm cell, depend chiefly upon the question whether the electrical power for working the cell and process can be obtained for less than 5 pfg. (or ·587d.) per KW.-hr. Upon this point the author will have something to say in another article at a later date.

The writer's thanks are due to Messrs. Siemens & Halske, of Berlin, for the photographs, and to Dr. V. Engelhardt, of Berlin, for many of the figures used in this article.

NOTES ON BUYING.

By G. BASIL BARHAM, A.M.I.E.E.

In every large electrical factoring or contracting business the position of buyer is one of extreme importance, and a great deal of responsibility must perforce rest on his shoulders, and a considerable amount of confidence must be placed in him by the firm by whom he is employed. It is consequently of importance that he should keep an exact account of the transactions in which he engages, so that his firm will have no difficulty at any time in referring to any negotiations with which he has been occupied or to business which he has carried out.

In a factoring business the selling organisation is largely, if not entirely, dependent upon him for the goods which are to be sold, and if those he purchases are not of the right grade or quality, or are bought at too high a price, or are not such as to either fill an existing or create a new demand, the sales department at first suffers, and ultimately rises up and demands an explanation.

In a contracting business the position is practically the same, except for the fact that the goods are in almost every instance bought for use, and not for re-sale. Purchases of poor or defective materials, payment of too high prices, over-purchasing, or the neglect to buy in time, all have a serious effect not only on the class of work done, but also on the time taken to carry it out. In such a business money may be, and frequently is, lost on a contract that should have proved most profitable, merely by reason of the buying having been done in a slipshod and inefficient manner.

In either class of business the buyer is, to a certain extent, dependent on the storekeeper. Unless he is furnished with all the facts relating to the quantities of materials in stock, the demands which exist and the output that is anticipated, it will be impossible for the buyer to keep the stock at a

proper level. The estimating department which prepares the tenders in a contracting business must also be kept in close touch with the buyer as, unless he is notified of the quantities of the different classes of material that will be wanted for each contract entered into, he will either be compelled to run the risk of overstocking so as to meet all possible contingencies, or else there will be a serious danger of the workmen finding themselves running short of some particular line as soon as the work is commenced.

It goes without saying that a buyer should not trust to his memory, but should tabulate everything in connection with his work in such a way that he can refer at a moment's notice to any particular item or detail. For instance, he must be able, without delay, to turn up the last quotations received from any firm, or all the quotations which have ever come to hand from different suppliers for any particular line of goods. He must have a record showing the names and addresses of every manufacturing house that is in a position to supply goods which he may be required to purchase. Further than that, he must have a readily accessible record of the terms which each of these factors or manufacturers have offered, such records showing whether goods are offered carriage paid or forward, and if the latter, what the carriage would amount to for certain definite quantities. Such records can only be satisfactorily kept by means of a card system which, whilst not being of a complicated nature, should be so arranged as to enable any and every detail to be looked up readily. The working of a card system is far from being so simple as it looks. Everyone in business uses a card index, but it has to be admitted that not all obtain the full advantages which should be secured. It is not in the province of this article to go into details as to the system, but it may be said that the employment of a sufficient number of guide cards simplifies its working. Where such an index is used alphabetically, it is apt to assume large proportions, and there is a grave danger of cards being misplaced and consequent confusion occurring. Undoubtedly, in such case, what is termed the vowel system should be made use of, in which every letter of the alphabet is divided into five sections, such as Ba, Be, Bi, Bo, Bu.

The use of a card index is only of advantage when the correspondence is carefully filed, and this of itself renders obsolete the press copying of letters. All replies must be filed in the shape of carbon copies with the inward letters, and this renders necessary the adoption of some simple definite system of transferring filed correspondence to filing cases, in which it is kept for reference. Where the system in vogue is that of merely transferring the entire contents of the correspondence files at stated intervals, there is often a great waste of time when anything has to be looked up, as, for a considerable time after the transfer has been made, all reference to filed correspondence must be to the transfer boxes as well as to the current file. A far better way is that in which the latter is allowed to run for a certain definite period, as 15 months, and then all letters bearing a date of more than 12 months back are taken out and placed in the transfer boxes. In that way, all recent correspondence is in the current files and is ready for immediate reference.

Of course, in a combined card index and file system no hard and fast rules can be laid down, as every business varies so considerably as regards the method in which it is carried out, that what would suit one house might prove to be a source of endless confusion and error if applied to the business of another. As a general thing, however, it will be found that the use of subjects rather than names for general correspondence will prove most satisfactory for a buyer's cards, although it may be necessary, if the business is large and has numerous ramifications, to employ both subject and name cards. But whatever method is adopted, the cards should contain the fullest possible information, and should show why any particular purchase was made, and give details as to the class and quality of the goods delivered. It should also record the time the firm took for delivery, the number of defective articles, if any, in the consignment, and whether the replacements were made and what time elapsed before they were received.

A subsidiary set of cards should be kept, made up from the storekeeper's weekly or daily reports, showing the amount of the different supplies that are in hand, the average time a certain quantity will last under ordinary conditions, and what orders, if any, are outstanding.

Received from	Date	Purchase Order No.	Serial No.
Quantity	Description		Weight
Condition		Received by	

Fig. 1.

Fig. 1 shows a type of card that could be used with advantage by the buyer to record the goods received from any firm, and whilst giving as full information as would be required in the ordinary business, may easily contain, written in the centre space, all the details specified above as being likely to prove of use in reference.

To Purchasing Dept.	Department	Date	Serial No.
Quantity	Description		
Requisitioned by	Dept. O. No.	Approved by	Purch. O. No.

Fig. 2.

Fig. 2 shows a card which should be made up by the storekeeper when notifying the buyer of goods required to make up stock to fill either ordinary requirements or special orders. The card, as illustrated, is self-explanatory.

Date	Department	Dept. O. No.	Serial No.
Quantity	Description	Weight / Rate / Value	
Requisitioned by	Issued by		
Material issued	Put only one item on each card		

Fig. 3.

Fig. 3 is a sample of the cards that should be kept by the storekeeper to record the orders for stock received from the different departments which he has to supply.

If the business is large, and the purchases and stock carried are heavy, and consist of a great variety of commodities, it may be found of advantage to adopt a system of classification in which cards of different colours are used; or master cards can be compiled, each of which is a key to a set of cards on which the actual details are written. The quotations of each firm of suppliers should be recorded, a card being devoted to each class of goods, so that the offers received, not only from competing houses, but from the same firm at different times, can be instantly compared. It will be obvious that such a system permits of the removal of a good deal of obsolete matter, as these quotation cards can be dealt with in the same manner as outlined for the correspondence—that is to say, all cards dealing with quotations made six months or a year ago can be removed to transfer cases, to prevent the current index becoming too bulky. The most generally suitable size for the cards, it may be mentioned in passing, is 3 in. × 5 in. One thing is important, and

that is, that whatever the size adopted may be, sufficient space should be available to enable special notes to be made, as such provision not only reduces clerical labour, but ensures a proper record of everything of importance being kept.

It is not only in his own department that records must be fully and accurately kept for the buyer. The storekeeper must also be given the fullest facilities for keeping true records of all that is done. The old-fashioned stock book is more often than not a great time-waster, while a card system is not only simpler for stock-keeping, but is also far more accurate. The cards kept should be provided with space for date of order and delivery, purchase order number, sale order number, and quantities requisitioned, a model heading being as follows :—

Date.	P. o. N.	Quantity.	Date received.	Quantity.	Date.	S. o. N.	Quantity.

The above is only a suggestion, as the form of card would naturally be arranged to suit the requirements of the business. The character of the goods and the classification which had been determined upon by the buyer would naturally govern the arrangement of the storekeeper's index. But however the cards be arranged, it will be necessary for a great deal of thought and attention to be given to them before the final form is adopted. Then, if properly classified, they will be of considerable assistance in enabling the heads of the firm to keep closely in touch with every detail of the commercial side of the business without trouble and with absolute reliance in the accuracy of the facts recorded.

REVIEWS.

Electricity and its Practical Applications. By Magnus Maclean. London : Blackie & Son. Price, 10s. 6d. net.

Electricity books and books on Electricity in enormous numbers are published nowadays—some large and pretentious, others small and unambitious—but we doubt whether twenty per cent. of these books serve any really useful purpose. It is certainly true that large numbers never get beyond their first edition and many others soon find their places in "the cemetery of dead books."

This purposeless production of books is all the more regrettable because of the lack of really sound books on electrical science, and also because many of the books predestined to failure on account of their purposelessness are written by capable men and contain excellent material. The cause of the trouble is not a simple one ; some books are cursed by meagre treatment, others by inordinate ambition to cover all the science in detail ; some fail because of adopting too mathematical a method and others because of extravagant attention to experimental details. But in general it may be said that the books that have failed have failed chiefly on account of lack of purpose—they were written in a general sort of way in the hope that they would be read in a general sort of way by the general student. The successful books have been written by men who have known their audiences and have studied the particular needs and difficulties of those audiences in order to write books to serve their needs and overcome their difficulties.

In the book before us Prof. Maclean has attempted to solve the problem of the student who enters upon a first year course in electrical engineering without having previously taken a preliminary course of physics. The problem is admittedly a difficult one, but Dr. Maclean has attacked it successfully, and by drawing on the work of Deschanel on the one hand, and on his own wide teaching experience on the other, has produced a good text-book of electrical engineering. As the technical instruction of engineers becomes more organised and progressive, we may hope to see the last of the type of student for whom the book has been primarily prepared, but even at that distant date we can prophesy with some certainty that "Maclean's Electricity" will be "still running."

It is interesting to notice the ease with which whole paragraphs from Deschanel's Natural Philosophy fit into this modern text-book of electrical engineering ; and although this method of treatment robs the book of the appearance of originality, it adds much to its usefulness.

The book consists of four parts : Electrostatics, Magnetism, Current Electricity and Direct-Current Generators. The first two parts are entirely descriptive, and follow very closely Deschanel's treatment ; the "engineering" part of the work begins with the "Current Electricity" section. Two chapters are devoted to electrochemistry and to the fundamental principles and experiments in electromagnetism, then follows an exceptionally well-conceived and well-illustrated chapter on Ammeters and Voltmeters. Wattmeters are also treated in considerable detail.

It is difficult to give an adequate impression of the chapter on E.M.F. and Resistance ; for, although it is only 20 pages long, it contains all the fundamental concepts of E.M.F., potential difference, Ohm's law, shunts, Kirchoff's laws, Joule's law, Wheatstone's bridge, various methods for measuring high and low resistances, and a complete description of two types of insulation testers—a most remarkable electrical *multum in parvo*.

It would seem invidious to criticise where so much is excellent, but the weak point in the book is undoubtedly the meagre treatment of so fundamental a subject as electromagnetic induction. The introductory statement that "The discovery (of induced currents) by Faraday in 1831 constitutes an epoch in the history of electrical science," would seem to justify something more than the bare statement of laws and descriptions of experiments which occupy the first four pages of the chapter. The rest of the chapter is devoted to the more fascinating, but less practical, subject of the conduction of electricity in gases. The sections on the storage battery are very complete and well written, while the chapters on arc lamps and incandescent lamps are probably the most exhaustive and up-to-date to be found in any text-book, metallic filaments being treated in great detail.

The treatment of power distribution is based on essentially practical lines, but, as the book does not deal with A.C. generators, the transmission of A.C. power is also omitted, so that the author has not to devote his space to detailed discussions of two or three-wire transmission systems, but is free to deal very thoroughly with some practical problems in main-laying and wiring.

The chapters on armatures and field magnets are clearly written and unusually well illustrated with good line diagrams. The concluding chapters on types of dynamos and motors are well up to the general standard of the rest of the book ; the characteristic curves are clearly drawn and discussed, and such important subjects as armature reaction, prevention of sparking, starters and controllers, are given due consideration. Some appendixes and tables of constants are also added.

The book is well bound and indexed, and is, on the whole, one of the best text-books of electrical engineering that we have seen.—P.H.S.K.

Electrical Machine Design. By A. Gray. 1913. London : Hill Publishing Co., Ltd. Price 17s. net.

The design of electrical machinery is an art to be acquired by practice, as well as a science to be understood and reasoned about, and no mere list of formulæ or collection of rules will enable a man to become a skilled designer. On the other hand, every designer collects data from his own experience, which he tabulates and analyses for future reference. This information is, of course, much more valuable to the compiler of it than to anyone else, but a student commencing design, having no experience, must fall back on the collected data of someone else. Hence the book under review—compiled as a course of lectures on electrical machine design at McGill University—will prove useful to those for whom it is intended.

The book is divided into four sections, dealing respectively with direct-current machinery, alternators and synchronous motors, polyphase induction motors and transformers, the general scheme being to build up the design on fundamental principles as far as possible.

Chapter I is introductory, and deals with the elements of magnetic induction, while Chapter II gives a shorter description of armature winding schemes, the nomenclature

adopted being that due to Parshall and Hobart. Coloured, instead of small black lined, diagrams would have been an improvement. The construction of machines is very briefly described in Chapter III, only two small illustrations being used.

Following, we have 12 pages devoted to the insulation of machines, with several examples of armature and field insulation.

Chapters V and VI deal with the theory of the magnetic circuit and armature reaction respectively, the treatment being along standard lines. The design of the magnetic circuit is discussed in Chapter VII. The usual methods are described, but the American units of circular mils per ampere, and the Brown & Sharp wire "gage" are used in illustration of the methods, which will probably not be familiar to English students.

Chapters VIII and IX give the theory of commutation, determination of reactance voltage, methods of reducing sparking, &c. Efficiency and losses, and heating, are treated respectively in the two succeeding chapters, in which a number of useful formulæ and curves are given.

Chapter XII considers procedure in armature design, and a 400-KW. armature is worked through in exemplification. The remainder of the direct-current section deals with motor design and ratings, limitations in design, interpole machines, and specifications, and is in no way remarkable.

In Chapter XVII, the first one in the second section of the book, we find a good description of alternator windings.

The generated E.M.F. is discussed fully in the next chapter, very clear descriptions being given of the numerous factors requiring consideration—such as the effect of harmonics due to armature slots, &c. The construction of alternators is dismissed in the succeeding four pages.

The information regarding the insulation of alternators given in Chapter XX is accurate, clear and concise. Typical methods of insulating several high-voltage alternators are described. Chapter XXI deals with the complex problems arising from armature reaction, and a good description of approximately calculating the leakage reactance is given. General considerations regarding the design of ordinary alternators are then described, and a 40-KW. machine is worked through.

A good outline of the serious difficulties attending the design of turbo-alternators is then given, together with the various methods now in common use for predetermining, and thereby eliminating, reducing, or overcoming them. Chapters XXVI and XXVII deal respectively with special problems on alternators, such as dampers, self-starting synchronous motors, &c., and specifications. The elementary theory of operation, and the graphical treatment of induction motors are described in the next three chapters. The interpretation of the Heyland circle diagram is put forward in a decidedly satisfactory manner.

The remainder of this section is devoted to the actual design and heating of induction motors, the treatment, on the whole, being good, but it is rather a pity that the actual construction of these machines is treated in such a meagre fashion.

Chapters XL and XLI deal with the working and construction of transformers. The reviewer has no fault to find with the vector diagrams in the former chapter, but he is of the opinion that the several rather poor reproductions of photographs in the latter chapter might have been advantageously replaced by plates of working drawings. Following these we find two short chapters briefly considering the magnetising current, iron loss and leakage reactance of transformers. Transformer insulation, losses and heating next receive attention, the information being full and up-to-date.

The actual design of transformers is next entered upon, and two examples are worked through at length. Auto-transformers are not touched upon—a fact which is to be regretted, since for small ratios of transformation the economy in first cost for this type of transformer is very considerable.

The three concluding chapters deal respectively with special transformer problems, transformer specifications, and the mechanical design of machines. In the latter chapter are given the investigation of the unbalanced magnetic pull due to an eccentric rotor, dimensions of bearings, journals, pulleys, &c.

The book is well printed and bound, and is singularly free from misprints for a first edition. While it contains practically no original matter, it is a good resume of the subject, and would probably have a fair sale in this country, if it were not for the fact that it suffers from the complaint common to so many American books, viz., it is expensive. Perhaps the American student has more money in his pocket than his English counterpart.—H. G. S.

La Telegraphie et la Telephonie Simultanees, et la Telegraphie Multiple. By K. Berger, Inspecteur Superieur des Postes d'Allemagne. Translated into French by P. Le Normand, Ingénieur des Postes et Télégraphes. Paris: Gauthier-Villars. Price 4.50 fr.

The painstaking thoroughness of German writers in all branches of science is well known to those who have had the opportunity of acquiring their language. Unfortunately, however, in this country a knowledge of German is still rare among engineers, and a large amount of information is thus shut off from many to whom it would otherwise be extremely valuable. Translations of German works are therefore welcome, if not in English, then, at least, in French, a reading knowledge of which, at any rate, is possessed by most of us.

The question of the simultaneous use of the same circuit for telegraphic and telephonic purposes, or for more than one telephone connection, has come prominently to the fore in recent years, owing to the great development in telephone requirements. The present volume gives an account of the history and present position of this phase of telegraph engineering, as far as the Continent of Europe is concerned.

In a brief introduction the arrangements used by Zetzsche in 1878 for simultaneous telegraphy and telephony, and by Elsasser in 1885 for multiple telegraphy, are described, and a general survey is taken of the various problems which are met with and the methods by which they can be solved.

Part I is divided into two sub-sections, telephony on single-wire telegraph lines, and telegraphy on metallic-loop telephone circuits. The author first deals with the Van Rysselbergh system. In this system the telegraph signals are prevented from being heard in the telephone receivers by the use of condensers and inductances, joined up in such a manner that the rate of change of the telegraph currents at the beginning and end of each signal is reduced so as not to cause the telephone diaphragm to move in the sudden manner necessary for the production of a sound. Several other arrangements, by which the telegraph signals can be prevented from influencing the telephone receivers, are also described.

Telegraphy upon metallic-loop telephone circuits is then considered. With such circuits much more efficient methods of separating the telegraph currents, for which an earth return is used, from those of the telephone circuit flowing round the loop, are available, based on the principle of the Wheatstone Bridge. Descriptions are given of the various bridge methods, and of the arrangements by which these methods are applied in practice. The means by which different portions of the same telephone circuit can be used for distinct telegraph circuits, and *vice versâ*, are then discussed.

In Part II the subject of multiple telephony is considered. The historical developments of the subject are first traced, and afterwards the principles of the methods used in modern multiple telephony and their practical applications, including superimposing on loaded telephone lines, are described.

The arrangement of the lines necessary to prevent inductive troubles, which cause serious difficulties in the case of superimposed telephone circuits, is next considered, and the second part concludes with a brief survey of the conditions which govern the desirability or otherwise of introducing superimposed working.

In an appendix a description is given of the Picard system of multiple telegraphy, by means of which the same line can be used for two distinct telegraph circuits.

The author gives a large number of references to the various sources from which he has derived his information, so that the reader is enabled to follow up in detail any particular portion of the subject which he may wish to investigate more thoroughly.

As is usual with French works, the book is bound only in paper. The paper and printing, however, are good, and the diagrams and illustrations are very clear.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CHILE.—The Government proposes to establish a new tariff of import duties to take the place of the present *ad valorem* tariff. Certain recommendations have accordingly been made by a Tariff Commission which was appointed for the purpose, of which the following will be of interest to readers of the ELECTRICAL REVIEW:—

	Dollars per kg.
Celluloid manufactures	4·00
Wire, of iron, galvanised or not	·01
Electric pumps of iron	·70
Electric meters	·20
Springs for tramway cars, &c.	·10
Wire of metal of all kinds	·01
Asbestos manufactures	2·00
Mica in sheets	·60
Mica manufactured	·75
Tramway cars	·10
Scientific instruments	free
Telegraph and telephone instruments and apparatus ...	·05
Machinery, apparatus, &c., for producing light by gas or electricity, insulators, commutators, interruptors, &c., necessary for electric lighting, arc lamps, incandescent lamps and carbons	·04
Electric batteries and jars for same	·05
Wire insulated with rubber, silk or other material ...	·10

N.B.—Chilean dollar = 1s. 6d.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,225. "Chains for supporting pendant electric lights, and for other like purposes." C. I. CLEMENTS. July 28th.

17,239. "Starting arrangements for engines using magneto ignition." T. J. E. ROBERTS and J. H. W. ROBERTS. July 28th.

17,245. "Lighting systems for kinematographs." C. ZEISS (Firm of). (Convention date, August 17th, 1912, Germany.) July 28th. (Complete.)

17,261. "Electric conductor for explosive charges." H. J. VON KLAEDEN. July 28th. (Complete.)

17,264. "Electric ovens and the like appliances." M. RAILING and G. H. IDE. July 28th.

17,265. "Electrically illuminated letters, signs, and the like devices." H. HIRST and B. H. JENKINSON. July 28th.

17,268. "High-speed motors for high-frequency multipolar electrical machinery." R. GOLDSCHMIDT. (Addition to 10,507, 1912.) July 28th. (Complete.)

17,275. "Electrical switches." W. J. FAHN and J. C. HUTTON. July 28th. (Complete.)

17,284. "Current motors." J. W. INGOSON. July 28th. (Complete.)

17,326. "Vapour electric devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) July 28th.

17,345. "Electric cut-outs." T. E. MURRAY, JUN. (Convention date, February 4th, 1913, United States.) July 28th. (Complete.)

17 351. "Ignition plugs, pressure connections and compression taps for internal-combustion engines." C. HUTCHINSON. July 29th.

17,361. "Means for, and methods of, changing the frequency of alternating electric currents." A. M. TAYLOR. July 29th.

17,384. "Multiple-way electric switches." A. P. WELCH and H. M. K. MCCABE. July 29th.

17,416. "Electric glow lamps." SIEMENS & HALSKE AKT. GES. (Convention date, August 2nd, 1912, Germany.) July 29th. (Complete.)

17,417. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT. GES. (Convention date, July 30th, 1912, Germany.) July 29th. (Complete.)

17,418. "Electric switch." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges., Germany.) July 29th. (Complete.)

17,453. "Electric cooking and heating apparatus." C. CLARKE. July 30th.

17,473. "Protective covering for sparking plugs" H. G. LONGFORD and W. W. LONGFORD, trading as Sphinx Manufacturing Co. July 30th.

17,480. "Magnet core for use in Ferrari's electricity meters." LANDIS AND GYR G.m.b.H. (Convention date, July 31st, 1912, Germany.) July 30th. (Complete.)

17,490. "Process for heating articles in electric furnaces." F. FISCHER. (Convention date, November 5th, 1912.) July 30th. (Complete.)

17,491. "Portable electric lamps." G. F. HITZELBERGER and NEW BRITISH EVER-READY CO., LTD. July 30th.

17,498. "Safeguard for the front of motor or electric-propelled vehicles." E. MOIR, E. WINEBERG and M. WINEBERG. July 30th.

17,529. "Apparatus for electrically igniting miners' safety lamps." V. E. JOYCE and SPAGNOLETTI, LTD. July 30th.

17,532. "Electric circuit-closing devices." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, August 16th, 1912, Germany.) July 30th. (Complete.)

17,562. "Variable electric resistance device." W. P. THOMPSON. (Soc. Anon. des Telegraphes Edouard Belin, France.) July 31st. (Complete.)

17,572. "Party line ringing systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) July 31st. (Complete.)

17,583. "High-tension electric switches." AKT. GES. BROWN, BOVERIE ET CIE. (Convention date, August 19th, 1912, Germany.) July 31st. (Complete.)

17,584. "Vents for electric accumulator cases and other receptacles." H. LUCAS and O. LUCAS. July 31st.

17,589. "Control of alternating-current motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, August 2nd, 1912, Germany.) July 31st. (Complete.)

17,603. "Electro-plating apparatus." T. R. CANNING. July 31st.

17,604. "Switches for opening and closing electric circuits." H. LEITNER. July 31st.

17,607. "Electrical systems." R. VARLEY. July 31st. (Complete.)

17,625. "Generation of electrical power and asynchronous-synchronous, transformer-motor, systems of electrical transmission of same, with means of speed regulation, in electrical propulsion of ships, railway, tramway, road, aeronautical, agricultural, military, submarines, locomotives, trains or similar self-contained or other vehicles; means of driving, mining, printing, laundry, agricultural, ship-auxiliary and other industrial machinery; means of generating high and variable frequency current for radio-telegraphy, radio-telephony, lighting, analogous-applications and the like." W. P. DURTNALL. July 31st.

17,629. "Double automatic switch." H. M. L. GABLER. July 31st.

17,634. "Electric lock." G. J. F. NEWEY and H. HOPKINS. August 1st.

17,665. "Electrically heated flat irons." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, August 6th, 1912, Germany.) August 1st. (Complete.)

17,681. "Electric lighting." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 1st.

17,688. "Electric cooking apparatus." M. J. RAILING and G. MAURICE. August 1st.

17,712. "Blow-outs for electric currents." SIEMENS BROS. DYNAMO WORKS, LTD., and R. A. R. BOLTON. August 1st.

17,713. "Electric lamp signalling." SIEMENS BROS. & Co., LTD. (Siemens and Halske Akt. Ges., Germany.) August 1st. (Complete.)

17,725. "Dynamo-electric machines." D. H. ANDREWS and E. C. KETCHUM. August 1st. (Complete.)

17,733. "Galvanometers, voltmeters, ammeters, and like instruments. GAMBRELL BROS., LTD., and A. ONWOOD. August 1st. (Complete.)

17,736. "Means for, and method of, changing the frequency of alternating electric currents." A. M. TAYLOR. August 1st.

17,759. "Electrolytic electrodes." SCHNOTT & GEN. (Convention date, August 21st, 1912, Germany.) August 2nd. (Complete.)

17,761. "Watertight electric switch-controller wall sockets." R. G. TYLER, E. H. FREEMAN and F. G. SHREWSBURY. August 2nd.

17,775. "Electrical switches or interrupters for telephone circuits and like purposes." W. A. LOGAN. August 2nd. (Complete.)

17,795. "Incandescent electric lamps." K. PROSYNSKI. August 2nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

TELEPHONE REPEATER SYSTEMS. E. Grissinger. 2,930. February 4th. (Divided application on No. 7,482 of 1912, March 27th.)

KEYBOARD TELEGRAPH TRANSMITTER. E. J. Kessels. 3,582. February 11th. (Addition to No. 21,332 of 1912.)

PRIMARY ELECTRIC BATTERIES. G. S. Engle. 3,861. February 14th. (October 8th, 1912.)

GOVERNING TURBINES OPERATED BY HIGH AND LOW-PRESSURE ELASTIC FLUID. Bergmann Elektricitäts Werke Akt.-Ges. 5,317. (March 22nd, 1912. Addition to No. 4,694 of 1913.)

APPARATUS FOR PRODUCING STAGE ILLUSIONS. L. McCormick. 7,007. March 22nd. (February 10th, 1913.)

ARRANGEMENT OF CURRENT TRANSFORMERS FOR HIGH VOLTAGES. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 8,027. April 5th.

AUTOMATIC SINGLE-POLE ELECTRIC SWITCH. W. E. Gorton. 608. January 8th. (May 16th, 1912.)

PROCESS AND DEVICES FOR PRODUCING IN A CONTINUOUS MANNER ROENTGEN RAYS HAVING ANY DESIRED DEGREE OF HARDNESS WHICH CAN BE ADJUSTED AT A MOMENT'S NOTICE, J. E. Lilienfeld. 1,843. January 22nd. (Addition to No. 23,169 of 1912.)

REMOTE-CONTROLLED CIRCUIT-BREAKER. S. Whipp, C. W. D. Bourne and F. Whipp. 2,233. January 28th.

CONSTRUCTION OF PORTABLE SECONDARY BATTERIES. E. J. Clark and Hart Accumulator Co. 2,908. February 4th.

APPARATUS FOR PRINTING TICKETS OR THE LIKE AUTOMATICALLY BY SELECTORS. Allgemeine Elektricitäts Ges. 3,680. February 12th. (February 23rd, 1912.)

ELECTRIC LEAKAGE TELEGRAPHY OR TELEPHONY. Signal Ges. m.b.H. 3,853. February 14th. (February 17th, 1912.)

ELECTRICAL SOCKETS FOR FUSE PLUGS, ELECTRIC LAMPS AND THE LIKE. Siemens Schuckertwerke Ges. 5,903. March 10th. (March 20th, 1912.)

AUTOMATIC FIRE-ALARM SYSTEMS. E. Garretson. 7,288. March 27th.

BAYONET-SOCKET HOLDERS FOR INCANDESCENT ELECTRIC LAMPS, ELECTRIC COUPLINGS AND THE LIKE. United Motor Industries, Ltd., and E. De Rodakowski. 7,477. March 29th.

OPTICAL RECEIVERS FOR FACSIMILE TELEGRAPHS. C. Stille. 9,061. April 17th. (April 24th, 1912.)

POLE CAPS AND INSULATOR SUPPORTS. H. Forster. 10,085. April 29th. (April 29th, 1912.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,423. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,424. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,425. May 28th. (Divided application on 15,952, 1912, July 8th.)

MACHINE TELEPHONE SWITCHING SYSTEMS. Western Electric Co. (Woodward.) 12,426. May 28th. (Divided application on 15,952, 1912, July 8th.)

DEVICE FOR LIGHTING GAS LAMPS. H. S. Cooke and F. Westwood. 13,140. June 6th. (Divided application on 152, 1912, July 2nd.)

DEVICE FOR LIGHTING GAS LAMPS. H. S. Cooke and F. Westwood. 13,141. June 6th. (Divided application on 152, 1912, July 2nd.)

PORTABLE ILLUMINATED ADVERTISING POUCH AND SILENT SALESMAN. A. Milhado. 2,192. January 27th.

SPARK PLUGS. F. R. Blake. 4,381. February 20th.

ELECTRIC CLOCKS. F. Brunko. 7,275. March 27th. (April 1st, 1912.)

ELECTRIC GLOW LAMPS. C. B. Herrmann. 8,198. April 7th. (December 16th, 1912.)

ELECTRIC HEATERS FOR LIQUIDS. C. O. Haskell. 8,395. April 9th.

ELECTRICITY MOTOR-METERS OF THE MERCURY TYPE. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz and Brocq. 8,601. April 11th.

METHODS OF EQUALISING THE LOAD ON SYSTEMS OF SUPPLY FOR ALTERNATING-CURRENT ELECTRIC MOTORS. S. Eckmann. 9,174. April 18th. (Addition to, and divided application on, No. 11,597 of 1912, November 14th.)

APPARATUS FOR ELECTRO-OSMOTIC EXTRACTION OF WATER FROM SUBSTANCES. Ges. für. Elektro-Osmose and G. B. Schwerin. 10,873. May 8th. (Addition to No. 23,545 of 1912.)

ELECTRIC DISCHARGE APPARATUS. R. Moretti. 13,918. June 16th. (Divided application on, and addition to, No. 16,164 of 1912, July 10th.)

THE

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THE LONDON TRAFFIC PROBLEM.

IN order to fully appreciate what the London traffic problem means, one must be able to think in millions. Year by year the journeys taken per inhabitant increase, and they now number 230 per head of the population, representing an increase of 51 per cent. during the last seven years.

The total number of journeys during the year 1911 reached the almost unthinkable figure of 1,908,846,973, or approximately 2,000 millions. The daily increase is 250,000, so that by the year 1920 the number of journeys per annum will exceed 3,000,000,000 (3,000 millions).

These figures include tramway and omnibus passengers, which account for about two-thirds of the total, the remainder being passengers on the local railways and on the trunk lines from a 30-mile limit. All of these, however, have to be dealt with in the streets of Greater London.

If we cannot quite grasp the magnitude of the problem from a contemplation of the figures 3,000,000,000, we can get a little nearer to it by glancing at the figures referring to the number of licensed vehicles in use and to the accidents which occur in the streets per annum. In the year 1912 there were 13,800 licensed power vehicles, including trams, 'buses and cabs; and only 2,800 horse-drawn vehicles.

The number of fatal accidents in 1912 was 537, or almost $1\frac{1}{2}$ fatalities per day due to street vehicles. The number of injured during the same period was 20,166, or at the rate of $5\frac{1}{2}$ persons per day.

The problem is not a new one, it was recognised as urgent in 1903, when a Royal Commission was appointed to inquire into it. This Commission reported on the matter in 1905, and one of the recommendations made was that the statutes relating to traffic in London should be simplified and consolidated, and that it should be one of the duties of the new body which they recommended to examine and report upon them.

That was in 1905, when the problem, urgent as it then was, did not present the difficulties which the motor-omnibus has since introduced. In 1907, there were 9,818 licensed horse cabs and hansoms, now there are only 2,385. There were also 2,961 horse omnibuses and tramcars, and 2,973 electric trams and motor-'buses, while last year there were 5,767 electric trams and motor-'buses, in addition to 8,000 motor-cabs, and the horse 'bus has practically disappeared. If, then, the laws relating to traffic were in need of simplification and consolidation, how much greater is that need at present, for it would appear that the recommendations of the Royal Commission have been entirely ignored and the deliberations, extending over two years, were so much time wasted. Let us hope that the work of the Committee, which has just gone over the same ground, will bear better fruit.

In the course of evidence given to the Committee, the provisions of the law were still described as "voluminous

scattered, redundant, defective, overlapping and difficult to understand." A witness, speaking from experience in the management of tramways, described our Traffic Laws as "antiquated, inadequate, and incomplete," whilst another, speaking on behalf of the London General Omnibus Co., complained of the great difficulty of having to consult innumerable special provisions scattered in many statutory orders.

As an instance of the unsatisfactory state of the law, it appears to be a prevalent idea that a conviction for dangerous driving cannot be obtained unless it can be proved that some person was thereby actually endangered. This is probably the reason why newspaper runners are permitted to race on bicycles through the busiest streets of London at breakneck speed distributing papers right and left to news boys. They are certainly a menace to life and limb, and we agree with the testimony of a police witness that the cycle is an unfit vehicle for the crowded streets of London. This view is emphasised by the fact that in the year 1912 there were 65 cyclists killed by power-driven vehicles, and 21 other persons were killed by ordinary cycles. As to non-fatal accidents during the past three years, no fewer than 12,813 reported injuries to persons were caused by cycles, a considerably larger number than is caused by any other class of vehicle.

The police, to whom the Committee pay a well-deserved tribute, have at present many difficulties to deal with, owing solely to the unsatisfactory state of the law. For instance, a driver of a motor-'bus may be incapable of carrying out his duties due to the influence of drink; but, unless he is legally "drunk," he cannot be charged. Again, the question of vehicles taking in or delivering goods across a pavement and partially blocking the roadway is one which makes the administrative duties of the police very difficult and unsatisfactory. A case in point is the difficulty which at present exists in the Strand. At a cost of £560,000 the City of Westminster widened the Strand at Holywell Street. The whole of this improvement is practically rendered valueless by the action of Messrs. W. H. Smith & Sons, who occupy a large portion of the widened area with their carts, which, "from early morning till late at night," stand with the tail of the cart against the curb and the horse's head out in the road, thus practically taking up the space of two lines of traffic. Owing to the present state of the law the police cannot stop this, as it does not constitute legal obstruction.

Touching on the question of the motor-'bus, this is impeached in the Committee's report as follows: "The Committee are of opinion that the record of the motor-omnibus in the matter of accidents is most unsatisfactory." The total number of fatal accidents due to motor-omnibuses in 1912 exceeds the total for every class of vehicle combined in 1905. The figures for 1912 are 182, or at least one person killed every two days by a motor-'bus. Moreover, the police returns of fatalities and accidents for the metropolitan area attribute to the motor-omnibus 41 deaths and 637 accidents in the first quarter of 1913, and 46 deaths and 845 accidents in the second quarter.

Apart from fatalities, however, the conditions of the roads are rendered quite unsafe by the present methods of running motor-'buses. We have done with the competition between the L.G.O. and the Road Car Co., a competition which was such a prolific source of accidents, but we have instead the competition between the L.G.O. and the electric tramcar. It was explained by witnesses how the 'buses run along the cars, and stop at the same places in such a way as to prevent people either entering or leaving the cars. Or if people are doing so a car will come up behind on the near side and terrify them by its noise. Many people, as the report states, are positively afraid of using the cars on account of the 'buses. A species of "dumping" is practised by the L.G.O., the fares charged on tram routes being lower, and in many cases about half the fares charged for a corresponding distance on routes where trams do not run.

But we must refer our readers to our summary of the report on p. 287 for details, and here allude only briefly to the recommendations. These are that a new Traffic Branch of the Board of Trade shall be created, which shall combine the duties of the Home Office, Local Government Board and Board of Trade, including the confirming of by-laws. That the veto of the Borough Councils in regard to tramway schemes shall be replaced by a full hearing before the new Traffic Branch, which shall report to Parliament, and that the County Councils in the Metropolitan area shall have the widest possible by-law-making powers, subject to confirmation by the new Traffic Branch of the Board of Trade.

Outside the Committee, few people will be found who consider that the foregoing recommendations will solve the traffic problem. On the contrary, it will lead to endless litigation between the County Councils and the omnibus companies. The seven County Councils concerned will make by-laws to suit their own particular area, and these by-laws will no doubt be different in different areas. This clearly is quite an unworkable system when we consider that the motor-'buses of one company alone would be subject to the laws of seven authorities, all of whom are interested in competing systems of trams. Nor does the past record of the L.C.C. inspire us with any confidence that they are competent to deal with the question. One has only to watch the disgraceful and dangerous scrambles which take place between 5 and 7 every night at certain of the tramway termini, by those wishing to get home, to appreciate that the L.C.C. is not a desirable body to entrust with the making of by-laws to regulate traffic in general.

The improvements which have recently taken place in the control of traffic in the City since the Commissioner of the City Police made regulations directing the routes of omnibus traffic, &c., lead us to think that the Commissioner of the Metropolitan Police might be able to effect similar improvements in the Metropolitan area. In this view we are in accord with the recommendations of the Royal Commission, which considered that in the Metropolitan Police area by-laws and regulations should be made by the Commissioner of Metropolitan Police, with the approval of the Secretary of State for the Home Office, and in the City by the Commissioner of Police of the City, with the approval of the Court of Mayor and Aldermen.

The police have always been subject to the Home Office, and it would lead to endless confusion if they are to be in future subject also to a sub-department of the Board of Trade.

MINE MANAGEMENT.

We have frequently drawn attention to the very unsatisfactory way in which our coal mines are managed, and to the somewhat questionable efforts of the Government to rectify matters by passing Acts of Parliament legalising all kinds of regulations, which, if much further increased, will do away with the necessity of any management at all, as only a policeman will be required to see that each man carries out his duty as specified by the Act or "regulation."

Under Sec. 86 of the Coal Mines Act, 1911, the Home Secretary is empowered to issue new "regulations" from time to time, or to alter old, as experience or circumstances may determine, and a set of new general regulations, which come into force on September 15th, have just been issued. These are divided into seven parts, and contain 190 separate regulations, in which the special electricity rules are included. The intention is to secure, as far as possible, uniformity in rules controlling the working of the mines and setting forth the duties of officials and workmen, which, previous to the passing of the 1911 Act, were defined under "Special Rules" drafted by the colliery company and approved by H.M. Inspector of Mines, which rules are now revoked.

The duties of the manager, under-manager, fireman, examiners, deputies, winding engineman, fan engineman,

boiler minder—and under the electricity rules—the electrician are stated. The manager, under-manager, and fireman must have "certificates," but no mention is made of the qualification required of the engineer, or the electrician, and so far as required by the regulations, anyone can be appointed by the manager to these positions if he considers him "competent." In fact, as regards the mechanical side of the plant, he need not appoint any mechanical engineer, as it is sufficient to appoint in writing a "competent" person to carry out certain special duties such as the re-capping of winding ropes, &c.

The manager's duties are thus defined :—

"35. The manager shall appoint in writing to be officials of the mine such number of *competent* persons as will be sufficient to secure a thorough supervision of all the operations in or about the mine and the enforcement of the requirements of the Act, and of the regulations and orders made thereunder. He shall assign their duties to the several officials of the mine, and shall to the best of his power see that each official understands and carries out and enforces those provisions of the Act and of the regulations and orders made thereunder, which relate to the matters in respect of which duties are assigned to him.

"36. He shall give attention to and cause to be carefully investigated any representations or complaints . . affecting the safety and health of persons in or about the mine.

"37. Relates to (safety) lamp stations.

"38. He shall see that *a sufficient supply of proper materials and appliances* for the purpose of carrying out the provisions of the Act, and ensuring the safety of the mine and persons employed therein, is always provided, and, if he be not the owner or agent of the mine, he shall report in writing to the owner or agent when anything is required for the aforesaid purpose that is not within the scope of his authority to order." (The italics are ours.)

Anyone with only a slight knowledge of the operation of a coal mine will agree that a colliery manager's lot, like the policeman's, will not be a very happy one, and after he gives his attention to all the multifarious reports and complaints from officials and workpeople, he will have little time left for the technical direction of the mine. And how is he to keep himself abreast of the times by the study of technical literature on the science of mining and mining machinery, which, like other industries, is always progressing, and especially that relating to electricity in mines? We cannot think that any good will be the outcome of this increase of responsibility in regard to superficial supervision by the manager. It would appear that his duty now is not to see that the work itself is done in a proper workmanlike manner, but to receive a report from the official or workman that it has been done. Then again, there is the question as to whether the manager has that skilled knowledge and experience which would enable him to say whether the work had been satisfactorily carried out. We allude principally to work connected with engineering and electricity. In addition to all the duties connected with the mine, he must also organise and equip one or more rescue brigades, depending upon the number of workmen employed underground. Many experienced mining engineers question the use of this apparatus, and in the House of Commons a question was raised as to the absence of rescue apparatus in the recent fire at Cadder Colliery, which caused the loss of 22 lives, when Mr. McKenna said that a full inquiry was to be made into the whole of the circumstances. We await the report of this inquiry with interest, as it is suggested that the fire was caused by electricity.

A point of importance is that, according to regulation (38), the manager is responsible for the supply of proper materials and appliances, but only up to the value of the amount he is given authority by the owner or agent to spend ; after that he is to put his requisition in writing to the owner or agent. But suppose it is a case of emergency, and neither owner or agent is available, who is responsible in case an accident results? Recently, at Ashby-de-la-Zouch Petty Sessions, the Meacham Collieries, Ltd., were fined £105 and £24 4s. costs in connection with offences under the electricity rules, while Mr. Watson, who, at the time, was manager of the colliery, and who was charged with the breach of the rules at the same time, was exonerated. The breach of the rules was admitted, but the question the Bench had to decide was as to who was responsible. The manager had duly reported the state of affairs to the managing director, Mr. Waddle, who, Mr. Watson said, refused to spend the necessary money, and he himself had no authority to order material beyond a very small amount. Mr. Watson's case is not solitary by any means, and many managers have not even the choice or selection of the stores or plant required or bought for the colliery. Probably in most cases owners are morally to blame for accidents, and not the distressed manager, who has the sword of dismissal constantly hanging over his head if he does not work the mine, not always as he would like, but at the dictates of his superiors and according to the material to his hand. No! What our collieries want is less law and more men trained in the actual science of mining and mine engineering, instead of in rules and regulations for working a mine and the best way to avoid them to save a little cost, as is actually happening now. Engineers are wanted, not lawyers' clerks, or glorified policemen.

Copper.

There has been a very large business done by consumers of copper both in Europe and America, and the tendency of the market, with fluctuations, has been one of much firmness, aided by good statistics and labour difficulties of serious moment in the Lake Superior district. As far as can be gathered this area is still in the throes of the labour trouble which broke out some weeks ago, and production at the mines and also at the local smelters has been entirely suspended. The Lake Superior district produces a matter of 8,000 tons of refined copper a month, and the market cannot afford to regard the withdrawal of such a quantity with equanimity. In addition to this there seem to be more or less grave difficulties impending in connection with the electricians at the mines of Butte and Utah, and there is a fear that if the threatened strike eventuates, the copper output of these important camps will also be checked. The market is in no condition to stand any further disturbance of output with equanimity, and it is only the generally more or less overcast outside influences which have stood in the way of a very considerable appreciation in values. It must not be forgotten that a year ago, with the statistical position far less strong than that of to-day, prices were a matter of £10 a ton higher. If once the impression gained firm hold in speculative circles that copper was in a dangerous position, from the point of view of the bears, there might easily be something approaching panic conditions witnessed. The last few weeks have seen the release of orders for many thousands of tons of copper needed in connection with the fulfilment of electrical schemes, which had been held up for a time, owing to the unfavourable political and monetary outlook. With the brighter atmosphere recently prevailing, however, there has been some revival of confidence, and the prospects are that the consumption of copper on both sides of the Atlantic will be at a record rate, at all events over the remainder of the year. The shortage in production is, of course, the most important factor for the time being, and the labour unrest might play a still more striking part within the next few weeks. The talk of increased production as regards the United States is mere talk, as far as can be ascertained from the figures which are obtainable, any increase from the newer and low cost properties being fully offset by the reduced yield of the older and higher cost mines. This is an aspect of the copper situation which it would not do to ignore. Considerable interest attaches to the next returns of the American Copper Producers' Association, the estimates of the market in connection with which vary widely. If the shortage of production at the Lake Superior mines is to show however, it is certain that there must be a further reduction in the available stocks of unsold copper at United States refineries, and if this prove to be the case, then the price of copper must go higher yet.

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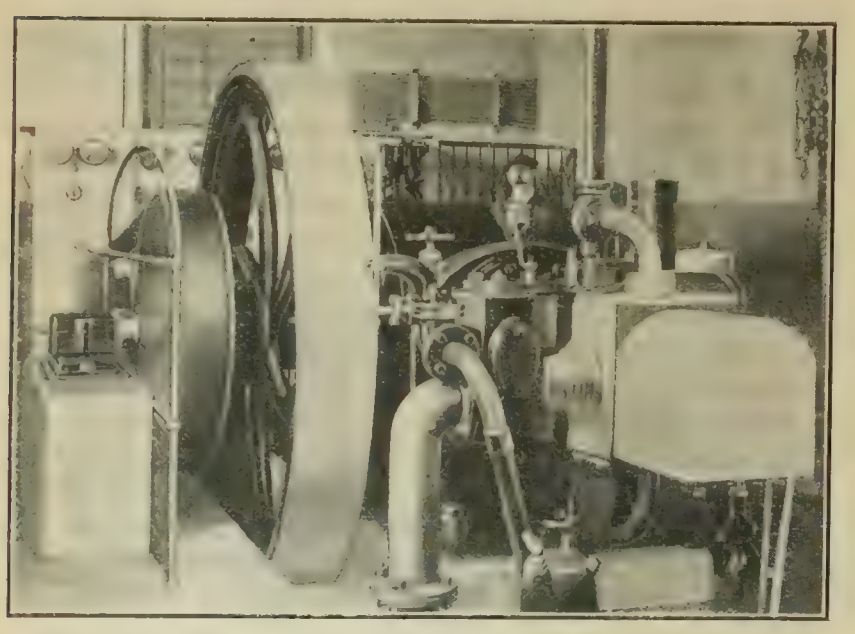
ELECTRICITY ON A HIGHLAND ESTATE.

A complete electric light and power installation has recently been installed at Belladrum House, Inverness-shire, which includes a 30-B.H.P. Hornsby oil engine running on shale oil



Belladrum House, Inverness-shire.

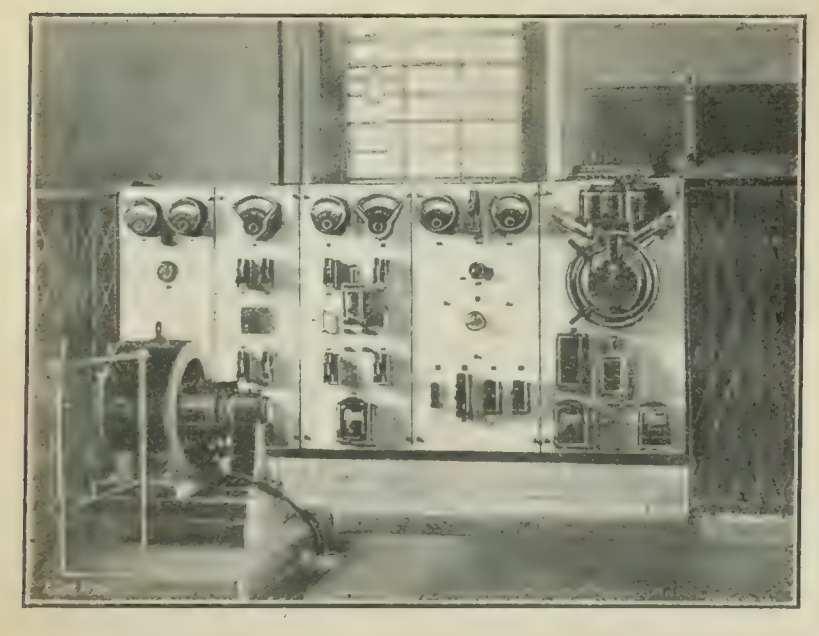
and belt connected to a 15-kw. dynamo by the Lancashire Dynamo Co., and an E.P.S. battery having a capacity of 650 ampere-hours for 10 hours, with regulating cells con-



Generating Plant, Belladrum House.

trolled automatically by a Bertram Thomas regulator, fitted on the main switchboard.

Besides the electric lighting of the mansion and gardens, home farm and outbuildings, electric power is used for



Main Switchboard, Belladrum House.

radiators and two electric lifts in the house, whilst current will ultimately be furnished to motors in threshing and saw mills attached to the home farm.

The wiring is carried out with solid drawn conduit, and the underground mains are laid in creosoted wood troughing filled in solid with plastic pitch and covered with tiles.

The lifts for passenger and kitchen service by Messrs. A. & P. Stevens, Ltd., are fitted with automatic push-buttons for "up," "down" and "stop" control, and emergency stop and return buttons.

A system of electric bells and telephones is installed throughout the house, also to several outbuildings on the estate.

The house is protected against lightning by conductors fixed to eight finials at roof corners. These are connected to a ring conductor traversing the outer edge of the roof, and the whole system is earthed at four positions, where 4 sq. ft. iron plates are embedded in the ground 2 ft. beneath the surface. This installation was entirely carried out by Messrs. Underhill & Ritchie, Ltd., Glasgow, to the specification of the consulting engineers, James E. Sayers and Caldwell, of Glasgow.

LIGHTNING.

By E. P. AUSTIN, A.M.I.E.E.

The vagaries of lightning are always a source of interest and wonderment, so that the following account of the effect of a recent severe lightning storm on a direct-current supply may be of interest:—

There are two distinct systems fed from one station, but by entirely separate generators and switchgear. The first is a three-wire supply system using triple-concentric paper-insulated cables, with the neutral earthed at the station only. Connected to the same bus-bars are two overhead lines supplying power. They follow a route up a hill side in open country, rising about 80 ft. in 600 yards; the route then follows a highway, underground cable being used for about 250 yards, changing to overhead, and descending the hill, falling about 60 ft. in 300 yards. At each end, and at junctions with underground cables, horn-break arresters and kicking coils are used.

The second system is an ordinary overhead tramway supply, with lightning arresters at all feeding boxes, to station bus-bars, and on the cars. The whole supply area lies in a hollow, and the highest point is crossed by the above-mentioned overhead line, which is higher than any hill within a radius of $2\frac{1}{2}$ miles.

With this brief topography of the district in mind, we will proceed to consider the behaviour of the storm and its manifestations. The storm approached from the south-east at 5.30 p.m., and broke with exceptional violence over the town, reaching its maximum force between 5.45 and 6.0 p.m. Lightning flashes were numerous and frequent, the intervals between being scarcely perceptible; and, as events proved, the discharges were frequently to earth.

The first indication of trouble was received on the traction system at 5.52, two distinct feeders connected to adjacent trolley wire sections being affected. In each case an arc jumped a gap from the live terminal to the earthed ironwork of the connecting boxes, the respective distances being $1\frac{1}{2}$ in. and 2 in. The short distance was in a pole box and a following-on current completely destroyed the interior fittings, and went to earth *viâ* bond and guard wires, which were fused. The arc in the other case discharged in a feeder pillar, and cleared itself without interruption to the supply. Not one of the many arresters showed signs of operation.

The trouble on the lighting system occurred at 5.55, and was more far reaching in its results. A distributor in the centre of the network was broken down in two places within 50 yards, at one point being burnt through, and at the other breaking down in a service box.

At the consumer's end of the previously-described overhead lines a high-potential discharge took place. In one case a large motor armature was broken down to frame, and in another case an arc jumped a space of 8 in. from one terminal of the board to the iron supporting frame. All

the lightning arresters were in perfect order, yet no signs of operation were shown on the horns.

During the storm a house was struck and badly damaged at a time corresponding with the mains disturbances, and on marking all the positions of trouble on the map, it was found that a straight line could be drawn from this house through all the points marked except one, and the distance was one mile. The remaining trouble occurred within half a mile of a discharge, which fatally struck a child standing in the middle of a broad roadway.

It has been observed previously that damage has resulted from lightning discharges up to a distance of 5 miles, apparently through terrestrial disturbances. The writer has experienced cases where sparks jumped across long gaps separating lead-covered house wires and gas pipes, with dangerous results during a storm, when a discharge occurred half a mile distant.

These effects point to the conclusion that breakdowns from lightning do not all originate from atmospheric disturbance, and that the use of condenser protective devices on supply systems is advisable to protect apparatus from terrestrial disturbances.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Shift Engineers: A Proposal.

Like your ingenious and thoughtful correspondent, W. E. Pritchard, I, too, have often wondered why the members of the fair sex should regard the modern day power house and its plant as a kind of "forbidden fruit." It requires but little imagination on a reader's part to conjure up a happy picture of switchboards attended to by blushing (or rushing) damsels, or Girton girls, if, as mentioned in the letter in the REVIEW, the applicants should "have had the advantage of higher education and some laboratory experience in the physics department." Could not the Universities be moved to grant a "Switchboard Attendant's" Diploma, in the curriculum of which the multiplication table and spelling-book might well count as valuable components?

What a picture of felicity every power house would present if the charming daughters of Mother Eve were but allowed to exercise their gentle wiles upon such unrelenting things as 20,000-volt switches, &c. How home-like everything would look. Again, what glorious opportunities would present themselves for the designer of switchboards to exercise his æsthetic tastes. A mirror could be fitted to each panel of the board to enable the operator to see whether her general appearance was in harmony with the surroundings, and a tea room with gipsy tables, &c., would become a feature of every power house which claimed to be up-to-date.

Approaching this subject from the economic side, it can easily be seen what a Godsend the new era would be to married men with wives mechanically or electrically inclined. For example, the husband could be on day-shift, and the "missus" relieve him of his arduous duties when the time came. Thus would money flow rapidly into the coffers of the Mr. and Mrs. "Shift Engineer, Ltd."

But, Mr. Editor, why confine the duties of shift engineers to men and women? Could not some enterprising gentlemen try the experiment of training baboons or chimpanzees for the coveted posts in our generating stations? Of course, practical difficulties might occur in the employment of these latter, for instance, their caudle appendages might easily have a tendency to short-circuit switches, &c., but, of course, these portions of their anatomy could easily be wrapped with insulating tape. This latter is merely a suggestion—other solutions will easily present themselves to a thinking mind.

In regard to engine driving, a "mere male" could, of course, perform such trifling functions as starting and stopping the running plant, and then hand over his reins of office (or to change the metaphor), his "swobbing" rod and oil can, to his feminine "relief."

In regard to the boiler-house working, women of course could, I think, easily manage a shovel, as from time immemorial, they have always been credited with a facile use of its companion, the poker.

In conclusion, I sincerely trust that this question will be fully considered in all its bearings by the "powers that be."

C. F. Browne.

August 16th, 1913.

I read with great interest the correspondence on the above subject, and quite agree with the writer, that the average educated woman *could*, easily, perform the ordinary routine work of the switchboard attendant.

I have no doubt she would also be a "Godsend" to the average charge engineer. Congenial companion on night shifts, for instance.

But, there is one other point which, apparently, has been forgotten. Women, as a general rule, are "fair weather" workers; when out of their natural sphere I tremble to think how a woman would have acted in a case such as the recent disaster at Stepney, when a 2,000-H.P. turbine, which "requires practically very little attention," left its bedplate, and various portions of it were hurled through the corrugated iron roof, to be found later embedded in the door-step of a neighbouring hostelry; to say nothing of minor pieces, which have not yet returned to earth. Or, again, the possibilities appertaining to a mouse in the boiler house! Several well-educated women, with whom I am acquainted, are afraid, positively afraid, of an electric radiator, and would not have one in the house on any account! They tell me that electricity is so dangerous! Imagine one of these women on the switchboard, in an emergency.

Oh! Oh! Mr. Pritchard how could you. Have no fear switchboard attendants, your realm will not yet be invaded by the fair sex, but as you value your self-respect, curtail your energies in that "sweeping up and dusting, which you cannot make a good job of, and stick to the switches."

"In jesting guise, but ye are wise
And know what the jest is worth."—*Kipling.*

A Mere Woman.

Suppose that among the Pritchard coterie there should happen to be a Sylvia, or one of that ilk, what would prevent it from dropping a bar of copper across terminals, and generally playing the game as it appears fair to the feminine instinct—I had almost written intelligence.

It may be doubted if Mr. Pritchard's circle would consent to mechanically-fed hoppers. What would happen at any lighting station which was discovered to be supplying a Cabinet Minister? The whole silly gang of shift boarders would hunger strike, and they would want to be called something else than shift.

Common Man.

I should like to be permitted to say a few words in answer to Mr. W. E. Pritchard's letter.

I don't know whether the writer is a suffragette or a hen-pecked husband, but, in any case, it is quite obvious that she or he is absolutely ignorant of the duties of a shift engineer. In the first place, the duties of a shift engineer do not consist in cleaning, attending to engines, or filling coal-hoppers; he is a man with a high technical knowledge of the profession, and one to whom the remainder of the shift look for instructions in times of trouble.

Above all things, it is absolutely essential that he should keep a steady and clear head when things are not running smoothly, for a slight error on his part, or lack of knowledge, may cause thousands of workpeople, trams, &c., to stand idle.

Seeing, therefore, that supply authorities realise that the reliability of their supply is their greatest asset, it is little wonder that women have not been employed in station work. If Mr. Pritchard would have a walk round some of our largest power stations, he would soon recognise that the duties of the man in charge are much more trying to the nerves than are typewriting, clerical work and window-smashing—such as women are able to manage.

Shift Engineer.

August 18th, 1913.

A Question of Etiquette.

I was very glad to see the letter of Mr. Riley in your issue of the 8th inst. He draws attention to a subject which is of vital interest to all connected with the development of the electrical industry, and you would be adding one more to your long list of public services if you were to open your columns to the views and suggestions of those concerned on this subject.

I have had some experience of municipal supply authorities, and have, therefore, some knowledge of the methods by which some of them conduct their sales departments; but I must confess to being amazed when I saw in the "Legal Column" of a recent issue of the Electrical Review that, as the result of a recent arbitration, an award was made against a well-known municipal supply authority on the ground that they had overcharged a customer to the extent of 60 per cent., and "that, having regard to all the circumstances, the work had not been carried out on a suitable system, nor with the best workmanship, and was not in accordance with the wiring rules of the I.E.E."

Now, a supply authority has an absolute veto over the work done by an electrical contractor in the district in which it operates, and, therefore, if it wishes to take up installation work, it can, as pointed out by your correspondent, stifle competition by a series of unnecessary rules and regulations which force the contractor to put in a price much higher than their own, and ultimately kill electrical contracting work in the district. It must be noticed that the supply authority is not obliged to enforce its own rules against its wiring department, hence there is practically no control exercised over the work done by any supply authority. Surely this is a flagrant injustice upon the private contractor. Ought not every supply authority to be obliged to do their own work in accordance with their own regulations? It does seem to me that the supply authorities have far too free a hand in this direction, and that the Board of Trade should exercise a much greater amount of control over the work done by them.

To Mr. Riley's query, I should most emphatically answer, "Yes, certainly inform the Board of Trade and the fire offices concerned, as it is in the best interests of the profession, the trade, and the public, that these parasites of a great industry should be exposed, and their jerrymandering methods put a stop to."

In the infancy of a new industry, a new profession, it is essential that it should be protected from the undermining influence of rotten materials and rotten workmanship, and all of us, therefore, who have the cause of electricity at heart, and who believe that it is capable of almost infinite development and expansion in directions hitherto only faintly foreshadowed, must feel that no effort should be spared which has for its object the introducing and maintaining of sound knowledge, sound materials, and sound workmanship.

It must not be thought that I am making an indictment against all supply authorities. Many of them run their sales departments on thoroughly sound lines, and are a real help to the local contractors; but the point that I should like to emphasise is not so much that a few supply authorities run their wiring departments in an unfair and rotten manner, but that all of them have the power to do so if they choose.

By all means let Mr. Riley disclose the names of the companies he has come across who put in rotten work, and, perhaps, it may have the effect of making the Board of Trade realise that they might with advantage look more closely into the work done by supply authorities and electrical contractors generally.

Cunningham, Ltd.
A. W. Kimber, *Manager.*

August 15th, 1913.

Dry and Wet Air Filters.

I find that Continental constructors of turbo-generators express themselves averse to water spray filters instead of cloth air filters, notwithstanding the temporary success of the water spray filter in this country. They point out that damp cooling air will especially affect generators under varying load. In such cases while the machine remains cold, damp may be deposited in its interior. We have met with cases of installations fitted with dry air filters where the generators became so damp that the water literally ran down them. This happened in damp and foggy weather, the air being taken from the outside, and we got over the difficulty by taking a part of the air from the engine-room. Generators thus suffer from damp even in cases where the air has not been specially moistened, and the generator builders fear that there will be many more such cases, where the air is filtered by a water spray. We are still afraid that the use of water spray filters will eventually injure the generators, and the temporary success of some installations using this type of filter can hardly be considered as a definite and final proof that water filtering is superior to dry filtering by means of a cloth.

H. R. Witting.

London, *August 13th*, 1913.

Systems of Wages Payment and Scientific Management.

I note that Mr. G. C. Allingham, in his letter in your current issue, confirms several of the points raised in my recent article. He, however, makes one misstatement, and infers another.

I have re-read my article, but cannot trace any statement that "scientific management was merely a system of wages payment." I simply said that writers on this subject sometimes claimed exaggerated results, and gave an instance of this. As a matter of fact, I am a great believer in scientific management myself when properly applied.

Mr. Allingham also infers that I stated that "no system is of any use." As one of the main objects of my article was to advocate the "fixed bonus system of wages payment," I cannot see upon what grounds this statement is made. I certainly wrote that no system is any use unless worked by an intelligent and zealous staff, and to this statement I strongly adhere. Especially do I do so as the tendency of some writers is to reduce the worker, and, to a large extent, the staff, to the level of mere machines. I would maintain that no system can be a success in the long run which requires the people operating it to convert themselves from human beings into machines.

Zähler.

August 18th, 1913.

Prevention of Accidents in Electric Lifts.

Messrs. Smith, Major & Stevens, in their letter published in your August 8th issue, admit that closing the switch last in order of time is a most attractive ideal.

Perhaps they will now agree that their championship of a wrong system eight years ago (see their letter published June 27th) was singularly unfortunate.

If Messrs. Smith, Major & Stevens will look again at each of Mr. Cooper's letters to this journal, they will see a reference to danger arising from the fact that with all ordinary locking systems the lift can start before counterlocking is effected, and that uncounterlocking and recounterlocking take place as the lift travels.

Such reference is also made (as they point out) in their own letters. Then why on earth did they make the following remark in their letter published June 27th?

"'Helicon' appears to understand what 'danger' was in Mr. Cooper's mind when writing about the moment at which counterlocking is effected. Frankly, we do not, nor can we find it defined in that gentleman's letters. Mr. Cooper certainly started out to describe a danger, but what followed referred merely to an irritating annoyance."

As regards locks that "fill the bill," of which your contributor has stated (not shown) there are four or five, presumably they are not very satisfactory articles, or their advantages are not sufficiently realised, for one hears little of them. They cannot be in accordance with the principles advocated by Messrs. Smith, Major & Stevens.

Helicon.

[We think it is time for this correspondence to be closed.—Eds. E.R.]

Harrogate.—The Lighting Committee of the T.C. has resolved that where the consumer's demand outgrows the capacity of the service cable, which necessitates the laying of a new service, the consumer be charged half the cost of the new service, and he be credited with 50 per cent. of the amount on his first year's extra consumption, and the remaining 50 per cent. on his second year's consumption, provided that where the consumption falls shortly after the new service has been put in, no credit be allowed.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

Some considerable time ago mention was made in this column of the fact that the Canadian Pacific Railway intended to electrify certain sections of line in the West ; it now appears that a contract has been let for the necessary machinery for the electrification of a section of line, some 30 miles long, in British Columbia, in which there are heavy grades and many loops.

Development of water powers in the province already mentioned is likely to proceed apace in the near future. Besides several other schemes recently proposed, there is that of the Bridge River Co., which is worthy of more than passing notice. No less than 200,000 H.P. is involved in the proposal, and the necessary works will include the construction of a large dam, and the driving of a tunnel $1\frac{3}{4}$ miles long, through a mountain. Apparently, it is the intention of the company to start work this year, if possible.

From Hamilton, Ontario, to the Niagara River *viâ* St. Catharine's, the Canadian Pacific Railway Co. propose to run an electric railway.

It is likely that a Commission will shortly be appointed by the Dominion Government, whose duty it will be to investigate the possibilities of water-power development from the head of the Great Lakes to Montreal. The name of this body will be the "St. Lawrence and Great Lakes Commission."

Although in Eastern Canada the Canadian General Electric Co. and the Canadian Westinghouse Co. seem to hold sway as regards contracts for electric plant of moderate and large capacity, it is not always so further West. Messrs. Vickers, Ltd., have lately received an order from the city of Winnipeg for three 5,000-KW. generators with spare parts, and Messrs. Bruce Peebles have secured the contract for the supply of one 1,200-KW. motor-generator for the city of Regina, Saskatchewan ; the Canadian British Engineering Co. has also done quite good work in the West recently.

The following scale of wages, which has recently been decided on jointly between the Toronto Hydro Electric Commission (not the Provincial "Power" Commission) and the electricians, may be of interest to some readers of the Review, though it must be remembered that the cost of living at the present time in Toronto is practically double what it is, say, in Manchester :—

Linemen.—Class A 37 cents per hour.
" —Class B 34 " "
" —Class C 31 " "
Helpers.—Class A 30 cents per hour.
" —Class B 27½ " "
Cable jointers.—Class A 38 cents per hour.
Helpers.—Class 27½ cents per hour.
Electrical Mechanics.—Class A 41 cents. per hour.
" " —Class B 38 " "
" " —Class C 34 " "
" " —Class D 32 " "
Helpers.—Class A 30 cents per hour.
" —Class B 27 " "

The men are to have all legal holidays with full pay and will have every alternate Saturday afternoon off.

The business section of Montreal was seriously hampered recently by having all telephone communication interrupted owing to an insignificant fire on the switchboard in the main exchange.

A Glasgow "Wireless" School.—The Faraday Correspondence Schools, Ltd., Glasgow, are contemplating the erection of a school for the training of students in wireless telegraphy. The site of the proposed buildings is in the suburb of Giffnock, to the South of Glasgow. There will be a large class room, two wireless instrument rooms, aerial room, engine room, storage battery room, &c. There will be six sets of portable wireless instruments, each capable of transmitting up to 20 miles, and receiving up to a radius of 150 miles. In the aerial room there will be, however, a powerful long-distance apparatus, capable of getting into touch with all the wireless stations in Europe. The school is planned to accommodate 150 students at one time, and the classes will be arranged to deal with 1,800 students per annum. Mr. J. H. Ballantyne is the managing director.

THE LONDON TRAFFIC PROBLEM.

Summary of Select Committee's Report.

A Select Committee was appointed in November, 1912 and reappointed in March, 1913, to inquire into the circumstances which have led to the large and increasing number of fatal accidents in the metropolis due to motor-omnibuses and other forms of power-driven vehicles, and to make recommendations as to measures to be taken to secure greater safety in the streets. This Committee has now issued its report, which is summarised below :—

	1907.	1912.
No. of horse cabs, hansoms, horse omnibuses, and horse tramcars	12,700	2,800
No. of electric trams, motor-'buses and motor-cabs	3,700	13,800
Total	16,400	16,600

Hence, whilst the actual number of street vehicles has not greatly increased, the position is reversed. The above figures do not include heavy commercial vehicles, where motors are replacing horse traction. The motor-driven vehicles comprised in the 1912 figures include 8,000 motor-cabs and 5,800 electric trams and motor-omnibuses. The number of journeys taken per inhabitant has increased by 51 per cent. since 1904, and is now 228 per head. Including the railway passengers from a 30-mile limit, the total in 1911 was almost 2,000,000,000, and if the same rate of growth be maintained, the number by 1920 will be 3,000,000,000. The figures for 1911 are as follows :—

Tramway passengers	821,819,741
Omnibus "	400,628,487
Local railway "	436,398,745
Trunk railway passengers from a 30-mile limit	250,000,000
Total	1,908,846,973

	1904.	1908.	1912.	Ratio 1912-1904.
Number of fatal accidents in the metropolitan area	155	326	537	About 3½ to 1
Number injured in metropolitan area	10,384	16,674	20,166	" 2 to 1
Percentage of accidents to population	0·177	—	0·303	" 1¾ to 1

During the past three years the fatalities caused by horse-drawn vehicles in the metropolitan police area have not varied to any great extent, averaging 150, whereas those due to power-driven vehicles have increased from 214 in 1910 to 369 in 1912. As the number of horse-drawn vehicles has decreased considerably there is some new factor which has affected horse traction and pedestrians.

Influence of Lighting.—During the past three years the number of fatalities which occurred before sunset was 508, and after sunset 355, of which 339 are said to have occurred where the lighting was good; lack of illumination does not therefore appear to be an important factor.

Influence of Width of Roads.—The statistics do not show that broad roads conduce to safety, as the greatest number of accidents occurred in roads between 30 and 40 ft. in width, whereas the smallest number occurred in the narrowest streets, viz., those under 20 ft. in width. The explanation of this is, no doubt, that in the broad streets motor-'buses run in greater numbers.

More exact statistics were obtainable in connection with the L.C.C. Tramways, from which it would appear that greater caution is observed in narrow than in wide streets :—

Miles of tramways.	Width of road.	Fatal accidents in 6 years, 1907—1912.	Accidents per mile.
13¾ ...	Under 32 ft. 6 in.	4	0·29
54¾ ...	Between 32 ft. 6 in. and 36 ft.	22	0·4
30⅝ ...	" 36 ft. and 40 ft.	30	0·98
26 ...	" 40 ft. and 50 ft.	27	1·0
14½ ...	Over 50 ft.	16	1·1

Influence of Congestion.—The data shows that the motor-'bus is more dangerous, the greater the congestion, whilst motor-cars are more dangerous in light traffic, where higher speeds are possible. The small number of accidents due to tramcars in very congested areas, is probably due to the fact that in many of the congested traffic points north of the Thames there are no trams. The following figures are interesting, and are for the three years 1910, 1911, 1912 :—

Nature of traffic.	Percentage of fatalities due to motor-'buses.	motor-cabs.	light motor-cars.	Total.
"Very congested"	58 per cent.	16 per cent.	—	141
"Congested" ...	52 "	—	19·6 per cent.	234
"Considerable" ...	36 "	14 "	27 "	304
Medium	10 " / 10 (trams)	—	39 " / 25 (heavy motor-cars)	92
Light	below 10 %	12 "	53 per cent.	92

Influence of Speed.—The evidence and data show that the enforcement of a speed limit would not have prevented fatalities, as about 30 per cent. occurred in connection with vehicles travelling at speeds below 5 miles an hour, 50 per cent. between 5 and 10 miles per hour, 10 per cent. between 10 and 15 miles per hour, and less than 3 per cent. at speeds between 15 and 20 miles per hour.

Tramways.—Data were obtained as to fatalities in streets served by tramways only, and by tramways and motor-'buses, but nothing

in the evidence given showed that the tramways, even indirectly, had any connection with the alarming rise of fatalities in recent years.

Children.—In 1911 there were 173 children killed and 5,075 injured, of which 75 per cent. were boys. The fatal accidents to children were 34 per cent. of the total in the metropolitan police area. Evidence tended to show that "in almost every case of a child it was impossible for the driver to avoid the accident." Tramcars stop before passing elementary schools, and instructions have been given to 'bus drivers to do so, in consequence of a communication from the L.C.C. The schools offer the best means for instilling caution into the children in regard to street dangers.

Cyclists.—Cyclists were involved in 4,705 accidents in 1911—about double the number which occurred in 1910. In 1912 the number of cyclists killed by power-driven vehicles was 65, and 21 other persons were killed by ordinary cycles. Of the 28,470 injuries to persons caused by vehicles other than power-driven vehicles, during the last three years 12,813, or 45 per cent., were caused by cycles, a considerably larger number than is caused by any other class of vehicle, including all types of motor vehicles. The number of cyclists killed was 23, 33 and 65 respectively, showing that the increased street danger due to the introduction of power-driven vehicles had affected cyclists in a greater degree than it had affected pedestrians.

A police witness was of opinion that "the cycle is an unfit vehicle for the crowded streets of London." The tramways manager of West Ham strongly criticised the venturesomeness of cyclists, and said they would not keep to the left side of the road, and "swerved about from right to left with a complete disregard of vehicles which are following them."

Carelessness of Drivers and Pedestrians.—A pedestrian has a clear right to the use of the road, and carelessness on his part does not justify lack of care on the part of a driver.

Regulation of Traffic in the City.—Out of a total strength of 1,180 officers and men, 228 are engaged in regulating traffic.

Subways.—Prior to the opening of the subway at the Mansion House there were 64 accidents at this point in 12 months: after the subway was opened there were only 41 accidents in 12 months.

At the Blackfriars Crossing there were 56 accidents in 3 years prior to the opening of the subway, the number being reduced to 25 in the same period after the subway was constructed. On December 3rd, 1912, 54,000 passed through the Mansion House subway of whom 33,000 were from the railway and 21,000 were crossing. During the same day 24,779 persons passed through the Blackfriars subway.

Recent Improvements in the City.—Under two recent Acts, viz., The City of London (Street Traffic) Act, 1909, and the City of London Various Powers Act, 1911, the City has power to make regulations dealing with every kind of vehicle, as to the route to be taken, the line to be kept, the use of streets by costers, the loading and unloading of coal, coke, beer casks, &c., on or across the footway. The effect of the new regulations has been of great advantage in helping to solve the serious problem of congestion and danger in the streets.

Inquests and the Softness of Juries.—In 92 per cent. of the inquests held, verdicts of accidental death without any rider were returned; in 2·3 per cent. were the drivers of vehicles censured; and in only 0·9 per cent. were verdicts of manslaughter returned. As soon as a man is in peril he becomes at once an object of sympathy. Even with benches of magistrates there is often a good deal of sympathy for the man brought before them, and both juries and magistrates are far too lenient.

Dangerous Driving.—An idea prevails that a conviction of dangerous driving cannot be obtained unless it can be proved that some person was actually endangered thereby. This view is quite erroneous.

Safety Guards on Trams and 'Buses.—The design of safety guard on the L.C.C. trams has proved very effective. In the last three years the guard was brought into action on 135 occasions and was unsuccessful in five cases only, in one of which a child was involved. The failure may have been due to the child's clothing. There were 121 cases in which people would have been killed but for the operation of the guard. A side-guard is considered impracticable and unnecessary on L.C.C. cars. In 1907-8 there was only one fatal accident per 14,000,000 passengers carried, in 1912 only one per 22,000,000.

Motor-'Bus Accident Record.—The fatalities in 1907 were 29 per 1,000 'buses, and in 1908, when the rivalry between the L.G.O. and the Road Car Co. was at its height, and racing and "nursing" were common practice, the fatalities rose to 54·7 per 1,000 'buses. The proportion fell in 1909, but has since risen to 62·6 in 1912.

The accidents per 1,000,000 miles run in 1912 were 2·14 for the 'buses, and 0·45 for the cars, or about one-fifth of the 'bus figures.

Competitive Working.—Evidence showed that 'buses run alongside trams in such a way as to prevent passengers entering or leaving the latter, and "numbers of people are afraid to travel in tramcars by reason of these omnibuses." The 'bus fares on tramway routes are in some cases half the fares for the same distance on routes where there are no trams.

Too Many 'Buses.—Each 'bus now carries on the average 60,000 fewer passengers a year than in 1910, and the same average number could be carried with 700 fewer 'buses.

Influence of Drink.—A constable is liable to be charged for "rendering himself unfit for duty through drink"; but a driver cannot be charged unless he is legally "drunk." Where a driver was so much under the influence of drink that he drove on to the pavement, he was not proceeded against, because the divisional surgeon could not say that the man was "drunk."

Speed.—No alteration in speed limit is recommended, but the Committee is of opinion that both tramcar and motor-omnibuses should be fitted as soon as practicable with some form of speed register.

Police Traps.—The practice of giving warning to other motorists of the existence of police traps has proved extremely prejudicial to the police in carrying out the duties of timing cars. Although this has, to some extent, been checked by a ruling of the High Court, the Committee suggests that in any contemplated legislation this class of offence should be specially provided for.

Unsound Vehicles.—It was stated in evidence that hundreds of vehicles in an unsound condition are deliberately sent out in the expectation that a breakdown may occur on the tramway tracks in circumstances which will enable the owner to secure compensation.

In 1903, a by-law, to deal with this state of things, was proposed by the L.C.C., but rejected by the Home Office, on the ground that its terms were unreasonable and lacking in certainty. The Committee regards the presence of unsound vehicles on the streets as a menace to public safety and considers it desirable that a by-law should be framed imposing penalties on any owner or driver who knowingly sends or takes an unsound vehicle into the streets.

General Recommendation.—The Committee is of opinion that the routes, time table and number of stage carriages, should be subject to regulations formed by County Councils and County Borough Councils, and confirmed by a new authority to be established as the New Traffic Branch of the Board of Trade. This New Traffic Branch should supersede or absorb the London Traffic Branch of the Board of Trade and should consist of a small number of specially qualified persons and the choice should not be limited to Government officials. Expert advice of the highest character should be put at its disposal.

IMPROVED AUTOMATIC STAIRCASE LIGHTING CONTROL.

Electric lighting of stairways in conjunction with automatic time switches is becoming very common, particularly in blocks of flats and tenements during late night hours. A person wishing to use the stairs switches on the lights by the aid of a push-button in a relay circuit, and, after a predetermined time, the lamps are automatically disconnected. A comparatively simple equipment is needed, and the convenience of the system to the occupants of the building is immense. By eliminating the use of matches on the stairs the fire risk is considerably reduced, and the automatic extinction of the lamps results in important current economy.

Modern automatic stair-lighting equipments almost invariably depend on the closing of an electromagnetic circuit from pushes on the various landings. The magnet armature closes the lamp circuit and actuates a clockwork train which opens the lamp circuit after a time interval which is regulable within limits. If the person using the stairs has not completed his journey, as may well be the case if he has several flights to ascend, he then finds himself in the dark and has to fumble for the next push-button before the lamps can be switched on for a further period. The search for the switch is likely to be prolonged, and even risky. In many cases, the lighting-control buttons are placed near the door bell pushes of neighbouring flats, so that, in the interests of all parties, a match has generally to be requisitioned, after all, where the above "automatic" control system is adopted.

To avoid such a *contretemps* and allow for human frailties—in the form of gossip by the way, avoirdupois and physical infirmity—while economising lighting to the maximum possible extent in the case of those persons capable of ascending the steps in standard time, a recent contributor to the *Elektrotechnischer Anzeiger* suggests an arrangement whereby a signal is given sufficiently in advance of the impending extinction of the lamps to enable the next push to be reached before darkness descends. The signal is given by placing resistance in series with the lamps, so that they are dimmed during the warning period. The import of the signal is unmistakable, even to the uninitiated, and it is a very simple matter to arrange the necessary electrical gear.

Referring to fig. 1, two controllers, I and II, are employed. Controller I is set for a shorter period than II (say, 2·5 min., as compared with 3·25 min.). On pressing any one of the series of landing buttons K, the electromagnets of both controllers are excited, the respective contacts M are closed, and the clockwork trains C are set in motion. Controller I connects the lamp circuit directly to the service terminals, but when its contacts are opened (after 2·5 min.), the lamps are still supplied for a further 0·75 min. through the resistance r, the pressure drop in which causes the lamps to be dimmed considerably. During the dimming period, there is time to reach the nearest press button K and reclose the field circuits of both electromagnets, if a further period of illumination is, for any reason, required.

The above system is only applicable to those controllers which can be restarted before the completion of the lighting period. In some cases, this cannot be done, and the arrangement shown in fig. 2 may then be employed. Controllers of this type are almost always provided with a special switch contact which temporarily disconnects the electromagnet coil during the lighting period, so that sticking or any continued pressing of the control pushes cannot cause overheating of the magnet winding or current wastage in this circuit. This special contact may be used to connect an auxiliary time switch which closes the lamp circuit through a dimming switch a short time after the main controller contacts are opened. The auxiliary time-switch may be of the strip or

mercury type, such as is largely used in connection with advertising signs. During the period in which the main controller contacts are closed, the field-circuit of the time-switch is closed by U, and, for a certain time after the latter contact is opened, the auxiliary switch contacts remain closed, and the lamps are supplied through the dimmer.

The dimming resistance should be so proportioned that it reduces the lamp current to about 75 per cent. of its normal value. The ballast resistance built for use with arc lamps may conveniently be used for dimming purposes, while a yet cheaper arrangement employs glow lamps as a dimming resistance. It is obviously possible to arrange that the stairway lamps shall be placed in pairs in series (instead of in simple parallel), during the warning period, but this arrangement would considerably increase the cost of the wiring and involve rather too severe dimming.

In figs. 1 and 2 it has been shown how the new system may be applied to stair-lighting controllers already on the market. If a special controller is to be built, the whole of the switching can be performed by a single apparatus, and it is indeed an easy matter to adapt the type of controller, shown in fig. 1, to this end. All that is needed is a sub-division of the end of one of the contact bars M (fig. 3), the gaps being bridged by sections of the dimming resistance *r*. Progressive dimming is then secured during the warning stage, and, by grading the time intervals and degree of dimming of the warning signals, the latter can be made very effective. If it is preferred to have only a single sudden dimming, only one division is made in M, and the whole dimming resistance is connected across this gap.

The suggested improvement in automatic stair-lighting switchgear should certainly increase the popularity and application of this convenient and economical system. The improved equipment described is quite suitable for installation in even small houses, and is cheap (particularly if installed at the time the house is built) in initial and working cost.—L. Crouch.

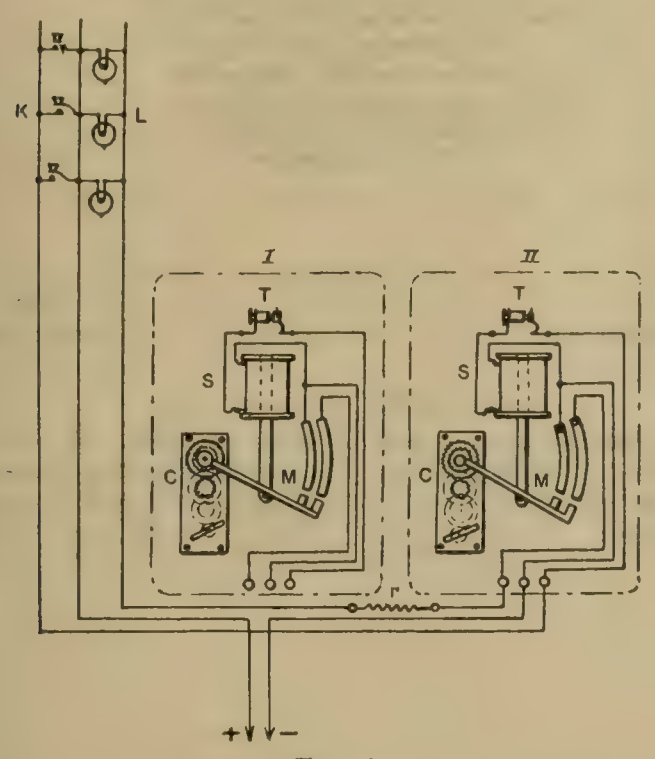


Fig. 1.

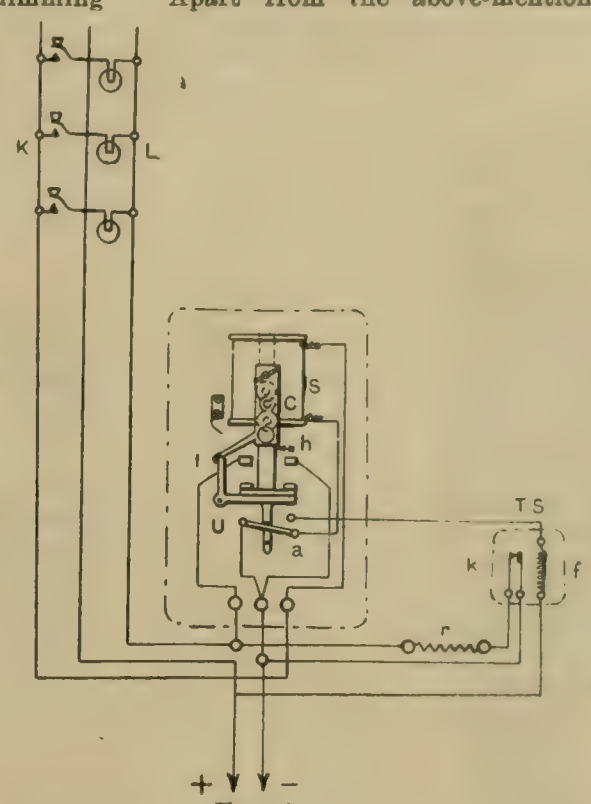


Fig. 2.

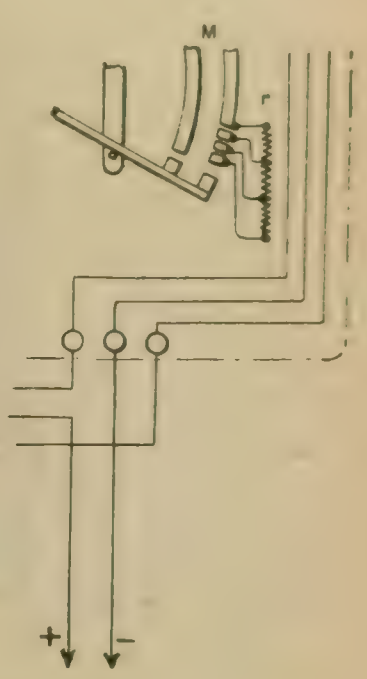


Fig. 3.

Automatic Staircase Lighting Control.

THE ELECTROCHEMICAL AND METALLURGICAL INDUSTRY IN NORWAY DURING 1912.*

While the value of imported raw materials and other goods for productive purposes during the first 10 years of this century rose from £7,400,000 to £13,300,000, or about 85 per cent., the value of industrial products exported during the same period increased by about 150 per cent., or from £2,800,000 to £7,000,000. At present the total capital invested as share capital in industrial concerns reaches the figure of £16,700,000, of which about £8,000,000 is Norwegian capital, about £2,800,000 is foreign, and £5,600,000 is partly Norwegian and partly foreign capital. The amount of foreign capital is estimated to represent about 30 per cent. of the total amount invested in industrial concerns, and it has chiefly been placed in electrochemical and mining undertakings. The electrical industry is of great importance to Norway. In June, 1911, there were 1,139 electrical power plants in use, with an equipment of 262,095 kw. During 1912 the first part of the scheme for harnessing the Rjukan Waterfalls was completed, which brought the aforesaid figure up to 370,000 kw., and if the capacity of all other plants which have been completed since 1911 be added, the total amount should by this time be about ½ million kw., of which some 200,000 kw. are used by the electrochemical industry. There are now to be harnessed three different rivers, viz., the waterfalls at Vamma, Matre and Tyin, each of which will be capable of producing about [illegible] h.p., while the question of harnessing the Nore Falls, which alone should produce about 170,000 h.p., will soon be considered.

The new nitrate industry in Norway has, during 1912, had an excellent year, and the economical results have been very satisfactory, which is not surprising in view of the demand for the products having been very brisk, while prices have been high. The greater portion of the production has been disposed of abroad; the rest has been used for inland consumption, so that the import of nitrates from Chile has almost completely ceased. The large power plant at the Rjukan Waterfalls was set in operation in May last, from which time the productive capacity was increased by 107,000 kw. The new plant has been found to work satisfactorily, and the work at the other factories has proceeded in the same way and without stoppage. The only disturbance that occurred was a small strike in June, which lasted, however, for only eight days.

It is thought that such stoppages may be avoided in future by improving the conditions for the men, and as a means of doing this, the companies have now decided to supply them with cottages, while other schemes for improvement are under consideration. Apart from the above-mentioned factories, there is now in course of erection in the neighbourhood of the town of Arendal another large plant for the manufacture of nitrides, which is going to employ 30,000 h.p. French capital is chiefly interested in this new enterprise.

As regards the carbide of calcium industry, the export of this product has increased very much, and amounted in 1912 to 64,208 tons with a value of £555,500. At the large manufactories at Odda, in Hardanger, part of the production is used as raw material for the manufacture of nitrates of lime.

The Hydro-Nitrogen Co. have carried out, at their factories at Notodden, experiments with a view to producing phosphates from appatite, which have given such good results, that it is now the intention to work the process for commercial purposes.

As regards the electrical smelting of iron ore, this industry has met with considerable difficulties during the year, and one of the new plants, the Hardanger Electrical Works, has shut down, because the process employed, viz., that of the Swedish Elektrometal, did not work satisfactorily with coke as fuel. In Sweden, however, where charcoal is available, the same process has turned out a great success. The production at the Hardanger Electrical Works amounted to 2,200 tons of pig-iron. At the Ulefos Iron Works a small electrical plant has been in operation, and has turned out 300 tons of pig-iron, which have been employed in the foundries of the works. This plant has been worked chiefly for experimental purposes, but it is the intention to erect large works there now.

The most hopeful development of this industry has, however, been made at the Tinfos Iron Works, although the plant was not completed before the end of the year. One furnace has been in operation for about half a year, and although several difficulties have had to be overcome, the results of the last month's working have been very satisfactory and encouraging. The process employed is a Norwegian process, invented by Engineer Bie-Lorentzen.

The Stavanger Electro-Steel Works, which have been built for the sole purpose of manufacturing steel from scrap-iron, were completed during the year, and so far the results have been very satisfactory. The plant has been built with a view to turning out about 6,000 tons of steel per year. The electrical steel furnace in the Yösingfjord, constructed according to Hiorth's patent, has only been worked periodically during the year.

The Hybinette process for the electrolytic production of copper has been acquired by a company, and been worked by the same at the Aamdal works with good results. The works have, however, been closed down, because the ore from the Aamdal Mines was not the most suitable for the process, while the situation of the works was not favourable for the importation of ore from elsewhere. The

* Partly from *Chem. Ztg.*

company has the intention to erect another plant for exploiting the process at a more convenient place. The production of ferro-silicon amounted to 6,493 tons in 1912, as against only 2,645 tons in 1909. The Meraker Electrical Smelting Works have recently taken up the manufacture of ferro-chrome.

Of zinc refining plants there are two, one at Trondhjem and the other at Sarpsborg. The raw material employed consists chiefly of imported zinc ore. The total production in 1912 amounted to 8,928 tons, the export value being £277,800, from which, however, has to be deducted the cost of the raw materials, which was £222,200.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Some E.A.C. Productions.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., have recently supplied a number of control pillars, one of which we illustrate in fig. 1, to a foreign railway.



Fig. 1.—E.A.C. Control Pillar.

Each pillar consists of cast-iron pedestal, and carries a non-automatic quick-break oil switch, totally enclosed fuse box, with porcelain handle, replaceable fuses, and a totally-enclosed air-break auto-transformer starter. These are bolted together, and no

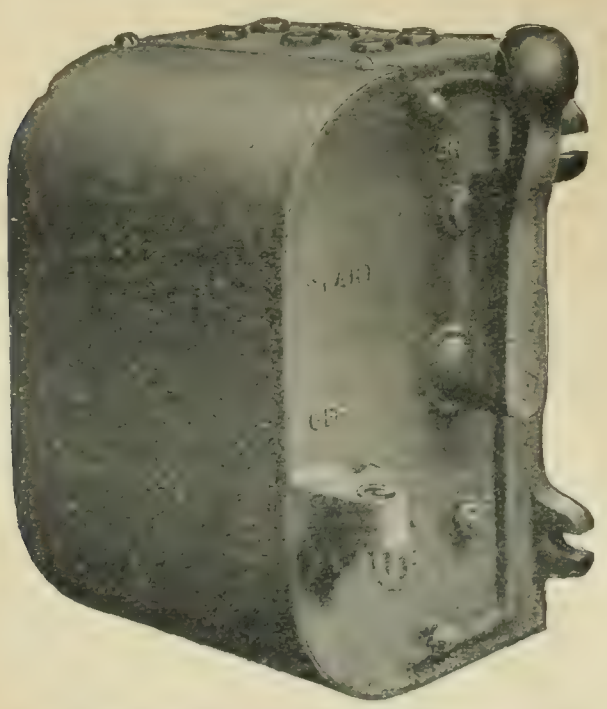


Fig. 2.—Air Break Star-Delta Starter.

connections are exposed, the panels complying with the latest requirements.

We also illustrate the E.A.C. star-delta starter, the designs of which have recently been revised, and now embody various improvements which experience in this class of switch has shown to be desirable. These starters are made in two forms, air-break (fig. 2) and oil-immersed (fig. 3), both being totally enclosed and capable of being made dust-proof and water-tight if desired.

The insulation throughout consists of very substantial moulded mica, and all the starters are fitted with the well-known E.A.C.

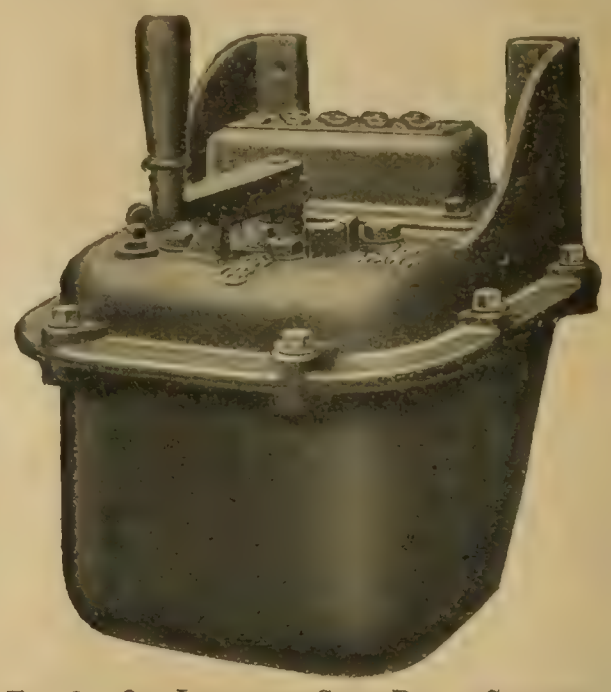


Fig. 3.—Oil-Immersed Star-Delta Starter.

finger, which, besides being very durable, is extremely easy to repair or replace should this ever become necessary. Particular attention has been paid to making the starters easy to wire up and install.

Acid Proof Silica Lamps.

The Westinghouse Cooper Hewitt Co., Ltd., of 80, York Road, King's Cross, N., have recently put on the market an acid proof silica lamp, which is particularly adapted for use in chemical and galvanising works where corrosive vapours are present in the atmosphere. The housing of the lamp is of earthenware, and with

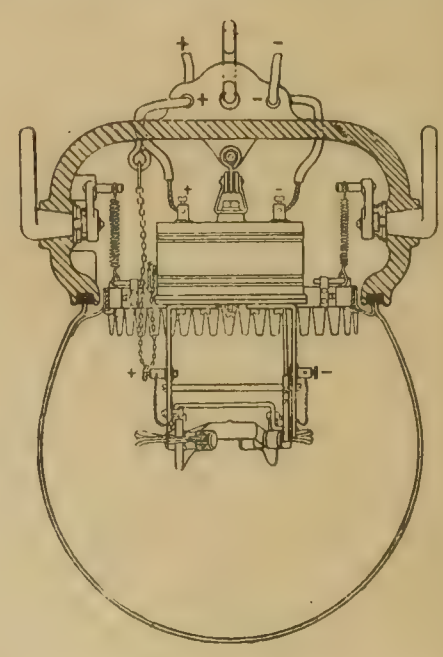


Fig. 4.—Westinghouse acid-proof Silica Lamp.

this the globe makes a tight joint; the lamp mechanism is of the standard pattern, as used in the other silica lamps made by this company.

The lamps are of 1,200 c.p. (110 volts), 3,000 and 1,500 c.p. (220 volts), and have an average life of 4,000 hours and a guaranteed minimum life of 1,000 hours.

An Emergency Oil Firing Device for Central Stations.

The employment of petroleum products as fuel, instead of coal, is rapidly increasing, as its advantages become more widely recognised. The price of fuel oil in this country alone prevents its more general application, but its use as a stand-by for steam raising in case of emergency, is at the present time receiving very considerable attention. When the necessary apparatus is fitted for using this fuel in conjunction with coal, the normal evaporation of the boilers can be increased by 30 per cent.

During recent tests, where a high air pressure for forced draught was available on a Yarrow type boiler, the evaporation was increased by 100 per cent. with a corresponding increase of steam per lb. of fuel burned of 35 per cent. At Wolverhampton electricity supply station some extensive tests have recently been made on a mechanically-fired Babcock & Wilcox boiler, when it was found that a 19 per cent. increased evaporation could be obtained without any alteration of the boiler as arranged for coal or other solid fuel.

Oil being a liquid, special appliances are required for its application, and unless this fuel can be used with scientifically designed apparatus, the results obtained are often far from satisfactory. The system which has been adopted at Wolver-

hampton is the result of many years of pioneer work by Mr. J. J. Kermode (Kermode's, Ltd.), Liverpool, and it is with a plant manufactured by Mr. Kermode's firm that the results quoted were obtained.

This firm have recently perfected a "power augmenter" specially designed for use in electrical power stations, which consists of a portable truck carrying an oil tank, also all the necessary valves for regulating the oil supply. On the truck is mounted one of the Kermode steam and induced air burners arranged so that it can by a simple movement be set at any reasonable angle. In this way the oil spray can be directed as required in order to assist a coal fire in the combustion chamber of any type of boiler. This portable plant can be applied to any furnace which it is desired to force temporarily in order to meet sudden demands for power, thus obviating the necessity of keeping boilers under banked fires to meet peak loads.

The apparatus shows a considerable saving in the cost of fuel in addition to providing a reliable means of at once augmenting the steam production as required.

Weight for weight the calorific value of oil fuel as compared with the best average Welsh coal is about as 14 : 6, or, in other words, 9 lb. of liquid fuel will evaporate the same quantity of water as 14 lb. of coal. In addition to this obvious economy, by means of properly designed atomisers it is possible to obtain 83 per cent. of the theoretical calorific value of the fuel used, whereas with coal the large proportion of fuel passes away unconsumed in the form of soot and smoke. A further saving is effected as no labour is required for removing the ashes or clinker. As an instance of the value of oil firing in emergency, it may be noted that many of the leading fire brigades in England and abroad now use this fuel on their steam-driven engines.

The Belling Electric Fire.

Messrs. Belling & Co., of Derby Road, Edmonton, N., have recently issued a new list calling attention to their well-known "Electric fires," which are specially adapted for domestic use. We understand that some marked improvements have been introduced on the last season's productions, viz, each bar is in parallel on the full voltage; the bars are fitted with a new type of clip, giving perfect contact and doing away with any connecting up when fitting a new bar; a rotating switch is used, sunk flush with the casting, and thus preventing damage in transit, &c. The list illustrates the uses of the Belling fire, and will gladly be supplied to electricity departments on application.

REVIEWS.

Liquid Air, Oxygen, Nitrogen. By G. Claude, translated by H. E. P. Cottrell. 1913. London: J. & A. Churchill. Price 18s. net.

Being written by a French scientific man, it might be expected that this book should contain lighter touches than are usually to be found in an English scientific work. We have not been privileged to read it in the original, but from the general style of this translation, we should judge that it is no mere paraphrase, but that an endeavour has been made to preserve the idiosyncrasies of the French author, either by will or unconsciously. Anyway, the result is a treatise on gaseous liquefactions steeped from end to end with humour, intermingled, regretfully be it said, with three persistent and painful faults in its English; to wit, a heavy crop of infinitives, split not always with single words, but with even short phrases like heavy parenthetic German; numerous instances of "and which" and some of that non-existent word "firstly." These three faults seem to be particularly favoured by engineers. We can, however, almost forgive them in this book because of its happy virtues.

Would that all scientific books could possess something at least of the style of Claude! He treats gaseous liquefactions as a joke and its phenomena as comic interludes. Gases are brought forward as personalities. Temperatures are introduced as frightfully or fearfully low, reminding us of the chatter of a tennis club, or of two rival clubs which played on a certain suburban field.

In Claude's book we find an illustration, the legend to which and index thereof, see page 22, is "Pitiable Behaviour of an Erstwhile Permanent Gas."

A gas is referred to as having been reduced compulsorily to liquefy, and other gases are convicted of the same "abject" behaviour. One reads and laughs, and reads on, interested in the question of the sanctum of the permanent gases to see the mere vapours kicked like poor cowards from the place as mere sham permanencies after all; and, given time, the reader will be carried right through the book, and learn the history and the present status of the subject, imbibe something of the possibilities that the future will yield, and the present, indeed, is already offering from the fractional distillation of mixed low temperature liquids, as he will already regard these abject gases. And he will see, too, the arrant follies of those liquid air enthusiasts who were so full of the motive-power fallacy in connection with liquid air.

To the electrician, one of the more interesting phenomena of low temperature is the enormous increase of electrical conductivity of metals, a fact reasonably to be anticipated from the opposite effect. Thus copper gains fiftyfold if cooled by liquid air. Liquid hydrogen boils at $-252°$ C., and would increase conductivity one hundred times. What a drop there would be in the copper market! In mechanical work shrink fits could be made by reducing the diameter of the inner piece, combined, perhaps, with mere hot water or steam heating of the outer piece, so avoiding dirt, dust and oxidation. And, though matter appears to become dead at low temperatures, even to the extent of the lying down together of the sulphuric lion and the potassium lamb, yet if solid fluorine be placed in liquid hydrogen there is spontaneous and violently explosive combination. What is the hidden meaning of this curious and strange exception to an otherwise, apparently thus far, universal rule?

At page 50 the critical temperature of a gas is given as that *below* which it is impossible to liquefy by pressure alone. Should not this read *above*?

The book is well illustrated with diagrams and with skeleton figures of apparatus used in liquefaction work, and also with half tones of the interiors of some of the leading works, in which oxygen and nitrogen are being produced from liquid air. The process, as here fully described, is most interesting.

Theory and Calculation of Electric Currents. By J. L. La Cour and O. S. Bragstad. London: Longmans, Green & Co. Price 16s. net.

This is the first volume of a projected series of works on the Elements of Electrical Engineering to be issued by Messrs. Longmans, Green & Co., under the general editorship of Mr. J. L. La Cour. This book is based upon the well-known work of the same authors, which forms the first volume of the "Wechselstromtechnik," edited by the late Prof. Arnold, and now taken over by Mr. La Cour. We are told in the authors' preface that the present volume is intended to serve as a text-book of that part of the theory of alternating currents and the allied branches of the theory of electricity which are necessary for a complete study of heavy-currrent electrical engineering. This is an excellent summary in a few words of the scope of the book, to which might be added the further statement that the treatment throughout is mainly of an analytical and mathematical character, and that it is confined to the consideration of electrical and magnetic circuits, without specific reference to particular forms of electrical machinery in which they occur.

The names of the authors are a sufficient guarantee that a work of this scope has been well carried out, and that its publication is a matter of importance to the electrical engineering world. The fact that this book on electrical theory has been written by engineers and for engineers, gives it a very special significance. We may be sure that it cannot fail to exert an important influence towards the adoption of some generally accepted system of calculation and of notation, which we may hope some day to see adopted by electrical engineers as being the best for the particular type of problems with which they have to deal.

Several works have been produced dealing with the theory of electric currents by authors whose point of view has been mainly that of the physicist or of the mathematician. Valuable as have often been the results arrived at by these writers, in many cases they have required further interpretation at the hands of practical engineers before they could be applied to the solution of commercial problems.

In their treatment of alternating-current problems, the

authors make use of the symbolic system of notation which is familiar to students of Steinmetz's works, while they also employ graphical constructions to a considerable extent.

An introductory chapter deals with the fundamental mathematical theory of continuous currents, magnetic fields, electromagnetism, electromagnetic induction, and complex quantities. These last are treated here purely as mathematical abstractions, and it is tacitly assumed that the results of the operations of addition, multiplication, &c., are equally applicable, whether the symbols represent the co-ordinates of a point, pure numbers, or the components of a vector. When the results come to be applied to actual electrical problems, it is somewhat disconcerting to the student to find that these rules may be applied when multiplying a vector of impedance by a vector of current in order to obtain the vector of E.M.F, but that when he wishes to calculate the power in a circuit by multiplication of the vector of voltage by the vector of current, another kind of rule has to be adopted for the multiplication.

Chapter I deals with simple alternating currents and their graphic and symbolic representation. The symbolic expression for the power in a circuit is here shown as being obtained by multiplication of the symbolic expression for the pressure vector, by the symbolic expression for the image of the current vector with respect to the axis of real values. It is interesting to compare this rule with that of Steinmetz, which is based on the idea that the product of two alternating quantities gives rise to an alternating quantity of double frequency, so that the significance of the symbol "j" is altered by the multiplication.

The next two chapters deal with the physical properties of alternating-current circuits, and with the analytical and graphical methods of representation. Circle diagrams are given for the electric circuit, and the use of geometrical inversion in changing from admittance to impedance, &c., is explained. Considerable use is made in the latter chapters of this method of inversion. Geometrical and analytical treatments are closely interwoven. In fact, for some readers the reasoning would have been easier to follow if geometrical and analytical proofs had been kept somewhat more distinct from one another and employed as alternatives, or as supplementary to one another.

Further chapters deal with series and parallel circuits, magnetically interlinked circuits, no-load and short-circuit diagrams, and with circuit load diagrams.

Distorted wave-forms are fully dealt with, both in connection with single-phase and polyphase circuits. A chapter on the measurement of electric currents gives rather briefly the underlying principles of some of the more important types of measuring instruments and is followed by an excellent chapter on the magnetic properties of iron. One is a little inclined to regret that the chapter which deals with the fundamental principles of electrostatics was not extended, so as to lead up to the problems of high-tension lines, but this would perhaps have opened too wide a field. Two chapters on the electric properties of dielectrics and the constants of electric conductors conclude the volume.

Without doubt the work will prove a valuable book of reference on points of theory and on methods of calculation to the experienced engineer, who will find it a mine of information as to the treatment of problems of an advanced character. To the advanced student of electrical engineering, it should prove a text-book of that rare type which deserves close study during his college career and a prominent place on his book-shelf in after years; for it will be long before a book such as this will have to be considered out-of-date, or deserve to be banished in order to make room for a successor.—C. F. S.

Single-Phase Commutator Motors. By F. Creedy. London: Constable & Co., Ltd. Price 7s. 6d. net.

Mr. Creedy's earlier work in connection with the theory of single-phase alternating-current motors is already well known and must entitle any book from his hand on this subject to a respectful and interested reception.

A perusal of the book before us will, we think, induce readers who are interested in the subject of single-phase motors, whether as students or designers, to go further and to give the work a most cordial welcome, and to accord it a more than usually careful study.

The book contains 10 chapters, which occupy just 100 pages, so that it might be thought, at first, that only a short time would be necessary in order fully to master it. Although, the method of treatment is simple and involves hardly any mathematical or geometrical difficulties, likely to trouble the reader who has made a study of alternating-current machines, the book is so concisely written and contains so much material which will appear unfamiliar to the reader that it will be found to contain much food for careful thought and will require close attention at every step.

Stated briefly, the book sets forth a general method, whereby the action of all types of single-phase commutator motors may be studied. Mr. Creedy's method is founded on an analysis by means of vectors, so that his treatment is in the main a graphic one, in connection with which the ordinary symbolic notation can often be used with advantage.

The essential departure from the ordinary treatment of alternating-current problems lies in the special characteristics possessed by the vectors used by Mr. Creedy. Instead of being rotating vectors, which represent phase relations by their relative angular displacements, the vectors employed in Mr. Creedy's work are regarded as alternating in value, and as representing actual space displacements by the angles at which they are drawn. Thus, a vector of flux will indicate an alternating field whose axis is fixed, and which has the direction indicated by the inclination at which the vector is drawn. Since the actual field of a single-phase motor is generally made up of two alternating fields, each having a fixed axis, it becomes necessary to combine such fields, in order to obtain the resultant elliptical field, which acts on the armature.

It will be obvious that the working out of a complete system for deriving the relationships between current, voltages and fluxes, when these are represented in a manner which differs fundamentally from that usually employed, must have involved much labour on the part of the author, and that for the reader much thought is necessary to enable him to adapt his views to the new conceptions with which he is faced throughout the book.

It is a valuable achievement to have developed a system which is comparatively simple, and at the same time is of general and practical utility.

The derivation and properties of the ellipse necessarily play an important part in the graphical treatment of a type of motor in which an elliptical rotating field is characteristic, when Mr. Creedy's form of diagram is employed. An appendix gives some of the geometrical properties of the ellipse, which have a bearing on the working of the problems arising in the body of the book.

The last chapter gives a comparison of the results arrived at by experiment with those derived from the previously given theory. This chapter should prove of special value to the college student, since, as Mr. Creedy points out, many technical colleges are equipped with single-phase motors of which little practical use is made, because a full comprehension of the action of alternating-current commutator motors lies outside the limits of an ordinary college course. By employing the methods given in this last chapter, it is not difficult to plot curves of field distribution by direct experiment, without a full knowledge of the theory of the motor, and in this way to obtain some clear ideas of its operation.

Any new method of representation needs considerable practice and thought before its value can be fully realised and assessed. Without being able to judge Mr. Creedy's methods from the standpoint of actual application in practice, it is possible, however, to congratulate him on having developed a system of representation which is general, which is simple and which is at the same time sufficiently exact for practical purposes.

Perhaps Mr. Creedy will allow the reviewer to mention, in conclusion, one further matter for congratulation, of a more personal nature. With the recollection of hours spent in following out the construction and description of earlier

diagrams of Mr. Creedy's, the reviewer ventures to offer his humble and grateful acknowledgments for the much clearer and simpler style of presentation, as well as for the important simplification of the diagrams which mark a real advance on Mr. Creedy's earlier work.

BUSINESS NOTES.

Bankruptcy Proceedings.—Joseph Swainson (trading as J. Swainson & Co.), electrical contractor, 22, Booth Street, Manchester, Lancashire.—The first meeting of creditors herein was held on August 14th at the offices of the Official Receiver, Byrom Street, Manchester. The total gross liabilities amounted to £1,489, of which £1,369 is expected to rank for dividend. The liabilities due to 60 unsecured creditors amount to £1,023, and three creditors who are partially secured claim £433, the value of their securities being £88. Preferential claims amount to £30 19s. 6d. The assets include stock-in-trade £78, work in progress valued at £65, good book debts £120, and doubtful debts representing £227. The deficiency disclosed amounts to £1,044. Debtor attributed his failure to losses on contracts, bad trade, special allowances to obtain cash, bad debts, and increased cost of material after acceptance of contracts. Mr. A. Yearsley, of Messrs. Trotter, Davis and Yearsley, accountants, Manchester, was appointed trustee, with a committee of inspection consisting of Messrs. R. H. Smethurst (Baxendale & Co.), Jas. K. Cooper (Drennan & Cooper), and Douglas C. Bate. The following are creditors :—

Bowler & Brown, Ltd. ..	£44	Baxendale & Co.	£120
Sloan Electrical Co.	40	British Union Lamp Co., Ltd.	33
Central Electrical Co. ..	21	Sandycroft, Ltd.	38
Northern Accessories Co. ..	21	Griffiths & Son	16
Drennan & Cooper	105	Bedford Steel End Co. ..	22
Newtons, Ltd.	20	Claff, S.	100
Douglas C. Bate	63	Turner, M. S.	148

Wyndham Wadsworth, engineer's agent and dealer in electrical accessories, 16, John Dalton Street, Manchester.—The public examination of this debtor was held at the Court House, Quay Street, Manchester, on August 15th, when the statement of affairs showed liabilities amounting to £591, and an estimated deficiency of £498. Debtor attributed his failure to lack of capital, heavy interest on loans from moneylenders, heavy travelling expenses, and moneys paid as guarantor to his brother. In answer to the Assistant Official Receiver, debtor said he commenced business in July, 1910, when he was 32 years of age, as agent for the sale of lock-washers, such as were used by large engineers. He had no capital excepting a loan of £50 from the company he represented. Being pressed for money he obtained loans from moneylenders, paying as much as 20 per cent. for a fortnight's accommodation. Of the unsecured liabilities, £215 was for money-lending transactions, the balance being wholly for goods supplied. He first became aware of his financial position last December, but continued to trade in the hope that matters would right themselves. The Registrar observed that the debtor appeared to have been paying for loans at the rate of 1,000 per cent. interest per annum. The examination was closed.

W. R. Wedge, electrical engineer, The Arcade, Northampton.—The first meeting of creditors herein was held at the Official Receiver's office, The Parade, Northampton, last week, when the matter was left with the Official Receiver, who will act as trustee.

F. L. Woilliard-Rigg, and H. E. Scarborough (Woilliard, Scarborough & Co., Halifax), electrical and mechanical engineers.—August 30th is the last day for receipt of proofs for dividend. W. Durrance, trustee, 12, Duke Street, Bradford.

For Sale.—The Devon County Asylum is offering for disposal two second-hand De Laval steam turbines and dynamos, of which particulars are given in our advertisement pages to-day.

Messrs. Percy Huddleston & Co. will, from August 25th to 29th, offer for sale by tender a quantity of electrical material and apparatus. Particulars are given in our advertisement pages to-day.

German Activity in China.—A Reuter dispatch from Peking (in the *Financial Times*) states that the German firm of Carlowitz have, through their Hong-Kong manager, who is also a director of the Hong-Kong and Shanghai Bank, offered to advance to the Governor of Yunnan £3,000,000 for the construction of a railway from Yunnan-fu eastwards to Poseting, on the West River. By the terms of the proposed concession, the German firm will both furnish the railway material and finance the undertaking. Messrs. Carlowitz, who represent Krupps, are to have for a period of 20 years a monopoly of all Government contracts for the supply of arms and ammunition and all mining and other machinery, in addition to an extensive series of mining concessions along the projected railway. The firm states that the proposal has been approved by the German Legation in Peking, but the latter denies all knowledge of the matter.

International Electrical Competition.—The subject of the respective manufacturing positions of the three principal producing countries is discussed in an article by Dr. Arthur Lietke in the *Mitteilungen*, of the Siemens & Halske Co. and the Siemens-Schuckert Works. Assuming one mark to represent one shilling, the author states that the exports of electrical products from Germany in 1912 amounted to £13,000,000, or about 22 per cent. of the value of the total domestic production, which is estimated at £60,000,000. On the other hand, Great Britain and the United States are credited with total exports of similar products of the value of £6,500,000 and £5,000,000 respectively in 1912, or about 30 per cent. and 7 per cent. of the total production, which is given as £22,500,000 for Great Britain, and £75,000,000 for the United States. The consumption of electrical products *per capita* of the population on the basis of these figures is put at 16s. for Germany and the United States, as compared with 8s. in the case of Great Britain.

The favourable geographical situation of Germany in Europe is rightly claimed to be largely responsible for the considerable exports realised by that country, which is also asserted to have been the first to appear technically competent in international markets; and about 70 per cent. of the total exports are to countries in other parts of Europe. In the case of Great Britain, which still imports electrical products of the value of £2,500,000, of which £1,700,000 emanate from Germany, it is stated that one-half of the total exports finds a sale in the British Colonies. On the other hand, the United States firms are not in the fortunate position of possessing such preferential markets as Germany and Great Britain, and this explains the smallness of the American exports in relation to the total production in the United States. At the same time it is submitted that the whole of North America down to Panama, including the West Indies, has become the principal market of the United States in recent years.

The first position in the oversea export trade—that is to say to countries outside of Europe—is occupied by Great Britain, which exhibits a total value of £5,250,000, whereas the oversea exports of the United States are calculated at £4,250,000, and those of Germany at £3,750,000, making an aggregate of £13,250,000. These figures show that Germany, whose total exports exceed in value those of her two principal competitors combined, is considerably behind-hand in the trans-marine export trade. The only markets, it is further stated, in which not one of the three countries enjoys special preference, are China and Japan and South America. These countries absorbed electrical products of a total of £5,750,000 in 1912, of which Germany claims 45 per cent., 30 per cent. is allotted to the United States, and the balance of 25 per cent. to Great Britain. It is added, in conclusion, that from the point of view of weight, the total exports from Germany have advanced from 97,000 tons in 1909 to 140,000 tons in 1912, or an increase of 45 per cent, and 44,000 tons, or 30 per cent. of the latter, was formed of oversea exports. The advance in the value in the same period of years has been 30 per cent., or an augmentation of 10 per cent. per annum.

Book Notices.—"Engineering as a Profession." By A. P. M. Fleming and R. W. Bailey. London: John Long, Ltd. Price 2s. 6d. net.

"English and German Technical Terms for Engineers and Manufacturers." By J. G. Horner and O. Holtzmann. London: Crosby Lockwood & Son. Price 3s. net.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 3. July, 1913. Toronto: The Society.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 8. August, 1913. New York: The Society. Price $1.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 2. August, 1913. Philadelphia: The Institute. Price 50 cents.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 6. June, 1913. New York: The Society. Price 75 cents.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXX, No. 3. July, 1913. Philadelphia: The Club.

"The Physical Review." Vol. II, No. 1. July, 1913. Lancaster, Pa.: The American Physical Society.

"Year-Book of the Michigan College of Mines, 1912-13." Houghton, Michigan: The College.

"Congrès des Ingénieurs Electriciens d'Angleterre et de France tenue a Paris du 21 au 24 Mai, 1913." Paris: Gauthier-Villars.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, No. 5. May, 1913. Liége: The Association.

"Revue Mensuelle de Radiotélégraphie and Radiotéléphonie." July, 1913. Vallenciennes: G. Hollande. Price 75 cents.

"Atti della Associazonie Elettrotecnica Italiana. Vol. XVII, No. 14. July 31st, 1913. Milan: Stucchi, Ceretti & C. Price L. 1.50.

"*Bulletin* de la Sociedad de Fomenti Fabril." Vol. XXX, No. 7, July 1st, 1913. Santiago, Chile: The Society.

"Telephone Erection and Maintenance." By H. G. White. London: S. Rentell & Co., Ltd. Price 1s. 6d. net.

Dissolutions and Liquidations.—Traction Supplies Co., Ltd.—A meeting is called for September 23rd at 50, Frederick Street, Sunderland, to hear an account of the winding up from the liquidator, Mr. T. Metcalf.

Redfern, Robins & Co., electrical experts and mechanical engineers, 93½, Hurst Street, Birmingham.—Messrs. J. S. J. Redfern and H. W. C. Robins have dissolved partnership. Mr. Redfern will attend to debts and continue the business as Redfern & Co.

British Electromobile Co., Ltd.—A meeting of creditors is called for August 25th at 1, Queen Victoria Street, London, E.C.

Mexican Fuel & Power Co., Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. R. C. F. Chichester, 13, Basinghall Street, E.C., by September 14th.

Catalogues Wanted.—Electrical catalogues and electrical information are wanted by Mr. Luis A. Escobar, Empresa Electrica de Tacna, Tacna, Chile.

Catalogues and Lists.—Messrs. Falk, Stadelmann and Co., Ltd., 83-85, Farringdon Road, London, E.C.—Two new catalogues have been issued. No. 359 is a production of close upon 300 pages, in which a very wide and choice variety of electric light fittings, and sundries for use in connection therewith, are illustrated and priced. A glazed paper is used, and the illustrations show up effectively. The ground covered is so large that we shall not be expected to indicate the contents in detail, but we may say that there are many admirable and artistic designs included, which it is a pleasure to study even merely as catalogue prints. Some prominence is given to French productions, a class of goods which we understand, is somewhat of a new departure for the firm. The collection of English fittings and designs has been materially amplified, and a section has been introduced dealing separately with indirect and semi-direct lighting. The range of statuary has been almost doubled, and the firm have an excellent assortment and large stock of this class of goods. Several pages are devoted to illustrations of a few representative illuminated advertising signs and illuminated facia, a novelty in the latter connection being shown in the form of "Lumate" facia. Outdoor lanterns, for both shop and street lighting, are listed, as is also the necessary gear wherewith to install them. Every line in the catalogue is stocked. The second publication received from Messrs. Falk, Stadelmann is a 150-page catalogue (No. 354) of electrical accessories, containing illustrations and prices of a host of manufactures, including numerous devices, all sorts of lamps, cables, fans, conduits, carbons, and so on; indeed, it is claimed that nothing in the nature of wiremen's sundries has been omitted.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—New catalogue of 44 pages, containing specification and description of their "Castle" W type motors and dynamos. A great deal of tabular information is included giving outputs, prices, weights and shipping dimensions, code-words, &c., while directions for coupling up motors, and useful general notes, also appear. The catalogue contains a number of half-tone illustrations of the machines, also of Holmes-Clayton A.C. machinery.

Messrs. Wm. McGeoch & Co., 28, West Campbell Street, Glasgow.—Fifty-six-page catalogue of designs of electric light fittings, including hall lanterns, electroliers, shade pendants, single drop and bedroom pendants, ceiling fittings, table standards, billiard fittings and bronze figures. The book is prepared especially for domestic installation requirements, but, as our readers know, Messrs. McGeoch make fittings for all classes of buildings. Prices are given of all the designs listed.

Messrs. Rose Bros., 38 and 39, Beech Street, London, E.C.—16 pp. illustrated and priced supplementary catalogue of electric pocket lamps, cycle and hand lamps, batteries and bulbs, electric heaters, electric motor horns, boys' scientific sets, and other sundries.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Three new fire-alarm pamphlets. No. 600 (20 pages) contains a detailed and excellently illustrated description of the Siemens dial indicator fire-alarm system; No. 601 (24 pages) deals in similar style with the Siemens recording fire-alarm systems; No. 602 is a four-page leaflet giving a list of places in all parts of the world where the firm's fire-alarm installations are in service.

Messrs. Armstrong & Co., 110, Cannon Street, London, E.C.—Illustrated list of bronze relief name-plates for electrical, machinery, and other purposes.

Messrs. Baxendale Brothers, 96, Whitechapel, Liverpool.—Twenty-four-page net price list of batteries, bells, cables, carbons, conduit and other fittings, cinematograph supplies, electric vibrators, and hot and cold-air douche, &c.

Messrs. Krupka & Jacoby, Ltd., Chapter Street, Westminster, London.—Price lists of Osram, Mazda and tantalum lamps.

The British Thomson-Houston Co., Ltd., Rugby.—Two new price lists: No. 5,000 (36 pp.) deals very fully, both descriptively and by illustrations and in tabular data form, with the B.T.H. controllers and resistances for industrial purposes. No. 5,001 (16 pp.) contains an account in similar form of their controllers and resistances for haulage service in coal mines.

Herr. Hans. Fickenscher, Ritterstr. 31, Berlin.—Twenty-page illustrated price list of hanging lamps, lustres, prism shades, electric table lamps, ceiling lighting, prism fittings, &c.

Messrs. Edwin A. Mansfield & Co., 12, Beckenham Road, New Brighton.—Twenty-four-page pamphlet containing descriptions and illustrations of their wireless cable testers, clock-work interrupter and detector coil, also their wireless pipe locator. Testimonials received from a number of American telephone companies which have used the testers are published.

Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.—Four-page pamphlet, fully describing and showing by means of very clear and detailed illustrations, the "Vulcan" patent blow-off valve.

Messrs. David Shanks & Co., Ltd., 115, Wainwright Street, Aston, Birmingham.—Twenty-four-page catalogue of electric light fittings for theatres, picture houses, public halls, &c. Special attention has been given to indirect and semi-indirect lighting, and the contents include examples of metal, real alabaster and imitation bowl fittings, such as have been supplied for leading buildings of the classes named, for auditorium, orchestra, vestibule, lounge and tea-room lighting. Illuminated signs for inside and outside service, also chair reflectors, are included in the list.

Mr. S. Utting, 4, St. Mary Axe, London, E.C.—Thirty-two-page illustrated catalogue, giving a very full account of the Prat system of induced draught, its construction, advantages in fuel economy and low power consumption, simplicity, capital and working costs, also its application to brick chimneys. The pictures show numerous works on the Continent where the Prat system is installed.

Messrs. Schoen Bros., 29-30, Cock Lane, Snow Hill, London, E.C.—Catalogue of 56 pages, giving illustrations and prices of a variety of electrical manufactures, including electric bells, indicators, batteries, terminals, pushes, switches, pocket lamps and lamp-cases, miniature lighting accessories, inspection, cycle and motor lamps, small dynamos and motors, medical coils, toy trains and trams, wireless telegraphy experimental apparatus, &c.

Rubber.—There has been a much more cheerful appearance about the market for crude rubber within the last couple of weeks, and it would almost seem that the actual merits of the article—for it really has merits—were beginning to assert themselves again. The last series of public sales in London went off with a distinctly firmer tone, and altogether the market wears a better appearance, as if the forced selling were over, and intrinsic circumstances were beginning to assert themselves. This is far from saying, however, that there can be any important advance based on merits. No doubt there is room for a small improvement, but the days of the boom have gone, and, it is much to be hoped, will not return. The really satisfactory thing about the market is that, statistically, the position leaves very little to be desired, the ever-increasing supplies all passing into consumption, while there are certain directions in which reduced output is notified. It is exceedingly doubtful if rubber can be collected from wild sources at a profit based on current selling prices of plantation grades, while the production of guayule in Mexico has pretty well ceased, not only on account of the revolutionary disturbances, but because of the threatened extermination of the plant from which it is produced. The reduction in the price of rubber has without a doubt enormously stimulated consumption, which is now on such a thoroughly sound footing, that probably nothing more will be heard of the scheme mooted a few months ago by which the plantation companies of the Middle East were to set aside a portion of their production to be sold at a big discount from the current rates, to consumers willing to enter into an arrangement to use it only in the development of new uses for the commodity. The market price of rubber is quite low enough to-day to permit of all reasonable experimental work in the ordinary course of business, and that consumers are availing themselves of their opportunities is abundantly clear from the way in which the arrivals are going into consumption. The longer that hard Para is held at an artifically high figure by manipulation, the more quickly will the merits of plantation grades force themselves home upon the trade, and the worse will it be in the long run for the collectors of wild rubber in Brazil. The use of rubber for flooring has enormous possibilities, and it is interesting to record the fact that the London Metal Exchange is the first London commercial centre to wake up to the advantages to be derived from its introduction as a sound deadener. The contract for the flooring of the Exchange with rubber has been signed, and probably other exchanges will follow suit when the advantages derived by the Metal Exchange are fully appreciated.

Lead.—Without any actual alteration in the position, the appearance of the Lead Market has been of late somewhat less stiff, especially as regards near deliveries, where some depreciation has been sustained in consequence of an easing in the position, arising out of pretty heavy arrivals reducing the acute phases of the situation. The price of distant deliveries has not suffered to anything like the same extent, and it is regarded with much satisfaction that the prices of prompt and forward metal should now more nearly approximate each other. Big divergencies in prices of this sort always breed distrust on the part of consumers, and, thanks to the reduced premium on near stuffs, a rather more confident air prevails. At the same time there is no desire to buy ahead of requirements, and the trade passing with the rollers remains very small, though, as some compensation for this, there is still a steady business doing with the electrical branches. All the lead which becomes available finds a home readily enough, but there has, the last week or so, been just about enough coming in to relieve the acute shortage, and this is a good thing, for unduly high prices always react disadvantageously upon consumption. Some talk has been heard as to a probable relaxation in the unrest in Mexico, but it amounts to nothing more than the expression of pious hopes that the end of the revolutionary movement may be at hand. Actually the news from Torreon is no better, although the siege of the place has been raised, with, it is said, heavy losses to the rebels. All the news, however, which filters through comes from New York, and should be received with the very greatest scepticism in view of its tainted source. As a matter of fact, apart from the knowledge that mineral production throughout most of the States of Mexico is practically suspended, as it has been for months, there is no definite knowledge to be obtained from any independent channel.

The Shops' Act.—Mr. Frank White, chief inspector in the Bradford Health Department, in his annual report issued last week-end, states that the Shops' Act, 1912, added considerably to the duties of inspectors, and, like many other Acts of Parliament, he says, is full of shortcomings. A notable oversight which he quotes is the failure to fix the number of hours during which a shop assistant may be employed. Since the coming into force of the Act, the day and night inspections of shops have numbered 7,576, and in 630 cases it has been found that no notice specifying the closing day was being exhibited, whilst in 15 cases assistants were found to be employed after 1.30 p.m. on the day appointed for their half-holiday.

Aster Engines.—The Aster Engineering Co., Ltd., have recently achieved a number of successes in motor-boat racing events by the Aster 12-14 H.P. marine engine.

Trade Announcements.—The Electrical and Incandescent Stores have removed to larger premises at 28, Burton Street, Nottingham.

The Siberian Steamship, Manufacturing and Trading Co., Ltd., have removed from 117, Kensington High Street, W., to 4, Cullum Street, London, E.C.

Messrs. T. M. Johns & Co. have removed their offices and works to more extensive premises at 39, Flora Street, Plymouth, where they are equipped for all kinds of electrical repairs and welding by the oxy-acetylene process.

Messrs. W. G. Watson & Co., Ltd., of Sydney, have opened an office for a short time in London, with the object of buying electrical goods for the Australian market. They will be glad to see any of the trade or manufacturers who wish to do business with them, at 41, Cheapside, London, E.C., where a list of requirements can be inspected.

Messrs. Kelvin & James White, Ltd., of Glasgow, announce that with the object of avoiding confusion which has frequently arisen between the name of their company and that of another firm of nautical instrument makers with which they have no connection, and also of rendering the firm's name more distinctive by including in it a reference to two of the present directors, the name of the company has, as from July 30th, been changed to Kelvin, Bottomley & Baird, Ltd. The name of Bottomley has for over 30 years been connected with the business now carried on by this company. Dr. J. T. Bottomley, LL.D., F.R.S., the present chairman, is a nephew of the late Lord Kelvin, the founder of the company, and inventor of the well-known navigational and electrical instruments which bear his name. Mr. Alfred W. Baird, a director, whose name also now appears in the style of the company, entered Lord Kelvin's service 29 years ago, and, later, joined the company on its formation. In the compass-adjusting department he is now ably assisted by a staff of competent adjusters, whom he has personally trained. In addition, Mr. Baird also supervises generally the outside business of the company. The registered address is unaltered.

The *Australasian Record* states that by the creation of 30,000 new shares of £1 each, the capital of Messrs. Haes & Eggers, Ltd., electrical and mechanical engineers, of 163, Clarence Street, Sydney, has been increased to £40,000.

The Electrical Apparatus Co., Ltd. — The meeting of creditors, called for August 29th, is that of the old company, and is a purely formal affair, the business, as our readers will remember, having been transferred to a new company bearing the same title which made a public issue of capital last month.

Annual Sports.—On Saturday, August 16th, Messrs. A. Reyrolle & Co.'s employés held their annual sports at Hebburn, before a large number of spectators. The games commenced at 2.30 p.m., the chief events of the afternoon being the 100 yards flat handicap, veterans' 40 yards flat handicap, egg-and-spoon races, tug-of-war and football matches. At 5.30 o'clock outdoor games ceased. Tea was served gratis to nearly 300 people in the company's new and commodious dining hall, after which dancing claimed attention until 8.30 p.m.

LIGHTING and POWER NOTES.

Argentina.—Rosario Public Lighting.—According to the *Review of the River Plate*, the special Committee appointed by the Rosario City Council to study the question of public lighting has resolved to request two of the firms who presented tenders—namely, Messrs. Colson, Brookhouse and Pyne and Messrs. Koerting & Co., to improve the conditions of same. From this, says our contemporary, it is easily seen that the special Committee intends to definitely exclude all other firms who tendered for this work. The two firms in question have been requested to put up a guarantee of $100,000, and new tenders were to be presented by July 26th. This action of the Rosario City Council is being most unfavourably commented upon, as it shows want of seriousness, and also indicates that everything is not as it should be. The *Review of the River Plate* thinks that instead of asking tenderers to put up guarantees of good faith the City Council should be made to do so, as its action in this question bears every indication of bad faith. Our contemporary gives the following particulars of the public electric lighting contract :—About the middle of 1911, due to the fact that in April, 1912, the contract for public lighting with the Rosario Electricity Co. would terminate the Mayor called for tenders for this service. All the tenders then received were rejected, and early in 1912 new tenders were called for, but these were also rejected. In September of the same year tenders were called for the third time on the basis of supply of current for a minimum of 1,000 arc lamps. Article 26 of the Specification also gave the right to the firm whose tender was accepted to establish a private service for light and power. After various reports had been drawn up by the municipal offices, the tenders were forwarded to the City Council. This in its turn passed them over for study by a special committee appointed from amongst their number. The majority were in favour of the tender presented by an Electric Light Co., but the minority were in favour of another proposal. Both reports were rejected by the City Council, and in view of this it appointed a second special committee to state which of the two tenders was the more favourable. A fresh report was received which the Council would not accept, thereby virtually throwing out all the tenders received ; in spite of this, however, the Council did not consider the matter as terminated, and resolved to appoint a third committee with power to call upon the representatives who had, in their opinion, presented the most favourable tenders, to modify their proposals, not as regards the public lighting, which was the primary object of the tenders, but to endeavour to obtain more favourable terms as regards the price of same. Here the matter rests for the present.

The German Electricity Co., of Buenos Aires, reports the following outputs for the first six months of 1913 :—Lighting, 29,483,000 units ; power, 12,427,000 units ; and traction, 29,860,000 units. Substantial increases, as compared with last year, are shown in the first two items.

The residents of Matheu (Buenos Aires) are proposing to form an E.L. company for the town. The Central Argentine Light and Power Co., capital £100,000, has been registered in London, to carry out a hydro-electric development on the river San Juan.

Australia.—The Brisbane South (Q.) Municipal Council has decided to float a loan for £100,000, for the purpose of carrying out various works, including the installation of an electric lighting system, at an estimated cost of £30,000. At the present time the illumination of the municipality is carried out by the South Brisbane Gas and Light Co., Ltd.

The Electric Light and Power Supply Corporation, Ltd., of Balmain, N.S.W., has ordered from the Australian Metal Co., Ltd., an A.E.G. 2,000-kw. turbo-alternator, complete with condensing plant and pipe work. The plant is to be running in March of next year.—*Mining and Engineering Review (Aus.)*.

Beauly (near Inverness).—The B. of T. has approved of the Special Drainage and Lighting Committee's scheme for the electric lighting of the village.

Bradford.—Tariffs for Shopkeepers.—A lengthy letter, explaining the position of shopkeepers as consumers of electric light, was recently sent by Mr. Roles, the city electrical engineer, to the Bradford Chamber of Trade, following on two interviews with representatives of that body.

Our readers will be familiar with many of the points raised by Mr. Roles to illustrate the disproportionate results which would accrue to the shopkeepers as a body by a reduction in the flat rates of 4d. per unit for inside lighting and 3½d. per unit for arc lighting. Figures are given to show that nearly 20 per cent. of the current supplied to shops is on the m.d. system, and that if that were left out of consideration, and the flat rates mentioned were each reduced by ½d. per unit, the department would lose in revenue £4,320 per annum, but of this amount the shopkeepers would benefit only to the extent of £1,270, and the shorter hour consumers would reap more advantage than those whom it was intended to benefit.

Mr. Roles then explains the altered position under the maximum demand tariff, and hints at a revision of the present m.d. tariff "on some such basis as 6½d. per unit for the first 365 hours' use of the m.d. per annum, and ½d. per unit after," which would, of course, be very much to the advantage of the long-hour shop consumer. The ½d. rate would also facilitate the adoption of electric heating and cooking by shopkeepers. The deputation had objected to a suggested tariff based on a standing charge of 20 per cent. of the rateable value, plus ½d. per unit, and the electricity department was considering alternatives.

In the course of the interviews the question of low charges made to large power consumers was raised, and Mr. Roles goes on to explain the influence which the large power output has in reducing the charges to lighting consumers. He points out that no great increase (comparatively speaking) in lighting units is possible, and gives data showing that in 1904 12,570,000 units were sold for all purposes, while in 1913 24,417,000 were sold, the revenue growing from £82,245 to £120,738. The lighting units, however, only increased from 2,226,000 in 1904 to 2,975,000 in 1913, and the lighting revenue from £36,700 to £40,608.

Thus during the 10 years there was an increase of 750,000 lighting units and of £4,000 in revenue from that source, while the total output increased by some 12,000,000 million units and total revenue by nearly £40,000, showing the value to the department of low-priced units supplied for power and traction purposes. Mr. Roles deals with the various reductions in price which have been made from time to time and their influence on revenue; also with the effect on net profit of the shortening loan periods of the present time—in fact, the letter contains a most instructive summary of the position of electricity supply in Bradford, as well as of other matters which perplex the average consumer.

Bromley (Kent).—A B. of T. inquiry was held at Bromley last week relative to the application of the West Kent Electric Co., Ltd., for permission to lay a series of mains in the town, the routes of which are objected to by the T.C. For the company it was stated that it had powers to supply electricity throughout a large area in the Beckenham and Bromley district ; it would not be the distributors, but would supply electricity in bulk to the Bromley Co. The mains would run through Lewisham, along the Bromley Road, round Beckenham, Hayes, Orpington, and Chislehurst, and eventually back to the South Metropolitan mains. One of the objections raised was that several of the roads on the route had too many pipes and cables under them. It was added that alternative routes suggested by the T.C. were quite impracticable for the company's purpose. For the Council it was stated that both sides of Bromley High Street were quite full of pipes and cables now, and the pavements were narrow, while the Council had at the present time a proposal to lay there a concrete bed and wood pavement. Mr. Patchell, the B. of T. Inspector observed that it would be a good opportunity for the Council to

do it when the mains were being laid, and to make the company pay part of the cost. He added that the B. of T. would give its decision in the course of a few weeks

Canada.—Work has been started on the hydro-electric power station of the Cedar Rapids Co., Montreal, which, when completed, will be the largest in the Dominion. The initial rating will be 100,000 H P., and later this is to be increased to 160,000 H P. The site is 30 miles above Montreal, at Cedar Rapids, on the St. Lawrence River. The generating equipment includes 12 10,800-H.P. water wheels and generators, which are to operate at 56 R.P.M., under a head of 30 ft. The plant is expected to be finished in October, 1914.

Fort William, Ont., which has no gas for domestic purposes, is going to reduce the cost of electricity for cooking purposes, from the present price of 3 cents per KW.-hour to 1½ cents, when it is used for cooking. The city purchases from the power company all the electricity that is used for lighting and domestic purposes, and retails it to the consumer. At present, Fort William, and its twin sister Port Arthur, enjoy the cheapest lighting rate of any cities in Canada.

The Hydro-Electric Commission has decided to enlarge the power station at Niagara Falls, and to double its line between London and Dundas. The towers are already built, and the stringing of the double line to provide Western Ontario with Niagara power, will be commenced at once. The work to be undertaken will cost $300,000.

Cheltenham.—The T.C. has received the sanction of the L.G.B. to a loan of £2,000 for future extensions of mains.

Chesterfield.—The T.C. has decided to apply to the L.G.B. for a loan of £4,000 for high-tension transforming machinery and a transmission line, and for an additional £3,000 for prospective expenditure on mains for five years.

Continental Notes.—FRANCE.—La Société Electrique Centre-Ouest has applied for a concession for the electric lighting for 195 small towns and villages in the Deux-Sevres, Vienne, La Vendee, La Charente and adjoining departments.

NORWAY.—Electric driving, with a separate motor for each loom, is being adopted at the new cotton weaving mills of Messrs. Knud, Graah & Co., at Christiania, a contract having been placed with the A.E G. for 160 ½-H.P. electric motors.

A regards the proposed harnessing for electrical purposes of the waters of the Aura, Mardola, and Lilledal water courses in the Romsdalen district, H.M. Consul at Christiania reports that the Norwegian Storthing has agreed to the granting of this concession. The concessionaire would appear to be connected with an international syndicate, which proposes to manufacture carbide, cyanamide, nitric acid. nitrate of ammonia, cyanide of sodium, &c.

Dartford.—WORKHOUSE LIGHTING.—The B. of G. of August 12th decided to have the male and female infirmaries at the workhouse lit by electricity under a specification drawn up by the electrical engineer to the U.D C.

The Council has informed the R.D.C. that arrangements had been made to supply current in bulk to the West Kent Electricity Co., which is the authorised undertaker for the rural area, and pointing out that as the U.D.C. would not now supply consumers in the rural district direct, the consent of the R.D.C. was not now required. As the matter mainly concerns the parish of Crayford, the R.D.C. has referred the question to the representatives of that parish for consideration

Dudley.—The *London Gazette* contains official notice of the intended transfer of the Corporation's electric lighting powers to the Shropshire, Worcestershire and Staffordshire Electric Power Co., Kingsway, London.

Ealing.—Commencing last Sunday, the Corporation's electricity supply was to be shut off from 3 a.m. to 6 a.m. on Sundays and Wednesdays until the end of September, owing to alterations in connection with the installation of a new switchboard.

Foleshill.—PROV. ORDER.—The Midland E.L. and Power Co. has informed the C.C. that it intends applying for a prov. order for electric supply in the area of the R.D.C., comprising the parishes of Wyken, Binley, Walsgrave-on-Sowe and Bedworth.

Greenock.—YEAR'S WORKING.—At a recent meeting of the Electricity Committee, the convener in referring to the department's finances, said the estimated income for last year was £48,549 and the net balance £3,322. After the estimate was submitted, the Committee made a reduction of a half-penny per unit for lighting energy, which reduced the estimated net balance to £1,820. The actual results were that the total income amounted to £49,279, as compared with £46,150 in the previous year, and the working expenses were £27,155 as compared with £27,717, a decrease of £367, although the sale of electricity amounted to 11,421,000 units, as compared with 10,204,000 units, an increase of 1,218,000 units sold. The gross profit amounted to £21,928, compared with £18,432 in the previous year, representing fully 9 per cent. on the capital expended on the undertaking. From the gross profit £7,478 had been paid for redemption of capital, £2,762 for depreciation, leaving a net profit on the year's working of £5,204. This was the more satisfactory in view of the fact that the coal contracts during the year were placed at an average cost of nearly 2s. per ton more than in the previous year, and that a reduction was made in the price of electricity.

Hong-Kong.—The Hong-Kong Electric Co. has recently introduced the restricted-hour system of charging for power users, and made arrangements for the hire of motors of from 1 to 20 B.H.P. These innovations are said to be much appreciated by Chinese business firms.

Hull.—An arrangement has been entered into between the Corporation and the Sculcoates R.D.C. whereby the Hull authority is to supply electricity for residential lighting purposes to Sutton, just outside the boundary. The arrangement is only temporary, as the Corporation will have to obtain a provisional order, and it does not apply to street lighting.

India.—The Madras Electric Supply Co. has given notice that in certain districts its mains are fully loaded, and that the present machinery in its power house is not, until further extensions are carried out, able to cope with any more load. The company now buys current in bulk from the supply company.

Japan.—The development in the use of electric power has been accompanied by the simultaneous extension of electric lighting in Japan. From the beginning of 1900 to 1910 the number of lighting companies has risen from 49 to 122 ; the buildings electrically lighted have increased from 47,701 in 1901 to over 600,000 in 1910 ; and the number of private lamps in use has advanced from 300 000 to 1,900,000, whilst the street lighting lamps have grown from 6,400 to 59,300 in the same period of years. Many of the lighting companies are also owners of tramways, and their total net receipts have increased nine-fold in the 10 years ended with 1910. Not only so, but the ratio of net profits to expenditure has constantly improved. It formerly stood at 3 to 1, but at present almost 50 per cent. of the total profits represents net profits.—*Far Eastern News.*

Kenilworth.—The U.D.C. has appointed a Committee to consider what steps shall be taken regarding an application by the Leamington E.L. and Power Co. for a prov. order for electric light.

Kingstown.—An amusing letter was read at the Council meeting on Monday, from Mr. T. M. Healy, M.P., thanking the Council for its resolution expressing approval of his action in reference to the Bill for the electric lighting of Kingstown, which was recently before the House of Commons. The Bill, it will be remembered, was blocked by certain members of the "official" Nationalist party, and Alderman Cotton, member for South Dublin, took an active part in the proceedings. Mr. Healy wrote :—"It was not easy to do anything in Parliament when opposed by such forces as your representative engaged in the service of the Gas Co. I hope, however, you may ultimately be able to convince fair-minded members that there is no true relation between patriotism and carbonic monoxide. For myself, I cannot see how it is contrary to National principles to maintain that Kingstown need not be perpetually doomed to the yoke of Alderman Cotton's gasometer." After a lengthly and somewhat acrimonious discussion, the letter was marked "Read and noted." A letter from Mr. Horner, M.P., on the same subject, was also marked "Read and noted."

Llanfairfechan.—The U.D.C. has held a special meeting to discuss the electric lighting question. The report of the consulting engineer (Mr. W. R. Walton) was considered, and resolutions were passed that negotiations be opened with the owners of the upper and lower mills as to their water rights. It was also decided to ask the North Wales Power Co. to receive a deputation on the question of its terms for supplying electricity in bulk to the district.

Lanarkshire.—Satisfaction was expressed at a meeting of the Wishaw T.C. that for the first time the electricity department accounts showed a credit balance of fully £80. The prospects for the future are bright, as a new agreement with the Clyde Valley Co. will mean a saving to the burgh of £200 per annum.

London.—In connection with extensions at Tilbury, the Port of London Authority proposes to add 12 electric luffing cranes of the same type as those recently ordered (and referred to in these columns), for the Royal Albert Dock. To meet the additional power requirements, the power station at Tilbury Dock will be extended. The Authority has arranged with West Ham Corporation for the supply of electricity for pumping at the new dry dock at the Royal Albert Dock extension, and has decided to abolish steam in favour of electrical plant at the Cold Store at West Smithfield.

Louth.—PROV. ORDER.—Messrs. Foote & Milne, Ltd., have informed the T.C. that they intend applying to the B. of T. for a prov. order for electric lighting.

Newport (Mon.).—Certain improvements in street lighting have been agreed to by which lamps giving some 20,000 C.P. will be substituted for lamps giving 8,000 C.P., at slight additional cost. The borough engineer has been instructed to report as to whether further improvements in the lighting of the town are advisable, and, if necessary, to prepare a scheme and estimates, &c.

PROPOSED LOAN.—The L.G.B. has fixed August 27th for an inquiry into the application of the T.C. for a loan of £10,600 for electricity purposes.

Newton-in-Makerfield.—We are informed that Mr. E. M. Lacey has been asked to report to the Council on the question of electricity supply.

New Zealand.—The Devonport B.C. has approved of the plans for electric lighting in the borough. The scheme has been drawn up by Mr. D. M. Davis, and the ratepayers have signified their desire to have an electric lighting system installed.—*New Zealand Shipping and Commerce.*

Ormskirk.—Workhouse Lighting.—At a meeting on August 14th the B. of G. decided to adopt gas instead of steam power for generating electricity for the workhouse.

Portslade (Sussex).—The U.D.C. has appointed a committee to consider the advisability of providing a supply of electricity for the district. Two firms have already applied to the Council for a supply of current for power, and there are other firms in the town who need electricity for their works.

Rhyl.—In a recent report to his committee, Mr. E. H. Wright, the Council's electrical engineer, pointed out that the growth of the load rendered it advisable to consider how the next season's probable load is to be met.

Sheffield.—The Installation Department.—The L.G.B. has sanctioned the borrowing of £79,700 for extensions at Neepsend electricity generating station.

At a meeting of the City Council, an amendment to the report of the Electric Supply Committee was moved and accepted—that the report relative to the future working of the installation and motor department be not confirmed, but that such report should be referred to a Special Committee for inquiry into the working of the commercial and other departments of the electric supply undertaking, and to report to the Council. The object of the amendment was, so the mover explained, to refer the question which had caused so much conflict in the past, to an independent Committee, and to lift it from the atmosphere of controversy.

Swinton.—Mr. H. C. Busbridge, the electrical engineer, reported to the D.C. last week that the erection of the experimental electric lamps in Manchester Road was expected to be completed in a few weeks. The electrical plant at Broad Oak Park sub-station was practically complete, and provided that the delivery of materials could be expedited, consumers might expect a supply in about two weeks.

Sunderland.—At a meeting of the T.C., on the 13th inst., the Electricity Committee recommended that the charge for exterior lighting of business premises be reduced to a uniform 1½d. per unit.

Uruguay.—The directors of the State Electric Light and Power Houses have resolved not to call for tenders for the construction of new stations and expropriation of existing private stations, as it has not been possible to place the loan of $4,000,000, proposed for this purpose.

Wallasey.—The L.G.B. has sanctioned the borrowing by the Corporation of over £11,000 for mains, services, and transformers for the electricity undertaking.

Waterford.—E.L. Scheme.—In connection with the scheme for the electric lighting of the city, the Lighting Committee received a number of applications from electrical engineers. These were forwarded to Mr. Mark Ruddle, Dublin, with a request that he should select, in his opinion, the most suitable candidate. We understand that the Corporation has decided to retain Mr. E. M. Lacey to report on the proposed scheme.

Wakefield.—Annual Report.—The gross income of the electricity department for the last year was £16,095, and the net balance to carry forward was £587. The outstanding debt at the end of the year was £62,297. The output of electricity was 3,276,609 units, of which 2,375,413 were supplied to private consumers, this being a considerable increase. The number of consumers was 876, an increase of 90. The total number of motors connected was 279, representing 2,551 H.P., an increase of 40 motors and 451 H.P. The number of lamp connections was 104 876. The gross profit of the year was equal to 7·4 per cent. on the capital expenditure, and the interest and sinking fund charges were equal to 5·9 per cent. on the same expenditure. These figures compare with the previous year's 6·1 per cent. and 5·36 per cent. respectively. The engineer reports that owing to the heavier demands, the plant extensions recently decided upon would require to be pushed forward as quickly as possible.

Whitehaven.—The Lighting Committee has had under consideration a report by the electrical engineer, who has recommended that in view of improved lamps which will shortly be available, and which will give a greater light with less energy consumption, there be one combined rate of charge for domestic lighting, heating and cooking.

Whitworth.—At the District Council meeting on the 13th inst., it was reported that an application had been made for sanction to the borrowing of £10,965 for the purpose of providing an electricity supply for the district. Councillor Holt said they had allowed for future extensions that might be required. Plans of a proposed sub-station are in course of preparation, and negotiations for the purchase of the proposed station are proceeding.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Mayor of Buenos Ayres recently granted permission to the Compania Tranvias Electricos del Sur to run over the Anglo-Argentine Co.'s lines to the centre of the city. The Anglo company is now appealing against this, pointing out its position under the municipal concession; the Compania del Sur operates under a national concession, which does not revert to the municipality as is the case with the Anglo company's concession.

Ashton.—It is stated that should the demands of the tramway men for an increase of ½d. per hour be granted, it will mean an additional expenditure of £1,200 per annum to the Stalybridge Joint Board, and of £300 a year to the Ashton Corporation.

Belfast.—At a meeting of the Tramways and Electrical Committee the general manager reported that in the past seven months the Glengormely branch—about the purchase of which such a terrible uproar was made for party purposes—showed a net working profit of £1,017, or the equivalent of £1,745 per annum. This was effected with a limited car service owing to limited power supply. A letter was read from the L.G.B. to the effect that Mr. P. C. Cowan, the Board's engineering inspector, would hold an inquiry about September 7th next into the Corporation's application for a loan of £35,000 for electrical purposes.

Canada.—The Canadian Pacific Railway intends to electrify the Rossland-Castlegar section crossing the Rocky Mountains, on the 2,400-volt direct-current system, and, if the results justify it, may extend the system to other branches.

Continental Notes.—Austria.—A preliminary concession has lately been granted in connection with a projected electric local railway between Wels and Klienmunchen, Upper Austria.

Russia.—The Government has granted a concession for the construction and working of an electric tramway to connect the town of Riga with the seaside resort of Majorenhof.

Italy.—The steam tramway between Pisa and Ponterda is to be converted into an electric line.

The Società Trazione ed Imprese Elettriche, of Milan, is about to commence the work of electrifying the railway between Milan and Gallarate. The same company is preparing the plans for a projected electric tramway between Portofino and Rapallo.

Turkey.—According to the *Morning Post*, several sections of the new electric tramway in Constantinople were opened to the public on August 16th.

Dublin.—At a meeting of the Corporation, this week, a resolution was passed instructing the law agent and town clerk to report to the Corporation on the steps necessary in order to obtain possession of the tramways in the city, which are owned by the Dublin United Tramways Co.

Dundee.—The Tramways Committee of the Town Council has authorised the manager, Mr. Peter Fisher, to obtain tenders for four additional cars. It was also agreed to equip all the cars on the system with wire mats, at a cost of £3 18s. per car.

Darlington.—The T.C. has applied to the B. of T. for an extension of time of three years, from October 24th next, for the completion of the electric tramway extension to Haughton.

Dunfermline.—After protracted negotiations with the T.C. the Dunfermline District Tramway Co. has decided to extend its system through Dunfermline to Milesmark, the western boundary of the burgh. When the company obtained its powers, it was a condition that it paid the Corporation £100 per mile in respect of the upkeep of the tramway track. As an incentive to the company the Council has agreed to reduce the payment to £60 for a period of five years.

Greenock.—Proposed Tramway Purchase.—Notice of motion to municipalise the local tramway system has been made by Councillor Mitchell. The motion is in the following terms:—"That the Corporation instruct the town clerk to give due and proper notice to the Greenock and Port-Glasgow Tramway Co. that the Corporation has decided to exercise the option they were entitled to in terms of Clause 17 of the lease entered into by the Corporation of Greenock and the tramway company to terminate said lease at the first break therein, viz., May 15th, 1914."

Ramsbottom.—Railless Trolley System Started.—After inspection on August 14th by Major Druitt and Mr. Trotter, of the B. of T., the new railless trolley-car system at Ramsbottom, near Bury, was opened for public use on the same day. The system, which is the first of its kind in Lancashire, has attracted much notice in the County Palatine. The single-decker vehicles, of which two were delivered last week, have seating accommodation for 28 persons each, and the seats are arranged transversely. The cars are equipped with a couple of 20-H.P. motors. Messrs. Siemens have supplied the electrical equipment, Messrs. Brown (Huddersfield) have made the chassis, and Messrs. Milnes, Voss & Co. (Birkenhead) have built the bodies—the whole being under the supervision of the Railless Electric Traction Co.

Messrs. Clough, Smith & Co. were the contractors for the overhead equipment. The power is supplied at a pressure of 10,000 volts by the Lancashire Electric Power Co., and is received at a

sub-station adjoining the tramshed, where it is transformed to a pressure of 500 volts. The route extends from Holcombe Brook to Edenfield, with a branch down Bridge Street to the railway station. The fares are 1d. for any four quarter-mile stages, and ½d. for each two stages beyond the mile. Delivery of other two cars was expected this week.

Reading.—The T.C. is to promote a Bill for the next session, for carrying out an extension of the tramways, and the running of railless cars and motor-omnibuses.

Ryton.—At the last meeting of the Council, the chairman suggested that the Gateshead and District Tramways Co. be asked to take into consideration the question of a motor-'bus service for the district, including Greenside and Crawcrook, when it considers the proposed service for Whickham and Blaydon districts.

South Africa.—Table Mountain Railway.—Two alternative schemes have been presented to the Cape Town City Council for a railway to the summit of Table Mountain. Scheme No. 2 has been provisionally approved, at an estimated cost of £75,000, and it remains to obtain the ratepayers' sanction. The approved scheme comprises two funicular railways, to be worked by power furnished by the Corporation electricity department; construction is expected to take 2½ years

Stirling.—An important proposal has been made the T.C. by Mr. G. Balfour, of Messrs. Balfour, Beatty & Co., with respect to the electrification of the Stirling and Bridge of Allan tramways, which are at present conducted by horse haulage. Mr. Balfour, in written propositions, stated that he was prepared to acquire the existing tramways undertaking, providing the company was agreeable to make a reasonable arrangement. If such an arrangement was made, he stated that he would apply to Parliament for powers to enable him to reconstruct and electrify the existing lines. He pointed out, however, that he could only carry out that proposal on condition that he acquired Stirling burgh electricity station, and he stated that in such case provision would be made for the reduction of the charges for domestic and street lighting. The T.C. decided to consider the matter.

Tasmania.—The Hobart electric tramway system was taken over by the Corporation from the company on July 1st. The purchase price was £210,000.

U.S.A.—According to the *Indian Textile Journal*, a three-wheeled electric carriage has been invented by Charles B. Chrysler, of Chicago, which, in places where current is available, seems destined to replace the jinricksha. The framing is of steel tube. The body is of basket work carried on strong bicyle wheels, and it is built to carry two stout persons at a speed of 5 miles an hour. The weight with Edison battery and Westinghouse motor is 300 lb. The front wheel is steered with a tiller. There is a special sunshade overhead, and the movement and brake are controlled by foot levers.

Whitworth.—It was reported at the U.D.C., on the 13th inst., that as a result of the Tottenham appeal in regard to the rating of the tramways, the Rochdale Corporation had paid the full rate to the Whitworth Council, and that that meant a gain to the latter of about £150, compared with last year's rates.

TELEGRAPH and TELEPHONE NOTES.

The Vancouver Submarine Telephone Cable.—A telephone cable which has been laid in the gulf of Georgia, connecting Vancouver, on the mainland, and Vancouver Island, B.C., is said to be the longest submarine telephone cable of the kind in the world. A great part of it is laid at a depth of 200 fathoms, being at one point 1,356 ft. deep.

The cable length, according to the Canadian *Electrical News*, is 28 nauts, and it is continuously loaded, having a diameter of nearly 2 in. and weighing 8 tons per naut. The electrical constants of each core per naut are—resistance 4 ohms; capacity ·35 mfd.; dielectric resistance 250 meghoms after 1 min. electrification at 75° F. The attenuation constant is about ·019 per naut of cable at 800 cycles. The cable, which is worked with a phantom circuit, and can be used for three simultaneous conversations, was supplied and laid by Messrs. Henley's Telegraph Works Co.

Canadian Farm Telephones.—According to the *Financier*, a report dealing with the telephone service of Ontario points out that, whereas five years ago there were less than two thousand telephones in farmhouses in Ontario, to-day there are, approximately, 460 systems owned by provincially incorporated companies, co-operative associations, partnerships and individuals, operating nearly 50,000 telephones, and representing a capital investment estimated at $4,000,000; 90 per cent. of these systems, which do not include those of the Bell Telephone Co., were organised by farmers, who, of their own initiative, have established this service and furnished most of the necessary capital.

German Wireless Telephone Experiments.—According to the *Standard*, experiments conducted at Nauen by the Ges. fur Drahtlos Telegraphie, with an instrument invented by Count Arco, have at last resulted in conversations being maintained between Nauen and Cologne, Metz, Strasburg, Wilhelmshaven and Vienna.

Italian Telephone Project.—An important scheme for linking up 300 small towns and villages by means of the telephone in the Province of Glessandria is at present under consideration.

Marconi Patents.—At the request of a member of the House of Commons, a return is to be prepared and issued of patents in respect of which royalties will be payable under the contract with the Marconi Wireless Telegraph Co., the dates when such patents were granted, the areas in respect of which they run, and the dates when they expire in the ordinary course.—*Times.*

Russian Wireless.—A dispatch from St. Petersburg to the *Financial News*, says that the Russian Wireless Co., in which German capitalists are greatly interested, is preparing an issue of new shares to a nominal total of 600,000 roubles, at the price of 101·5 per cent. The capital of the company will thus be increased to 2,400,000 roubles.

Siberia-Alaska.—According to the *Electrical Review and Western Electrician*, direct wireless communication has been established between the U.S. Army station at Nome, Alaska, and the Russian station at Anadyr, Siberia, 500 miles distant. The U.S. officials have been trying to establish communication with the Russian stations for the past six months, but it appears doubtful whether the Nome station will be available for commercial service.

Telephone Payments.—The Postmaster-General has under consideration the question of the payment of telephone subscriptions quarterly, instead of yearly.

Trans-Continental Telephone.—According to American reports, steps are being taken to obtain three complete telephone circuits between Denver and San Francisco; Denver and New York City have had telephone communication for some time, so that in the near future the service will extend across the Continent.

Venezuela.—Telephonic communication has just been established between the towns of Amparo and San Carlos, in the district of Ricaurte.

Post Office Employés.—The House of Commons' Select Committee has issued its report on wages and conditions of employment in the Post Office. A general increase of wages is suggested for all grades within six months. It is recommended that male telegraphists and counter clerks in London shall rise to a maximum of 65s. per week, beginning at 18s. at 18 years of age. For the provinces telegraphists in the first class are to have 16s. at 18 years of age, rising to 58s. maximum. The figures for females are to be:—London, 16s. (under 18) to 40s. maximum; provinces, 13s. (under 18) to 36s. in the first class. The Committee find that there has been an increase in the cost of retail prices of standard commodities of 13·7 per cent. since 1905. Holidays are to remain unaltered. It is stated that the telephone staff have no ground of complaint with regard to the terms of their transfer from the National Co.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" August 15th.

Perth.—October 8th. Bolts for the P.M.G. See "Official Notices" to-day.

Melbourne.—October 7th. Electrically-driven machinery for operating pneumatic tube services. See "Official Notices" to-day.

Melbourne.—November 4th. Automatic switches for exchanges in metropolitan network. See "Official Notices" to-day.

Melbourne.—September 9th. City Council; electricity recording meters and maximum demand indicators. See "Official Notices" to-day.

Austria.—August 25th. The Austrian State Railway authorities at Prague are inviting tenders for an electrically-operated goods lift at Weinberg.

Basingstoke.—September 17th. Corporation. (Section *a*) Diesel generators, balancer set and booster set; (*b*) storage batteries; (*c*) switchboard and instruments; (*d*) cables and cable laying; (*e*) overhead travelling crane. See "Official Notices" to-day.

Belgium.—The municipal authorities of the little town of Ouffet (province of Liége) have just invited tenders for the supply of electrical energy for public and private lighting and power purposes.

September 3rd.—The municipal authorities of Liége are inviting tenders for a steam turbine and alternator of 4,000 kw. capacity. Specifications can be obtained for 1 fr. from Le Chef de Bureau des Services Industriels, Annexe de l'Hotel de Ville, Liége.

Birmingham.—August 27th. 205,000 tons of coal for the Corporation generating stations for one year. Mr. R. A. Chattock, city electrical engineer, 14, Dale End.

(*Continued on page* 303.)

THE GLASGOW PICTURE HOUSE.

(PROVINCIAL CINEMATOGRAPH THEATRES, LTD.)

Some 18 months ago we published an illustrated description of the Leeds "Picture House," but progress in the cinematograph industry has been so rapid, that we cannot but think that a few further details of the design and equipment, illustrating the most modern practice in this branch of industry, will prove of interest to our readers.

On behalf of the directors of the Provincial Cinematograph Theatres, Ltd., Sir John Ure Primrose opened the "Picture House," 140, Sauchiehall Street, Glasgow, on December 19th, 1911, but so popular did the cinematograph form of entertainment become, that it was soon found necessary to double the accommodation.

In August last the old theatre was closed for extensive alterations, and an average number of 250 men were continuously employed — night, day and Sunday—without intermission for four months in its reconstruction, which has cost upwards of £30,000; in the result the Provincial Cinematograph Theatres, Ltd., has added to its list a building which it justly claims to be the premier cinematograph theatre of the world.

The site, which is 220 ft. deep, has a frontage of 60 ft. to Sauchiehall Street and has been divided into three parts.

The Entrance Hall and Vestibule, from which two broad staircases lead to the balcony; this is panelled in dark oak, and includes the ticket office, two cloak rooms and a telephone exchange with public call office.

The Palm Court, a magnificent tea lounge and waiting hall, 50 ft. sq.; this is surmounted by a handsome cathedral glass dome 20 ft. in diameter, and has a fairy fountain which plays continuously into a mosaic basin 9 ft. in diameter, the water rising to a height of 8 or 10 ft. A prominent feature of this lounge is the panelling, staircases and pavement, which have been carried out in grey, white and rose tinted marble.



Projection Hall, Glasgow Picture House, Showing the Lighting.

The Projection Hall, which is one of the largest in the country, has a floor area of 120 ft. × 60 ft. and is surmounted by a barrel vaulted ceiling 50 ft. above the theatre floor. The decoration consists of fumed oak panelling and fibrous plaster work, six of the bays being hung with real tapestry figure subjects. A striking feature of the proscenium is a handsomely modelled group of statuary representing Phœbus, the Sun God.



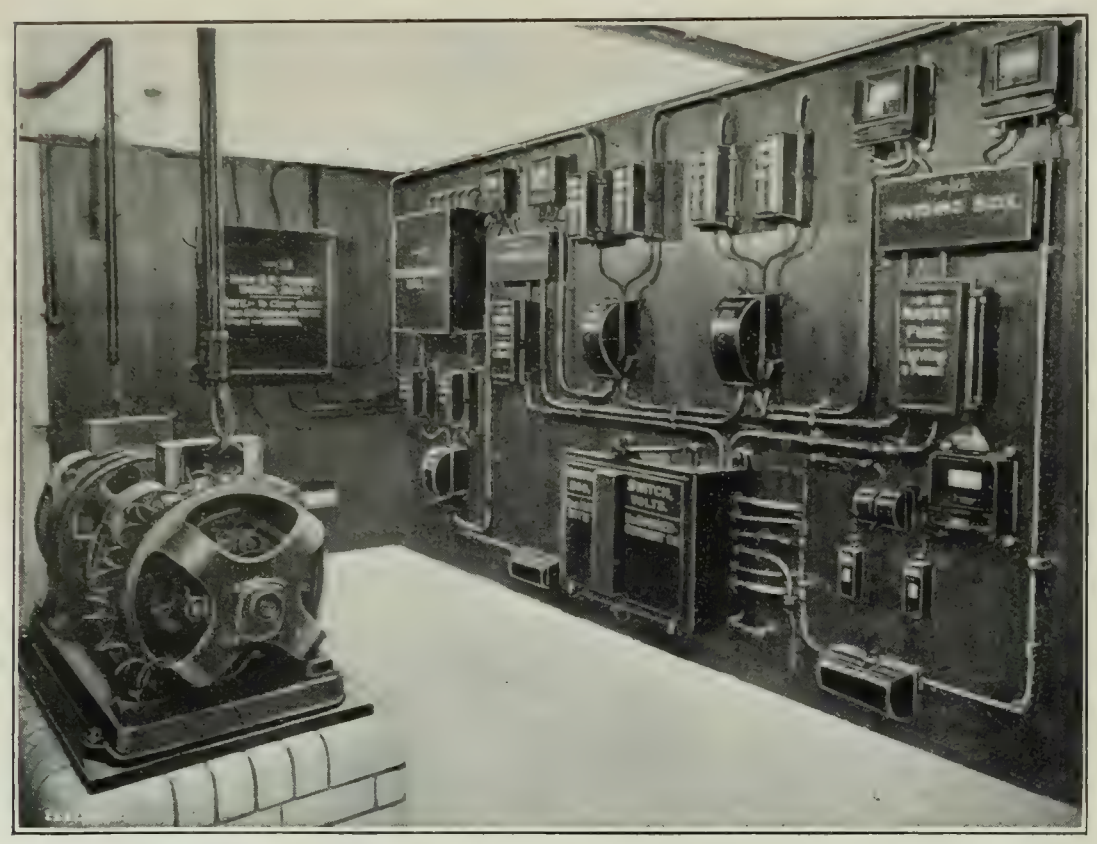
The Palm Court, Glasgow Picture House.

Under the ground floor of the main hall, with direct access from the Palm Court, is the Jacobean Café, furnished in comfortable masculine style, where the business man may enjoy a quiet smoke or read, with telephonic and other facilities at hand.

For the ladies, the Wedgewood Café has been provided on the first floor adjacent to the balcony of the Palm Court, and during the past two years, this room has firmly established itself as one of the favourite meeting places of the city.

As our readers will fully appreciate, the technical equipment of such a building is a serious financial item, requiring

not a little initiative and forethought in addition to technical skill in its design as well as careful supervision during erection, for the success or failure of the whole undertaking depends to a very large extent on efficient lighting, heating, ventilation and projection.



Meter Room, containing Main Switches, Motor-generator, &c.

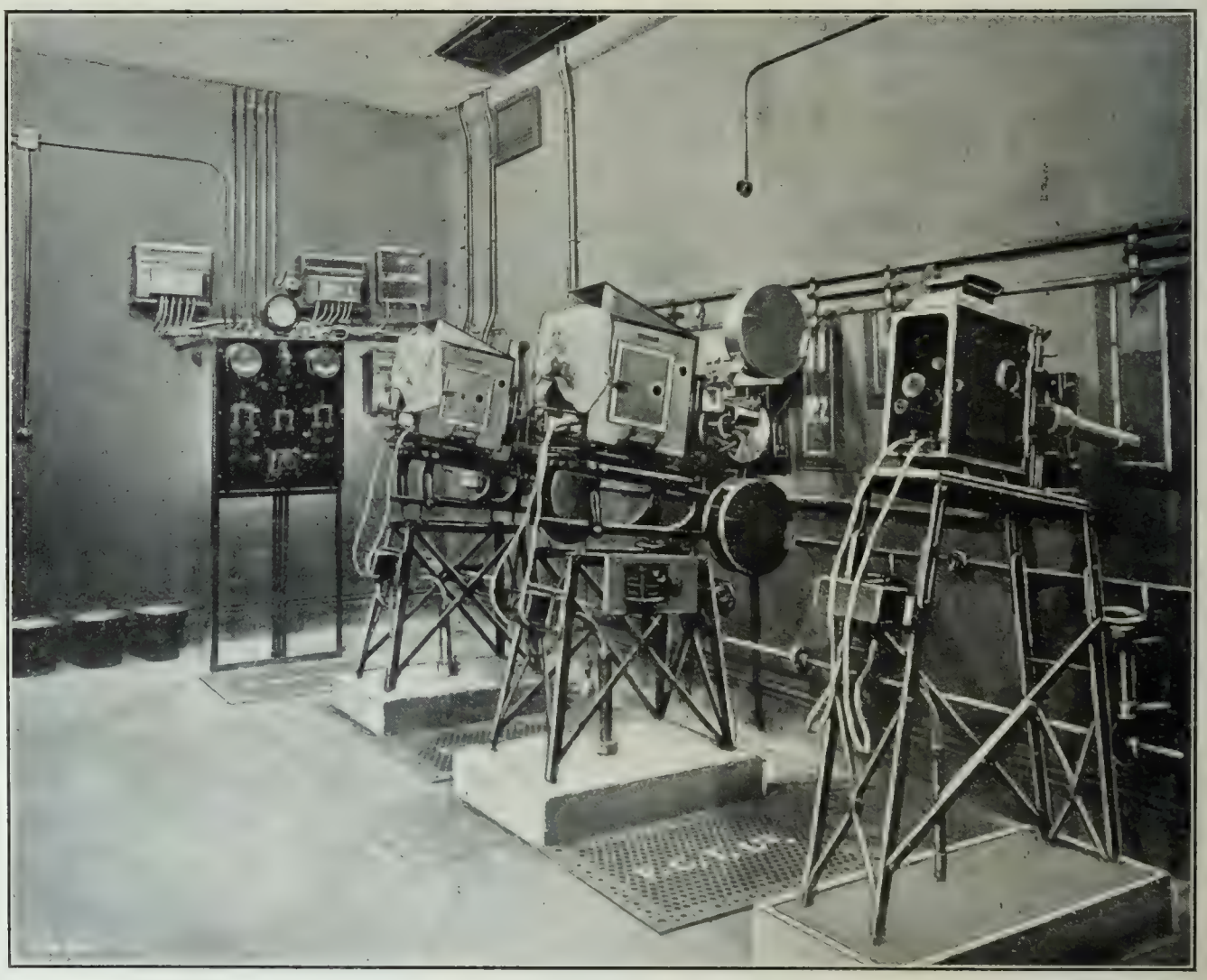
Turning to the electrical side, two four-wire 0·25 sq. in. lead-covered and armoured services are tapped off the Sauchiehall and Renfrew Street mains of the Glasgow Corporation Electricity Supply and connected to a 250-amp., 500-volt, four-pole throw-over ironclad switch, supplied by Messrs. Ward & Goldstone, and fixed in a special meter room situated in the centre of the building. From this switch, 37/16 V.I.R. connections are taken to two ironclad main D.P. five-way lighting distribution boards and two six-way S.P. power boards, which were supplied by the Wandsworth Electrical Co. to the Provincial Cinematograph Theatres, Ltd.'s own standard designs.

The incandescent lighting, which is fed from seven local distributing boards placed at convenient points throughout the building, has been carried out on the "indirect" system, and a striking feature of the Projection Hall is the three 42-in. ceiling, and six 30-in. cornice bowls, which carry 1,000 and 600-watt Osram lamps respectively. These fittings are of hammered brass, but those used in the balcony of the Palm Court are of ½ in. alabaster turned from the solid, some exceedingly artistic effects being obtained with the varying coloured veins. On the ground floor of the Palm Court it was practically impossible to use reflected lighting owing to the various levels from which the fittings are seen, and, therefore, a lantern treatment harmonising with the Louis XVI decoration, was adopted. In order that the beauty of the cathedral glass dome shall not be lost at nightfall, six 1,000-watt Osram lamps are fixed on the upper floor, and a beautifully diffused light—natural by day and artificial by night—is, therefore, transmitted through the stained glass.

For the Oak Lounge, a quaint old lantern design of electric fitting was adopted for the pilasters, and this, in conjunction with two-light candle brackets of the Dutch period, produces a most pleasing effect.

The ventilating plant installed is a very elaborate and costly one, and the company claim that it is by far the largest of its kind in the British Isles. The temperature of each apartment can be kept constant, entirely independent of the fact that the temperature of the outside air may vary from 30° F. to 80° F., or the number of persons present from 1 to 1,200. As to the chemical constitution of the atmosphere, the CO_2 is not allowed to exceed 6 parts in 10,000 parts of air, while ozone is infused into the air by the most modern of plants, supplied by Messrs. Ozonair, Ltd. Some idea of the capacity and size of the plant may be obtained from the fans, which were supplied by Messrs. Davidson & Co., and are driven by electric motors of a combined output of 30 B.H.P., the machines being built to the company's standard specification by the Electric Construction Co.

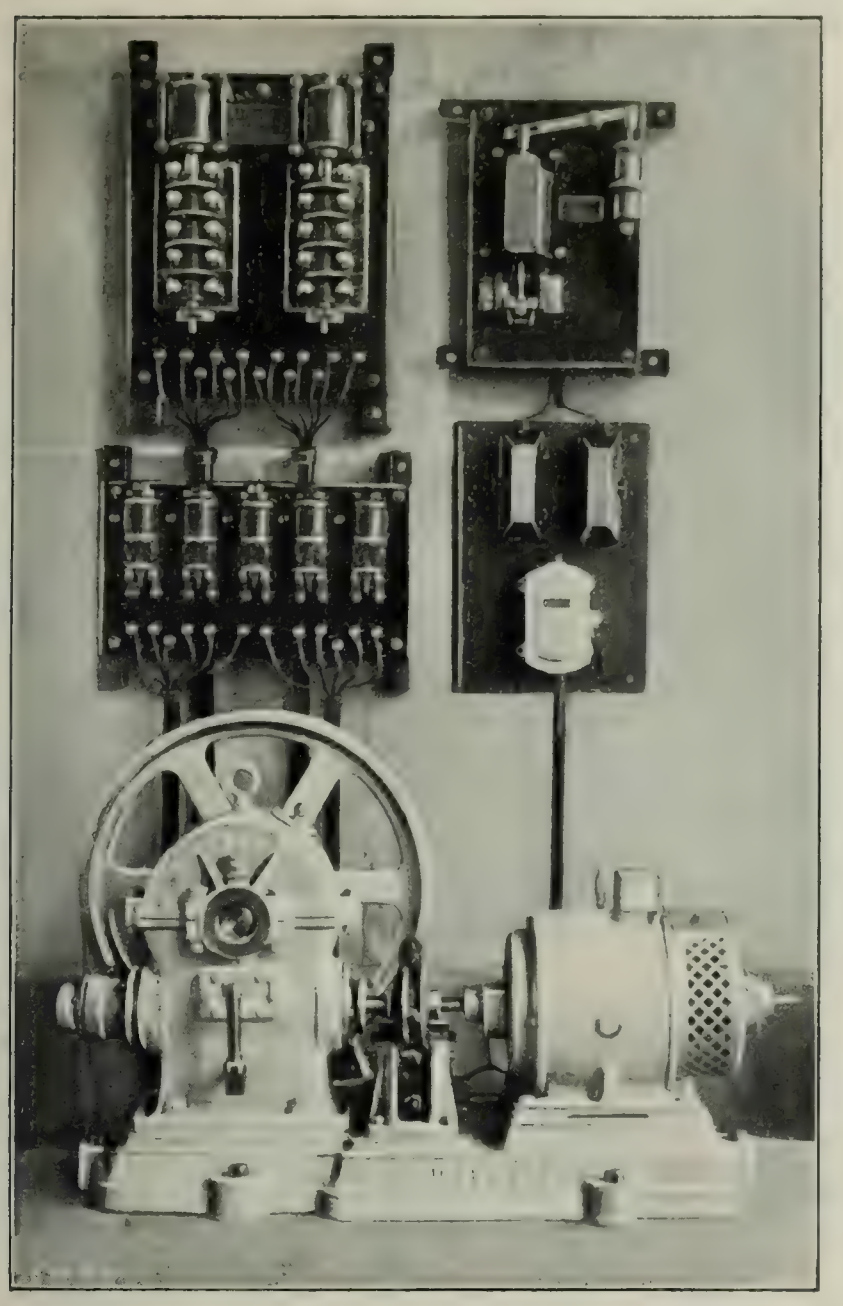
As may be expected, the heating and hot water supply plant has also been carried out on the same elaborate scale, and four boilers of the sectional independent type, made by the National Radiator Co. and the Strebel Co. respectively, have been installed in the basement. The heating installation is on the small bore, forced-circulation system, the pump being direct-coupled to a totally enclosed 1-B.H.P.



The Lantern Room, Glasgow Picture House, showing the Projectors, Switchboard, &c.

E.C.C. motor and connected in the main return header for the purpose of forcing the cooled water back to the boilers.

At one end of the boiler room a 1,000-gallon tank has been sunk into the floor, and this is connected by a 4-in. pipe to the fountain basin previously mentioned in the Palm Court. Near



Electric Lift and Push-Button Control Gear.

by a 14-b.h.p. totally-enclosed E.C.C. motor has been direct-coupled to a Rees-Roturbo pump, capable of delivering 15,000 gallons per hour into an overhead tank 90 ft. above, and from this point the water falls by gravity to the fountain, passing through the air filter screens on its way down.

Since the average attendance at the Picture House is more than a million people a year, it can readily be understood that elaborate provision has to be made for the removal of the dust and dirt carried in from the streets, and for this purpose an electrically-driven 8-b.h.p. vacuum pump, connected through a 1½-in. pipe line to all parts of the building, has been installed, which is capable of maintaining an 8-in. vacuum on the range when dealing with 10,000 cb. ft. of air per hour from five 12-in. renovators, some 2 cwt. of dust being removed from the carpets and seats each week by this process.

The lantern room, which is probably the most important point in the whole buildings, is a well-ventilated apartment, measuring 21 ft. × 16 ft. × 12 ft. high. Two moving picture projectors and one slide projector are installed, the electrical equipment being supplied by Messrs. Morris and Lister, to the company's standard designs and specification. For the electric supply to the projection arcs, which require



Picture Indicator.

100 amperes each, a four-bearing semi-enclosed direct-coupled motor-generator, by the Submersible and J. L. Motors, Ltd., is fixed in the meter room. As a stand-by to this set, in the event of breakdown, a five-way paralleling resistance of 16 amperes capacity per way connected direct on to the outers is fixed above the lantern room, but needless to say, this is only used in emergency as 80 amperes at 500 volts is a rather expensive item when taken for 10 hours per day.



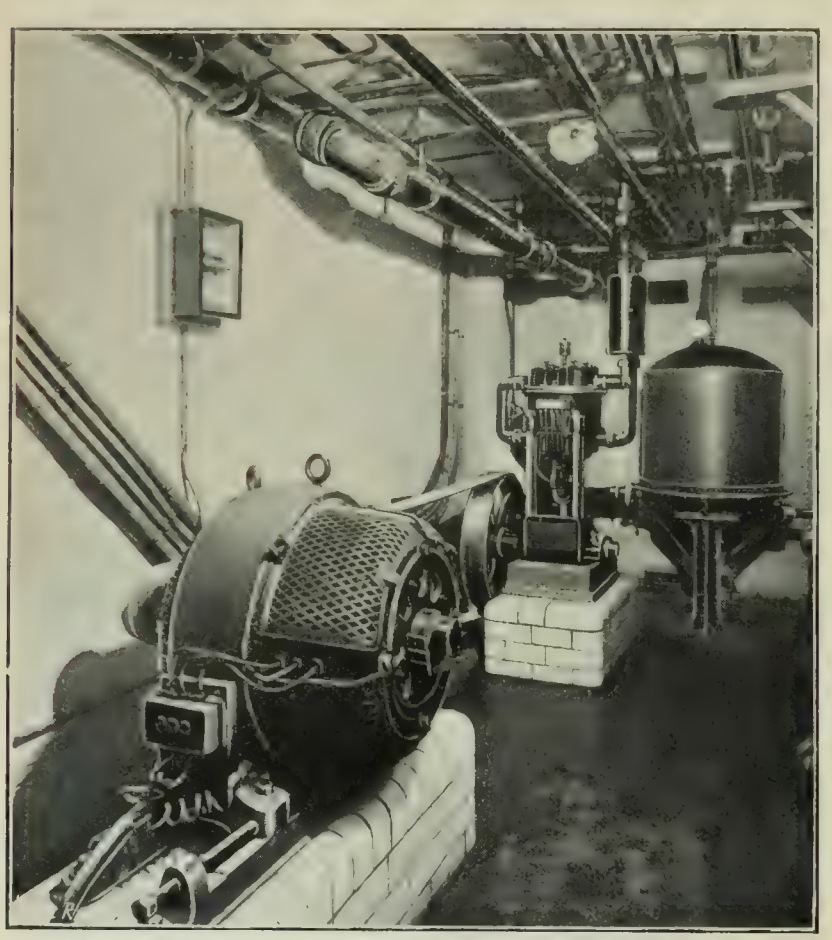
The Oak Lounge Glasgow Picture House.

In order to ensure quick service of refreshments in the cafés, the kitchens are connected to the still rooms of the various cafés by an electric lift, provided with push-button control and supplied by Messrs. W. J. Furse & Co.

Correct time throughout the building is ensured, as all clocks are fitted with electric impulse movements, controlled by one master clock fixed in the Palm Court, which, together with the intercommunication telephone system, was supplied by Messrs. Gent & Co.; picture indicators are fixed in the various cafés

and lounges, in order to keep patrons *au fait* with the progress of the programme.

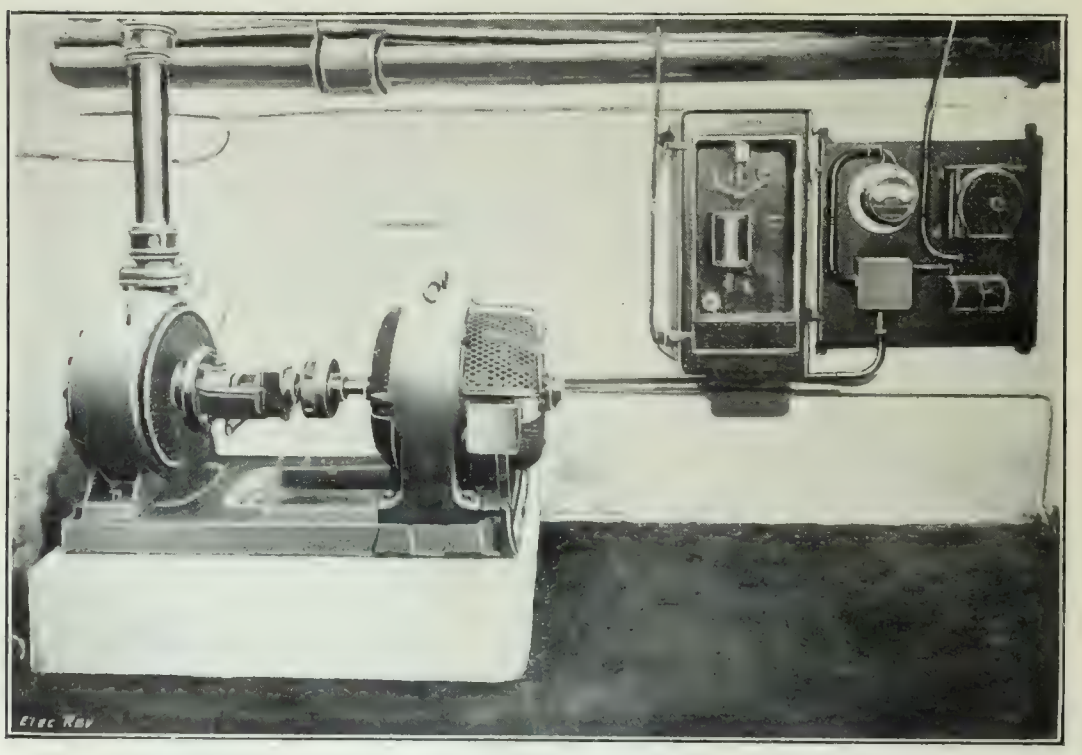
In connection with the electricity supply, it is interesting to note that the maximum demand is approximately 135 KW., made up as follows :—60 KW. motor load ; 40 KW. stand-by resistance ; 35 KW. incandescent lighting.



Vacuum Cleaning Plant, Glasgow Picture House

Taking an average load factor of 35 per cent.—the entertainment is continuous from 11 a.m. to 10.30 p.m.—and neglecting the stand-by resistance, the approximate consumption will be 250,000 units per annum.

Messrs. G. N. Haden, of Glasgow, carried out the low-pressure heating and the domestic hot water supply ; the fountains were supplied by Messrs. Laing, Wharton, Ltd. ; the electrical fittings by Messrs. D. Shanks & Co. ; the cable by Messrs. Gillespie & Beales and the General Electric Co. ; and the solid drawn conduit by Messrs. Simplex Conduits, Ltd.



Pumping Plant for Fountain and Air Screens, Glasgow Picture House

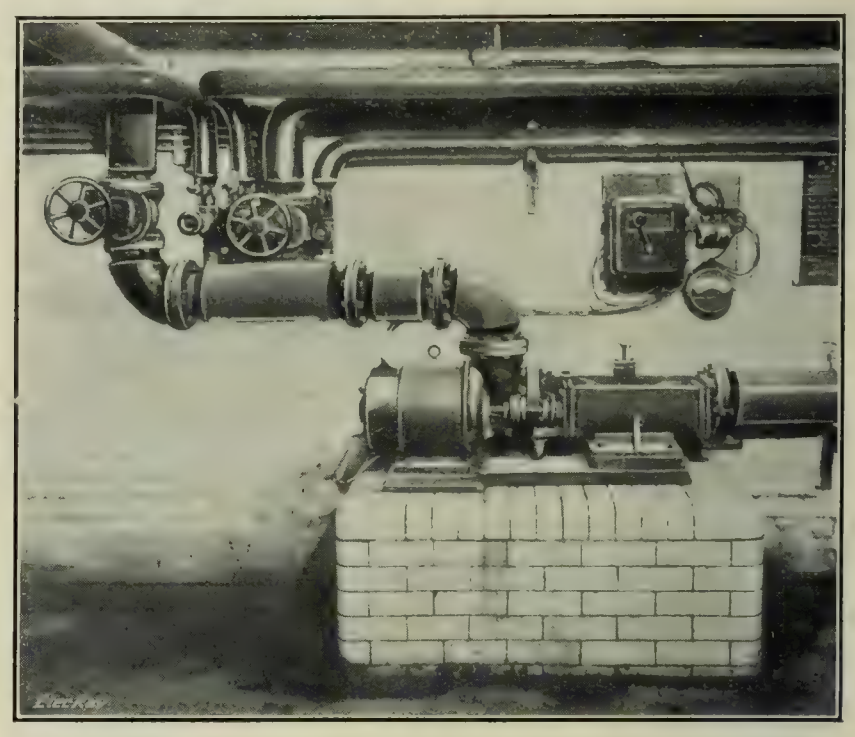
Sheffield Tramways.—A motor-'bus service is to be commenced in a few weeks for the convenience of those residing in the Upperthorpe district.

HIRE-PURCHASE AND INCOME-TAX.

[COMMUNICATED.]

A CASE of considerable importance to users of wagons and similar plant in particular, and to traders in general, relating to hire-purchase transactions has been decided recently in the Scottish courts.

It would appear that the Darngavil Coal Co., Ltd., had on various occasions entered into agreements with the Scottish Wagon Co., Ltd., by which on payment of specific periodical instalments extending over stated intervals they were entitled to the use of certain railway wagons, and on the termination of these agreements, and the payment of the instalments, they were also entitled to the absolute ownership of the wagons upon the payment of certain nominal sums.



Electrical Circulating Pump for Heating Installation, Glasgow Picture House.

For a long time the Inland Revenue have, perhaps not consistently, declared that no part of these payments or instalments is either a payment of interest, or a payment of simple hire, they, with the nominal sums to be paid or paid for acquiring the ownership of the property, being partial payments on account of capital, and that therefore they must not be allowed as deductions in the process of computing profits for income-tax purposes.

The attitude and determination of the Inland Revenue may be gathered from the following general instructions issued to surveyors of taxes in 1909.

No part of the quarterly or other instalments (called rent) is a payment of interest or a payment of simple hire, and it should not be treated as such, or allowed as a deduction (even if any part of the instalment were interest it would be annual interest, and consequently not an allowable deduction). The whole of the instalments as well as the final nominal payments are to be regarded as payments of a capital sum for the purchase of wagons, and no part thereof allowed as a deduction, except in a few cases where the sellers undertake to keep the wagons in repair free of expense to the traders. In these cases an annual allowance not exceeding £2 a wagon may be made for repairs during the continuance of the payment of instalments, but no longer. Allowances may be made for the actual sums paid and borne by the trader for the repairs and maintenance of the wagons, and also for depreciation of the wagons at the rate of 3 per cent. per annum on the cost to the trader, exclusive of sums

included therein for repairs as written down yearly by such deductions. Interest paid under such agreements on overdue instalments, being short interest and accounted for by the sellers, may also be allowed as a deduction.

It must be seen that the whole amount paid for the purchase of wagons is disallowed, and that all credits for receipts from letting the wagons on hire, as well as all debits for the use of the wagons by the trader himself, are properly adjusted in the income-tax computation. Cases in which wagons are financed or surrendered to the wagon company for a money payment before being fully paid for, and immediately acquired again on fresh hire-purchase agreements for a new term of years, should be noted, and whatever adjustments may be necessary in consequence of the way in which the trader has dealt with the transactions in his books, should be made.

In some cases, the terms of the agreements incorporate a hiring expense, in addition to the usual hire-purchase instalments, and others do not do so. In the present instance, the agreement was one of hire with an option to purchase at a stated period, and the Lord President in his judgment, in which Lord Johnston and Lord Mackenzie concurred, held that the cost of hire was an expense to be deducted in the ordinary course when ascertaining the income-tax liability; but as a large proportion of each instalment was really in respect of the future purchase of the wagons, the case must be remitted to the Commissioners to decide, if the parties concerned could not do so, how much of the payments consisted of payment for hire, and how much consisted of payment towards the purchase of the wagons (since the Court had not the information before it to enable it to so analyse the instalments), with an instruction that the portion of the charge represented by hire must be allowed as a deduction in the usual way.

It may be observed in connection with these problems, that although the word "hire" appears usually in this description of agreement, it is quite possible for the terms to be such that they do not really contain any charge for hire, and in such circumstances they amount in effect merely to long-term credit purchases with the usual hiring condition. Hire and purchase terms are two quite different matters. The use of the word hire may be only a kind of legal protection.

CONTRACTS OPEN.

(*Continued from page* 298.)

Bournemouth.—August 27th. Reconstruction of 3 miles (single track) of permanent way for the Corporation Tramways Department. Mr. I. Bulfin, tramway manager. Deposit for specifications, £2.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" August 8th

Bury.—August 25th. One 2,000/3,000-KW. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" August 1st.

Cardiff.—September 12th. Corporation. (1) One 2,000-KW. turbo-alternator, with surface condensing plant and auxiliaries; (2) one 700-KW. rotary converter; (3) boiler house plant. (*a*) Water-tube boilers, super-heaters, stokers, &c.; (*b*) turbine-driven feed pump and heater; (*c*) fuel economiser. See "Official Notices" to-day.

Clonakilty (Co. Cork).—August 26th. The Urban Council is prepared to give £100, or a lesser sum, for the lighting of Clonakilty by 50 electric lamps of 50 C.P. Power of lamps to be increased or diminished as Council may direct. Total power of lamps to be 2,500 C.P. Separate estimates to be given for underground and overhead systems. J. Dunovan, Town Clerk.

Doncaster.—August 26th. 20-ton hand crane for the electricity works. Mr. E. S. Rayner, borough electrical engineer, Grey Friars Road.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe-work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" August 1st.

August 26th.—Supply of A.C. meters, single-phase and three-phase, for two years, for the Corporation. See "Official Notices" August 15th.

Dundee.—Corporation electricity department. Supply of cables. Mr. H. Richardson, general manager.

Edinburgh.—September 8th. Electric light and power installation at the new Town Hall, High Street, Portobello. Particulars from Mr. Newington, electrical engineer, Duncan Place.

September 22nd. Corporation. Two mixed-pressure steam turbines and direct-current generating plants, each of [illegible] kw. capacity. See "Official Notices" to-day.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour. See our last issue for particulars.

Germany.—September 22nd. The Hafenbauamt at Bremen is inviting tenders for the supply of 22 electrically operated cranes of 2½ tons capacity each.

Lancashire.—September 9th. Tell-tale clocks, telephones, electric clocks and fire alarms, for the Visitors for Whalley Asylum. See "Official Notices" to-day.

London.—L.C.C.—August 25th. Electrical installation, 320 lighting points, for Middle Row School, Kensal Road, N.W. See "Official Notices" August 8th.

September 1st.—Electrical installation (100 lighting points), for the Royal Hill Central Elementary School, Greenwich, S.E. See "Official Notices" August 15th.

September 23rd.—Main high-tension switchgear, including the reconstruction of existing main high-tension switchgear, at Greenwich generating station. See "Official Notices" to-day.

Morocco.—October 13th. Moroccan Adjudications Commission, on behalf of the Shereefian Posts and Telegraphs Administration. (1) 20,000 kg. of silicon-bronze wire for urban telephone lines; (2) 177,600 kg. of silicon-bronze or phosphor-bronze wire; (3) 6,000 wooden telegraph posts; and (4) 100,000 insulators on galvanised iron brackets. Tenders to 'Mons. le Président de la Commission Générale des Adjudications et des Marchés," Dar-en-Niaba, Tangier. Particulars as to deposits, forms of tender, &c., at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

New Zealand.—November 10th. Dunedin City Council invites tenders for (1) supply meters, (2) maximum demand indicators, (3) insulated cable and bare wire, for a period of two years. Specifications from the Electrical Engineer, Dunedin.—*New Zealand Shipping and Commerce.*

The same contemporary states that the time for sending in tenders for a 13-panel E.H.T. switchboard for the Christchurch City Council (City Electrical Engineer's Office) has been extended to September 6th.

Ormskirk.—Tenders are about to be obtained for plant required by the Board of Guardians in connection with the generating of electricity by gas in place of steam power, which has been used in the past.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Rochdale.—August 27th. The Electricity Department invites tenders for steam coal, cartage of coal and removal of ashes, supply and erection of wet-air filter, and circulating water screens. Specifications, &c., from Mr. C. C. Atchison, engineer and manager, Dane Street, Rochdale, £1 1s.

Shanghai.—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant: four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

Skewen.—September 1st. Electric lighting installation at the Free Library, for Coldfranc Parish Council: The Librarian.

Spain.—August 30th. The municipal authorities of Llerena (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" August 1st.

Walsall.—August 25th. Automatic electric plant, wiring, lamps, &c., for Great Barr Hall and other buildings in Great Barr Park. Form of tender from Mr. A. H. Ward, Clerk to the Walsall and West Bromwich Unions Joint Committee, 22, Lombard Street, West Bromwich. Plans and specifications from Messrs Edwards & Shaw, consulting engineers, 105, Colmore Row, Birmingham (deposit £2 2s.).

West Ham.—September 4th. Electrical fittings for six or 12 months, for the B. of G. Mr. Thomas Smith, Clerk, Union Road, Leytonstone, N.E.

Wimbledon.—September 1st. One 1,500-KW. turbo-alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" August 8th.

CLOSED.

Australia.—The *Mining and Engineering Review* states hat the Gawler (S.A.) municipality has accepted the following tenders :—

Three 15-kw. transformers and 2,000-volt lightning arresters.—Australian Metal Co., £86.
Time-switch consumers' meters, insulators and street brackets.—Wm. McLean & Co., £142.
Aluminium cable.—Todd & Samuel (B.I. and Helsby Cables, Ltd), £142.
Erection of plant.—Wm. McLean & Co., £282.

SYDNEY.—The *Australasian Record* announces the placing of the following contracts :—

Electric passenger lift at Seventh Shop, George Street.—Standard Waygood, Ltd. (acc.), Sydney, £630.
Carbons.—Siemens Bros., £3,382.
Australian Metal Co., £3 872.
W. G. Watson & Co., schedule.
Union Electric Co., schedule.
Crompton & Co., schedule.
Electric goods lift (No. 5) at new Parcels Post Office, Central Railway Station.—Australian Metal Co., Ltd., £635.

According to *Tenders*, the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Sydney, has obtained the contract for the electric lighting plant for the town of Goulburn (N.S.W.).

Banbury.—The T.C. has accepted the tender of Mr. W. Upton (£70) for installing electric light at the Town Hall.

Belgium.—Four concerns, all German, submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels for the supply and laying of a quantity of telephone cable in the town of Boorn, the lowest offer being that of the Siemens and Halske Co.

Bolivia.—The Bolivian Government has accepted the tender of the Electric Light and Power Co. for carrying out various railway works.—*Review of the River Plate.*

Bolton.—The Electricity Committee has accepted the tender of Messrs. Wm. Pollitt & Co. for laying cable conduits in connection with the new generating station at Back-o'-th'-Bank.

Bury St. Edmunds.—The B.C. Electricity Committee has accepted the following tenders :—

Underfeed Stoker Co., Ltd.—Two B 3 gear-driven mechanical stokers with mechanical draught.
Wm. Cory & Co., Ltd.—1,000 tons of slack coal at 15s. 7d. per ton delivered to Electricity Wo ks.

Chesterfield.—The T.C. has accepted the following tenders :—

Marsden Bros.—Sub-station, Whittington Moor, £205.
Chas. Ross, Ltd.—Girders for switch gallery, £44.
B.I. & Helsby Cables, Ltd.—1,200 yds. low-tension triple-concentric armoured cable, £294.
Brush Electrical Engineering Co., Ltd.—Two trailer car bodies, £80 each.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named :—

WAR OFFICE.

Electric cable.—Callender's Cable and Construction Co., Ltd.
Carbons.—General Electric Co., Ltd.
Cable laying and jointing, R.M. College, Sandhurst.—W. T. Henley's Telegraph Works Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—B.I. and Helsby Cables, Ltd.
Electrical equipment for wagon turntables.—Craven Bros., Ltd.
Telegraph poles, &c.—Bullers, Ltd.
Switchboards.—Siemens Bros. & Co., Ltd.

INDIA OFFICE.

Telegraph apparatus.—Automatic Telephone Manufacturing Co.
Cable.—Siemens Bros. & Co.
Insulator cups.—Bullers, Ltd.
Dynamo parts.—J. Stone & Co.
Insulators.—Bullers, Ltd.
Lightning arresters.—General Electric Co.
Perforator.—Gell Telegraphic Appliances Syndicate.
Standards, &c.—Siemens Bros. & Co.

POST OFFICE.

Electric lifts, Battersea Post Office.—Wadsworth & Sons, Ltd.
Telephone exchange equipment, Chepstow.—Automatic Telephone Manufacturing Co., Ltd.
Telephone exchange equipment, Darlington.—Western Electric Co., Ltd.
Telephone exchange equipment, Lee Green, S.E.—Western Electric Co., Ltd.
Telephone exchange equipment, War Office, S.W.—British L. M. Ericsson Manufacturing Co., Ltd.
Telephone exchange equipment, Purley.—Western Electric Co., Ltd.
Telephone apparatus.—B.I. and Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Battery boxes.—Standard Woodwork Co., Ltd.
Telephonic cable.—Connolly Bros., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Dessicators.—Norman, Dickson, Pringle & Co.
Strip india-rubber.—B.I. and Helsby Cables, Ltd.
Telegraphic ironwork.—Bullers, Ltd.; F. W. Cotterill, Ltd.; Guest, Keen and Nettlefolds, Ltd.; T. W. Lench, Ltd.
Porous pots.—C. T. Maling & Sons.

Harwich and Dovercourt.—In connection with the electrification of the sewage pumping station, the T.C. has accepted the tender of the Rees Roturbo Co. for pumps, at £1,098.

Heywood.—The T.C. has sealed an agreement with the Tudor Accumulator Co., Ltd., for the repair and maintenance of the battery at the electricity works.

Melton Mowbray.—Subject to the consent of the L.G.B. to a loan, the U.D.C. has accepted the tender of Messrs. Dawson and Manfield for a refuse destructor.

New Zealand.—The Government contract for the whole of the equipment of automatic telephone apparatus, for which tenders were recently called, has been placed with the Western Electric Co., Ltd., whose local agents are Messrs. Arthur D. Riley & Co., Ltd., Wellington. The system is to be full automatic, and provides for coin-box telephones, party line working, private branch and satellite exchanges, &c. The contract now placed is for the equipment of six towns, of which the following are the approximate details :—

	Present equipment.	Ultimate equipment.
Wellington	5,500	14,500
Auckland	6,500	14,000
Blenheim	600	2,000
Hamilton	800	2,000
Masterton	800	2,000
Oamaru	600	2,000

A large proportion of the lines are for party working. The two firms tendering—viz., the Automatic Telephone Co. and the Western Electric Co.—each submitted a working model equipment, and the former had already supplied their apparatus for recent extensions at Auckland and Wellington. It is understood that the contract now placed will amount to about £100,000.

According to *New Zealand Shipping and Commerce*, the Christchurch City Council has accepted the offer of a private firm to supply 2,000 poles for the coming Lake Coleridge electric supply. "Councillor Scott was opposed to letting out any of the work in connection with the Lake Coleridge scheme to private firms without public tenders having been called for, especially when the contract ran into thousands of pounds."

Sherburn.—The P.C. received the following tenders for street E.L. extensions :—

S. Gillett & Co.	(accepted)	£ 6 10 0
J. H Stephenson		44 18 0
F. Reid, Ferens		46 7 0
S. Stobart & Co.		50 0 0
Fa conar, Cross & Co.		52 10 0

Sunderland.—At a meeting of the T.C. on 13th inst. the Electricity Committee recommended that the following tenders be accepted :—

I.R. & G.P., &c., Co.—19/20 cable.
B.I. & Helsby Cables, Ltd.—·15 cable, ·25 cable.
Ferranti, Ltd.—Meters.

The Council has also adopted the Tramways Committee's recommendation that the following offers be accepted :—

Hadfield's Steel Foundry Co.—Relaying a manganese railway and tramway crossing.
Tudor Accumulator Co., Ltd.—For welding 500 tramway rail joints.

Tynemouth.—The tender of Messrs. Dick, Kerr & Co., Ltd., has been accepted by the T.C. for a supply of lamps at 40 per cent. discount off the standard list.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, August 23rd. At 3 p.m. Visit to the Churchill Machine Tool Co.'s works at Frederick Road, Pendleton.

Institute of Metals.—Thursday and Friday, August 28th and 29th. Autumn meeting at Ghent, Belgium.

NOTES.

Results Obtained from Active Electric Cooking Campaign.—The American *Electrical Review* gives particulars of actual results accomplished by carrying out energetic electric cooking campaigns during the past few months by the commercial department of the Great Shoshone and Twin Falls Water Power Co., of Twin Falls, and the Southern Idaho Water Power Co., of Pocatello, Idaho. Early in the summer of 1912, the new business department of these two companies commenced a campaign of advertising, publicity, and education of the public in the use of electricity for cooking purposes. This was not done, however, until many tests had been made to determine the most reliable electric cooking devices that were available. The newspaper advertising was followed by a rapid succession of circular letters, tending to further interest the public in the advantages of the electric range over fuel ranges. Public demonstrations of electric cooking were held, and the people turned out by the hundred. At one exhibition in Twin Falls, over 1,000 people visited the display rooms in one day, and each one was served with a small portion of one or more daintily prepared, electrically-cooked foods. The demonstrations were followed up by a well-planned solicitation for the sale of electric ranges among the consumers.

During the fall of 1912, about 60 complete electric ranges of various sizes were sold. A car-load of American Simplex No. 7 ranges (125) was ordered during the winter, and practically all of the shipment has already been actually sold or spoken for. Five hotels and several restaurants and bakeries, during the past six months, have discarded all kitchen fuel, and are using electricity exclusively for all cooking and baking purposes. The greatest difficulty experienced, thus far, in the sale of electric ranges, is the fact that the customers have no means of disposing of their fuel ranges. Were the people able to dispose of their fuel ranges at anything

like a reasonable price, there would be no difficulty in selling 1,000 electric ranges during the current year.

The two companies referred to have adopted a rate of 2·5 cents per KW.-hour for current used for domestic cooking, and a guarantee rate schedule as follows for commercial cooking .—

COMMERCIAL COOKING RATES.

Monthly guarantee per KW. connected.	Rate in cents per KW.-hour.
$1.50	2
2 00	1.5
2.50	1.4
3 00	1.2
3.50	1

There has been found to be a marked diversity factor to be considered in determining the actual revenue obtained from electric cooking installations. This is especially true in the case of domestic electric range equipments. It is reasonable to consider three diversities, one due to the non-coincident use of all the ranges connected, one due to their being a separate switch for each heating element, and one due to the three-heat arrangement on each individual element. The maximum demand of the Simplex ranges used in Idaho is cut down by the use of a switch so arranged that the oven and broiler cannot both be connected at the same time. By this arrangement, the maximum demand of the No. 6 range is reduced to 3,215 watts, and of the No. 7 range to 3 510 watts. This has been found to result in little or no hardship on the one using the range, and is somewhat of an advantage to the electric service company. From the consumers' records of the companies it has been found that the average revenue from the domestic cooking ranges installed prior to April 1st, 1913, was $3.89 per range per month.

In another town where the rate is 3 cents per KW.-hour, the average monthly bills of three families using Hughes No. 40 ranges were $5.88, $2.75 and $1.45. Three other families using Hughes No. 30 ranges averaged $2.91, $3.32 and $3.56. A small hotel with the latter type averaged $5.74.

Inquiry.—Makers of magnetic lathe chucks are asked for.

Institute of Metals at Ghent.—On August 28th and 29th the Institute of Metals is to hold at Ghent its first foreign meeting. Metallurgists from all over the world will assemble in the Palais des Fêtes of the Exhibition, which has been placed at the disposal of the Institute by the Belgian Government. Prof. A. K. Huntingdon, Assoc.R.S.M., will preside.

The first session of the Congress will commence at 10 a.m. on August 28th, with an official welcome of the members on behalf of the University and the Municipality of Ghent. Afterwards, and during the morning of August 29th, there will be presented a number of important scientific papers, which will be read and discussed. Of these probably the most noteworthy is the second report to the Corrosion Committee, by Dr. G. D. Bengough, M.A., and Mr. R. Jones, B.Sc. This document will show that the experimental work which the Institute has been conducting at Liverpool for the past two years has yielded very practical results, indicating clearly not only the causes of the corrosion of condenser tubes, but how such corrosion may be eliminated.

Two foreign papers will be "The Specific Volume and Constitution of Alloys," by Dr. W. M. Guertler (Berlin), and "Copper Rich Alloys," by Prof. S. L. Hoyt (University of Minneapolis). English metallurgists will be well represented, Dr. T. K. Rose, Assoc.R.S.M., of the Royal Mint, presenting a paper on "The Annealing of Gold," and Dr. W. Rosenhain, F.R.S., and Mr. D. Ewen, M.Sc., both of the National Physical Laboratory, have an important paper on "The Intercrystalline Cohesion of Metals—Second Paper." Other contributions are by Mr. J. H. Chamberlain, M.Sc., on "A Further Study of Volume Changes in Alloys"; Dr. C. H. Desch and Mr. S. Whyte, on "Micro-Chemistry of Corrosion: I. Some Copper-Zinc Alloys"; Mr. F. Johnson, M.Sc., on "A Method of Improving the Quality of Arsenical Copper"; Prof. A. A. Read, M.Met., on "The Influence of Phosphorus on some Copper-Aluminium Alloys"; and Mr. T. West, M.Sc., on "The Determination of Oxygen in Copper and Brass."

After the presentation of these papers, visits will be paid to the works of Messrs. Van de Kerkhove (engineers), and the manufacture of Diesel engines will be investigated at the works of Messrs. Carels Freres. One afternoon will be devoted to the International Exhibition, and a concert is being arranged for the first evening of the Conference, whilst on the last day there will be a Municipal Reception at the Town Hall by the Bourgmestre and Reception Committee.

Legal.—HIRING A MOTOR.—In the City of London Court, on Wednesday, before Judge Lumley Smith, K.C., a claim was made by Messrs. J. O. Grant & Taylor, electrical engineers, 62, Queen Victoria Street, E.C., against Mr. P. G. Fraser, 32 and 34, City Road, to recover the sum of £38 13s. 8d. for the hire of a motor and pan together with shafting and belting. The particulars were:—To running cables to motor as per estimate February 4th, 90 ft. run at 1s. 3d. per ft., £5 12s. 8d.; supplying and fixing main switches and fuses as per estimate, £1 15s.; cost of installing mill, hire of tackle and cartage and storage, £10 6s.; hire of motor and pan, for 4 months, £21. Alternatively, the plantiffs claimed 5 gns. a month for 6 months. Harry Greenaway, plaintiffs' electrical engineer, said that the defendant instructed them to fix up a motor on premises at City Road, which they did. Defendant said that the motor was never put up properly and that it would never work. It had done him a lot of harm and damage and he would have to make a claim against the plaintiffs. The shafting was broken. The men whom plaintiffs sent to fix the motor were inefficient. Greenaway replied that the defendant had not given the motor the proper foundations. He had had the motor for six months; the shafting was not broken.—Judge Lumley Smith found for the plaintiffs with costs.

TAYLOR *v.* LEYTON U.D.C.—On August 14th at the City of London Court, George Taylor, fish porter, was awarded £15 damages and costs against the defendant Council, for injuries and loss of earnings through being thrown from the top of a motor-omnibus by one of the defendants' tramcars, which overturned it.

ARON *v.* X.L. ELECTRIC CO., LTD., AND OTHERS.—The motion in this action, by which the plaintiff sought to obtain a writ of sequestration against the company and attachment of one of the directors for an alleged breach of an undertaking not to proceed with a resolution for a voluntary winding-up, was again before Mr. Justice Astbury as Vacation Judge on Wednesday, August 20th.

After hearing evidence filed on the motion, his Lordship intimated that he was not prepared to make an order. In his opinion, cross-examination of the witnesses on their affidavits was essential.

Mr. Moritz, for the defendants, asked that the motion should be dismissed with costs.

Mr. Simmons, for the plaintiff, submitted that there was ample ground for making the application.

His Lordship asked whether he was willing that the costs should be made costs in the action, or that they should be reserved to be dealt with at the trial?—Mr. Simmons said he was.

Mr. Moritz pointed out that the action had been in abeyance for a long time, and might never come to trial.

After some further discussion, his Lordship said he would make no order on the motion, but would direct that the costs should be the defendants' costs in the action.

Institution Note.—SALFORD TECHNICAL ENGINEERING ASSOCIATION.—The next meeting (lecture on "Grinding Machines," by Mr. K. D. Morgan) will be held on September 20th instead of September 6th.

New Laboratory at Dundee.—The new engineering laboratory at University College, Dundee, is to be opened on October 14th by Sir Alexander Kennedy.

Royal Assent.—The following are among the Acts which have received the Royal Assent:—

Post Office (London) Railway Act.
Telegraph (Money) Act, 1913.
Tramways Orders Confirmation Act, 1913.
Electric Lighting Orders Confirmation (No. 1) Act, 1913.
Electric Lighting Orders Confirmation (No. 2) Act, 1913.
Electric Lighting Orders Confirmation (No. 3) Act, 1913.
Electric Lighting Orders Confirmation (No. 4) Act, 1913.
Electric Lighting Orders Confirmation (No. 5) Act, 1913.
Electric Lighting Orders Confirmation (No. 6) Act, 1913.
Electric Lighting Orders Confirmation (No. 7) Act, 1913.
Wemyss Tramways Order Confirmation Act, 1913.
Richmond (Surrey) Electricity Supply Act, 1913.
Chesterfield Corporation Railless Traction Act, 1913.
Wimbledon and Sutton Railway Act, 1913.
Westgate and Birchington Gas and Electricity Act, 1913.
Metropolitan District Railway Act, 1913.
Metropolitan Railway Act, 1913.
Rhondda Tramways (Railless Traction) Act, 1913.
Mexborough and Swinton Tramways (Railless Traction) Act, 1913.
Kent Electric Power Act, 1913.
Central London Railway Act, 1913.
London Electric Railway Act, 1913.
London County Council (Tramways and Improvements) Act, 1913.
Metropolitan Electric Tramways (Railless Traction) Act, 1913.
City and South London Railway Act, 1913.
Western Valleys (Monmouthshire) Railless Electric Traction Act, 1913.

Fatalities.—A correspondent says that "two miners were killed on Friday night in Moor Green colliery, Nottingham. A gang of men were working at an electric holing machine, which cuts out of the coal face, when two of them, Edward Clarke and Edward Spalding, both of Eastwood, received an electric shock. Spalding was killed as the result of the shock. Clarke was thrown right on to the machine, his body being caught by the driving wheel of the drill and whirled round at a terrific speed. Practically nothing but pulp remained."

It is reported that a collision between a touring car and a telephone pole at Hoboken, New Jersey, on Friday evening caused an alarming electric display resulting in the chauffeur receiving a fatal shock. The car was running at high speed and carried the pole some 30 ft. before it turned turtle amid a network of blazing wires. The fact that the rubber tires held down several wires saved the lives of the owner of the car, Mr. Alexander Negill, a Jersey City manufacturer, and a friend. They were eventually taken from the wreck severely burned and suffering grave injuries, and lay unconscious in hospital.

The Moulders' Strike.—It is stated that the strike of moulders at Sheffield was brought to an end on Monday by the return of the men pending consideration of the matters in dispute at a joint conference of the Masters' Association and representatives of the Ironfounders' Society.

Value of Kyanising in the Preservation of Various Pole Timbers.—Poles preserved by the Kyan process, *i.e.*, impregnated with mercury chloride (corrosive sublimate) solution, are now used to a great extent on the Continent, particularly near towns where their clean appearance and the possibility of painting them are important advantages. In southern countries in particular, kyanised timber is very popular. Where wooden poles are used to support electrical conductors of one description or another, it is important to realise great and uniform durability against attack by rotting and insect pests. The timbers which have usually to be considered in Europe in this connection are pitch pine, Scotch fir and larch, and it is important to ascertain whether kyanising gives equally satisfactory results with pine and fir, and if not, what modification had best be made in the process to ensure the best and most uniform results.

As is well known, the general process of kyanising consists in steeping the air-dried timber for 14 days in a weak solution of corrosive sublimate (often as weak as 0·7 per cent. of mercury salt). The nature of the wood is naturally of great importance in determining the quantity of solution absorbed; even assuming equal dryness of the timber prior to impregnation, pitch pine absorbs much less solution than Scotch fir, and this characteristic is noticeable in other impregnating processes as well as in kyanising. Tests with solutions of a number of metallic salts show that pitch pine absorbs about 0·4 times as much solution as Scotch fir in a given time but, in most cases, the impregnating solution is absorbed as such. Where mercury chloride solution is employed, however, the timber absorbs a greater percentage of the salts than of the solvent, so that the solution soon becomes deplenished of chloride, and must be restored to the desired strength by the addition of strong mercury chloride solution. As a consequence of this selective absorption, it is not sufficient to record the amount of solution absorbed by timber during kyanisation; the important factor is the actual amount of corrosive sublimate absorbed. It is a well established fact that air-dried pitch pine absorbs considerably less sublimate in a given time than does Scotch fir equally well seasoned, and since the durability of the timber in service depends on the protective action of the sublimate, it is necessary to secure equal proportions of the latter in the treated timber. Different timbers must be kyanised separately, and whereas seven days' immersion of air dried barked Scotch fir may suffice, at least 10 days' immersion is required for the sufficient impregnation of pitch pine.

From observations made in connection with the kyanisation of telegraph poles for the Austrian Government, R. Nowotny (see also *Elek. u. Maschinenbau*, XXXI, p. 511, *et seq.*) says that 1 cb. m. of pitch pine timber absorbs about 1 kg. of corrosive sublimate in the course of 10 days' immersion in kyanising solution. The same proportion of chloride was absorbed by Scotch fir during seven days' immersion but by extending the impregnating period to ten days in the case of the pitch pine an equally durable timber was obtained. Naturally absorption proceeds more rapidly during the first days of immersion than towards the end of the impregnating period, thus whereas the average rate of absorption was 0·1 kg. of chlor d per cu. m. per day in the case of the pine wood, the total absorption after seven days' immersion was 0·8 kg. per cu. m.

Kyanisation being a low pressure impregnating process, the penetration of the solution is limited to a few mm. depth from the surface of the wood and the salt absorption per unit surface area of the timber is therefore insignificant. It is found that pitch pine absorbs 0·033 kg. of chloride per cu. m. of surface area during seven days' immersion and 0·042 kg. during ten days' immersion, whereas Scotch fir absorbs 0·045 kg. per sq. m. of surface during seven days impregnation.

The above absorption data represents the highest degree of impregnation which can practicably be obtained by kyanisation and considerably lower degrees of saturation are frequently employed. For pine, an absorption of 0·6 kg. of sublimate per cu. m. (0·0375 lb. per c. ft.), *i.e.*, 0·03 kg. per sq. m. (0·0062 lb. per sq. ft.), of surface is generally considered sufficient. The chief conditions for success are that the timber be thoroughly air-dried by prolonged stacking in such place and manner as to permit free access of air to the poles; and that the poles be completely freed from bark (the outer skin of the heart wood being also removed by the stripping tool) at least two months before the taking process. By varying the period of immersion, the absorption of the sublimate can be varied (up to a certain maximum), and timbers of various kinds can be rendered equally impervious to attack and decay.

Directors' Contra Account. What is Ultra Vires?—In the City of London Court on Wednesday, before his Honour Judge Lumley Smith, K.C., Wakelin Bros., Ltd., electrical engineers, 3, Fenchurch Street, E.C., claimed £20 7s. 11d. against Messrs. D. McGregor & Son, bootmakers, 76, Tottenham Court Road, for electrical goods supplied. Defendants paid £10 3s. 9d. into Court and £5 18s. was abandoned by the plaintiffs. Defendants raised a set-off for boots and shoes supplied to Mr. J. F. Wakelin, the managing director of the plaintiff company, and Mr. Tibbs, one of the directors. Mr. Hatch, plaintiffs' solicitor, said that the company was in liquidation and that the liquidator was suing. Defendants could not set off for boots and shoes supplied to anyone other than the company itself, and the company did not have the boots and shoes. Mr. Wakelin, called for the defendants, said that the company owed him and Mr. Tibbs considerable sums of money; and it was agreed at board meetings that they should have boots and shoes from the defendants, and that those items should be treated as contra. It was a practice for all four directors to run contra accounts.—Judge Lumley Smith said that the liquidator was no party to the contras. He was bound to collect the debts of the company.—Mr. Hatch urged that the contras would be *ultra vires*. The directors could not take goods for themselves and ask the company to pay the accounts.—Judge Lumley Smith: One never knows what is *ultra vires* in these days.—Mr. Wakelin added that the directors did not draw their full salaries, and that was why they had the arrangements which he had put forward.—Judge Lumley Smith: Contra means something that this electrical company was going to have. The company was not going to wear boots and shoes. Mr. McGregor said that the plaintiffs had been doing electrical work for them for 20 years in fitting up one boot and shoe shop after another. The contras had been going on all the time.—Judge Lumley Smith said that judgment must be given for the plaintiffs for £4 6s. 2d. beyond the amount paid into Court and costs. Defendants must get the money for the boots and shoes from Wakelin and Tibbs.

The Paris Telephone System.—According to the *Times*, a number of improvements have lately been introduced in both the urban and the inter-urban telephone services of Paris. As regards the urban service, the Paris telephone system comprises about 100,000 stations, which communicate with each other by means of 11 exchanges. The annual growth in the number of subscribers, which was 3,387 in 1910, reached 5,648 last year. To cope with the increase in the traffic two new exchanges are being provided on the right bank of the river, and one on the left bank, to relieve existing exchanges, and the three temporary exchanges which, after the fire of 1908, were installed in the Rue Gutemberg, have been transferred to the Hôtel Téléphones. For the inter-urban system 530 circuits converge on Paris, 20 being international, 263 inter-urban, and 247 suburban. The circuits are carried to the new exchanges in the Rue des Archives, the equipment of which is of the most modern character.

Canadian Opportunities.—A piano manufacturing company has commenced the erection of a factory in Nova Scotia, and will require time-recording clocks, motors, generators, boilers, and fire extinguishers.

A company has recently been formed in Quebec Province, with a capital of $149,000 (about £30,600), to carry on the business of electricians, engineers, machinists and manufacturers, and to acquire and exploit water power for the purpose of generating electrical energy. The names of the companies, &c., to which the foregoing notices relate may be obtained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Copper.—The bi-monthly statistics issued by Messrs. H. R. Merton & Co. show a continued falling-off in the figure for visible supplies, though the differences from month to month are not so heavy as might be anticipated in a period of brisk demand. English stocks, on August 15th, were 18,131 tons, against 18,037 tons on July 31st, thus actually registering a small increase. French stocks had dropped 268 tons. European stocks were 1,249 tons less, but, for the whole of Europe, including estimates, this figure is reduced to 962 tons.

Supplies during the fortnight ending August 15th from North America were above the average, from Spain and Portugal low, from Chile and Australia average. Deliveries, at 27,371, bid fair to be above the average. American stocks increased 308 tons during July, the figure at the end of that month being 23,926 tons. The world's visible supply, including Holland and Germany, stood at 59,553 tons on July 31st, having lost 2,261 tons during the month.

Electro-chemical Industries in Norway.—H.M. Consul at Christiania (Mr. E. F. Gray) reports that, according to the local Press, an association of the chief Norwegian undertakings and firms connected with the electro-chemical and electro-metallurgical industries has recently been formed under the title of the "Norsk Forening for elektro-kemisk og elektro-metallurgisk Industri."—*Board of Trade Journal.*

Accidents.—On the 15th inst. at the Rochester Gas Works, an explosion, followed by fire, caused considerable damage to the works and serious injury to Reginald Jennings, an employé. The retorts are fed by an electrical hopper, and while the operation was in progress at 8 o'clock a.m., an electrical wire fused. An explosion among the coal dust followed, and this set fire to the coal in the hopper. Jennings pluckily tried to stop further mischief by closing the hopper, and did not desist till he had been seriously burned about the face and hands. He was removed to the local hospital in an unconscious state.

A correspondent writes:—"A serious accident occurred on the newly-electrified railway between Bury and Holcombe Brook on Wednesday, August 20th. One of the cars was driven up on a siding, and workmen were engaged upon it. One of them named John Bennett, of the tin-plate works, Newton Heath, who is employed on the contract, got on to the top of the car to attend to the bows that run on the overhead wires. The ladder on which he was standing slipped, and to save himself he grabbed one of the bows of the car. Unfortunately the other bow was connected with the wire, and he received an electric shock of great severity. He was removed to Bury Infirmary."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—BAILIE W. B. SMITH, Convener of the Glasgow T.C. Electricity Department, and MR. W. W. LACKIE, Chief Engineer of the Electricity Department, left on Friday evening last week from Princes Dock per ss. *Grampian* for America. They expect to arrive at Montreal about August 24th, whence they will proceed to Toronto to view the electric generating plant at Niagara Falls. They will examine several large power stations at Chicago and thereafter proceed to Pittsburg where Bailie Smith will attend a conference on smoke abatement. After seeing the works of the G.E.C. and Westinghouse Companies, a visit will be paid to New York to inspect the large power stations there. They are due back in Glasgow about October 5th.

At St. Etheldreda's, Ely Place, London, on August 14th, the marriage took place of MR. J. WALDRON BUSSEY, of the Great Eastern Railway electrical engineer's department, and Miss Olga M. Bishop, second daughter of the late R. Bishop, of Yokohama.

An Australian exchange states that MR. V. HUTCHINSON, formerly of Hobart, has been appointed municipal electrical engineer at Brunswick (Vic.).

The Ealing B.C. has fixed the following salaries from the 1st prox.: MR. C. B. HEAVISIDE (shift engineer), 50s.; MR. S. F. RIDDLE (shift engineer) 45s. to 47s. 6d.; and MR. P. ANLEY (installation inspector), 50s. The Council has, on the recommendation of its Electricity Committee, appointed a special Committee to consider the payment of wages during illness.

MR. G. B. WHEELER, of Southport electricity works, has been appointed chief assistant engineer at the Hamilton electricity works.

MR. G. G. DEELEY has been appointed senior charge engineer at Southport electricity works, and MR. S. PENDLEBURY as assistant mains superintendent at Southport.

General.—MR. ROBERT HAMMOND is, we understand, starting for South Africa on the 30th inst., by the R.M.S. *Edinburgh Castle*.

Indian Engineering says that SIR C. S. WILSON, on completion of his leave, has been permitted to resign his post of Director-General of Posts and Telegraphs, and will retire from the service.

MR. HAMYLTON RIGG has severed his connection as sales engineer with the Electrical Power Storage Co., to accept a similar post with Edison Accumulators, Ltd., of 49, Old Bond Street. His private address will be at Manchester as hitherto.

The *Daily Telegraph* states that SIR ALEXANDER KING, Secretary to the Post Office, has appointed MR. T. R. GARDINER to be his private secretary in place of Mr. C. L. K. Peel, promoted.

On the 18th inst. at St. Paul's Church, Rock Ferry, Cheshire, MR. H. EATON, of the electrical department, Anchor Thread Mills, Paisley, and youngest son of Captain Eaton, was married to Miss Olive Blanche Forrester, youngest daughter of Mr. Richard Forrester, of Birkenhead.

We learn that MR. W. YOUNG, late London manager of the Sunbeam Lamp Co., has just relinquished his office with the G.E.C., which he joined some 14 months ago, to take up the representation in London of the Cryselco Co., of Bedford. Mr. Young has had a long and varied experience of the lamp business, his connection on the commercial side of the industry dating back to the early days of carbon lamp making by the Edison & Swan Co., with whom he spent a number of years in responsible capacities. His friends, who number many in the lamp world, will join us in wishing him every success. His business address will be care of Cryselco, Bedford, and his private address, 14, Leander Road, Thornton Heath.

MESSRS. FERRANTI, LTD., announce that MR. H. GREAVES has been appointed to the position of buyer—Mr. J. Robinson being unfortunately compelled to resign on account of ill-health. Suppliers are asked to send on to Hollinwood copies of their latest catalogues.

The *Daily Telegraph* states that SIR ALFRED HOPKINSON, K.C., lately Vice-Chancellor of the University of Manchester, is proceeding to India in October to advise the Senate of the University of Bombay in regard to questions of administration and organisation, and to inspect the working of the affiliated colleges.

Obituary.—MR. A. D. WILLIAMS.—The death has taken place, after a long illness, of Mr. Arthur Doughton Williams, who was associated in business with his father, Mr. Thos. Williams, electrical and general engineer, Aberystwyth. Deceased, who was only 28 years of age, had carried out some important electrical work in the district, including the equipment of the Lisburne Mines.

MR. W. THOM.—We regret to record the death of Mr. W. Thom, head of Messrs. Yates & Thom, of Blackburn, which occurred on August 13th, at the age of 72 years. Mr. Thom retired from the business, retaining his interest, several years ago.

NEW COMPANIES REGISTERED.

Igranic Electric Co., Ltd. (130,660).—This company was registered on August 14th, with a capital of £35,000 in £1 shares, to carry on the business of electrical engineers, manufacturers of electrical apparatus, &c., to acquire established businesses manufacturing or dealing in electric control gear, including the business recently carried on by the Adams Manufacturing Co., Ltd., as manufacturers of "Igranic" electric apparatus, &c. The subscribers (with one share each) are:—G. R. Tiltman Gold, 147, Queen Victoria Street, E.C. engineer; M. A. Dewsnap, 147, Queen Victoria Street, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are F. R. [illegible], F. L. Pearce, A. W. Butterfield and G. A. Mower. Registered office, 147, Queen Victoria Street, E.C.

British Railway and Tramway Interchangeable Rail Co., Ltd (130,629). This company was registered on August 14th, with a capital of £15,000 in £1 shares to acquire Patents No. 8,[illegible] of 1911, and 1,[illegible] of 1913, for improvements relating to tramways and the like, and to adopt an agreement with H. Cradgington and H. T. Wa[illegible]. The subscribers with one share each are:—H. Cradgington, Alexandra Road, [illegible], metal merchant; F. W. Alabaster, 103, Mackney Road, [illegible], [illegible]. Private company. The number of directors is not to be less than two or more than seven; the first are F. N. Layman, E. Barnes, E. Cradgington and H. Cradgington; qualification, 100 shares. Registered office, 28, Victoria Street, S.W.

Mitchelite Lighting Co., Ltd. (130,641).—This company was registered on August 14th, with a capital of £[illegible],000 in [illegible] per cent. cum. participating preferred, to acquire any inventions relating to the production, treatment, storage, application, distribution and use of gas, petrol and electricity, and to adopt an agreement with O. H. Perrin. The subscribers (with one share each) are:—W. O. Jones, [illegible], and [illegible], Hanbury Lane, W.C., solicitor; C. Boyle, 76, Bisson Road, Stratford, E., clerk; Miss Grace M. Maund, Maythorn, Chaplin Road, Wembley; W. J. Ealey, 74, Masbro' Road, West Kensington, secretary; Bessie J. Hosking, [illegible], Louise Road, Stratford, E., clerk; Mary L. Tristram, 62, Stanhope Gardens, N., clerk; A. C. Rivers, 51, Murchison Road, Leyton, N.E., clerk. Minimum cash subscription, £14,000. The number of directors to be not less than four or more than 10; the first are T. D. Stubbs, B. B. Sanders, A. W. Heron-Maxwell, C. Hugh Purvis, S. L. Elphinstone-Cliff and J. W. M. Purvis; qualification, £105; remuneration, two guineas each per meeting attended. Registered office, 161, Piccadilly, W.

Reineke's Wireless Telephones, Ltd. (130,667).—This company was registered on August 14th, with a capital of £25,000 in 22,000 preference shares of £1 each and 60,000 ordinary shares of 1s. each, to acquire from L. W. Holmes, of 48, Great Russell Street, W.C., the benefit of an agreement between Josef H. Reineke, of the first part, the Studien Gesellschaft of the second part, Geo. A. Kubler of the third part, and the said L. W. Holmes, of the fourth part, and the full rights and interest of the inventor in the process or system of wireless telephony for mines invented by the said J. H. Reineke. The subscribers (with 500 preference shares each) are:—L. W. Holmes, M.I.E.E., 48, Great Russell Street, W.C., electrical engineer; G. MacElwee, 62-7, Norfolk House, Norfolk Street, W.C., gentleman; E. Denholm Young, 15, Rutland Street, Edinburgh, W.S. Private company. The number of directors is not to be less than three or more than ten; the first are Sir Archer Croft, Bt., L. W. Holmes, M.I.E.E., G. MacElwee, E. Denholme Young, W.S., and Gordon S. Goldie; qualification £500 preference shares; remuneration £150 each per annum (£50 extra for the chairman) and a percentage of the profits. Registered office, Norfolk House, Norfolk Street, W.C.

Davy Lamp Igniter Co., Ltd. (130,633).—This company was registered on August 13th, with a capital of £6,000 in £1 shares (500 preference, 1,000 ordinary and 400 founders'), to acquire any invention relating to machines or apparatus for the ignition of safety or other lamps, to carry on the business of manufacturers and repairers of, agents for and dealers in, electric igniters, lighters or relighters adapted for use with safety or other lamps, electrical engineers and contractors, &c., and to adopt an agreement with A. Paxton. The subscribers (with one share each) are:—A. Paxton, 5, Welfa Street, Roath, Cardiff, electrical engineer; H. W. C. Hinchley, 348, Whitchurch Road, Cardiff, commercial traveller. Private company. The number of directors is not to be less than three or more than five; the first are not named: qualification, £100 shares. Solicitor, W. Jones, Swansea. Registered office, Tynycoed Place, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Priestman Brothers, Ltd.—Mortgage or charge dated March 19th, 1901, created to secure £42,500 "A" and £11,500 "B" debenture stock, has been cancelled pursuant to the Scheme of Arrangement which was sanctioned by the High Court on July 1st, 1913, and has been notified. Particulars of £21,250 debenture stock, created August 8th, 1913, pursuant to a Scheme of Arrangement and secured by trust deed of even date, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital and engineering works, lands, buildings and premises in Williamson Street, Thomas Street, and James Street, Hull, with machinery, &c., thereon, and land with warehouse thereon in Williamson Street. Trustees: Sir James Reckitt, Bart., Swanland Manor, Yorks.; and A. T. Watson, Sheffield.

Bristol Tramways and Carriage Co., Ltd.—Acknowledgment of indebtedness dated July 24th, 1913 (supplemental to trust deed dated January 24th, 1908), to secure £125,000 deb. stock, ranking *pari passu* with £250,000 like stock issued under principal deed, charged on all the company's property, subject to original deed. Holders: Sir George White, Bart., Cotham House, Bristol; and S. White, Dorset House, Clifton, Bristol.

British Westinghouse Engineers' Club, Ltd.—A memorandum of satisfaction in full on July 14th, 1913, of deb. dated June 17th, 1908, securing £675, has been filed.

Marbro, Ltd. (105,619).—Particulars of £250 second debentures, created July 16th, 1913; filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £150. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Return dated July 30th, 1913 (filed August 6th). Capital, £2,000 in £1 shares (1,500 pref. and 500 ord.); 752 pref. and 500 ord. shares taken up; £1 per share called up on 502 pref.; £500 paid, leaving £2 in arrears; £750 considered as paid on 250 pref. and 500 ord. Mortgages and charges: £1,000.

Llanelly Motor and Electrical Engineering Co., Ltd.—Mortgage on land with garage, shops and offices thereon in Llanelly, dated July 30th, 1913, to secure all moneys due, or to become due, from the company to National Provincial Bank of England, Ltd., 15, Bishopsgate, E.C.

Foster Engineering Co., Ltd.—Particulars of £9,000 second debs., created July 30th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £8,484. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Lea, Son & Co., Ltd.—Mortgage on certain freehold land in Stafford, dated July 22nd, 1913, to secure all moneys due, or to become due, from the company to London City and Midland Bank, Ltd., 5, Threadneedle Street, E.C.

Midland Electric Corporation for Power Distribution, Ltd.—A memorandum of satisfaction in full on July 11th, 1913, of charge dated July 25th, 1909, securing £250,000, has been filed.

CITY NOTES.

Manaos Tramways and Light Co., Ltd.

THE fourth ordinary general meeting of the shareholders of the above company was held on August 14th, at the offices, 9, Cloak Lane, E.C., Mr. G. M. Booth presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 227), the CHAIRMAN, after referring to the resignation of Mr. J. Mitchell from the chairmanship, said that they had to report that the expectations, entertained a year ago, that the State of Amazonas would liquidate its debt to the company for the public lighting of the City of Manaos, had unfortunately not been realised. No payment whatever had been made by the State on this account during the year, and the total debt for public lighting on April 30th, 1913, amounted to £23,676. Every endeavour had been made to obtain some payment on account, but the State Treasury was denuded, and claimed that its revenues, dependent entirely upon the export tax levied upon rubber, had decreased to such an extent that for the present at any rate they could not meet their liabilities. The directors felt strongly about this matter, and considered that it was particularly hard on the company, in view of the fact that they on their part had carried out loyally every single obligation of their State contract. They continued to exert pressure on the Treasury. The position in the State Treasury arose from the fact that the Government of Amazonas collected, and this was practically its sole revenue, about 20 per cent. *ad valorem* on an article which has been steadily falling in value. It was common knowledge that the price of rubber had fallen more than 50 per cent., and the present price of Para fine rubber in London, viz., 3s. 10d. per pound, was lower with one exception, viz., the period between October, 1907, and March, 1908, of the American financial crisis, than had been seen for a generation. He did not think that it was so low that trading conditions could not adjust themselves to it, but after a period of great extravagance and undue prosperity time was needed for adjustment to harder conditions, and the period of this adjustment was bound to be one of restricted trading. In tropical countries the facilities offered by tramway and electric lighting services were so necessary to comfort, that the population would continue to enjoy them at the expense of other economies, and while at the present juncture they could not look for much expansion in their revenues, he did not apprehend any serious contraction, and he believed the Amazon Valley would ultimately benefit from being compelled, by these difficult times, to adopt practices of economy and more businesslike methods and principles of conducting its great rubber industry. Turning to the accounts during the year under review, the tramway receipts amounted to £106,148, as against £109,718 for the previous year, a decrease of £3,570; the lighting receipts amounted to £44,148, as against £35,602, an increase of £8,546; the total gross income increasing from £147,290 to £151,741. The total operating expenses had decreased from £112,634 to £101,942 (the ratio of operating expenses to gross receipts had fallen from 76½ per cent. to 67·2 per cent.) and their net surplus had increased from £16,318 to £28,107, an increase of over 72 per cent. Capital expenditure during the year amounted to £21,509. This expenditure was mainly due to extension of track work necessary under the terms of the concession, and the additions, when completed, would improve operating conditions. They had also paid for the four large cars mentioned in last year's report. Additional expenditure on capital account had also been required to meet the demands of new consumers in the private lighting department, the number of lamps for private lighting having been increased by nearly 26 per cent. Coming to the recommendations for the appropriation account, it would be seen that they proposed to set aside £16,000 to various reserves. They recommended that £10,000 of this total should be transferred to the contingencies and accident reserve account. In the course of the year they had had to write off from this account £4,274 to meet a payment against an old accident claim. The amount appeared large, but it was much less than that originally claimed, and while there were one or two old claims still outstanding, they trusted that no heavy damages would result, no serious accidents having occurred during the last three years. Deducting this amount, and adding the £10,000 mentioned before, raised the sum to the credit of this account to £15,725. They proposed to credit renewals reserve with £6,000, making a total to the credit of this account of £21,000. Out of the final balance of £15,435 they recommended the payment of a dividend of 4 per cent., absorbing £12,000, the balance of £3,435 to be carried forward. The property had been maintained in excellent condition, and they were fortunate in being able to retain the services of Mr. Kirk, their manager in Manaos, who, supported by an effective staff, was doing everything possible to make the undertaking successful.

MR. W. C. BURTON seconded the motion.

Replying to questions, the CHAIRMAN said he believed that the reduction in the tramway receipts was due to the fact that the whole Amazon valley had been depressed, that fewer people had gone to Manaos. Speaking generally, there had been a steady increase in the tramway receipts all over Brazil, due to the fact that the country was getting more highly civilised, and ladies could now go about and do their shopping by themselves. Their own accounts were really better than the 4 per cent. dividend, but they wished to be well prepared for any eventualities that might occur in the next two or three years. So far they were ahead in their receipts, as compared with this time last year, but if they had as good a year as last, he would be satisfied. He was afraid there was not much chance of reducing the operating expenses further, as the country was a very expensive one to work in. They were still supplying the city with light, as, indeed, they were bound to under their contract, and he need hardly say that the directors were giving close and anxious attention to the debt which the Government owed them. The report was adopted.

Marconi's Wireless Telegraph Co., Ltd.

THE directors state in presenting their report for the year ending December 31st, 1912, that as it was not found possible to complete the audit until comparatively recently, they deferred the submission of their report, they having entered into a new contract with the Postmaster-General and considered it desirable to await its ratification by Parliament.

In the report for the year 1911, it was stated that the share premium account would be increased in the next balance-sheet to the sum of £256,630. The balance-sheet now presented shows this this figure standing at £255,707, the expenses in connection with the issue (£923) having been debited. During 1912 the business continued to make satisfactory progress, the gross profit having amounted to £537,243 as compared with £214,407 for 1911, and a net profit is carried to the balance-sheet of £413,295, as compared with £141,717 for 1911. A part of the above profit having been derived from the realisation of shares, the directors deem it prudent to take this opportunity of creating a reserve account and have appropriated £100,000 for this purpose. The directors recommend the payment of a final dividend for the year 1912 of 10 per cent. on both classes of shares. Summarised, the proposed appropriation of the available balance is as follows:—

Preference Shares—Dividend of 17 per cent. for year ended December 31st. 1912, of which 7 per cent. was paid on August 1st, 1912	£42,500
Ordinary Shares—Dividend of 20 per cent. for year ended December 31st, 1912, of which 10 per cent. was paid on August 1st, 1912, on the amounts paid up on July 8th, 1912...	149,921
General reserve account	100,000
Balance carried forward to next account	146,726
	£439,147

The directors propose to declare at the general meeting, which is to be held to-day at the Hotel Metropôle, a dividend at the rate of 7 per cent. for the year 1913 on the preference shares.

In the balance-sheet, patents and shares in associated companies are again taken into account at their cost price, with the exception of the Spanish shares and a portion of the American shares, which figure at their par value. The directors desire to draw the attention of shareholders to these words, for notwithstanding that the same statement was made in the directors' report for the year 1911, misunderstanding arose in the minds of some in consequence of its having been stated by some that the profits appearing in the balance-sheet had been arrived at by means of writing up the shares held in associated companies. In order that there shall not be any misunderstanding of this nature in the future the directors desire to make it clear that whenever shares are acquired by the company they figure in the margin of the balance-sheet at their par value, and no matter what that total may represent they are taken into account in the balance-sheet only at their actual cost price to the company. To this figure is added the cost of patent renewals, patent applications, and any sum which may be paid in acquiring or protecting patents. Thus in the balance-sheet now submitted the £856,119 represents the cost to the company of the whole of its patents and shares in associated companies, the latter being represented in the margin at their par value of a total of £1,594,584. Whenever the company sells any portion of its share holding the share and patent account is credited with the average or actual cost price of the shares, including a proportion of the cost of patents as stated above.

The total cost of shares and patents shows an increase over the figures of the preceding year of £347,596. This is accounted for largely by the addition of shares in the American Co. which were acquired at par.

The total par value of shares shows a decrease as compared with the preceding year of £480,140. This arises principally in consequence of the re-adjustment of the capital of the Argentine Co. The Argentine directors considered that the capital of the company which was formed in 1906 with a capital of $6,750,000, of which $6,000,000 was in "A" shares of $5 each, and $750,000 in "B" shares of $5 each, was excessive, and this company has consented to the cancellation of 200,000 "A" shares, of which this company's proportion was 155,898, and that one new "AA" share should be exchanged for four shares of the original capital. It has also been agreed that the "B" shares, of which this company holds 78,250 of a total of 150,000, and which rank preferentially as regards capital, shall receive a preferential dividend of 5 per cent., and an increased proportion of any remaining profits.

By these arrangements this company's holding in the Argentine Co. shows a nominal decrease in the par value of its "AA" shares of £676,781, and an increase in the value of its "BB" shares of £5,325, paid in respect of calls on these shares. This company's interest in the Argentine Co. is, therefore, practically unchanged; the alteration affects the number of shares and their nominal value only.

With the development of the wireless industry throughout the world, the business of the associated companies in which this company is interested is extending considerably.

Belgian company (Compagnie de Telegraphie sans Fil).—The business of this company has continued to increase and show very satisfactory profits. It has recently been reorganised, and its capital increased to £90,000, of which this company holds one-third.

French company (Compagnie Francaise Maritime et Coloniale de Telegraphe sans Fil).—This company has declared a dividend for the year 1912 of 10 per cent. on the ordinary shares and 31·25 fr. per share on the founders' shares.

Marconi International Marine Communication Co., Ltd.—The business of this company during the year 1912 showed an increase of over 60 per cent in its receipts, and a dividend of 10 per cent. was declared, an increase of 3 per cent. over that of the preceding year. The company's business continues to develop in a very satisfactory manner.

German Company (Deutsche Betriebsgesellschaft fur Drahtlose Telegraphie m.b.H.) (Debeg.).—This company has paid a dividend of 8 per cent. for the year ending September 30th, 1912.

Russian Company (Société Russe de Télégraphes et Téléphones sans Fil).—This company has declared a dividend for the past year at the rate of 6 per cent. Its business continues to show very satisfactory development, and the business in hand this year represents a very substantial increase over that of the preceding year.

Marconi Wireless Telegraph Co., of Canada, Ltd.—Under their contracts with the Canadian Government for the operation of wireless telegraph stations on the Great Lakes, four stations have been established and placed in operation during the past year. One station is at present being enlarged and three other stations are to be built during the current year. The negotiations with the Newfoundland Government were brought to a satisfactory termination in December by the completion of a contract which will continue the company's exclusive rights in Newfoundland until the year 1926. Under agreements with the Canadian and Newfoundland Governments, the company operates 32 stations in Eastern Canada and Newfoundland and five stations on the Great Lakes. The company also carries on a public telegraph service on 44 steamers. The Canadian Government has passed a law making wireless equipment of passenger vessels compulsory, which will necessarily result in further business for the company. The company has now in hand for the Department of Railways the construction of two high-power stations at Hudson Bay and Le Pas, Manitoba, in connection with the construction of the new Hudson Bay Railroad by the Canadian Government. Under their agreements with the Canadian and Newfoundland Governments the Canadian company's subsidies from these Governments now exceed $100,000 per annum.

Spanish Company (Compania Nacional de Telegrafia sin Hilos.—Seven of the first group of stations in Spain and the Canary Islands are in operation. The construction of the stations of the second group has been commenced, the first of which has been completed and opened to service. During the breakdown of the cable between the Canary Islands and Spain the telegraph service was satisfactorily conducted by the Marconi stations. Arrangements are being made for this service to be opened permanently in the course of the next few weeks. Negotiations are pending for wireless telegraph services to be opened with this country and with Italy. The company has obtained orders from the Spanish Government for military stations, and also secured the whole of the orders placed by the Minister of Marine during the last year for the equipment of ships of the Spanish Navy.

Argentine Company (Cia Marconi de Telegrafia sin Hilos del Rio de la Plata).—Besides the change in the capital of the company, to which reference has already been made, there has been an alteration in the directorate and management. Upon the occasion of the visit of the company's representative to Buenos Ayres last year it was found that the Government concession for the erection of a high-power station for external telegraph service was not in a satisfactory form. Subsequent negotiations, however, resulted in a new arrangement being entered into with the Government and the construction of a high-power station has now been commenced. A similar station will be erected in this country, and when completed a direct wireless telegraph service between the Argentine and Europe will be opened.

Marconi Wireless Telegraph Co., of America.—This company has declared a dividend of 2 per cent. for the year ending January 31st, 1913, a satisfactory result having regard to the fact that the contract with the United Wireless Telegraph Co. did not come into force until the month of July of last year, and called for considerable negotiation with shipowners and others to bring about more satisfactory terms upon which the work was in future to be conducted. The full benefit of these improved working conditions was therefore only enjoyed for a comparatively short period of the year. It will also be borne in mind that the increase of capital to the extent of £1,400,000 was for the purpose of providing a network of long-distance telegraph stations and the creation of telegraph services. Time is necessarily required to construct these stations, but this work has proceeded with all possible expedition. It is contemplated that before the end of this year a rapid and reliable telegraph service will be opened between this country and New York. Arrangements will be made to open collecting stations in the City of London and in each of the principal towns in England and Scotland. Similar arrangements have been made in the United States. It is expected that a substantial revenue will accrue from this source. Stations are in course of construction at San Francisco and the Hawaiian Islands, which are approaching completion. It is hoped that before the end of the year we shall see a wireless telegraph service in operation between the United States and Japan, which will then be extended to the Philippine Islands and China.

The contract with the Norwegian Government having been ratified by the Norwegian Storthing, a further trans-Atlantic station will be erected immediately to conduct a telegraph service direct with the North of Europe. Under the terms of the agreement the Norwegian Government will send all telegrams handed in at the telegraph offices for the United States by wireless unless specially routed otherwise by the sender. The company and the Norwegian Government will pool the receipts of their respective stations, which should add a substantial source of revenue to the American company.

Important negotiations are in progress with South American States which should result in the construction of additional stations in the United States in the early future and open up direct wireless telegraph service between North and South America.

At all of the stations under construction the new duplex system is being installed, which will provide for a service to be conducted in both directions at the same time. Automatic sending and receiving apparatus is also being supplied which will enable messages to be transmitted at a speed up to about [illegible] words per minute in each direction, and this rate of working is likely to be exceeded.

Field Station Department.—During the past year very considerable progress has been made both in the design and sale of portable wireless telegraph stations for military purposes. Important improvements have been made in the company's apparatus, and to meet the demands of the armies of the world the company has added the following to their standard types of stations: (1) A 3-KW. station for transport by cart or motor-car; (2) A 1½ [illegible] station for transport by horses or camels; (3) A ½-KW. cabinet station for use as a permanent station where space is limited.

Highly satisfactory demonstrations of the company's field stations were carried out during the past year in several countries, from which a large business is expected to result. Important orders have been received for field stations apparatus from the British War Office and the Italian, Turkish, Roumanian, Greek and Servian Governments, and the total sales of this class of apparatus have nearly quadrupled in the past year and continue to show substantial increase. The company has made such arrangements as will enable it to give immediate deliveries of all classes of field stations, for which a big demand arises unexpectedly, and prompt deliveries are of all importance.

General Business.—During the past year this company and its subsidiaries have received contracts and executed work for the Governments of the following countries:—Great Britain, Canada, Newfoundland, India, South Africa, Ceylon, Falkland Islands, Trinidad, Italy, Russia, Turkey, Spain, Portugal, Norway, Roumania, Servia, Greece, Montenegro, United States of America, Brazil, Chile, Bolivia, Columbia, Japan and China.

Shareholders have been advised that owing to the delay in submitting to Parliament for ratification the contract entered into with his Majesty's Postmaster-General for the construction of the Imperial stations, and the substantial rise in the cost of materials, the directors gave notice that they no longer considered that contract binding upon them. A new contract has been entered into in which provision is made for any extra cost which may be incurred by reason of the delay in the construction of the stations, and certain alterations and additions have been agreed to. The directors do not believe that the altered conditions will prove of any disadvantage to the company, and having regard to the position which the company holds in the wireless industry, and which position the directors are confident the company will continue to hold, they contemplate that they will construct all the stations required for the Imperial chain. For a long-distance wireless telegraph service a number of the company's recent patents play an essential part, and during the last 12 months the company's scientific adviser, Mr. Guglielmo Marconi, has applied for patents for a number of important inventions and improvements for apparatus used in both transmitting and receiving stations. "Notwithstanding all that has been stated and published in recent times respecting the continuous wave system of wireless telegraphy, experience has not yet proved that that system will be capable of conducting a long-distance wireless telegraph service as efficiently as the slightly damped spark system at present in use. Mr. Marconi has invented what the directors believe to be the simplest and most economical method of generating, transmitting and receiving continuous waves and he alone has been able to transmit messages across the Atlantic by a continuous wave system, of which a satisfactory demonstration, and the only one, was given to the Advisory Committee appointed by the Government. Further tests are being conducted but considerable work and time are required before it will be possible to say with any degree of assurance that any advantage in practical working is to be obtained, either by the continuous wave system alone, or used in conjunction with the spark system. With the ability of the large staff of engineers employed by this company, together with their valuable experience, directed and assisted by Mr. Marconi, the directors are confident that the development of the wireless industry will continue to be pioneered by this company. The high-power station which is being constructed in Carnarvon and which will be worked by the company to conduct a direct service with New York, it is anticipated will be completed and opened for service during the present year. It is being supplied with both the spark and continuous wave systems, which alone will prove from actual experience the comparative merits of the slightly damped wave and the continuous wave in all weathers, under all conditions, every day, week and month of the year. Important negotiations are being conducted with several foreign Governments for the erection of long-distance stations which it is hoped will be brought to a successful issue at an early date.

The successful arrangements made in April, 1912, for placing share capital of the American company have recently been made the subject of legal proceedings by Mr. O. Locker-Lampson, M.P., and Mr. P. E. Wright against the company, the directors and other persons. Within the last few months and shortly before the issue of the writ these gentlemen acquired two and one shares respectively of this company. Mr. Locker-Lampson has since increased his holding by 20 shares. No relief is claimed against the company which is merely joined as a nominal defendant. The apparent object of the proceedings is to impeach the action of the directors and other persons in connection with the above arrangements. The writ was issued so long ago as May 23rd last, but at present Mr. Locker-Lampson and Mr. Wright have not delivered their claim. Beyond this passing reference the directors are advised that would not be proper for them at this stage to make further comment explanation.

The action for the infringement of patents against the National Electric Signalling Co. was heard in New York during the month of June last, in connection with which Mr. Guglielmo Marconi gave lengthy evidence. The Court has not yet delivered its judgment.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of income-tax, for the half-year ended June 30th last, both payable September 1st.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

American Telephone and Telegraph Co.—$34,101,600 convertible 4½ per cent. gold bonds.

Morgan Crucible Co., Ltd.—Seven per cent. non-cumulative preferred ordinary shares of £10 each, £2 10s. paid; and 7 per cent. non-cumulative preferred ordinary shares of £10 each, fully paid.

And to allow the following securities to be quoted in the Official List—

Buenos Ayres and Lacroze Tramways Co.—£500,000 5 per cent. consolidated mortgage debentures, in lieu of the scrip.

Morgan Crucible Co., Ltd.—10,000 7 per cent. non-cumulative preferred ordinary shares of £10 each, fully paid.

South London Electric Supply Corporation, Ltd.—Further issue of £19,095 5 per cent. first mortgage debenture stock.

The Committee has appointed special settling days as under:—

Thursday, August 28th.—Midland Electric Corporation for Power Distribution, Ltd.—Scrip, fully paid, for £400,000 five per cent. first mortgage debenture stock.

And has also ordered the undermentioned securities to be quoted in the Official List:—

Midland Electric Corporation for Power Distribution, Ltd.—Scrip, fully paid, for £400,000 five per cent. first mortgage debenture stock.

Para Electric Railways and Lighting Co., Ltd.—The directors have declared an interim dividend at the rate of 10 per cent. per annum, less income-tax, on the ordinary shares for the half-year ended May 31st, payable September 1st.

Liverpool District Lighting Co., Ltd.—The directors have declared an interim dividend for the half-year to June 30th, at the rate of 4 per cent. per annum, less income-tax.

Oldham, Ashton and Hyde Electric Tramway, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year ended June 30th.

China.—The *Indian Textile Journal* states that during the financial year ended March 31st, 1912, the profit of the Hankow Light and Power Co. was £1,732. The gross receipts for the year under review show an increase of £1,797, or nearly 20 per cent. The working expenses for the year were 38·95 per cent. of the total receipts, as against 50·89 per cent. for the year ending March 31st, 1911, showing a decrease of 11·94 per cent.

National Boiler and General Insurance Co., Ltd.—For the year to June 30th last, the directors propose to dispose of the £26,585 standing to the credit of profit and loss account as follows:—Dividend at the rate of 7s. per share for the half-year ended June 30th, 1913, £3,250; bonus of 3s. per share, £2,250; to current risk and reserve fund, £10,000; writing off depreciation of investments, £2,311, and carrying forward £6,774.

Ontario Power Co., of Niagara Falls.—In their report for the year 1912 the directors state, says the *Financial News*, that the growth of the business during the past year shows a very marked increase over the previous year. For 1912 the total receipts were $1,255,955.38, net income $1,014,376.69, interest $648,935.92, surplus $365,440.77. The company has 10 generators installed, with a rated capacity of 117,000 H.P. The two additional generators and turbines would give a total capacity of 143,000 H.P. Units Nos. 13 and 14, of 13,000 H.P. each, had been ordered. The company had the right to put in a third conduit, 18 ft. in diameter, which would furnish water for the development of approximately 70,000 additional H.P. As the earnings increased so rapidly during the last of the half-year, the directors felt justified in declaring in November an initial dividend of 1¼ per cent.

Continental.—BELGIUM.—La Société Technique de la Force Motrice is the name of a new company which has just been formed in Liége (17 Rue des Guilleonins) with a capital of £50,000, to acquire and exploit certain patents in connection with the use of electricity for power purposes.

Aberdeen Suburban Tramways Co.—The directors report that the profit earned during the half-year amounted to £1,595, and there is a balance of £3,792 at the credit of profit and loss account. The directors recommend that £2,000 be added to the credit of the renewal and depreciation account; a dividend at the rate of 2½ per cent. for the past year, £780; directors' fees, £42; leaving to be carried forward, £969. According to the *Financier* the directors have had under consideration the question of extending the company's operations by the working of trackless tramway cars or other mechanically-propelled vehicles, and they are satisfied that the working of such vehicles would not only be profitable in itself, but would be profitable as a means of attracting fresh traffic to the company's undertaking.

STOCKS AND SHARES.

Tuesday Evening.

ADVANTAGE is generally taken of this season of the year to look back over the progress made by the prices of stocks and shares throughout the current year. General business as a rule is very quiet; and since it is quite likely that few people bother themselves about Stock Exchange prices in the holiday time, this seems to be a more convenient time to institute the comparisons than the end of June. Consequently, we set out upon our regular market pilgrimage, drawing representative examples from the various sections and tabulating the results in the ordinary way.

Prices in most cases have moved in the direction contrary to that in which proprietors of stocks and shares would prefer to see them go. For this the three principal reasons are:—The Balkans war, the tightness of money, and the general trade prosperity—with a host of minor factors swinging upon the main considerations. The revolution in Mexico is another important influence in several of the markets with which these notes especially deal.

The Electric Lighting Market has spent a quiet and uneventful eight months. Prices have dipped to some extent, but just lately have shown a reviving tendency in consequence of satisfactory dividend announcements. We take the ordinary shares of a few well-known companies, and the comparisons come out as follows:—

	Dec. 31, 1912.	Aug. 19, 1913.	Rise or fall.
Brompton and Kensington	9	8⅝ xd	— ⅛
Charing Cross	4⅞	4⅝ xd	— ⅛
Chelsea	4¾	4⅞	+ ⅛
City of London	17	15⅝	— 1⅜
County of London	11¾	11¼	— ½
Kensington and Knightsbridge	7⅝	7⅜ xd	— ¼
Metropolitan	3⅝	3⅜ xd	— ¼
St. James's and Pall Mall	9⅞	8⅝	— 1¼
Westminster	9	8¼ xd	— ¾

The effect of the Mexican Revolution comes out clearly in the fall which has taken place in Mexican Light and Power issues and Monterey bonds. The market in these Colonial and Foreign Electricity and Supply descriptions has been dull all the way through. Stocks and bonds connected with the utility companies of the Western Hemisphere have given way substantially, and a brief selection of the Traction securities may be added to that of the Supply division:—

	Dec. 31, 1912.	Aug. 19, 1913.	Rise or fall.
Mexican Light and Power, Common	85	70	— 15
do. 7 % Cum. Pref.	104½	98½	— 6
Monterey Railway Light and Power 5 per cent. First Mort. Deb.	87½	77½	— 10
Montreal Light, Heat and Power	229½	220	— 9½
Northern Light, Power and Coal 5 per cent. First Mort. Bonds	27½	20	— 7½
Shawinigan Water, Capital	145	136½	— 8½
Anglo-Argentine Tramways First Pref.	4⅞	4 13/16	— 1/16
Brazilian Traction, Light and Power	94½	95	+ ½
British Columbia Electric Railway Def.	141½	127½	— 14
Calcutta Trams Ord.	5⅞	6	+ ⅛
Mexico Trams, Common	112	98xd	— 14
do. Gen. Con. 5 per cent. Bonds	104	101	— 3
Para Electric Railways and Light Ord.	7½	6½	— 1
Rio Trams First Mort.	103	102½	— ½

Coming to Home Railways, it will be noticed that there are material falls in the Undergrounds, though a fair part of the drop has recently been recovered. Within the past week or two the market for Home Railway stocks has developed a much better tone, but the fear of labour difficulties lays a restraining hand upon the enterprise of a good many people who might otherwise be tempted to embark money in such stocks. So far as the Undergrounds are concerned, the suggested appointment of a Traffic Board for London led to a little dullness in the prices at first, this, however, being subsequently compensated by a recovery:—

	Dec. 31st, 1912.	Aug. 19th, 1913.	Rise or fall.
British Elec. Trac. 6 per cent. Pref.	12½	9	— 3½
" " Deferred	6	5	— 1
Central London Railway, Ordinary	83	74	— 9
" " Deferred	83	76	— 7
London United Trams, 4 per cent. Deb.	70½	62	— 8½
Metropolitan Consol.	53¼	47⅞	— 5⅜
Metropolitan District	40¾	34¾	— 6
Underground Electric Railways	4½	4	— ½
" " " "A"	21/32	9/16	— 3/32

The Telegraph market has pursued the tenour of its usual even way. Most of its stocks have been subject to the influences operating against, or in favour of, investment securities as a whole. There have been violent movements in Marconi shares, but within the last week a material rally occurred upon the publication of the company's report in respect of 1912-13. Reuters gave way sharply during the period under review, but in their case, too, there has been some recovery. To the Telegraph list we add a brief catalogue of movements in the manufacturing section—it will be noticed that the principal alteration is a good rise in the price of India-rubber shares:—

	Dec. 31st, 1912.	Aug. 19th, 1913.	Rise or fall.
Anglo-American Telegraph Deferred	26	23¼	— 2¾
Eastern Telegraph Ordinary stock	134½	128½	— 6
Eastern Extension	13¼	12¾	— ½
Great Northern Telegraph	28½	31	+ 2½
Marconi's Wireless Telegraph	4⅝	4¼	— ⅜
Reuters	10⅝	10	— ⅝
United River Plate Telephone	7 1/16	6¼	— 13/16
West India and Panama Telegraph	3⅛	2⅝	— ½
Do. First Pref.	10⅜	9⅞	— ½
Western Telegraph, Ltd.	13¼	18	— ¼
Babcock & Wilcox	3 3/16	3 3/16	—
Brush 4½ % Second Debenture	30	25	— 5
Callender's Cable	10⅞	11½	+ ⅝
Castner-Kellner	3 1/16	3¼	+ 1/16
Edison & Swan "A"	1/16	1/16	—
Henley's Ordinary	12⅝	12⅞	+ ¼
India-Rubber	10	13¼	+ 3¼
Telegraph Construction	35½	37	+ 1½

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	8¼ — 10¼ xd	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9½ xd	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅞ xd	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	10	8¼ — 8¾ xd	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅝ xd	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞ xd	+ ¼	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜ xd	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	15 — 16½	..	5 9 1
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	+1	4 9 1
County of London, Ord.	10	6	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	79 — 82	..	5 9 9
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90	..	5 0 0
Hove	5	9	9†	7¾ — 8½	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7⅛ — 7⅜ xd	- ⅛	5 1 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 77	..	6 15 5
London Electric, Ord.	8	2½	2½	1¼ — 1½	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅛ — 5⅜	- ⅛	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 7 0
Metropolitan	5	4	4†	3½ — 3⅝ xd	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 15 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 12 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	8†	6 — 6½	+ ⅛	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9⅜ — 9⅝	+ ⅛	5 12 8
Do. 7 % Pref.	5	7	7	6¾ — 7	..	5 9 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85¼	..	4 1 10
South London, Ord.	4	5	5½	2⅞ — 3⅛	..	7 0 0
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅛ — 1⅜	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£8	Nil	Nil	⅛ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord, ...	5	10	10	8 — 8½ xd	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	5	6	5 — 5¼	..	5 14 8
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	+ ½	5 8 1
Canadian Gen. El. Com. ..	$100	7	7	108 —112	..	6 5 0
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	3	5	5/8 — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	8	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	7/16 — 5/8	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	+4½	6 1 11
Mexican Lt. & Power, Common	$100	4	4†	68 — 72	+7	5 11 1
Do. 7 % Cum. Pref.	$100	7	7	96 —101	+3	6 18 7
Do. 5 % 1st Mort. Gold Bds.		5	5	90 — 92	+1½	5 8 8
Do. 5 % 2nd Mort. Bonds ..	100	5	5	80 — 82	+6½	6 1 11
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79	..	6 6 7
Montreal, Lt., H. and Power ..	$100	8	9†	215 —225	+ 8	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	134 —139	+ 8½	3 19 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅜d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	132 —135	+1½	5 18 6
Do. Collat. Trust	$1000	4	4	90½ — 92½	..	4 6 6
Anglo-American Telegraph ..	Stock	8	8	62 — 65	+ 2	4 12 4
Do. 6 % Pref.	Do.	6	6	108 —109	..	5 10 1
Do. Def.	Do.	30/-	30/-	23½ — 24	+ ⅜	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 8
Chili Telephone	5	7	8	7 5/16 — 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15½ — 16½	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	6¾ — 7¼	..	5 10 [illegible]
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 8½ % Pref. Stock	Do.	8½	8½	75½ — 77½	..	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	..	4 2 11
Eastern Extension	10	7	7	12½ — 13	+ ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	+ ¼	5 4 4
Do. 6 % Pref.	10	6	6	12 — 12½	..	4 16 0
Great Northern Telegraph ..	10	18	20	30 — 32	..	6 13 0
Indo-European Telegraph ..	25	13	13	55½ — 57½	+ ½	5 13 1
Mackay Companies Common ..	$100	5	5	82 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 3/16 — 4 5/16	+ 1/16	2 12 10
Do. 7½ % Cum. Partic. Pref.	1	17	..	3½ — 8¼	+ ⅛	4 10 8
Monte Video Telephone, Ord. ..	1	5	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	¾ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¼ — 100¼	+ ½	4 9 4
Oriental Telep. and Elec. ..	1	8	10	1 3/32 — 1 5/32	..	5 8 6
Do. 6 % Cum. Pref.	1	5	5	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	9¾ — 10¼	+ ¼	9 17 6
Submarine Cables Trust ..	Cert.	5	5	124 —127	..	4 14 5
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2¾ — 3	+ 1/8	4 3 4
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10½	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 9⅞	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12¾ — 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	+2	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	8 — 10	+ ½	..
Do. Do. Deferred ..	100	..	..	4 — 6	+ ½	..
Do. Do. 6 % Cum. Pr'f	100	6	6	80 — 83	+2	7 4 7
Do. 7 % Non-Cum. Pr'f.	100	..	3	43 — 46	+5	6 10 5
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	72 — 76	..	5 18 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	..	81 — 83	..	4 16 5
Do. Pref.	100	4	4	73 — 80	..	5 0 0
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	80 — 82	+1	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	9/16 — 11/16	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol. ..	100	17/8	1⅝	47¼ — 47⅞	— ¾	3 8 5
Do. Surplus Lands	100	2⅞	2⅝	60 — 62	+1	4 8 9
Do. 3½ % Deb.	100	3½	3½	83 — 85 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	81 — 83 xd	..	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79 xd	..	4 8 7
Metropolitan District Ord. ..	100	Nil	Nil	34½ — 35	— ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	+1	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	—1	5 7 6
Potteries, Ord.	1	4½	3⅓	9/32 — 13/32	..	..
Do. 5 % Pref.	1	6	6	17/32 — 21/32 xd	..	7 12 5
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — ¾	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	8⅞ — 4⅛	+ ⅛	Nil
Do. "A"	1/-	4½	..	½ — 5/8	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	Nil	4½	99 —101	..	4 9 1
Do. 6 % Income	100	8	6 †	93½ — 94½	— ½	6 7 0
Yorkshire (West Riding), Ord.	5	..	..	⅛ — ⅜	— ⅛	Nil
Do. 6 % Pref.	5	..	3†	3½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 1/16 — 4 5/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	+ 1/16	5 18 11
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	95 — 97	+ ½	4 12 9
Do. 5 % Deb.	100	5	5	97½ — 99½	+ ½	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	94 — 96	+1½	6 5 0
Brisbane Trams Invt., Ord. ..	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	125 —130	+1	6 3 1
Do. Pref. Ord.	100	6	6	110 —115	+1	5 4 4
Do. 5 % Pref.	100	5	5	102½ —105½	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7	5†	5½ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 1/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5 5/16 — 5 9/16 xd	+ ⅛	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	1/32 — 3/32	..	..
Do. Pref.	1	6	..	25/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	+ ½	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99 xd	..	5 1 0
Mexico Trams Com.	$100	7	7†	100 —102	+4½	6 17 3
Do. Gen. Con. 5 % Bonds ..	..	5	5	93½ — 95½	+5	5 4 9
Do. 6 % Bonds	100	6	6	93 — 95	+5½	6 6 4
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6½ — 6¾	+ ⅛	7 8 2
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101½ — 103½	+1½	4 16 7
Do. 5 % Mort. Bonds ..	100	5	5	95½ — 97½	+ ½	5 2 7
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101 — 103	..	4 17 1
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	94½ — 96½	..	5 8 8
Un. Elec. Trams Monte Video ..	5	7	7	4½ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —102	..	4 8 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	2/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	23/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	28	16	31/32 — 32½	+ ⅛	4 18 6
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord. ..	1	Nil	..	1 5/16 — 1 1/16	+ 1/16	..
Do. 6 % Cum. Pref.	1	Nil	6	¾ — ⅞	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	..	5 17 8
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	95 — 98	..	4 11 10
British Westinghouse, Pref. ..	8	Nil	Nil	¾ — 1	+ ⅛	Nil
Do. Deb...	100	4	4	63 — 67	+1	5 19 5
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70⅓ — 75⅓	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10¾ — 11½	+ ⅛	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3 11/16 — 3 13/16	..	5 4 11
Do. Deb...	100	4½	4½	102 —105 xd	..	4 5 9

Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/32 — 9/32	..	..
Do. Pref.	1	6	6	31/32 — 1 3/32	..	7 18 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1 — 1¼	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	5	9¾ — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12½ — 13¼	+ ½	5 13 2
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb...	100	4½	4½	100 —102	..	4 8 8
India-Rubber, G. & T.	10	..	7½	12¾ — 13¾	..	5 9 1
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction.. ..	12	17½	20	36 — 38	+1	6 3 10
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	¼ — 5/16	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

AMERICAN EXPORTS OF ELECTRICAL GOODS.

THE following figures, showing the exports of electrical goods from the United States during the year ended June, 1912, are taken from the recently-issued official trade statistics; where possible, figures for 1910-11 have been added for purposes of comparison, and notes of any increases or decreases given :—

	1911-12. Dollars.		1911-12. Dollars.
*Telegraph instruments.**—			
To Canada	17,000	To Other countries ...	18,000
„ Central America ...	9,000		
„ Mexico	13,000	Total ...	68,000
„ Argentina ...	11,000		
*Telephone instruments.**—		*Other electrical instruments and appliances.**—	
To United Kingdom ...	56,000	To Canada	3,102,000
„ Canada	582,000	„ Mexico	926,000
„ Central America ...	17,000	„ Central America ...	286,000
„ Mexico	24,000	„ Cuba	504,000
„ Cuba	107,000	„ Argentina ...	414,000
„ Brazil	59,000	„ Brazil	2,296,000
„ other S. America ...	20,000	„ Japan	508,000
„ Japan	21,000	„ Philippine Islands	349,000
„ Australia	53,000	„ Australia	184,000
„ Other countries ...	35,000	„ United Kingdom ...	828,000
Total ...	974,000	„ Other countries ...	1,283,000
		Total ...	10,682,000

	1910-11. Dollars.	1911-12. Dollars.	*Inc. or dec.* Dollars.
Electrical machinery.—			
To Canada	1,665,000	1,870,000	+ 205,000
„ United Kingdom ...	580,000	883,000	+ 303,000
„ Mexico	1,350,000	950,000	— 400,000
„ Central America ...	138,000	136,000	— 2,000
„ Cuba	185,000	346,000	+ 161,000
„ Argentina	187,000	153,000	— 34,000
„ Brazil	484,000	996,000	+ 512,000
„ British India	126,000	147,000	+ 21,000
„ Japan	1,307,000	941,000	— 366,000
„ Australia	383,000	534,000	+ 151,000
„ Philippine Islands ...	151,000	117,000	— 34,000
„ South Africa	269,000	134,000	— 135,000
„ Other countries ...	1,198,000	1,238,000	+ 40,000
Total ...	8,025,000	8,445,000	+ 420,000

	1911-12. Dollars.		1911-12. Dollars.
Gas engines, stationary.†—			
To Canada	131,000	To Other countries ...	94,000
„ Argentina ...	74,000		
„ Australia	38,000	Total ...	394,000
„ Europe	57,000		
Petrol engines, stationary.†—		*Steam engines, stationary.*†—	
To Canada	755,000	To Canada	248,000
„ Argentina ...	397,000	„ Cuba	90,000
„ Australia	307,000	„ Mexico	61,000
„ Mexico	43,000	„ Brazil	42,000
„ United Kingdom ...	98,000	„ Philippine Islands	22,000
„ Other countries ...	863,000	„ Other countries ...	288,000
Total ...	2,463,000	Total ...	751,000

* Not shown separately in 1910-11; the total exports of "electrical instruments and appliances (including telegraph and telephone instruments)" in that year were valued at $10,703,000.

† Not shown separately in 1910-11; the total exports of "steam and other power engines and parts thereof, stationary," in that year were valued at $4,043,000.

Australian Electric Heating Apparatus.—According to the *Mining and Engineering Review*, the C. AND C. ELECTRIC HEATING SYNDICATE, of Melbourne, is being formed into a company, with a capital of £150,000, to take over the patents and enter on the manufacture of electrical apparatus, such as cooking stoves, hot plates, soldering irons, kettles, &c. "The experiments already carried out by the syndicate show that a very durable heating element has been evolved. The patentees claim that it possesses considerable advantages over any other element on the market, and can be produced at a low cost."

Barcelona Exhibition.—The project for holding an International Electrical Exhibition at Barcelona in 1915 has been officially approved by the Government.

GERMAN EXPORTS FOR THE HALF-YEAR.

THE following table shows the exports of electrical goods from Germany during the half-year just closed figures for the first half-year of 1912 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1912. Kilogs.	1913. Kilogs.	*Inc. or dec.* Kilogs
Dynamos, electric motors, transformers, &c., weighing up to 25 kg.—			
To Great Britain	26,000	31,000	+ 5,000
„ Austria	48,000	57,000	+ 9,000
„ Russia	39,000	99,000	+ 60,000
„ Other countries ...	136,000	187,000	+ 51,000
Total ...	249,000	374,000	+ 125,000
Ditto, weighing from 25 kg. to 100 kg.—			
To France	100,000	100,000	—
„ Great Britain	100,000	147,000	+ 47,000
„ Holland	89,000	112,000	+ 23,000
„ Austria	302,000	266,000	— 36,000
„ Russia	113,000	217,000	+ 104,000
„ Spain	70,000	97,000	+ 27,000
„ Other countries ...	570,000	548,000	— 22,000
Total ...	1,344,000	1,487,000	+ 143,000
Ditto, weighing from 100 kg. to 500 kg.—			
To Belgium	289,000	310,000	+ 21,000
„ France	152,000	156,000	+ 4,000
„ Great Britain	200,000	357,000	+ 157,000
„ Italy	222,000	194,000	— 28,000
„ Holland	210,000	251,000	+ 41,000
„ Austria	423,000	279,000	— 144,000
„ Russia	224,000	391,000	+ 167,000
„ Spain	179,000	274,000	+ 95,000
„ Brazil	248,000	286,000	+ 38,000
„ Argentina	216,000	189,000	— 27,000
„ Other countries ...	800,000	996,000	+ 196,000
Total ...	3,163,000	3,683,000	+ 520,000
Ditto, weighing over 500 kg.—			
To Belgium	813,000	1,133,000	+ 320,000
„ France	270,000	542,000	+ 272,000
„ Great Britain	268,000	640,000	+ 372,000
„ Italy	1,321,000	863,000	— 458,000
„ Spain	858,000	1,270,000	+ 412,000
„ British South Africa	586,000	625,000	+ 39,000
„ Japan	1,536,000	1,204,000	— 332,000
„ Argentina	1,417,000	831,000	— 586,000
„ Brazil	500,000	610,000	+ 110,000
„ Norway	529,000	412,000	— 117,000
„ Russia	524,000	832,000	+ 308,000
„ Holland	580,000	530,000	— 50,000
„ Other countries ...	1,860,000	2,737,000	+ 877,000
Total ...	11,062,000	12,229,000	+1,167,000
Accumulators.—			
To Sweden	524,000	503,000	— 21,000
„ Japan	213,000	201,000	— 12,000
„ Argentina	2,257,000	537,000	—1,720,000
„ Chile	356,000	371,000	+ 15,000
„ Other countries ...	1,325,000	1,582,000	+ 257,000
Total ...	4,675,000	3,194,000	—1,481,000
Cable.—			
To Belgium	1,510,000	1,520,000	+ 10,000
„ Holland	2,410,000	2,650,000	+ 240,000
„ Norway	443,000	1,871,000	+1,428,000
„ Sweden	1,630,000	744,000	— 886,000
„ British South Africa ...	135,000	1,008,000	+ 873,000
„ Japan	1,139,000	2,024,000	+ 885,000
„ Argentina	2,267,000	4,134,000	+1,867,000
„ Chile	181,000	386,000	+ 205,000
„ Other countries ...	5,387,000	6,894,000	+1,507,000
Total ...	15,102,000	21,231,000	+6,129,000
Arc Lamps.—			
To Great Britain	34,000	33,000	— 1,000
„ Russia	34,000	68,000	+ 34,000
„ Argentina	27,000	46,000	+ 19,000
„ Austria	33,000	27,000	— 6,000
„ Other countries ...	144,000	122,000	— 22,000
Total ...	272,000	296,000	+ 24,000

	1912. Kilogs.	1913. Kilogs.	*Inc. or dec.* Kilogs.
Metal-filament lamps.—			
To Great Britain	150,000	69,000	— 81,000
„ Austria	72,000	84,000	+ 12,000
„ Russia	214,000	98,000	— 116,000
„ Italy	67,000	69,000	+ 2,000
„ Spain	64,000	48,000	— 16,000
„ Argentina	23,000	54,000	+ 31,000
„ Brazil	37,000	43,000	+ 6,000
„ France	39,000	59,000	+ 20,000
„ Other countries ...	281,000	381,000	+ 100,000
Total ...	947,000	905,000	— 42,000
Telephone appliances.—			
To Great Britain	51,000	62,000	+ 11,000
„ France	19,000	31,000	+ 12,000
„ Russia	50,000	60,000	+ 10,000
„ Italy	29,000	50,000	+ 21,000
„ Other countries ...	226,000	224,000	— 2,000
Total ...	375,000	427,000	+ 52,000
Electric light, power, &c., appliances.—			
To Belgium	507,000	627,000	+ 120,000
„ Great Britain	334,000	481,000	+ 147,000
„ Austria	597,000	912,000	+ 315,000
„ Russia	666,000	1,118,000	+ 452,000
„ Spain	219,000	584,000	+ 365,000
„ British S. Africa ...	218,000	179,000	— 39,000
„ Japan	242,000	204,000	— 38,000
„ Argentina	712,000	697,000	— 15,000
„ Brazil	261,000	382,000	+ 121,000
„ Chile	137,000	242,000	+ 105,000
„ Italy	529,000	661,000	+ 132,000
„ Switzerland	266,000	408,000	+ 142,000
„ Other countries ...	1,758,000	2,503,000	+ 745,000
Total ...	6,446,000	8,998,000	+ 2,552,000
Electric meters.—			
To Great Britain ...	48,000	143,000	+ 95,000
„ Italy	151,000	168,000	+ 17,000
„ Austria	196,000	191,000	— 5,000
„ Russia	135,000	242,000	+ 107,000
„ Spain	65,000	119,000	+ 54,000
„ Argentina	59,000	130,000	+ 71,000
„ Other countries ...	405,000	516,000	+ 111,000
Total ...	1,059,000	1,509,000	+ 450,000
Batteries.—			
To Great Britain	105,000	162,000	+ 57,000
„ Holland	54,000	51,000	— 3,000
„ Russia	30,000	50,000	+ 20,000
„ Sweden	17,000	40,000	+ 23,000
„ Switzerland	37,000	46,000	+ 9,000
„ Other countries ...	171,000	263,000	+ 92,000
Total ...	414,000	612,000	+ 198,000
Insulating tubes of paper.—			
To Russia	163,000	192,000	+ 29,000
„ Sweden	121,000	200,000	+ 79,000
„ Switzerland	439,000	419,000	— 20,000
„ Italy	119,000	168,000	+ 49,000
„ Other countries ...	658,000	869,000	+ 211,000
Total ...	1,500,000	1,848,000	+ 348,000
Finished armatures and commutators —			
To Belgium	224,000	104,000	— 120,000
„ Great Britain	259,000	200,000	— 59,000
„ Italy	313,000	201,000	— 112,000
„ Austria	217,000	281,000	+ 64,000
„ Russia	153,000	232,000	+ 79,000
„ Japan	143,000	202,000	+ 59,000
„ Argentina	118,000	100,000	— 18,000
„ Other countries ...	622,000	890,000	+ 268,000
Total ...	2,049,000	2,210,000	+ 161,000

Kilog = 2·204 lb.

Half-Watt Lamps.—We are asked to correct certain erroneous rumours on the subject of the new "Half-Watt" lamp. The lamp in question will, at any rate for some considerable time to come, only be supplied in units of extremely high C.P. to compete with high pressure gas arcs for street lighting, &c, and, of course, electric arc lamps. It is probable that such "Half-Watt" lamps will be available in commercial quantities during the present year, and Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, hope before long to give a demonstration of such a lamp, embodying certain novel processes of manufacture not hitherto applied to electric lamps.

MONOPOLY v. CO-OPERATION: CONSERVATION v. WASTE.

By DOUGLAS S. MARTIN.

It is to be feared that the anonymous article entitled "Co-operation between Private and Public Supply Systems," which appeared in the Electrical Review for March 28th, is likely to lead to a lot of misunderstanding on the part of English engineers, if its statements are accepted at their face value.

The author cannot be blamed for having been fascinated by the scheme proposed by Mr. Percival Moses, consulting engineer, of New York City, and the apostle of the isolated plant—a scheme in which all kinds of industrial waste shall be eliminated through the friendly interchange of power between central stations and isolated plants. Mr. Moses, as is very well-known in America, has been pleading the cause of the isolated plant very eloquently and persistently for many years, knows his subject thoroughly, and is gifted with an easy and convincing style. The writer of the article in question has apparently fallen to him very quickly, but may not be censured on that account by persons who happen to hold views which are the direct opposite of those shared by Mr. Moses. He is deserving of nothing but censure, however, for his reckless jumping to conclusions, and his utterly unwarranted inference that this (to many) wild-cat scheme of power-exchange has any considerable number of adherents in the States.

Let us take a look at the scheme which has been proposed. I have not read this particular article of Mr. Moses in the *Engineering Magazine*, though I am familiar with his writings and views on the electric supply business. I am considering the application to British conditions discussed by the anonymous author. Your contributor's references to the virtues of the private electrical plant in an industrial establishment have possibly misled many readers, for they display a complete ignorance of the *raison d'être* of central station service. Was the writer aware that it is by the cultivation of the diversity factor alone that a central station can be successful; that complete advantage can only be taken of the time diversity of many peaks by throwing them all into one system; that individual peaks —rolling mills, street railways, machine shops, and so on— disappear individually when charted on a magnified picture of the whole load? If he has for the first time now realised these things, can he not see that there is no place for the small plant in this scheme of balance and mutual power flow; that every small plant must go in order to provide all the diversity for the main station which can possibly be obtained? Granting the one point that individual peaks are cancelled out when their circuits are fed from the same systems, and that by this means we are able to care for a maximum diverse time demand, say, of 100,000 KW., with a supply plant of, say, 25,000 KW., then all these smaller plants, feeding their few hundreds of kilowatts into the system, simply represent so much sheer waste of investment. They perform no useful work. The central reservoir is there, and can care for 1,000 KW. of factory motors one minute, for 1,000 KW. of street railways the next, as the workmen ride home, and for 1,000 KW. of house lighting 15 minutes later when the men have reached their dwellings. The essential point is to give the benefit of the diversity to the central station. The idea of the stalwart and all-sufficient central reservoir is an excellent one. Why drag in these diminutive pools of ornamental water, these merest bubbles on the surface?

In regard to another section of the article, of course, the load density in a given locality may increase to such a point, and the physical location of the load centre may be such, that it may become advisable to erect an auxiliary station to care for it. But the prime essential remains the same; when the auxiliary station is built and put into operation, it must be a big station, in order that its efficiency may be high and "industrial waste eliminated," and it must be given as high a diversity factor as possible. To that end every isolated plant in that locality must go out of business, all this aggregation of petty coal bills and petty

labour bills must be eliminated, and the beautiful reservoir must be left to itself to work out a true programme of conservation. London is far bigger than any American city, but London has not yet grown anywhere near the point beyond which the cost of transmission from a central plant would become anything to worry about, compared with the overwhelming economy in actual generating costs which such a scheme would make possible. The watts lost in the mains would not amount to a millionth part of the awful waste which is now going on in thousands upon thousands of individual hand-fired boilers. Certainly, auxiliary and supplementary stations would be built to care for the distant loads ; and in cases where the distance became really great, the bus-bar voltage would be stepped up to 33,000, or 66,000, or 110,000 for transmission to the next big town, and for tying-in with the supply bus-bars there. But where on earth in this scheme is there any room for the small station ? Three main generating stations at Birmingham, Bristol, and Greenwich, could probably care for the whole of the South of England if *every* isolated plant were shut down ; if the main transmission lines were carried cross-country, by Act of Parliament, at 110,000 volts ; if the distribution feeders were run at 33,000, and local lines at 11,000 volts ; or, in general, if the most economical voltages were selected for the various locations and the various loads. You would get all the balancing effect that you would want out of such a system as that ; and so far from admitting that the scheme of Mr. Moses is one "which it is practically certain will become more and more realised as time goes on," I would willingly forecast, baseing my view on the extraordinary progress which has been made in America in the last three years in tying-in main stations and systems, at extra high voltages, situated many hundreds of miles apart, that in 50 years from now some such scheme as this will actually be in operation, and the isolated plant will be an utterly extraordinary thing.

In this scheme, therefore, the isolated plant receives no consideration as possessing any of the elements of real economy ; and it can be shown that, where new construction alone is in question, nothing should be done to increase the number of such plants now in operation. Where the starting point of the argument is that isolated plants do, in fact, exist, and that we must, adjusting ourselves to conditions as we find them, evolve some scheme for cutting down the waste to the greatest possible extent, we find that the scheme which has been proposed even then is not the one which will produce the best results. Assuming that the isolated plants are there, and that they have got to be used, it will appear that the maximum of waste can be prevented, and the maximum of time, money and energy conserved, if they are operated for as short a time each day as possible—not that the boilers are kept constantly under steam with the generators pumping into the ring, according to the picture drawn in the article under notice. When an individual factory owner is already in possession of an isolated plant, the best use he could make of it would be to keep it as a stand-by for his peak, assuming that during the day his individual peaks are not worth worrying about, and that the only peak to be considered is his 4 o'clock winter peak, which his private plant, anyway, would be incapable of handling unless it were over-powered to an extent excessive for its normal load. Under such conditions, it would be economical for him to allow his plant to stand idle during the steady portion of the curve, taking all of his power from the supply company's mains ; and to start up and throw in his isolated equipment as his peak came on, taking the necessary precautions to see that his generator carried sufficient of the peak load to prevent any of his maximum demand from reaching the company's meter. I am not saying that this course would not be beset with difficulties, and that some time or other he would not let his peak register on the mains. All I contend is that he might draw his 50-KW. normal load from the line during the daytime ; and, when he knew his heavier load of 150 KW. or 200 KW. was coming on, he might start up his small set—not with the idea of helping out the central station, but of saving money for his own pocket. If the same plan were followed by 50 other factories in a single town, each already possessing a private plant, the net result would be that the maximum degree of conservation would be realised in the whole community, and the central station, theoretically, would be able to operate on an even load with a factor of 75 to 100 per cent. Disregarding the "theoretically" in the foregoing statement, it is immediately obvious that such a scheme, while representing the best possible returns for the individual owners of existing equipment if any scheme of tying-in is going to be adopted, actually will not be so economical to the individual as operating entirely independent of the central supply ; and it is hardly necessary to point out that this method of relieving the central station from the peak by splitting it up into 50 or more individual peaks is frightfully extravagant, compared with the straight central station scheme of carrying all the combined peaks, which will themselves show some diversity on a single large-capacity set, fired and sent into operation for the purpose of the peak. It is better to remove the individual day-peaks, having some inevitable time-diversity, by carrying them all on the same system, and allowing them to level each other out. It is better to meet the total afternoon peak by the provision of as few and as large single units as possible. In any case, cut out the small isolated plant.

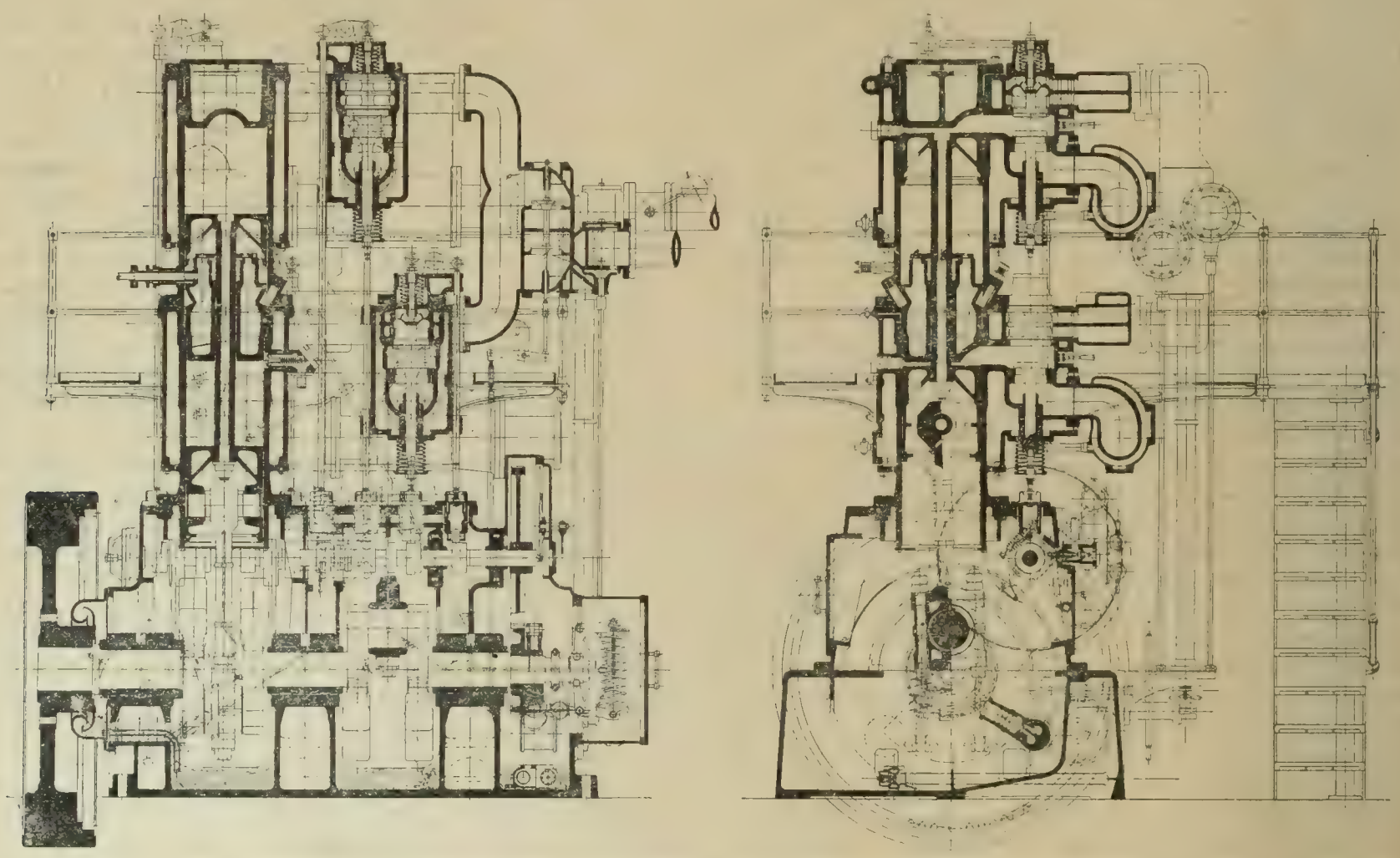
All this, of course, is, after all, a matter of opinion, and I am no more entitled to my views than is the writer of the earlier article entitled to his. My main quarrel with him is his reference to the line along which American engineers are bending their energies, and of the direction of which he is obviously ignorant. Everyone in the States is looking towards the bulk-supply idea — not because Americans necessarily worship the large corporation, but because in the electrical supply business competition is a sheer waste and hindrance, and economy lies in monopoly-regulated monopoly. The supply companies in the big cities are meeting with a lot of competition from the isolated plant, but they are fighting it—cleanly and openly—with every means in their power, and will eventually win out. Right is on their side, if we judge right by the standards of achievement. Perhaps the competition is a good thing in spurring the central stations on to great achievement. Certainly all the advances which have been made in the progress of the electrical age in America have been made by the central stations. The manufacturers have put their best engineering into the development of apparatus for the big supply systems ; it is only through the big systems that electrical service has become a real achieved fact in American everyday life, in street railway, in factory, in theatre, in dwelling place ; and it will only be through the further development of the big-station idea that electrical service will be made increasingly available to the mass of mankind. Where they have to fight the isolated plant, central station men fight it not through personal animus towards the leaders of the movement, but because they are acting according to their convictions, and their convictions tell them that the isolated plant means waste. Therefore, they must set their rates to kill the isolated plant—not because they delight in killing, but because their line of business can only be run efficiently by raking in all loads and every kind of load.

Co-operation on these lines is therefore out of the question, because, in the first place, any such scheme must, from the nature of it, be incomparably inferior to a straight central station supply scheme ; and because, in the second place, central stations are too much occupied with the development of their own engineering ideas along sound lines to have any care for propositions of this—at best—makeshift character. "An indication of the line of thought which is being actively pursued in America" can be gained from noting what is really happening in this country, in a territory where a network is being set up which is already within measurable distance of the ideal forecasted by Edison, Ferranti, and Steinmetz—no small fry here, no duplication and multiplication of buildings, boilers, bunkers, boosters, and bus-bars, but a few giant steam and hydraulic stations turning out their load according to a real schedule of conservation. . . . "The economical operation of such systems as the Southern Power Co., a large network in itself, which is tied in with the Yadkin River Power Co., at Method, and is contemplating tying in with the Georgia Power Co., at Easley, and the latter with the Tennessee Power Co., at Rome, is a problem of considerable importance. The Southern Power Co. is operating approximately 350 miles of 100,000-volt

lines as well as an extensive network of 44,000-volt and 11,000-volt lines, and the Yadkin River Power Co. has approximately 190 miles of 100,000-volt lines. The Georgia Power Co. will have approximately 200 miles of 100,000-volt lines, and the Tennessee Power Co. nearly 200 miles of 120,000-volt lines, as well as approximately 100 miles of 66,000-volt lines, making a total of nearly 800 miles of 100,000-volt lines in the four systems, and hundreds of miles of lower voltage lines, all tied in one vast system. The total distance by transmission line from Blewetts Falls to Nashville will be over 700 miles."

THE NATIONAL GAS ENGINES AT ACCRINGTON.

In our last issue we described and illustrated the Mond producer and gas-engine installation, which is now in use at the Corporation Electricity Works, Accrington. As the engines used in this plant, which were supplied by the National Gas Engine Co., of Ashton-under-Lyne, are of considerable interest, embodying many recent improvements, a more extended description of them may be of interest.



Sectional Views of Two-Crank Vertical Tandem "National" Gas Engine.

They consist of two 1,000-B.H.P. vertical four-crank enclosed gas engines, fitted with two tandem cylinders to each crank—eight cylinders in all—and running at a speed of 200 R.P.M. As mentioned last week, each engine is direct-coupled to a Peebles three-phase 50-cycle 6,600-volt alternator rated at 938 K.V.A., ·8 power factor, and designed for 25 per cent. two-hour and 50 per cent. momentary overloads. The engine being of the four-cycle single-acting type, with four pairs of tandem cylinders, the crankshaft receives four impulses per revolution, or 800 impulses per minute; by employing eight cylinders, the cylinder diameter can be such that water-cooled pistons and exhaust valves are dispensed with, water cooling only being used for the cylinder covers and jackets.

The engine is of the totally enclosed type, fitted with forced lubrication throughout; the oil pumps are valveless and in duplicate, and suck from oil filters also in duplicate, which can be removed for cleaning purposes, one at a time, whilst the engine is running without any fear of dirty oil being drawn into the system. The oil pumps deliver through an oil cooler, through the internal tubes of which the whole of the cold water passes on its way to the cylinders.

The engine bearings have cast-iron shells lined with white metal; for operating the valve gear a two-to-one steel reducing gear is employed with helical teeth, the large gear being on a camshaft which is carried in bearings supplied with oil under forced lubrication. All the cams and rollers are of case-hardened steel.

One end of the crankshaft carries the governor for regulating the speed, which actuates the valves in the throttle box for both gas and air; the usual speeder gear attachment is provided. The connecting-rods have marine adjustable ends both top and bottom; the cylinders are without liners, and the top cylinder is a separate casting from the bottom one.

Extreme care has been taken in providing for expansion, in evidence of which the company have not yet had the misfortune of a cracked cylinder with these engines working on producer gas, and only in exceptional cases due to bad water and shortage of water have they experienced any difficulty of this kind with an engine working on coke-oven gas.

The exhaust pipes are also provided with exceptional facilities for expansion, the idea running through the whole design of this engine being to free castings from initial stresses.

The bottom pistons are of the usual trunk type, fitted with case-hardened steel piston pins of exceptionally large dimensions; Ramsbottom rings are fitted to each piston. The top and bottom pistons are connected by a cast-iron sleeve ground true in the lathe along with the pistons, which acts as a distance piece and as a means of packing the space between the two pistons. Through the centre of the sleeve a chrome-nickel steel bolt is fitted, holding the two pistons rigidly together. The sleeve when in action works up and down in metallic packing placed in the middle cover or intermediate head, which is stationary and retained by radial screws; the packing is composed of many cast-iron rings working on the cast-iron sleeve, an arrangement which is found, with a normal amount of lubrication, to have a very long life, in fact, after a year's continuous running no shoulder is usually formed on the rod. The top cylinders and metallic packing are lubricated from a sight feed lubricator driven off the camshaft.

The inlet valves are fitted in a self-contained cage, complete with operating lever, spring, and valve stem guide, and are provided with an isolating gas valve, in order to prevent the gas and air uniting and forming an explosive mixture in the inlet pipes. This gas cone valve is firmly secured to the spindle, as experience has shown that springs in this position

very soon break or lose their temper. The exhaust valve is of cast-iron, with a short steel stem at the lower end to carry the spring ; no water cooling is employed ; the valve is provided with a renewable seat. The time required to take out an inlet valve does not exceed 10 minutes, the bottom inlet valves being equally as accessible to the crane as the top ones ; about the same time is required to withdraw an exhaust valve, and a line of pistons may be taken out of these engines when hot within the hour. The general design of these engines is shown in the sectional views, which, however, show a two-crank, not a four-crank engine.

The ignition system is in duplicate, low-tension magnetos being provided, which are driven by means of a heavy silent chain from the camshaft. The current from the low-tension magnetos is passed through coils, the high-tension current resulting being supplied through a distributor to the various plugs in due rotation. Each cylinder has two sparking plugs, each plug deriving its current from an independent source.

Facilities are provided on the end of the camshaft for indicating the starting position of the engine, also a very neat safety barring gear is supplied for turning the engine round.

In connection with the governing, a safety governor—or runaway governor—is fitted, usually arranged to come into action if the speed of the engine exceeds 12 per cent. above the normal.

It is found from experience that this type of engine is extremely easy to handle, and especially good at paralleling ; the usual time taken to parallel two of these sets, from the time of turning air on to being in parallel, is about a minute and a quarter. The remarkable flexibility of this type of engine was shown by an accident which occurred to one of two engines in a colliery power station operating on coke-oven gas. The accident was due to unsuitable water, causing accumulation of sediment in cylinder jackets, covers and exhaust pipes, with the usual result of a seized piston. The piston line was completely withdrawn, and the engine ran in parallel with the other three-crank engine on a 50-cycle supply within three hours, and did a proportionate amount of the load.

It may be noted that the Accrington engines are operating on gas produced in a Mond by-product recovery plant, the percentage of hydrogen in a gas of this nature being about 27 per cent. ; one engine is running 165 hours per week and the other is working cotton mill hours, viz., 56 hours per week. The oil consumption for the whole of the above plant for one week is 35 gallons, and the fuel consumption per unit generated averages rather over 1½ lb.

The complete arrangement of the engines at Accrington, together with the water coolers, exhaust boilers, compressed air starting, &c., was illustrated on page 258 of our last issue. The cooling water from each engine is circulated by a motor-driven centrifugal pump through a Little's cooler, made by Messrs. Heenan & Froude ; the waste heat boiler for each engine is of the tubular type, by Messrs. Adamson and Co., and generates about 2 lb. steam per B.H.P.-hour at 100 lb. pressure at full load.

A motor-driven three-throw boiler feed pump is installed, drawing its water from a portion of the cooling water passing round the exhaust pipes on the engines, at a temperature of about 130° F. In conclusion, we are indebted to the National Gas Engine Co. for the above particulars of their engines.

Heywood. — Bulk Supply Arrangements. — The question of obtaining a bulk supply from the Bury Corporation was discussed at a meeting of the T.C. on August 14th. Councillor J. Ashworth said prices had been obtained from the Bury Corporation and from the Lancashire Electric Power Co., and the offer of Bury had been accepted for a supply for a period of 10 years, with the option of a further five years. The result, in the opinion of the engineer, would be a saving of £1,388 per year. To take on this supply it would be necessary to expand an approximate sum of £12,000 for transforming plant, cables, &c. The interest and sinking fund on this would be £750 a year, and when this £750 had been met, the net gain to the Corporation would be £1,388 per year. Had they decided to build new works to have met expected future demands, they would have been faced with an additional expenditure which, with present capital charges, would have meant a total capital expenditure of £84,000. The Committee felt that when the arrangements were completed the Corporation would be in a position to supply large consumers on equal terms with neighbouring authorities. The arrangement for the bulk supply was unanimously supported.

DELIVERIES.

[COMMUNICATED.]

In the early part of the year a leading article in the Electrical Review* dealt concisely with the question of the personal factor in the engineering world, in the course of which attention was drawn to a number of causes having varying effects upon the present-day progress of manufacturers engaged in the electrical industry.

Not least amongst those mentioned is the time taken for the execution of orders, and although it is only reasonable to suppose that all our manufacturers are giving this vexed problem every attention, yet beneficial results do not, on the face of things, seem very apparent.

There may be a few purchasers of electrical machinery and apparatus who have not had their arrangements considerably hampered by repeated delays in delivery of orders guilelessly given in the hope of being executed in a reasonable time, but certainly these are not many and their less fortunate friends feel that the average manufacturer has more than a double dose of original sin, whilst the friction engendered by the contractors' delinquencies, unfortunately, is in no way relieved by the total inability of their customers to understand or to appreciate the difficulties with which the manufacturer has to contend, particularly in boom periods.

For some considerable time there has been observed a tendency in certain directions to adopt an independent attitude, no doubt due partly to that element of human nature which asserts itself when it is possible to pick and choose the more profitable class of business. When, however, the volume of business wanes, this attitude will vanish more quickly than it appeared, and, no doubt, those manufacturers who at the present time are observing the interests of their clients to the best of their ability, are surely also improving their own position, and will find it easier to withstand the inevitable slack time, for, despite the cynic, sentiment fortunately still has a voice in the business world.

It must not, however, be assumed that the electrical manufacturers are the principal culprits in this respect, because this is not the case, the trouble having been experienced throughout every branch of the engineering trade, and, no doubt, in others. The iron and steel people in particular have really been so flooded out with orders as to have been obliged to refuse business in large quantities, and this, coupled with similar, if lesser, difficulties in connection with other raw materials, is one of the legitimate excuses the electrical manufacturers can put forward—for common justice compels the statement that some of the reasons for bad deliveries *are* perfectly legitimate. The miners' strike of last year is now ancient history, but it is necessary to refer to it, because this conflict was the cause of more deep-seated trouble than any other industrial occurrence of recent years, and far-fetched as the statement may seem, it is quite conceivable to the insider that its effect had not entirely worn off until a comparatively recent date ; this, despite the prevailing impression that the explanation was worn threadbare long since, and that the strike was a perfect godsend to the manufacturer in the way of providing prolific excuses. It is only necessary to refer to the annual reports of most trading concerns in the country to see how far-reaching the effects of the coal strike really were, and what a lengthy time elapsed before a normal condition prevailed.

So much having been said by way of extenuation on account of the "boom" and "strike" phases of the situation, what cannot be defended is the unreasonable times often taken for execution of work, when trade is slack. The fact that when work is scarce the number of hands employed is considerably reduced, and that other facilities are curtailed, cannot carry much weight, because there is in all shops an irreducible minimum of skilled labour, to go below which would be a suicidal policy on the part of the management, and the ratio of this minimum to the work in hand is proportionately greater in slack times. Again, it is obvious that, if only from a monetary point of view, it should be the manufacturer's principal aim to execute orders in the shortest possible time, for it will be appreciated that the sooner he effects delivery, so automatically his account is

* Issue dated March 14th.

more quickly due for payment. Everyone is familiar with the sign frequently posted in the windows of retail tradesmen reading—"Small profits, quick returns"; this, with little or no modification, may very aptly be applied to the electrical industry, in so far as this question of delivery is concerned, not to mention any others, when a radical alteration might be essential.

Generally speaking, the principal causes of delay are, perhaps, to be briefly summarised as: difficulty in obtaining raw material (already dealt with above), congestion in the drawing office and factory, manufacturing troubles, whilst possibly red tape also has its victims. It may, however, be reasonably urged that, with a certain amount of foresight, these difficulties can be more or less guarded against, and, consequently, such excuses are beside the mark. On the other hand, there are very many contingencies which will readily occur to most readers, against which it is quite impossible to introduce any form of safeguard; for example, a reasonable promise of delivery may be given in all good faith with a tender, but in the interim between submitting this and the receipt of the order, the factory's facilities may well have been swamped by a bulk order. Naturally, in such circumstances the correct procedure is at once to acquaint the client of the altered position of affairs, explaining fully its effect upon his order and ask his indulgence, but it is too often the case that our friend the manufacturer, hoping for something to turn up and afraid of cancellation, says nothing, and eventually finds his Micawber-like policy is but leaning on a broken reed, that he has put his client in a predicament, and seriously prejudiced future prospects. It should be unnecessary to point out the obvious flaws in this attitude, but unfortunately for the welfare of the industry at large it is too common. However, ignoring such contingencies as herein mentioned, it should be a reasonably safe policy, when estimating deliveries, to strike a mean between the times usually taken by the factory in the past for making similar apparatus or material, say, over a term of 12 months; of course making, where necessary, due allowances for increased or decreased manufacturing facilities.

Again, one is prone to suspect that very frequently promises are made, perhaps under pressure from the customer, which in the very nature of things, cannot reasonably be maintained, the result being that an unenviable reputation militating against repeat orders is quickly acquired.

Taking all things into consideration therefore, it is not necessary to seek very far to ascertain the reason for the prevalence of that bugbear, the penalty clause, the dislike of which is in no way diminished by its "liquidated damages" *nom-de-guerre*, and very rarely indeed, made equitable by the addition of a corresponding bonus clause.

Another aspect of this liquidated damages clause is that it is somewhat enlightening and annoying to the prospective purchaser, if he compares the time of delivery he is quoted for identical apparatus—(*a*) without a penalty clause; (*b*) with a penalty clause; (*c*) with a bonus-clause; (*b*) and (*c*) being added at succeeding stages of the correspondence. In the case of (*c*) the position grows quite interesting to behold, for almost invariably the manufacturer lays himself out to earn the bonus and frequently succeeds, not realising that by so doing he is perhaps laying his good faith open to imputation. Of course comment is needless, and it is reasonably safe to assume that the other orders in the shops suffer in a greater or lesser degree.

It is a moot point if the larger manufacturers or the small specialising firms are the bigger sinners; in all probability there is not much to choose between them, for whilst we are all familiar with the negative statement concerning the spiritual and physical welfare of big industrial corporations, yet the larger firms, with their special routine, if well schooled and free from red tape, are in a better position to obtain raw materials than their smaller competitors, if only on account of their being able to bring greater pressure to bear upon their suppliers. On the other hand, it is equally true that the small specialist manufacturer is able to devote much more personal attention to the progress of the order through all its stages.

In the foregoing, undue prominence has been given to the customer's point of view, but it must not be assumed that the trouble is one-sided in its origin. Quite the reverse, and undoubtedly manufacturing problems would be much easier of solution if consulting and supply engineers and other purchasers did not expect the impossible, but endeavoured to adopt a more tolerant attitude than is sometimes the case. By allowing really ample time for the execution of the work, the buyer helps matters mutually all round, and in this connection it is very often the case that the ample time may be given by the simple expedient of not taking unnecessarily lengthy periods for the consideration of the various tenders. He himself is benefited by receiving a lower price, for it is not to be wondered that the manufacturer—knowing he is going to be allowed but a short delivery, and, furthermore, to be saddled with a penalty clause—is going to take care of possible contingencies in his price.

ELECTRIFICATION OF THE CANNOCK CHASE COLLIERY.

A PAPER on the above subject was read before the South Staffordshire and Warwickshire Institute of Mining Engineers by Mr. S. F. Sopwith, of which the following is an abstract:—In view of the effect of additional legislation to increase cost of production, it has become essential that modern methods should be introduced into the older collieries if the all-too-narrow margin which normally exists between costs and sales is not to be reduced to vanishing point.

It was on this account that the Cannock Chase Colliery Co. decided to adopt electricity, with a view to reducing colliery-consumption and providing a means of transmitting power underground for haulage and other purposes. The substitution of electric drives for the screens and picking-belts formed the nucleus of the scheme, which has gradually been extended in other directions.

In the power station, steam at a pressure of 165 lb. superheated 100° F., is raised in two Lancashire boilers. A third boiler is provided as a stand-by, and a fourth is in course of erection. Feed-pumps of the Weir type supply hot feed-water to the boilers through a Babcock & Wilcox heater, the heat being obtained from the exhaust of the engines, which passes to the atmosphere.

The generating plant consists of three direct-coupled steam alternators, two being of 200 and one of 500 KW. capacity. The engines are compound and triple expansion respectively, and together with the alternators were made and supplied by the Brush Co. The switchboard is of the Ferranti remote-control type.

Three-phase current is generated at 3,000 volts and 50 cycles, and distributed by overhead bare copper conductors, supported on creosoted redwood poles, to sub-stations at Nos. 2, 3, 7 and 8 Pits, where it is transformed to 600 volts. Lightning arresters are placed at the power station and sub-stations, and at one point between the two.

The plant at No. 2 Pit sub-station consists of a 100-KW. transformer of the core type, stepping down from 3,000 to 600 volts. Current is supplied underground for a 75-B.H.P. motor that drives the main endless haulage-gear, and two 10-B.H.P. portable haulage-gears. On the surface a 20-B.H.P. motor drives a creeper and screen-conveyor of the Marcus type; a 20-H.P. motor drives the sawmill, and a 20-H.P. motor drives a crosscut saw for cutting mining timber. The 75-B.H.P. motor was applied to the crank-shaft of the old steam-driven gear through epicyclic reduction-gear, the ratio of speeds being 960 to 90 R.P.M. This gear, known as the "Whitehall," and made by Messrs. Strachan & Hensbaw, serves the double purpose of reduction-gear and clutch, the motor running continuously.

At the No. 3 Pit sub-station two transformers of 100 and 50 KW. capacity respectively supply the current for two 20, one 40, and one 5-B.H.P. motor for driving the screens and picking-belts, these motors having replaced numerous small steam engines. One 40-B.H.P. motor drives a three-throw pump underground.

A 15-B.H.P. motor drives a crosscut saw and a small saw-bench for cutting mining timber into lengths, making sleepers, &c. Current is also supplied to a Simplex coal-cutter with a motor of 20-B.H.P.

At No. 5 Pit, the high-tension current is taken direct from the power station bus-bars down the shaft, where it drives a motor of 180-B.H.P. operating a main-and-tail haulage-gear about a mile from the shaft inset; a 70-B.H.P. haulage-gear and a centrifugal pump of 25-B.H.P., the current for the latter being transformed to 600 volts on the spot. Arrangements are being made for the installation of a 40-B.H.P. main-and-tail haulage-gear, a 20-B.H.P. hoist for winding coal from a lower level, and a small compressed-air hammer-drill plant.

At No. 7 Pit sub-station, one 50-KW. transformer supplies current for a 25-B.H.P. turbine pump at the Five-Foot level, at a depth of 257 ft. from the surface. A small feeder of water (chiefly from the shaft garlands) is dealt with at the Old Park level 408 ft. from the surface by a hydraulic motor driven from the turbine-pump rising-main, which raises the water to the main lodge-room.

No. 8 Sub-station contains three 50-KW. transformers, shortly to be replaced by two of 100-KW. capacity, which supply current

on the surface for two 20-B.H.P. motors for driving the screening machinery, and underground for one 120-B.H.P. main endless haulage, two 30-H.P. auxiliary main-and-tail haulages, and one 10-H.P. portable main-and-tail haulage. A portable compressor and hammer-drill equipment have recently been installed, and other small haulages are in contemplation. The existing transformers will be used underground where required.

Arrangements for conveying the current to the company's pits at Hednesford are in progress. The overhead bare wires will be connected through a switch on the surface to the main shaft cable and the pressure will be transformed to 600 volts, and used for haulage, heading, and coal-cutting purposes.

The cables for medium pressure are three-core bitumen-insulated throughout, and paper-lead covered, and the high-tension cables are doubled-armoured with steel tape and wire.

In addition to the foregoing plant, lighting transformers are placed underground at important junctions, and in some cases supply current on the surface.

The following is a summary of the cost of the entire installation :—

POWER STATION AND TRANSMISSION LINES.

Power house, boiler house, buildings, boiler seatings, engine foundations, &c.	£4,000
Two 200-KW. steam alternators	2,500
One 500-KW. do. do.	2,574
Switchboards and fittings	520
Three boilers, pipework, feed pumps, superheaters, feed-water heater, &c.	3,289
Transmission lines to connect to sub-stations	562
Total	£13,445

SUB-STATIONS.

Adapting old buildings at Nos. 3 and 8 Pits, and building new houses at Nos. 2 and 7 Pits, say	£200
Transformers	1,167
Switchboards and fittings, cables, &c.	2,059
Motors, haulage gears, pumps, &c.	3,888
Labour and excavation for motor houses, laying cables, &c.	500
Total	£7,814

Thus the total capital outlay on power and sub-stations, mains, &c., was £21,259.

It may be pointed out that in certain cases additional steam-power would have been necessary to carry out what is now being done electrically.

It is interesting to note the cost of generation, which compares favourably, even in the case of a comparatively small plant, with the cost of buying current from a public supply company. There are undoubted advantages in the latter method, and had there been such a company existing from which to buy power the pros and cons would have been seriously considered. The cost per unit for the half-year ended December 31st, 1912, was as follows :—

Wages	£223·2
Fuel, 1,506 tons of slack at 6s. per ton	451·8
Stores	40
Depreciation and interest on power station and transmission lines, at 10 per cent. on £13,445	672
Total	£1,387
Total units	337,000
Cost per unit	0·987d.
Normal load	about 350 KW.
Load factor	15 to 20 per cent.

The advantages derived from the adoption of electricity may be summarised as follows :—(1) The colliery consumption has been reduced by at least 1¼ per cent., say 6,875 tons. (2) Some 25 horses have been dispensed with underground. (3) A great reduction in labour has resulted from the substitution of mechanical for horse haulage. (4) The Lancashire boilers no longer required (owing to the conversion of steam to electric power) are being utilised at other pits to supersede old egg-ended boilers, thereby reducing labour and consumption. (5) The current is available underground for further extensions in the way of auxiliary haulage, coal cutting, &c., and for lighting up important stations, which, if not actually economical, is more convenient and safer.

The annual saving effected is shown in the following table :—

Colliery consumption, 6,875 tons at 4s. 6d. per ton		£1,546
25 horses less at 10s. each for fodder, &c., per week	£650	
50 boys at 2s. 6d. each = £6 5s. per day, or for year of 250 days	1,562	
	£2,212	
Less wear and tear on ropes, hauliers' wages, &c. (10 men at 5s. per day, or for year of 250 days), say	622	
		1,550
Reduction in hauliers due to the substitution of main-and-tail for endless haulage		500
Substitution of mechanical for hand-sawing of timber		250
Screen engine boys, &c.		100
Total annual saving		£3,946

The total saving thus represents about 18½ per cent. interest on the capital outlay, apart from any saving derived from the use of portable compressor plant and power drills, which have fully justified their adoption during the short time that they have been in use.

In the discussion which followed (according to the *Iron and Coal Trades Review*), one speaker criticised the scheme which had been adopted, holding that it would have been cheaper to have improved the existing steam plant, or wait until electrical power came along at a cheap rate. Mr. Bernard Clark, being somewhat familiar with the plant and difficulties which had to be overcome, considered that electricity had only been applied where there was an obvious saving or other advantage, and that the design of the plant left little to be desired. The cost of production was high, on account of the low load factor, which would improve as the plant was extended. At a Welsh colliery power station where the working conditions were better, the output being 82,000 units per week, and the load factor 50 per cent.—60 per cent., the total generating and capital costs per unit were ·36d. The plant capacity was 5,000 KW., and the normal load on the main shaft 3,000 KW. Other speakers held that with a load factor of 15 to 20 per cent., the costs were quite satisfactory, and these might have been manipulated and made much lower if other figures had been chosen for depreciation. It was the first H.T. plant in the southern part of the county.

The Author, who received a cordial vote of thanks, dealt briefly with the proposals of a certain power company which had not materialised, but which if certain guarantees of load had been forthcoming, would have been prepared to supply at between ·36d. and 1d. per unit according to load factor. The Cannock Chase plant was rather large for the present load and the load-factor was low, and, under these conditions, he did not think a cost of under 1d. per unit could be expected. He briefly described the conditions which had to be met, pointing out that some endeavour to standardise in motors and transformers had been made, and that exhaust turbine plant was unsuitable on account of the cost of condensing. In the first instance, unarmoured cables were used underground; in other cases armoured cables were used everywhere, double-armoured for high-pressure, and single-armoured for medium pressure. Double wire-armoured shaft cables were used, and the earthing was through the armouring to the surface. The unarmoured underground cables were earthed through an old wire haulage rope.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SWEDEN.—The Board of Trade have received a copy and translation of a new Swedish Law, which contains some important provisions regarding the marking of goods imported into Sweden. Sec. 1 of this Law contains the following provisions :—

Goods bearing a label which gives them the appearance of having been produced or manufactured in Sweden may not be imported from abroad for sale.

The fact that goods bear a label written in the Swedish language or bear a picture with a Swedish motto shall, even if in the latter case the picture is accompanied by an explanation, not be considered a hindrance to the importation of the goods.

The above prohibition does not apply :—

When it is obvious that the goods were really produced or manufactured in Sweden and have previously been exported from the country;

When the mark attached according to custom of trade is only intended to demonstrate the nature of the goods (generic marking); or

When, besides the Swedish mark of origin, it is stated on the goods in a clear, easily visible and permanent manner, that the goods are of foreign origin.

The Law also provides that goods prohibited by Sec. 1 shall be seized by the Customs officers.

The owner or consignee of the goods shall be afforded an opportunity of defending himself in the proceedings before the Administration. The goods are to be declared confiscated if the Administration finds that they were legally seized by the Customs officers, unless the prohibited marking thereon can be erased or the goods supplied with such markings as shall indicate their foreign origin. In addition, the consignee or owner shall be liable to a fine.

The provisions of this Law also apply in cases where illegal marks are affixed to the coverings in which goods are packed when imported, provided that the coverings are of such a nature that the articles are intended to be sold therein.

Sec. 18 of the Law deals with the importation into Sweden of goods which bear false *foreign* marks of origin, and is to the effect that if they are marked as being the origin of a country which has a treaty with Sweden for the mutual protection of marks, whereas they are in reality the origin of some other country, they may be confiscated in a similar manner to that described above, and may only be admitted for sale if and when the false marks have been erased or the real country of origin indicated.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,816. "Mine signalling apparatus." R. Nicholas. August 5th.

17,821. "Enumeration of telephone calls." S. D. Williams. August 5th.

17,836. "Electric fire-alarm and the like." V. M. Wolbrauch, trading as V. Wallace and H. L. Read. August 5th.

17,849. "Shade or globe supports for gas or electric incandescent lights." Mrs. J. N. Mollett. August 5th.

17,859. "Wireless signalling." R. C. Galletti. August 5th. (Complete.)

17,879. "Electric relay." Siemens & Halske Akt. Ges. Addition to 17,137/13, Convention date, November 18th, 1912, Germany.) August 5th. (Complete.)

17,889. "Portable electric lighting apparatus." H. H. Hirsch. August 5th. (Complete.)

17,899. "Electric switchgear." J. A. Hirst and P. S. Brook. August 6th.

17,907. "Electric arc lamps." W. R. Ridings. August 6th.

17,918. "Electric imitation candle lamps." Chandolite Co. and F. Taussig. August 6th. (Complete.)

17,922. "Means for regulating the efficiency of electric-current generators working at variable speed." F. Eichert. (Convention date, April 4th, 1913, Germany.) August 6th. (Complete.)

17,925. "Electrodes." Fried. Krupp Akt. Ges. (Convention date, September 18th, 1912.) August 6th.

17,926. "Electrically-controlled valve." H. J. Read and W. J. Branson. August 6th.

17,927. "Optical pyrometers." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt. Ges., Germany.) August 6th. (Complete.)

17,947. "Thermo-magnetic current consumption regulator." G. B. Caminati. August 6th. (Complete.)

17,954. "Lanterns for electric-filament lamps." A. G. Bloxham. (R. Bosch (Firm of), Germany.) August 6th. (Complete.)

17,969. "Electric ozone generators." C. W. Denny. August 7th.

17,996. "Protective devices for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 7th.

17,997. "Electrical starting apparatus for internal-combustion engines." H. W. van Raden. August 7th.

18,002. "Heating elements of electric cooking and heating apparatus." M. J. Railing and C. H. Archer. August 7th.

18,008. "Train electric control systems." B. Starie. August 7th.

18,018. "Telephone transmission systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) August 7th. (Complete.)

18,019. "Automatic signalling and alarm systems for railways and the like." O. M. de Munnick. August 7th. (Complete.)

13,024. "Wireless apparatus." G. E. Heyl and T. T. Baker. August 7th.

18,032. "Dials and indicating mechanism of meters for registering supplies of electrical energy." J. W. Beauchamp. August 7th.

18,072. "Electric furnaces." W. N. Grafts. August 8th. (Complete.)

18,073. "Electric shaft furnaces." W. N. Grafts. August 8th. (Complete.)

18,102. "Process and apparatus for the electrolysis of halogen alkalies." Siemens & Halske Akt. Ges. (Convention date, February 20th, 1913, Germany.) August 8th. (Complete.)

18,103. "Apparatus for measuring the magnetic potential between any two points of a magnetic circuit." W. Rogowski. (Convention date, August 9th, 1912, Germany.) August 8th. (Complete.)

18,106. "Supplying current for electric devices for setting the points of electric railways with sliding bow and roller-bow arrangements." G. Breucker. August 8th.

18,110. "Arc lamps." H. Ayrton. August 8th.

18,122. "Telephone exchange systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) August 8th. (Complete.)

18,128. "Railway safe-running device." A. R. Angus. August 9th.

18,138. "Engine-room telegraph apparatus for ships." L. Hauxwell. August 9th.

18,160. "Telephone locking system." W. A. Morse and A. M. Morse. August 9th.

18,164. "Battery regulators." E. Lowe. August 9th. (Complete.)

18,170. "Cables for the transmission of electric energy." J. G. Cunliffe and R. G. Cunliffe. August 9th.

18,171. "Iron alloy for dynamo-electric purposes." W. Rubel. (Convention date, August 24th, 1912, Germany.) August 9th. (Complete.)

18,178. "Electric motors." H. A. Whiteside. (Convention date, August 10th, 1912, United States.) August 9th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Contact Fingers for Electric Controllers or the Like. A. H. S. Dyer. 13,695. June 11th.

Apparatus for Electroplating. G. P. M. Lee and W. A. Brame. 13,746. June 12th.

Means for Securing Electric Continuity in Metallic Conduits. Electrical Conduits, Ltd., and J. R. A. Hemming. 16,104. July 10th.

Electric Discharge Apparatus. R. Moretti. 16,164. July 10th. (July 15th, 1911.)

Track Apparatus for Operating Railway Signals. L. Ducellier and H. Guillon. 16,534. July 15th.

Displaying Advertisements in Connection with a Transparent and Reflecting Screen. Ludwig Macho & Co. 16,900. July 19th. (August 29th, 1911.)

Electrical Recording Instruments. W. R. Cooper. 17,388. July 26th.

Electric Hand Apparatus for Producing Light. W. E. Lake. (Fabrique Internationale d'Appareils a Magneto S.A.) 17,752. July 31st.

Interlocking Electric Starting Switchgear. A. H. Railing and C. C. Garrard. 21,120. September 17th.

Electric Motor-regulating Resistances. A. H. Railing and C. C. Garrard. 21,504. September 21st.

Electric Controlling Devices for Automatic Photographic Devices. S. Grossi. 21,598. September 21st.

Starting Devices for Electric Motors and like Apparatus. G. Ellison. 22,423. October 2nd.

Automatic Electric Current Controllers. L. Abbatecola. 23,542. October 15th. (March 26th, 1912.)

Electric Illuminated Revolving Advertising Apparatus. J. W. Horton. 23,977. October 21st.

Material for the Mirrors of Projectors. Siemens-Schuckertwerke Ges. 25,233. November 4th. (November 3rd, 1911.)

Electric Meters and Meter Systems and Relays adapted to Control the Same and for other Purposes. Siemens-Schuckertwerke Ges. 25,831. November 11th. (November 11th, 1911.)

Electrical Switches. B. D. Horton. 26,671. November 20th.

Electrical Apparatus for Indicating Speed and Direction of Revolution at a Distance. N. C. E. Flaman. 26,685. November 20th. (November 25th, 1911.)

Telephone Installations in which the Subscribers' Connections are Grouped according to the Number of Calls. Siemens & Halske Akt.-Ges. 28,701. December 13th. (December 19th, 1911.)

Devices for Discharging Electricity from Paper in Printing and like Machines. J. J. O'Toole. 29,735. December 24th.

Methods of Liberating Small Quantities of Gases or Vapours in Closed Glass Vessels under the Action of Light or Heat. Siemens & Halske Akt.-Ges. 29,891. December 28th. (December 30th, 1911.)

Electric Relays. British Thomson-Houston Co., Ltd. (General Electric Co.) 12,060. May 21st.

Lighting of Miners' and like Safety Lamps. A. Paxton. 14,547. November 25th. (November 25th, 1912.)

Telephone Exchange Systems. W. Aitken. 16,906. July 20th.

Electrical Apparatus for Timing and Recording the Finish of Races and the Like. R. Carlstedt. 17,666. July 30th. (May 14th, 1912.)

Method of Operating Electromagnetic Striking Tools by Means of Alternating Current. L. Schuler. 18,184. August 7th.

Brush Gear for Dynamo-electric Machinery. Lancashire Dynamo and Motor Co., Ltd., R. S. McLeod and J. H. Wild. 18,777. August 16th.

Electrical Arrangements for Protecting Ships' Bottoms and Submerged Structures from Barnacles or Aquatic Life and the Like. J. E. James. 19,297. August 23rd. (Addition to No. 14,181 of 1910.)

Apparatus for Producing Electric Oscillations Adapted for Wireless Communication and other Purposes. W. Dubilier. 19,763. August 29th. (Addition to No. 11,091 of 1912.)

Electric Traction Systems. J. E. Pollak. (Elektro-Motoren-Werke Hermann Gradenwitz.) 20,446. September 7th.

Protective Attachments for Telephone Mouthpieces and Earpieces. S. T. Richardson. 20,580. September 10th.

Telephone Apparatus. R. Lagus. 21,351. September 19th.

Dynamo-electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co.) 21,761. September 24th.

Ventilation of Dynamo-electric Machines. British Thomson-Houston Co., Ltd., and H. W. Taylor. 21,866. September 25th.

Electric Telephones. L. G. Hammer. 24,408. October 25th.

Electric Furnaces and Process of Operating the Same. British Thomson-Houston Co., Ltd. (General Electric Co.) 26,082. November 13th.

Devices for Electrically Operating Tramway and Like Points. G. Davidson. 26,145. November 14th.

Automatic Reverse-current Cut-out Arrangement for Electric Circuits. P. Ackermann. 27,090. November 25th.

Electrically-heated Garments. A. C. Stubling. 28,846. December 14th.

1913.

Electric Terminal Connections for Aluminium and Similar Conductors. L. W. Chubb. 2,146. January 27th. (February 16th, 1912.)

Electromagnetic Switching Mechanism for Heavy-current Switches with Automatic Release. Bergmann Elektricitats Werke Akt.-Ges. 2,778. February 3rd. (February 1st, 1912.)

Electrical Signalling Apparatus for Lifts and the Like. G. A. Loudon. 4,256. February 19th.

Devices for Automatically Adjusting the Time of Ignition of Internal-combustion Engines. R. Bosch (Firm of). 4,692. February 24th. (March 14th, 1912.)

Electric Furnaces for Treating Metallic Filaments. G. Ludecke and Brimsdown Lamp Works, Ltd. 6,952. March 20th.

Telegraphic Transmitters. W. E. Shaw. 8,024. April 5th.

Cells which are Sensitive to Light and Provided with Aluminium Electrodes, and for which Acetone is Used as Electrolyte. C. Stille. 9,060. April 17th. (April 24th, 1912.)

Telephonic Reproducers. C. Stille. 9,644. April 24th. (April 24th, 1912.)

Loud-speaking Telephone Instruments. Kelvin & James White, Ltd., and M. B. Field. 9,782. April 25th.

Power Transmission and Control Apparatus on Motor Vehicles. J. G. P. Thomas and Thomas Transmission, Ltd. 12,841. July 23rd. (Divided application on No. 17,130 of 1912, July 23rd.)

Electromagnetic Weight-lifting Apparatus. Magnet-Werk Ges. Eisenach. 13,911. June 16th. (July 16th, 1912.)

Automatic Short-circuiting Device for Lightning Arresters. Siemens and Halske Akt.-Ges. June 19th. 14,214. (September 9th, 1912.)

Seasoning Timber Electrically.—In describing his latest researches in the electrical seasoning of timber, Dr. Nodon claims that his process can be applied in the forest where the trees are felled, since no cumbrous or costly equipment is required. The process depends on the electrolysis of cellulose and its derivatives. The newly-felled trees are sawn into thick planks and laid on a false flooring, one on top of the other, with the interposition, however, of moistened matting or similar material between each layer, to act as electrodes for the introduction of alternating current which is passed for 10 hours or so. The effect of the current is to produce chemical changes in the cellulose and the sap, rendering them impervious to decay. Further, the sap loses those gummy and hygroscopic characteristics which normally prevent rapid drying. It is claimed that timber thus treated is ready for use a few weeks after it is felled, and is harder, stronger, more homogeneous, easier to work and less warped by moisture than timber which has been seasoned by the ordinary air-drying process. Paving blocks treated by the Nodon process are said to have been in use at Bordeaux for six years without showing appreciable deterioration.

THE

ELECTRICAL REVIEW.

VOL. LXXIII. AUGUST 29, 1913. No. 1,866.

ELECTRICAL REVIEW.

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PERSONAL CONTROL.

IN the earlier days of engineering there would have been no necessity for the following remarks; at the present day, however, we are constrained to suggest that engineers may possibly be tempted by the presence of the large range of automatic apparatus for recording and indicating all kinds of mechanical and electrical phenomena, to relax the endeavour to exercise that strict personal control over the operations of an engineering installation, which is even now so necessary to secure proper working results. A brief survey of some of the better known and more commonly used indicating and recording devices will illustrate the point. Taking an electric generating station, for example, one may obtain automatic tell-tales as to the percentage of carbon dioxide in the flue gases, the frequency of firing when the boilers are hand fired, the state of the smoke stack, the pressure of steam, the quantity of feed water passing at any instant, the rate of flow of steam to the engines, &c. In the engine house, automatic indicators and recorders can be applied to high pressure, intermediate pressures, and vacua, number of revolutions, if required, temperatures at critical points of an engine, and the operation of auxiliary plant. The switchboard presents a panoply of recording and indicating instruments that are necessary to a very great degree, although it may be claimed that on some of the more elaborate boards refinement is carried to excess. Sub-station indicators, spark gap discharge indicators, and other automatic devices further safeguard the system, and it is possible in a comparatively easy way to enable most of these indications to be carried to a room entirely separate from that containing any machinery whatever. In some of the larger power installations, the detached control room is becoming a feature, and if the system is not carried to excess, it proves most valuable.

At the same time a danger lies in the fact that an engineer having available at his elbow when sitting at a desk all these means of checking the functioning of the various portions of the plant, is tempted to rely more and more on these automatic indicators, and less and less on his own personal inspection and investigation gained by frequent and vigilant tours throughout the works. At this point remote control, using the term in its widest sense, becomes a snare. It is, of course, a reasonable thing to say that the best ganger never handles a spade, and therefore the engineer who can see furthest, and carry on the general operations of the plant in the best manner, must not occupy his time with cumbersome detail checks of a personal nature, but that is only one side of the shield. The other is that of the man whose drivers rarely see him, and who, therefore, either waste oil in their engines or cut down the oil to such an extent that their bearings seize. It is a case of the man who never goes into the stokehold, and whose stokers, therefore, please themselves as to how they fire the boilers.

The personal element of control is absolutely essential to avoiding those petty differences between one man and another that go so far to lessen the efficiency of a station staff, and while the expert organiser can learn very much from his automatic indicators, using them simply as a guide and an argument, the successful power house engineer is a man who knows how to feel the big-end without falling into the engine, and who can, if necessary, pick up a shovel and show how a peak-load fire can be kept up on slack. He does not need to spend all his time doing this, but a comparatively little time adequately employed will earn a tremendous amount of respect and efficiency. In addition to this, it will teach the chief engineer a good many things about his plant that his indicators and recorders will not tell him. It will, for example, let him know whether the cotton waste is gritty, and will probably explain some of the minor breakdowns. It will probably teach him a good deal more quickly than differential calculus the precise price per ton of coal which means minimum cost per unit, and it will make a man and a brother of the coal trimmer.

Personal control in power-house operations is a thing that is not to be despised. In times of emergency men will always do more for the chief when they know something about him to his advantage than they will for a man who rings up on the telephone from the city office, and in these days when the business-getting side of electricity supply is being so much insisted upon, it may be worth while counterpoising the tendency by advocating a return, to a certain extent at any rate, to the older type of chief engineer, who knew how to distinguish between a spanner and a tommy-bar.

British-made Half-watt Lamps.

On Wednesday last a Press view was held of the first "half-watt" lamps made in this country. It is interesting to note that this lamp, of which much has been heard from time to time from Continental sources, originated in the research laboratory of the British Thomson-Houston Co.'s associates at Schenectady, New York, under the direction of Dr. C. W. Witney, where a series of investigations has been taking place during the past two years. The lamps which were shown in operation were produced at the B.T.H. Co.'s works at Rugby, and they will, it is expected, be commercially available in about three months' time; running on 80 volts they give, roughly, 1,600 c.p. with 10 amperes, and as series lamps for street lighting purposes, they appear, at the moment, likely to have the field very much to themselves.

Traffic Developments in Berlin.

The severity of motor-omnibus competition in Berlin is being experienced in a similar manner to that which prevails in London, although initial steps are now being taken with a view to overcoming the difficulty. As far as can be understood from the existing state of affairs, the principal sufferers from the rivalry are the Grand Berlin Tramways Co. and the Berlin Underground and Elevated Electric Railway Co., which also compete with each other along certain routes. The congestion of traffic in the inner parts of the city is so great that tramway expansion is declared to have reached its maximum limit, and in some quarters the opinion is even entertained that the time is not far distant when it may be necessary to take into consideration the question of partly suspending the tramway service in the city in the interests of traffic in general, after the example, it is said, of other capitals (!) In this event the motor-omnibuses would be required to form the connecting link between the tramways. However that may be, the Underground and Elevated Railway Co. has decided to acquire a large interest in the omnibus company by taking over shares of the nominal value of £200,000 and at the price of 180 per cent., and the tramway company has felt constrained to follow the example by the assumption of a financial interest of equal amount, both transactions being rendered possible through the shares held by their banking interests as represented by the firm of Bleichroder and the Deutsche Bank respectively. Apart from loans, the only outstanding share capital of the omnibus company on the completion of the transactions in question will be £200,000 nominal, but it is not expected that either the tramway or the railway company will endeavour to obtain possession of these shares so as to secure a majority control over the omnibus undertaking. On the contrary, it is rather thought that efforts will be made to bring the present triangular duel to a conclusion by the negotiation of working agreements for the avoidance of destructive rivalry in the future, and the hope is expressed that any such understanding, whilst of advantage to the undertakings directly concerned, will not be disadvantageous to the general public.

The Lead Position.

The course of lead prices has been rather irregular, with an occasional further easing down, more particularly for near deliveries, although the arrivals from abroad since the early part of the month have been decidedly limited again. As regards forward deliveries, however, the position has not improved at all, for the latest news is to the effect that a serious labour outbreak has occurred in the State of Missouri, which is responsible for an annual output of 140,000 to 150,000 tons. This introduces another complication into a market already vexed by the suspension of production at the leading Mexican properties, and in that country there is not the smallest indication of any improvement. On the contrary, news to hand from private sources is, if anything, rather worse than before. The North American Continent seems, indeed, to be afflicted with unrest of one sort or another, which is especially marked in metal circles, this arising, no doubt, from the exceptional activities of the Western Federation of Miners, who put a stop to mining and smelting operations throughout the entire Lake Superior copper region, and who have now caused a suspension of operations in the Missouri lead fields.

The state of affairs in Mexico is now commencing to show itself in the shipments from that country. Our imports from there during July only amounted to 286 tons, compared with 1,295 tons in the previous month, the total for the seven completed months of the year reaching 9,614 tons, compared with 11,901 tons in 1912, while the shipments from the United States to Europe consisting of Mexican lead treated in bond, amounted for the first half of the year to 24,037 tons, compared with 29,476 tons a year ago.

The United States lead smelters look like being very seriously hampered in their operations, for not only is the Mexican raw material cut off, of which upwards of 70,000 tons a year annually are treated in United States plants, but the Missouri trouble wipes out a yield about double as large. It seems too much to hope that the troubles across the Atlantic will not be felt here, more especially on the West Coast, for, in the ordinary course of events, a good deal of lead is shipped from North America to Glasgow, Liverpool and Manchester. The interruption of shipments to these important consuming centres is not to be regarded with indifference so far as prices are concerned. The only thing in favour of lower lead prices at the present time seems to be the cheapness of spelter, which encourages its use in place of the heavier metal.

There is a chance of more ample supplies coming forward from certain of the other important producing countries, and it is upon this that the hopes of consumers must chiefly rest. Both Australia and Spain have yielded more freely this year than last, their combined shipments showing an increase of about 20,000 tons, but the overseas trade has absorbed the whole of the surplus quantities which have been rendered available.

The technical condition of the lead market is now one of considerable strength, but it is believed to be the policy of the controlling parties not to force prices up, but rather to keep them down lest consumption be damaged. In the meantime there is a fair sized "bear" account open, and the covering of this may put rates up further.

INCREASING FREQUENCY BY STATIC TRANSFORMERS.

By S. M. POWELL.

One method which has been employed to increase the frequency of an alternating current is illustrated in fig. 1. The primary alternating current is carried to two windings *a a* wound in the same sense on two transformers, while an auxiliary magnetising current is supplied to windings *b* wound in opposite directions. In the secondary alternating-current circuit *d*, connected to the windings *c c* (oppositely wound), there is then produced alternating current of double the supply frequency. By representing the intensity of the secondary current graphically as a function of the self-induction L in the secondary circuit, a resonance curve is obtained. The inductance L is, in turn, a function of the magnetic properties of the transformer core which naturally varies with the magnetising current in the auxiliary windings. By suitably adjusting the secondary resistance, inductance

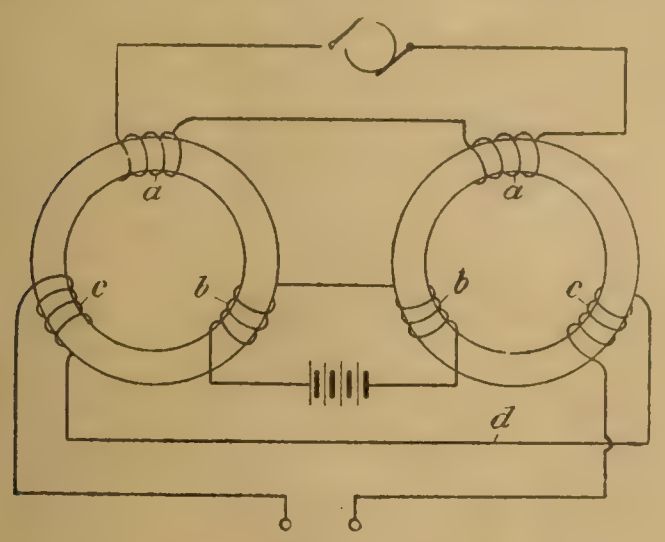


Fig. 1.

and capacity, it can easily be arranged that the secondary current varies in the neighbourhood of the resonance peak, hence the secondary current can be varied within large limits by comparatively small variations in the auxiliary magnetising current, and this fact forms the basis of an analogous method, recently patented by the Gesell. für Drahtlose Telegraphie (see also *La Lumière Electrique*, 23, pp. 20-23), for the production of high-frequency current for use in wireless work. By variations in the auxiliary magnetising current, obtained, for instance, by the manipulation of a resistance in this circuit, the secondary can be tuned accurately to the frequency imposed upon it.

The same phenomenon can be utilised to produce from low-frequency alternating current, high-frequency current of such frequency that the signals received at the far station

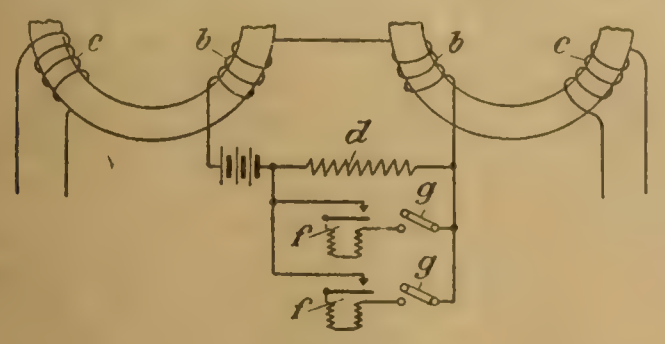


Fig. 2.

can be heard as musical sounds in telephone receivers. For instance, a resistance *d* (fig. 2) may be inserted in the magnetising circuit, and in parallel with this one or more periodic interrupters *f* having the frequency desired. The latter may be placed in action by the switches *g*, thus producing distinct and definite musical radiations. The resistance *d* is so chosen that the secondary current attains as nearly as possible its maximum resonant value when *d* is short-circuited by *f*, and falls as far as possible down the ascending or descending slope of the resonance peak when *d* is inserted in the magnetising circuit. The interrupters *f* are so arranged that the circuit is closed for a longer period than it is opened, and, instead of mounting them in parallel with resistance, they may be used to open and close the magnetising circuit. Fig. 3 shows the resistance *d* shunted by a key *h*. Yet another alternative is to superpose a low frequency alternating current of suitable intensity on the magnetising current, the net value of which thus varies between the limits corresponding to maximum variation in the secondary current. Going yet further, the continuous magnetising current may be entirely suppressed in favour of a low-frequency alternating current.

In telegraphic installations, *g* (fig. 2) is a Morse key, but in telephonic equipments the variations in the microphone resistance are made to vary the magnetising current, and thus produce corresponding but augmented variations in the high-frequency aerial current. The single group of transformers shown in fig. 1 doubles or trebles the primary

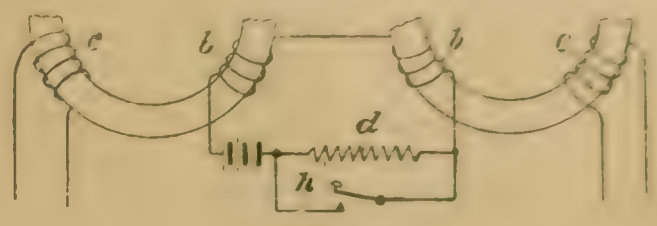


Fig. 3.

frequency, but by connecting a number of such groups in cascade (the secondary current from one group being used to excite the primary of the next group), any desired overall increase in frequency can be attained. The transmitting key and tuning adjustments are placed in the magnetising circuit of the last (highest frequency) group of transformers. If it be desired to eliminate the special magnetising windings *b*, *b*, the direct-current battery and control circuit is connected to the primary or secondary windings *a* or *c* through reactance coils, preventing the flow of high-frequency currents through the magnetising circuit.

THE CONDENSER MACHINE.

[BY OUR BERLIN CORRESPONDENT.]

The condenser machine invented by Dr. H. Wommelsdorf is a new electro-static machine for the direct generation of high-tension continuous current. While its principle was described some years ago in the scientific Press, it has only recently been so improved as to become suitable for practical use in X-ray and other work.

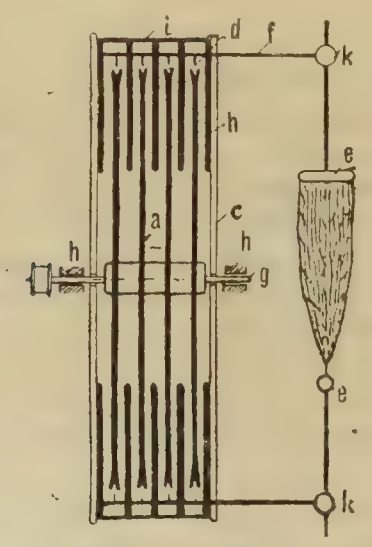
The characteristic feature of this machine is the alternating arrangement of the rotary and stationary disks, which is based on the condenser principle. It will be remembered that in an influence machine the rotating disk is only influenced on one side, the generated electricity being drawn off from the other. The rotating disks of the condenser machine, on the other hand, undergo electrostatic induction on both sides, the electricity produced in them being collected from a groove in their extreme periphery by steel wires penetrating therein. It will thus be seen that each disk, in accordance with the theory of condensers, takes up and supplies twice as great an amount of electricity as an influence machine. Actual experience, moreover, shows that the output of the new machine, thanks to some additional advantages connected with the condenser principle, is even considerably higher than could be expected. It is mainly due to the close arrangement of the disks that the condenser machine yields an amount of electricity 20 to 50 times as much as a Holtz-Wimshurst multiple-disk influence machine of equal size, the type so far almost exclusively on the market. Another point of considerable importance is that the condenser machine is absolutely independent of atmospheric conditions.

The sectors of the condenser machine are not attached to the surface of the disks, but embedded in their interior, thus augmenting the output, pressure and self-excitation of the machine, and increasing the life of the disks. In fact, the unceasing inflow and outflow of high-tension electricity from the suction combs, brushes and sectors to the insulating disks was bound in a very short time to destroy even the best insulating material. The stationary disks of the

machine are likewise entirely encompassed by insulating material.

The condenser machine mainly comprises a substantial frame closed on all sides which carries in its interior the statical fields, that is, the stationary disks. The rotating disks above described, to which is due the influence effect, are sandwiched in between these fields, thus being also comprised in the interior of the frame. This compact arrangement protects all vital parts of the machine not only against dust, but at the same time against radiation losses which would otherwise be an important item.

That this remarkably simple and efficient machine—as it were, a continually charging and discharging condenser—should have had to wait a number of years before being placed on the market, was due to some drawbacks of its original construction and to the fact that no insulating material suitable for the purpose could be found. In fact, the effects of the electricity and ozone produced by the condenser machine are, just because of its extraordinary



a, Rotating disks; *c*, end cover; *d*, collector; *i*, frame; *e*, electrodes.

SECTION OF CONDENSER MACHINE.

output, so powerful that rubber, a substance that could not be dispensed with on account of the high voltage of the machine, would become conductive after a very short time.

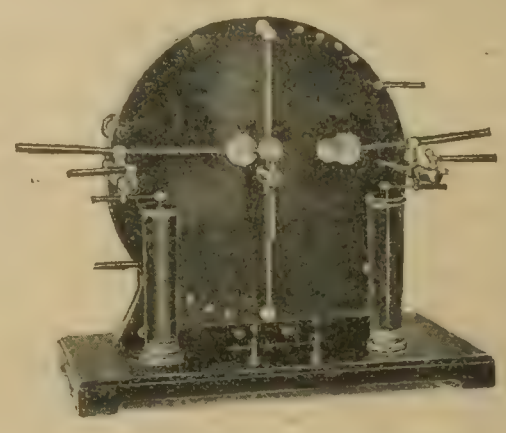
The adoption of a certain brand of Bakelite with which the caoutchouc disks were coated all round first made the condenser machine durable and suitable for commercial purposes. This Bakelite layer—insoluble and brilliant as enamel—endows the disks with a remarkably hard surface, and can only be removed by scraping with a knife, in the form of an amber-like yellow powder.

The arrangement of the current collectors at the extreme circumference of the disks has enabled the spark length of the condenser machine to be increased to twice its former value, thus allowing sparks considerably longer than half or even two-thirds of the disk diameter to be produced.

The condenser machine will be found an extremely useful apparatus for X-ray work, affording, as it does, a means of producing high-pressure continuous current directly without any conversion, rectification, &c. This allows hand operation to be used in the case of moderate effects, while increasing the life and constancy of X-ray bulbs, the more simple of which can be used without cooling, thus cheapening operation. Wherever there is no suitable electricity supply, *e.g.*, in the case of portable installations for military and other purposes, the condenser machine will afford an ideal means of operating X-ray apparatus. It will also be found useful in cases where only an alternating or three-phase current supply is available, which could not be used without resorting to converters, rectifiers, &c. Apart from hand operation, a small continuous, alternating, or three-phase current motor (of $\frac{1}{5}$ H.P.) can be used to drive it. The output of a motor-driven condenser machine having a single rotating disk 55 cm. in diameter is as much as $\frac{1}{2}$ milliampere. Machines comprising four, eight or ten rotating disks, such as have been constructed, show a correspondingly higher output.

Another field in which the condenser machine is bound to prove of the greatest usefulness and to excel all other apparatus so far in use, is the field of electrotherapeutics, viz., the medical applications of electricity. An especially important feature in this connection is that the output of the machine can be controlled at will and reduced to zero, the current intensity being proportional to the number of turns per second. This is an enormous advantage over powerful induction coils, which cannot be used for small outputs.

If, for instance, the electric currents yielded by the machine be applied to the human body, their physiological effects can be altered quite gradually and controlled at will, from a hardly perceptible shiver up to an unbearable



THE CONDENSER MACHINE.

intensity. At the same time, the operation of the machine is absolutely safe and harmless, the upper intensity limit being readily adjusted for by choosing a proper size of Leyden jars.

The machine also comprises two special terminals from which alternating currents or rapid oscillations can be collected for high-frequency current work and for performing the methods devised by Oudin, D'Arsonval, Apostoli, &c. The same large condenser machine also lends itself for franklinisation proper, that is, for static electricity treatment, and for experiments with the insulating stool.

The high pressure of the machine is noticed at a considerable distance by a spider-web feeling due to electrically-charged particles. These remote effects can be strikingly demonstrated by lighting Geissler and Tesla tubes from a great distance.

The exceptionally high Leyden jars used in connection with the condenser machine are countersunk in its base, and are, like the disks, coated with Bakelite. The polariser at the same time serves as short-circuiter, for rapidly and accurately breaking the flow of sparks.

Though the machines so far constructed are doubtless the starting point of types much larger and more powerful, they are able to comply with the most exacting requirements of X-ray work and electrotherapeutics.

The condenser machine is constructed by Messrs. Berliner Elektros. G.m.b.H., of Schöneberg, near Berlin.

THE ELECTRIC DRILL.

A GREAT many difficulties have arisen in the practical application of electricity in a direct manner to the operation of drilling stone and rock, and it is, therefore, a matter of congratulation that so much progress has already been made in this direction. The use of electric drills allows in many cases of the purchase of power from electric transmission companies at low cost, and the elimination of the expensive steam and air pressure plants usually required in connection with hydraulic or pneumatic drills. Where energy cannot be purchased, a small generating plant can be installed at a comparatively small cost, and the ease with which power can be transmitted throughout the mine workings by wire, and the rapidity with which the lines can be changed to suit the varying conditions, allow the mine operator to advance his work much more rapidly than can be done when using other types of drills. The small cost of installing and maintaining the electric wiring, the absence of leakage and the ease with which lines can be changed, show a large saving when compared with pneumatic lines.

A type of electric drill which has proved its value is that made by the Fort Wayne Electric Works, of Madison, Wisconsin. In general construction the drill is of the rotary hammer type,

operated by an electric motor which is mounted on the frame of the drill. The mechanism of the drill itself consists of two parts, one being a rotating helve containing the hammers, the other a chuck mechanism for holding and rotating the drill steel. There is a flexible belt connection between the motor and drill, allowing a suitable speed variation. There are no springs, solenoids, or other devices to complicate the design or to make the cost of maintenance too high. The drill mechanism is altogether enclosed inside a heavy cast-steel casing, strong enough to stand up to the hard usage which a mining drill of this type receives. There are two chambers in the revolving helve, in each of which there is a hammer consisting of a solid block of special steel floating freely. As the helve revolves, the hammer is thrown outward by centrifugal force, and at each revolution strikes a blow on the projecting head of a drill steel cap, which receives the energy of the blow and transmits it to the drill steel. After the blow has been given, the hammer rebounds into the chamber within the helve, where it is completely cushioned upon air which it traps. During the recoil of the hammer the helve is, of course, revolving, and the hammer passes the projecting drill steel cap. The hammer is again thrown into the striking position by centrifugal force during the remaining portion of the complete revolution of the helve. The chuck is a steel sleeve through which a shank of the drill steel passes, and holds this in position to receive the hammer blow, as well as transmitting the rotary motion. This rotation is effected by a heavy wormgear reduction driven from the helve shaft. A slip friction cone mounted on the wormgear shaft protects the gears from undue strain, in case the drill steel sticks. Buffer plates are attached to hold the drill steel in the chuck and to absorb the blow from the hammer when the drill steel is not striking rock, or is being backed out of a deep hole in broken or uneven ground. Grease packed roller or ball bearings are used; the motor is fully enclosed and splash proof, so as to be capable of operation in wet places, and either continuous or alternating-current motors can be used, for three-phase circuits of the usual frequencies in the latter case. The motor is quickly connected to the line by connector plugs, so designed that the untechnical operator cannot make a mistake in the connections. A 100 per cent. over-load margin is given to the motor design, and very great care is taken also with the motor to withstand the severe mechanical strains imposed upon it from time to time. The whole apparatus is mounted either on a tripod, column, shaft bar or quarry bar, and, when so used, is adapted for sinking, channelling, stoping or other operations where rock drills are required. The chief working advantages are that the drill steel is not reciprocated, and hence cannot be jammed into a fissure or cleavage crack. The large number of blows which are struck, together with the constant and positive rotation of the drill steel, produces an effect approaching that of boring and the holes drilled are straight and round. Owing to the rapidity of the blows, it is found in practice that before it can be fed far enough into a fissure to wedge itself the drill has hammered for itself a square shoulder or face, and should a fissure be encountered the buffer head prevents the drill steel from being plunged forward. Evidently, therefore, the electric rock drill is an accomplished fact, and in yet another department of industrial life the practical application of electricity enters into direct competition with the older forms of power production and transmission.

CATALOGUES AND PROCESS BLOCKS.

By G. BASIL BARHAM, A.M.I.E.E.

In the electrical trade it is a matter of great difficulty for any firm to do business unless it issues a fairly comprehensive and well-illustrated catalogue. No matter how widely the firm and its productions may be known, or how capable and tactful its representatives may prove themselves, the business obtained will depend to a considerable extent on the attractive appearance of their lists and leaflets and the freedom with which they are distributed.

A great deal of money can be wasted on catalogues if a cheese-paring policy is adopted and the expenditure on paper, printing and process blocks is insufficient. The slight extra cost involved by using an 80 instead of a 58 or 60-lb. double medium art paper is more than repaid by the enhanced appearance of the work, provided that a good quality of ink is used for the printing. If more money still is spent and an art or toned art paper, a ream of which in double medium size weighs 120 lb., is used the effect is better still, and if the printing is up to the mark and the blocks or electros used are of the best quality, a catalogue can be brought out which will prove one of the most powerful of selling agents that can well be imagined. It is a mistake to save money in paper and printing; it is a bigger mistake still to cut down the price of retouching photographs and cutting blocks. A block may be so good that it will give a good effect even on poor paper, provided the printer makes-ready properly. But no amount of care in printing will make a bad block appear good, even if the best of paper and the finest of inks be used. An artistic, clean cut and sharply defined illustration has a value which cannot be over-estimated, and it is surprising to find, from an inspection of catalogues issued in the engineering trades generally, not only that a number of firms buy process blocks which are not so good as they might be, but that there are those who apparently take little or no care of their blocks after they are made. A good block, taking photographing, retouching, block-cutting and electrotyping into account, is a costly item, being not a matter of shillings but actually of pounds. An instrument or a piece of office furniture costing as much would be taken care of, yet it is a common thing to see half-tone cuts placed one on top of another, on a dusty shelf, covered with grit and dirt, and not protected against injury in any way. The surface of a block is of copper, or sometimes zinc or nickel, covered with an emulsion. The glass-like polish of an unworn block will withstand the pressure of the printing press for many thousands of runs, as it is termed, but it is not proof against sharp particles of grit; it will be grooved and scratched if it is allowed to rub against the surface of another block; and it may be irretrievably damaged by being used either as a paper weight or as a means of driving tacks.

Of course there are cases, but in the electrical and engineering trades they are infrequent, when a block, after printing off a limited number of illustrations, is never used again by reason of changes in the pattern of the article it represents. Generally, however, illustrations are typical, and consequently are used in successive editions of a catalogue. In such instances it is surely wise to see that the blocks are preserved, so that it is not necessary to have a new block made every time a few lists are to be printed off.

The best plan to adopt is to have one or more good electrotypes made from the block when it is new and to print off these, carefully wrapping the original in tissue paper smeared with vaseline or other non-acid grease, and putting it safely away where it will not be exposed and yet can be readily looked up if necessary. Some firms prefer to print direct from the half-tone block, a policy which although it has certain drawbacks has nevertheless much to commend it. If the printing is done from an electro it matters very little if the electro is damaged in the press, as a new electro can always be made in a few hours from the original. But if the original is used it may be ruined beyond redemption if the machineman drops a wrench on it during the work of "readying" the machine for press, or by the forme in which it is being dropped whilst being taken from the "stone" to the machine bed. Where printing is done from originals an electro should be taken from the block either by the block cutters before delivery or by some firm of electrotypers directly after delivery, and this electro should then be treated as the original and wrapped up and stored away out of harm's reach.

It is not as though the proper care of process blocks and electros were either costly or troublesome. With a proper system, an intelligent boy can easily look after them and save his firm a good deal of expense. Without a system it is almost impossible to keep them as they should be kept, and the block-cutting firm will then do a considerable amount of business in providing duplicates of originals of the electros that have been mislaid or lost.

All process blocks and reproductions should be kept in shallow drawers, a trifle more than type high. A nest of such drawers is quite inexpensive, and if there should be any difficulty in obtaining one, a handy carpenter can knock one together, preferably out of bass or American white wood, with very little trouble. Such a nest of drawers will answer the requirements of a firm issuing only a small catalogue, but when lists are issued on a more extensive scale several nests, each corresponding to a section of the catalogue or a branch of the trade, will be required. In addition to the drawers a card index will be necessary.

Each block, when it comes from the block cutters, will be mounted on a hard wood base, generally of oak or mahogany, and from the base to face will be about the height of a piece of type, so that when it is locked in a printers' forme with the type for the necessary wording the whole will be level on the top, and, after the printer has made the necessary arrangements for bringing out the detail, ready for printing. On this wood base a number should be written in ink. It is of little use attaching paper labels, as these are so easily detached, nor is it wise to write the number on the back of the base, as after a few printings the wood will become compressed to a slight degree, and the printer will proceed to paste paper over the bottom of the base in order to raise the printing surface. The numbering should be done on the side of the block, and if there is any likelihood of the printer mistaking the top for the bottom, the block should be marked to prevent error.

The numbers of the blocks in each drawer should be written on the outside to permit of ready reference, and a card in the index should be prepared for each block. On this card should be written the block number and the name of the article it represents, with any descriptive matter as to type or pattern that may be necessary as well as the figure number it bears in the catalogue. The card should then be divided into an inwards and an outwards section by a heavy line, and should be ruled off horizontally in spaces about a quarter of an inch in depth so that the necessary entries can be made.

When a block is received from the etchers, the full description should be entered up on a card, and on the first horizontal space on the inward side, should be written the date received. This should be a white card, and immediately behind it in the index should be arranged coloured cards, made out in exactly the same way, one for each electro that is made from the block. As either originals or electros go out the cards should be entered up with the outwards date and the name of the printer to whom the block or the electro has been sent, or the name and address of the client to whom it has been lent. When it is returned the date on which it was received should be entered on the inward side, with the name of the firm from whom it was returned. At any moment, then, the cards can be gone through, and outstanding blocks can be traced and their return asked for without trouble

Whenever a block goes out it is a good plan to place a slip of card bearing its number in the place from which it has been taken, so that a glance through the drawers will show which blocks have gone. Otherwise, if a drawer were not full, there would be nothing to show whether there had ever been a block in the vacant space.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Reyrolle Flat Back Switchgear.

Figs. 1 and 2 show a three-phase low-tension switchboard recently manufactured by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, for use in a generating station, with slabs of white polished marble on angle-iron framework; fig. 1 shows the front view, and fig. 2 the view behind the board. The views are of interest as showing that Messrs. Reyrolle do not confine themselves solely to their totally enclosed ironclad gear.

The gear shown is used in these cases where economical considerations as to initial cost do not warrant the complete enclosure of all conductors. The conductors at the back are all visible and coloured, to indicate the phase to which each one belongs, and no live conductors are exposed in the front.

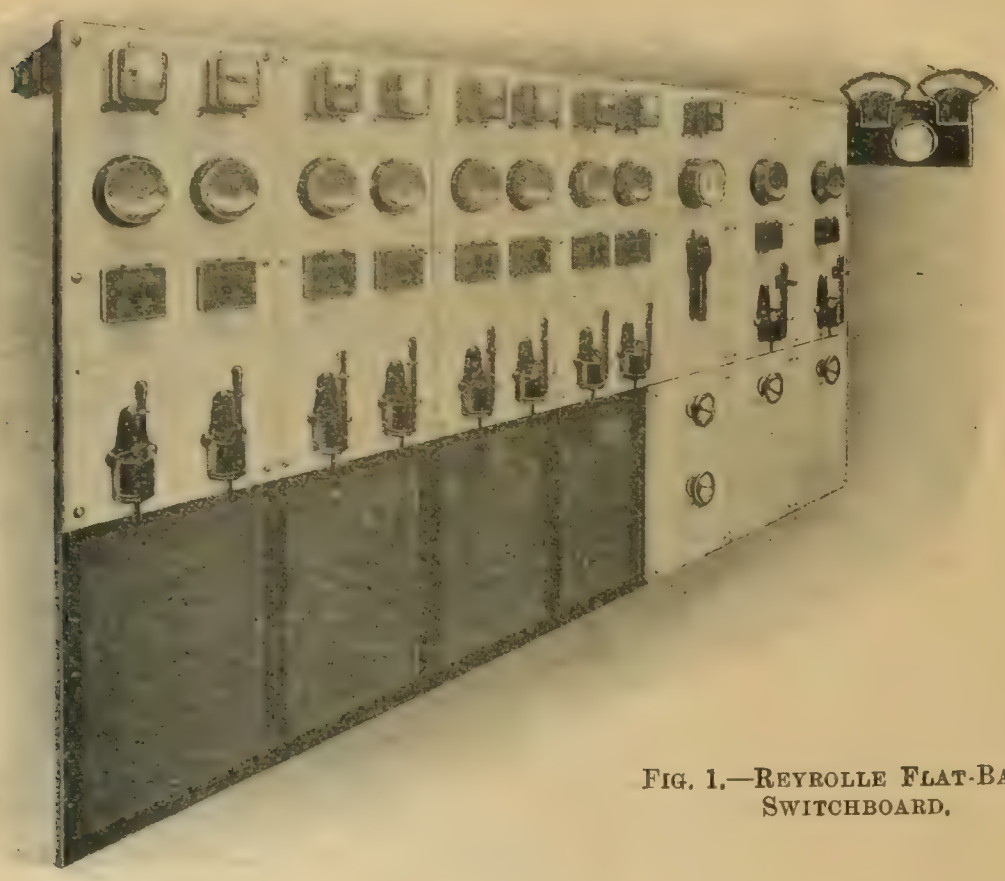


Fig. 1.—Reyrolle Flat-Back Switchboard.

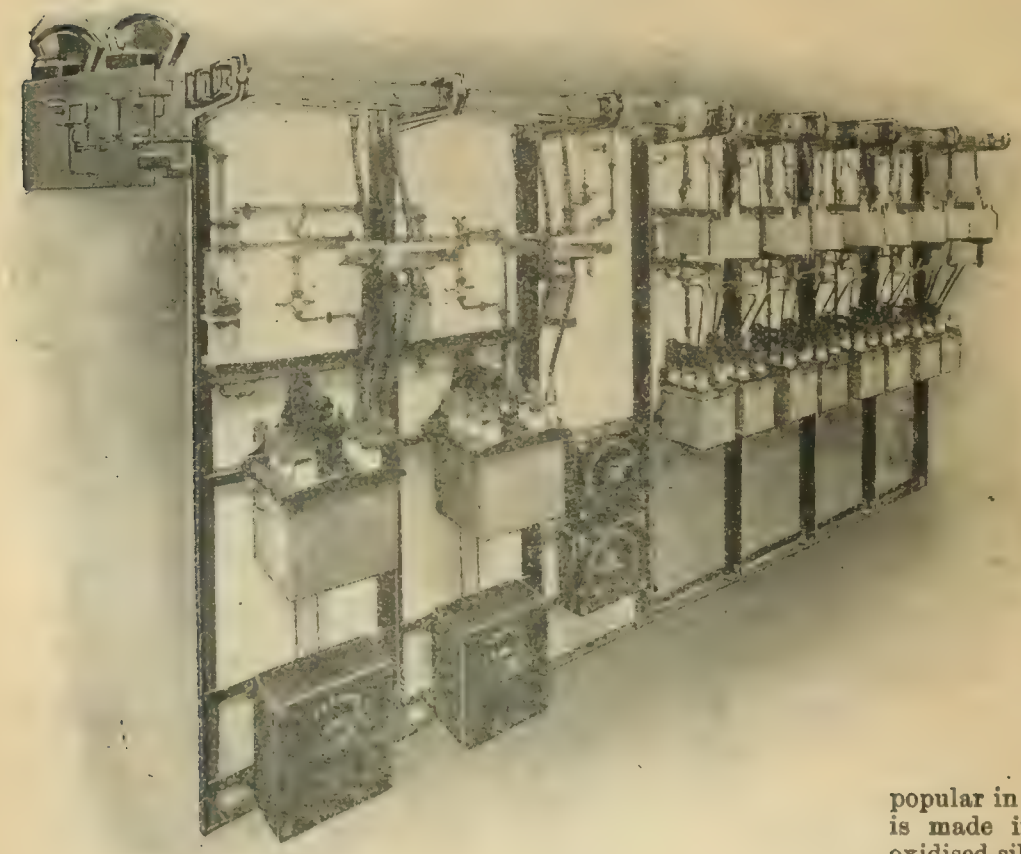


Fig. 2.—Back View, Reyrolle Switchboard.

The bus-bars are supported on the firm's special bracket, and consist of laminated strips made in unit lengths, so that any section of bar or any arrangement of tapering the section can be readily adopted; the section of the bars can also be easily increased when the board is extended, and there is no difficulty in joining up new lengths of bus-bars to the original ones.

Some Theatre Fittings.

Messrs. David Shanks & Co., Ltd., of 115, Wainwright Street, Aston, Birmingham, have recently introduced a special line of fittings for picture houses, theatres, and similar buildings, of which we reproduce some representative examples.

Fig. 3 is a design specially adapted for low ceilings. It is a 16-in. cast metal-metal ceiling fitting, the lower band being in the form of a shade carrier, which is suspended from the ceiling plate by three rings and hooks, as shown in the illustration. This fitting is designed to take one 100-c.p. metallic-filament lamp, and one 8-c.p. ruby lamp, operated by two switches.

Fig. 4 is an Ormolu two-light flambeau bracket, which is very popular in some of the better-class picture houses and theatres; it is made in various finishes, the most liked being rich gilt or oxidised silver.



Fig. 3.—Low Ceiling Fitting.



Fig. 4.—Two-Light Flambeau.



Fig. 5.—Hall Lantern.

Fig. 5 is a Louis XV hall lantern; it is solid cast, beautifully chased, and a rich gold colour. It is one of a range of fittings of similar designs installed by Messrs. Shanks in various picture theatres throughout the country.

Fig. 6 is a good specimen of the latest semi-inverted fittings. It has a cast ceiling-plate with three hooks, and the metal rim is large, half ball pattern, with fancy cast lugs, and carries a real green alabaster bowl 12 in. in diameter. The veining of this alabaster is exceedingly pretty, and when the lamp is switched on is very effective. This pattern is one of a large range of designs of alabaster bowl fittings which Messrs. Shanks manufacture from 8 in. up to 24 in. in diameter, and different coloured alabasters can can be supplied, including green, white, red, clear, &c.

Messrs. Shanks claim to be among the pioneers of the scientific lighting of picture houses, and their fittings have been adopted very widely for this class of work. They are amongst the largest

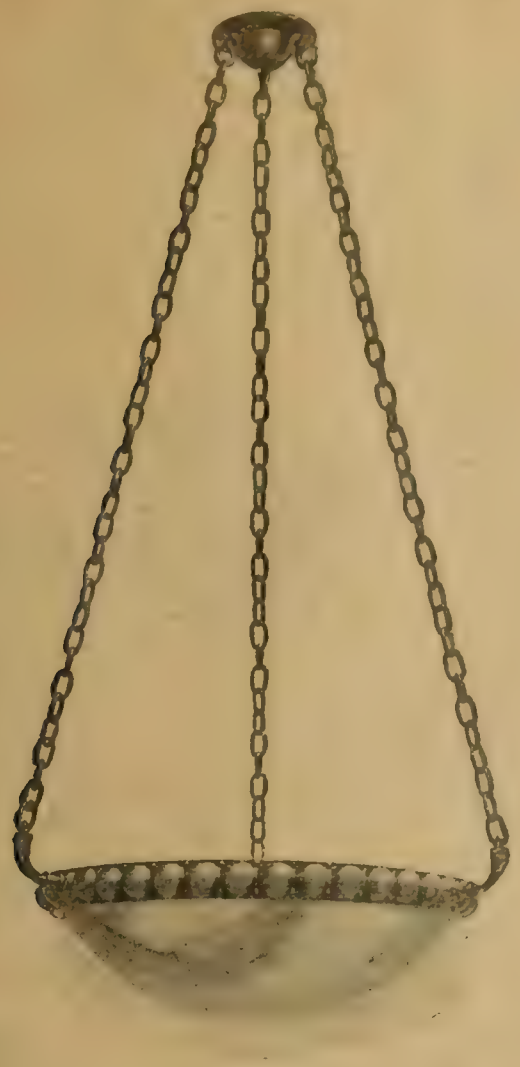


Fig. 6.—Semi-Inverted Ceiling Fitting.

manufacturers of fittings for Holophane glass, and are generally prepared to execute almost anything in the way of decorative fittings.

"Calor" Heating and Cooking Appliances.

From the very comprehensive selection of cooking and heating apparatus made by Messrs. Townshend's Art Metal Co., Ltd., of Ernest Street, Birmingham, we illustrate some examples which are likely to be of interest to our readers at the present time.

Fig. 7 is representative of a number of similar designs of electric fire constructed on the Townshend patented system.

It contains an 880-watt "Calor" heating element carried in a 14-in. aluminium or copper reflector with a polished brass stand. The heating element, which can be replaced in one piece, consists of a special alloy resistance wound in the open slots of a circular



Fig. 7.—Glowing Electric Fire with Circular Reflector.

base composed of highly-refractory clay, which quickly becomes red hot, presenting a cheerful appearance and throwing off great heat. Similar designs, but with rectangular reflectors, are also made, as well as upright "fires" in patterns which range from the very simple to the elaborate, one of which, illustrated in fig. 8 is 23 in. high by 16 in. wide, in antique finish brass.

Fig. 9 illustrates a "Tamco" oven in sheet steel with double walls, the internal dimensions being 16 in. × 16 in × 14 in. It is fitted with a 1,200-watt heating plate, removable at will, and which when removed can be used as an ordinary boiling plate. A circular plate is provided in the top of the oven, which, when removed, allows of the hot plate being inserted top downwards, thus providing an efficient top heat for browning purposes and for preliminary oven heating.

An 8-in. boiling plate for 1,200 watts is also provided; both plates are complete with switch for three heat regulations and a hot chamber can also be supplied to fit on the oven top for plate warming, &c.

Fig. 10 shows the "Heetorboil" patent extending food warmer, constructed in aluminium, copper or brass, which, from 15 in.



Fig. 8.—Antique Finish Electric Fire.



Fig. 9.—"Tamco" Oven and Boiling Plate.



Fig. 10.—"Heetorboil" Extending Food Warmer.

long × 8 in. wide, can be extended to 21½ in. long. It provides a top heat with 600 watts, and there are three heat regulations.

Boiling and heating can be done at the same time by sliding the top open to uncover the boiling place and at the same time increasing the length of the heating surface.

Non-conducting feet and handles are provided and a rack underneath for plate warming. The heating element is replacable in a

few minutes at trifling cost, and the heater can be used wherever electric light is installed; all "Calor" appliances are guaranteed for 12 months.

We also illustrate in fig. 11 a milk boiler, in polished aluminium, brass or copper, to hold 1½ pints. The top heat is obtained with



Fig. 11.—Electric Milk Boiler.

440 watts and three heat regulations are provided, the lower ones for warming. The utensils which are not attached to the stands, have either wickered or ebonised handles, and, when necessary, plated interiors. Messrs. Townshend's make a variety of cooking and warming utensils of a similar type.

B.T.H. Rotary Snap Switches.

An interesting line of rotary snap switches has recently been placed on the market by the British Thomson-Houston Co., Ltd., of 77, Upper Thames Street, E.C. In their design the weight of the moving parts has been reduced to the minimum consistent with durability and proper current-carrying capacity. This feature greatly increases the wearing qualities of the switch, by diminishing the force of the hammer blow in the "on" and "off" movements. Bases of the best quality porcelain and ebonised handles



Fig. 12.—Series-Parallel Three-Heat Switch for Radiator Circuits.

with self-contained springs are used in these switches. The employment of flat binding posts gives easy access to the binding screws in however confined a position the switch may be fixed, as the screw-driver works from the front of the switch, at right angles to the wall. The danger of cutting the wires at the screw contacts is also removed.

B.T.H. rotary snap switches are supplied with nickel (fibre insulated) and porcelain covers. Single and double-pole switches, fig. 13, are made for 100-250 volts and 250-600 volts, with current-carrying capacity ranging from 3 to 20 amperes, and with or without indicating dials in the cover.

There is a three-way switch in three sizes; 3, 5 and 10 amps., 100-130 volts, or 1, 3 and 5 amps., 200-250 volts. There is also a

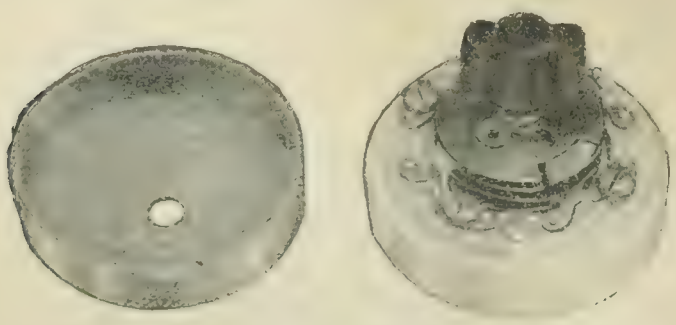


Fig. 13.—B.T.H. Rotary Double-Pole Snap Switch.

three-circuit rotary switch for automobile lighting, suitable for use on voltages up to 250, and supplied with or without an indicating dial. It is arranged with three circuits so that the head-lights, tail-light and interior lights of a motor-car can be switched on or off separately or together.

Another type—the series-parallel three-heat switch, fig. 12, provides a simple and reliable means of regulating the heat of radiators or cooking devices. It is supplied in two sizes, for 10 and 20 amperes, and can be used on voltages up to 250.

The Vancouver Telephone Cable.

We referred on page 298 in our last issue to the continuously loaded submarine telephone cable which has been laid by Messrs.

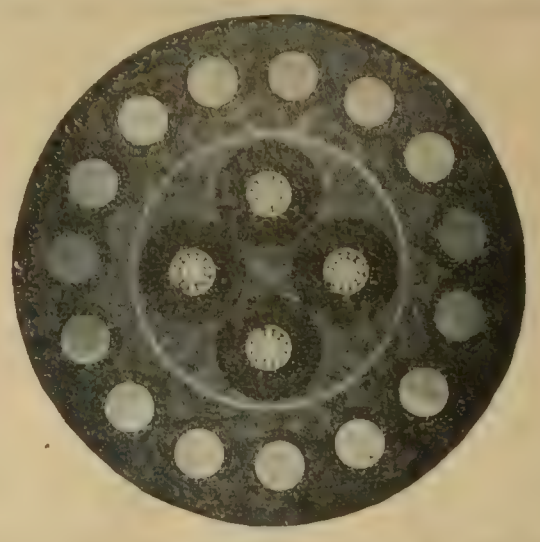


Fig. 14.—The Vancouver Continuously Loaded Telephone Cable in Section.

Henley's Telegraph Works Co., Ltd., between Vancouver B.C., and the island of the same name. The cable is the longest of the kind so far laid, and the above view, fig. 14, is a full-sized section of it.

Ferranti Transformers.

Messrs. Ferranti, Ltd, of Hollinwood, Lancs., have built transformers for over 15 years, and have continuously improved their designs and methods of manufacture at all points, so that the apparatus they now offer is the best of its kind, as may be judged from the following details.

Series of tests have been conducted to discover a suitable alloy for the core, with the result that, by careful selection, it is ensured that the iron used is of the best quality obtainable. The iron losses have been reduced by skilful proportioning of the core, and the efficiency has been greatly increased, while decrease of efficiency due to ageing is practically eliminated.

The high conductivity copper coils are wound on circular formers with wire of rectangular section and rounded corners, which has been dried before winding. The coils are sub-divided, so that the potential difference across the ends of each coil is very low. The increased amount of copper necessitated by the circular shape of coil is more than compensated by the absence of more or



Fig. 15.—Ferranti Transformer.

less sharp bends in the wire, and the result is immunity from breakdown. Each coil is lightly taped, thoroughly dried and impregnated with a special varnish by a vacuum and pressure process, which forces the varnish into every interstice of the coils. Thick insulation of the coils has been discarded, partly because it prevented the penetration of the varnish, and partly because it has been possible to effect a very great improvement by the use of specially-moulded insulating tubes between the primary and secondary windings. The tubes safely withstand the maximum test pressures. The older and more usual method of applying insulation to the coils is defective, because bending the insulating material round the coils does not improve its insulating properties, and breakdown is very likely to occur. The varnish has been subjected to prolonged test in contact with oil at the highest temperature obtained in transformer work, and it has been proved that there is no reaction between the oil and the varnish. The end turns of the high-tension coils are heavily insulated to withstand the high voltage differences which occur during surges when switching on and during periods of atmospheric disturbance.

All but the cheaper and smaller transformers are fitted with heavy terminals mounted on long porcelain insulators mechanically clamped in a substantial iron frame and so arranged that a damaged insulator may be readily replaced. The incoming and outgoing cables pass through heavy insulators in the sides of the tank.

An oil has been found which complies satisfactorily with all the essential requirements of transformer work, and is now used

exclusively in this apparatus. A very liberal quantity of oil is used, and there is an ample head of oil over the transformer.

The construction of the tanks has undergone many developments in the effort to obtain a strong light oil-tight enclosure with ample radiating surface. The construction now adopted as standard consists of a steel tank with deep corrugations, fitted with a steel bottom plate welded to the sides, rendering oil leakage impossible. The tank is supported in a cast-iron cradle; a grooved top casting is placed over the tank and the corrugations enter the groove. The two castings are tied together with tie bolts. The apertures in the top casting giving access to the terminals are closed by substantial boiler-plate lids. The tank is dust-tight, but may be hermetically closed by running white metal into the groove in the top casting. The transformer stands on heavy channel irons and bearers which distribute the weight over the cast-iron cradle.

ELECTRICITY SUPPLY IN DOVER.

The importance of the historic town of Dover—probably the most popular of our gateways to the Continent—has been enormously increased during the past few years by the completion of the vast harbour works, enclosing an area of about 1 sq. mile, and forming a most valuable and commanding naval base. The population of Dover is small (47,000), and though there is a considerable "floating" population of travellers and (during the summer) visitors, it is to the tramways and the Admiralty works in the neighbourhood that the central station must look for its greatest increase in output.

There is every prospect of high-pressure overhead supply being afforded to St. Margaret's Bay* (4·5 miles from Dover) in the near future, and it is quite reasonable to anticipate a considerable colliery load and, later, other important power demands growing up with the development of the Kentish coal fields.

The station is fortunate in being situated at practically the centre of the present supply area—a T-shaped district of about 3 sq. miles extent, stretching along the shore and inland along a valley.

The works, which are finished internally very handsomely, even extravagantly according to modern standards, are built on natural flint foundations, and are flanked by a creeper-clad brick smoke stack 120 ft. in height.

Supply was commenced in April, 1895, by the Dover Electric Supply Co., Ltd., the station being one of the famous early Brush installations, and in 1904 the undertaking was purchased by the Corporation. The original equipment of four Brush-Mordey generators (two of 100 kw., one of 75 kw. and one of 50 kw., later removed) was extended by two 100-kw. McIntosh-Seymour sets in 1897, a 225-kw. Ball & Wood set in 1901, a 400-kw. Ferranti set in 1903, a 400-kw. Parsons turbo-set in 1905, and a 350-kw. Allen set in 1906. The American horizontal low-speed sets were installed at a time when this type was thought to be the best available for traction supply, and when English manufacturers were so filled with orders that numbers of purchasers had perforce to buy from American firms.

In 1908, a 25-kw. Entz reversible booster was installed, and has since brought about important reductions in the generating costs.

Further extension of the building is impracticable on the present site, but the generator capacity will be increased when necessary by the substitution of turbo-machinery for some of the older units.

Boilers of a total evaporative capacity of 42,000 lb. per hour are at present installed; of these, two are rarely used and a third is generally laid-by for cleaning. Water supply is drawn from the River Dour for both circulating and feed purposes (20 per cent. make-up). Of the 21° total hardness, about 15° is temporary and no softening treatment is adopted, it being found that the use of turbine tube cleaners once in 2,000 working hours occupies little more time than the removal of such mud as would collect from a treated feed. The condenser discharge is passed through a wood-wool oil eliminator before returning to the hot well, and an economiser heats the feed water from 90° F. to 310° F. A Krel CO_2 recorder is installed, but it has been found that the normal working results obtained here permit of little improvement by its use.

In the early days of working, large Welsh coal was employed. Crossthwaite grates were installed in 1905 to allow of the use of small Welsh coal, which then cost 6s. per ton less than the larger grade. The costs of the two qualities gradually became more nearly equal, and chain grates were fitted to two boilers in 1908, and to two others in December, 1910, and February, 1911, since when Featherstone slack has been burnt smokelessly under the ½-in. natural draught provided by the stack. It is worth noting that to the contract price of sea or rail-borne coal must be added (per ton) 1s. 7d. town dues and 1s. for carting and trimming; sea-borne coal is also subject to 2½d. per ton harbour dues and 2d. per ton extra for carting. Owing to the high railway freights, sea-borne coal is the cheaper. A good but friable coal from the neighbouring Shakespeare pit of the Kent colliery costs about 22s. per ton at the pit mouth. Accommodation is provided in a covered yard for 550 to 600 tons of fuel (roughly seven weeks' supply).

Some years ago it was possible to obtain 9d. or 10d. per load for ashes, but these have now to be given free, and even a small payment has had to be made for their removal, owing to the recent slack state of the building trade.

The boilers deliver into the upper length of a narrow rectangular ring main erected in a vertical plane entirely within the boiler house and extending 90 ft. along the latter. From the bottom of the ring are taken the engine steam pipes. This arrangement favours heavy condensation losses, and at one time only 35° out of 100° F. superheat at the

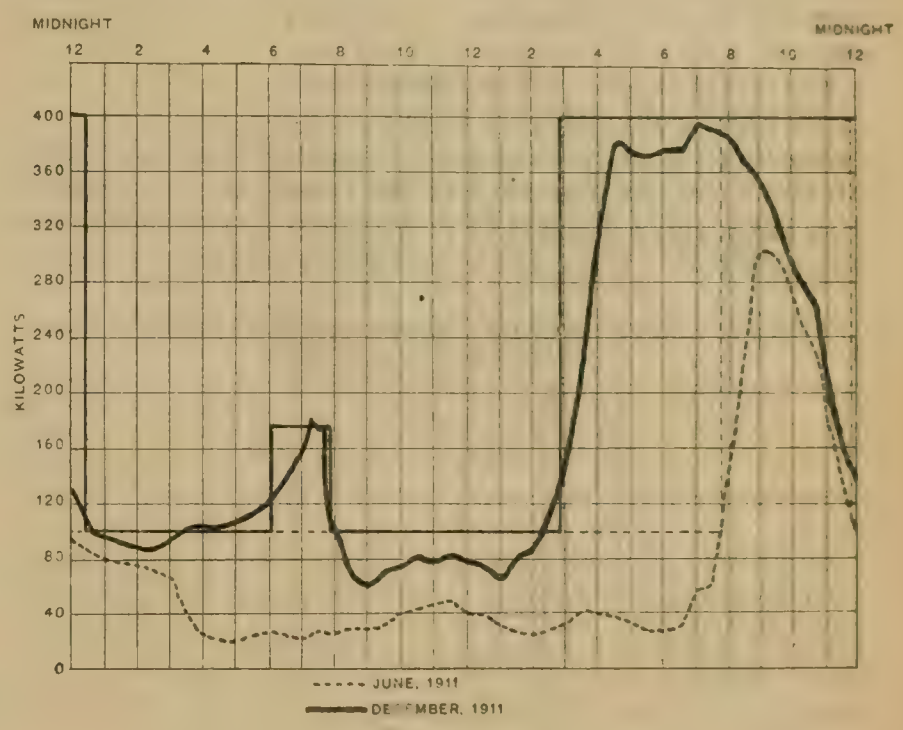


Fig. 1.

boilers could be realised at the turbine stop valve, and an even less amount at some of the engines connected near the centre of the lower half of the ring. Owing to a careful overhaul of the pipe lagging (which now consists of 2¼ in. magnesia composition), at least 55° superheat can now be obtained at the turbine.

As a combined result of the use of chain grates and improved pipe lagging, and thanks to the economy effected by the Entz reversible booster, the fuel costs per unit sold have been greatly reduced during recent years (see Table I), and despite the increase in the repairs and maintenance charges, the total works costs have decreased to the present reasonable figure of 1·62d. per unit. The coal consumption during the days in which the load curves of fig. 1 were obtained averaged 6·04 lb. per unit generated on June 17th, 1911 (3,152 units generated), and 4·60 lb. per unit generated on December 22nd, 1911 (6,269 units generated).

Owing to the very heterogeneous nature of the generating units, it is interesting to examine in some detail the manner in which they are used and the results which are obtained. The oldest units are the Mordey alternators, which have been in regular service since 1895, and which still give good results. Occasionally a new alternator coil is required, but beyond this, their repair bill is extremely low (Table I).

*The load at present available is about 20 kw. lighting, together with a considerable heating and cooking load, there being no gas upply, and the resort being frequented by a good class of visitor.

One of the 200-KW. lighting sets runs on a central condenser and is used whenever possible in preference to the other small sets, which have self-contained condensers and auxiliaries. On account of its higher efficiency (see Table II), the turbine unit is used on the evening A.C. demand five nights in each week, the Ferranti set being kept in order by running on the remaining two evenings. The whole of the steam-driven plant runs condensing (even down to the 12½-KW. exciters, the two sets of which are used in alternate weeks).

TABLE I—Costs per Unit Sold.

Year ending March 31st.	Fuel. d.	Repairs.* d.	Total works costs. d.
1913	·69	·41	1·76
1912	·55	·41	1·62
1911	·61	·44	1·79
1909	·73	·40	1·89
1907	·72	·28	1·64
1905 (15 months) ...	·89	·30	1·89

* Recent increase in repairs costs is due to the L.G.B. requirement that the wages of all permanent employés be paid from revenue.

The D.C. traction load is supplied by one of the 100-KW. McIntosh-Seymour sets during the early morning and evening, and the 225-KW. Ball & Wood, or 350-KW. Allen set is used during the afternoon. A 268-cell Tudor battery floats on the D.C. mains and supplies the whole direct-current demand from 12 mid. to 5 a.m. (fig. 2). The battery discharge capacity is 400 amperes momentarily, and the maximum charging current is 200 amperes. The cells were installed in December, 1898, with a guaranteed capacity of 560 ampere-hours at 10 hours; after they had been maintained for 10 years by the makers (on a contract basis), a further 10 years' maintenance contract was entered upon in December, 1908, and a capacity of 360 ampere-hours at 3 hours is still obtained. When flue cleaning is in progress on Sunday morning or during other light-load periods the battery supplies the power demand, and, through a 30-KW. motor-generator, such A.C. demand as may exist.

TABLE II.—Test Data on Generating Units (Dry Steam at 150 lb. per sq. in.).

Set.	Lighting or traction.	Lb. steam per KW.-hour at ½ load. Actl.	½ load. Guar.	1/1 load. Actl.	1/1 load. Guar.	6/5 load. Actl.	6/5 load. Guar.	Year of instln.
75-KW. Brush ...	L	—	—	34·6	32·5	33·4	—	1895
100-KW. Brush ...	L	—	—	31·2	30·8	32·0	—	1895
400-KW. Ferranti ...	L	—	29·5	25·0	25·0	—	—	1903
400-KW. Parsons Turbo*	L	26·47	25·25	23·79	22·25	—	—	1905
100-KW. McIntosh-Seymour	T	—	—	30·0	—	—	—	1897
225-KW. Ball & Wood	T	—	—	27·0	—	—	—	1901
350-KW. Allen ...	T	28·75	29·5	26·0	25·3	—	—	1907

*This set occupies 118 sq. ft. and 650 cb. ft., as compared with 255 sq. ft. and 3,750 cb. ft. occupied by the Ferranti set of equal capacity.

The battery floats on the D.C. mains and supplies the whole direct-current demand from 12 mid. to 5 a.m. (fig. 2). The battery discharge capacity is 400 amperes momentarily, and the maximum charging current is 200 amperes. The cells were installed in December, 1898, with a guaranteed capacity of 560 ampere-hours at 10 hours; after they had been maintained for 10 years by the makers (on a contract basis), a further 10 years' maintenance contract was entered upon in December, 1908, and a capacity of 360 ampere-hours at 3 hours is still obtained. When flue cleaning is in progress on Sunday morning or during other light-load periods the battery supplies the power demand, and, through a 30-KW. motor-generator, such A.C. demand as may exist.

Owing to the arrangement of the steam piping, and the early design of the greater part of the equipment, high steam efficiency cannot be expected, and the actual performance of the various sets, as summarised in Table II, is by no means unsatisfactory.

(*To be concluded.*)

A Jubilee Outing.—To celebrate the jubilee of the firm, Messrs. Baxendale & Co., Ltd., of Miller Street, Manchester, entertained their employés to an outing to Chester last Saturday. Five special trains were needed to convey the 1,600 employés and their wives and friends. At Chester a number of steamers were waiting, and the river journey to Eccleston Ferry was enjoyed. By permission of the Duke of Westminster, the party were able to go through the grounds and gardens at Eaton Hall. The return to Chester was by char-a-banc. Luncheon was served at the Roodee. During the afternoon there were sports, a football match, and an *al fresco* concert, and the band of the Old Cheshire Military played selections throughout the day. Mr. Charles Darrah, senior partner, presented a gold watch to each of five employés who had completed over 40 years' service with the firm.

THE FIVE-DAY WEEK.

[COMMUNICATED.]

A few years ago the industrial world was startled by the cry for an eight-hour day. It was fondly imagined that the claim to work for only eight hours in the 24 was voiced only by the agitator, and that to grant it was wholly without the domain of practical politics. *Sed tempora mutantur!* The dream of a few years ago has become a reality! In one great industry at least the eight-hour day is hallowed and sanctioned by Act of Parliament. The same division of time in every department of industrial activity is still insistent, while the colliers who claimed, and won, their eight-hour day, are now putting forward a demand for a five-day week.

It is only a few weeks ago that the leaders of the Miners' Federation set about balloting the members of that body on the question of enforcing a five-day week. A simple sum in arithmetic shows that this proposal would result in the miners working for a period considerably less than two *whole* days and nights in seven. The agitators urged their followers to support this extraordinary claim. As luck would have it, many of the men did not see eye to eye with those who pull the strings of the Federation. The proposal was carried by a small majority; but it was fortunately so small that it was decided not to take any immediate action. Bitter experience, however, has taught us that what is looked upon as a mere topic for agitation in one year is likely to take practical shape in the next.

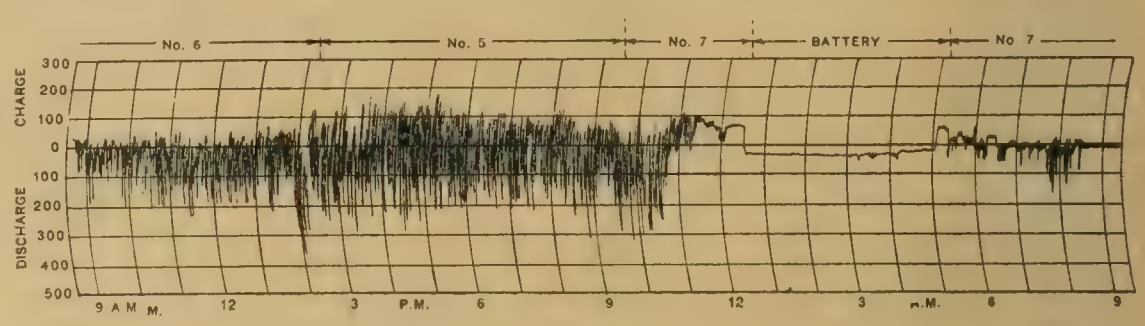


Fig. 2.

What is the cause of the slackening of the national fibre which is manifested by this claim for more leisure and less work? One knows that the miner's life is a life of arduous toil, and that in some districts, at any rate, he runs grave risks. But, on the other hand, one knows that he is well paid; and that he is generally a man of great physical strength who can earn in four days (or even three) enough to support himself and his family during an entire week. Why, then, need he concern himself with any demand for a five-day week?

A glance at the hard facts of the case shows that the miner is well paid for the labour he expends. If the average pithead value of coal is 8s. 4d., that sum is made up as follows: Labour, 6s.; expenses and maintenance, machinery, &c., 2s.; capital, 6d. Yet there are those who believe in an agitation which has for its object the nationalisation of mines on the ground that the miner is the victim of the bloated capitalist. If all the working classes in the country were in as flourishing a condition as the miners there would be little true ground for complaint.

Is there a real genuine desire in the mind of any pitman that he shall only be entitled to work on five days in the week? If there is, we can only explain his state of mind by assuming that he is in ignorance of the true facts. So long as the demand for coal is large, the miner can earn enough for his requirements in a short time. The state of affairs when the demand for coal is small and the prices go down is not revealed to him by those who urge him to political action from the tub at the street corner. He will then have to work much more than 40 hours a week in order to produce enough coal to keep body and soul together.

The brains of those who direct the policy of the proletariat are perpetually devising new campaigns in the prolonged war against Capital. They are not content with one victory, they must seek fresh conquests. In truth and in fact they live and maintain their popularity and reputation by conquest.

Your labour leader is always seeking some fresh battlefield

in his war against Capital, but he is doing nothing to consolidate and render perpetual the victories he has already secured. He relies upon the ignorance of his followers. So long as the proletariat can live upon the spoils of war—the increased wages wrested from Capital—so long, we doubt not, will they give support to their misguided leaders. But they will learn in time, and by bitter experience, that the country, as a whole, is not made richer if Capital is impoverished and destroyed at the expense of labour.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Conservation and Waste.

Mr. D. S. Martin would be more convincing if less intolerant. He is so thoroughly imbued with the superiority of the central station idea that he justifies the setting of rates to kill the isolated plant—the words are his own. Surely if the central station were so superior as he endeavours to make out the "setting of rates to kill" would be a superfluity. The mere fact that it is necessary to *set* a rate is evidence that the ordinary rate is one on which the isolated plant can live. And I learn from New York that the central station men are all of his type and are out to kill. But I do not learn that, having succeeded in their attempts, they retain the killing price when the isolated plant has been broken up. Mr. Martin has but one idea of motive power. With him there is only steam to be considered—an attitude of mind with which one can be extremely sympathetic, for steam plant is far nicer than gas plant. But its niceness is not a quality that will stop the spread of gas plant; and modern engineers must inevitably face the future of power manufacture free from shackles which will hold them to any pet motive power. If gas were as general a fuel as steam now is, there would be a tendency to the spread of smaller power stations. The existence of a gas power station to every group of even 1,000 people can be shown to be capable of co-operative production of heat, light and power, far beyond anything that it is in Mr. Martin's power to derive from the big station scheme. The true economy to be derived from co-operation is in the generation of all the requisites of the people's life within a heat transporting possibility of distance from the homes served. Gas is the thing to be sent round from a central generating station, where also it would be used to generate power for large factories and for such public utilities as tramways.

The finish of Mr. Martin's article deals with the hydro-electric industry, which cannot properly be used by him as an argument for great central fuel-driven stations. Water turbines have an efficiency of 80 per cent. of the water used, and 75 per cent. of its energy of fall may be converted into electrical energy. Some would state even a higher figure. This may be compared with the miserable fraction of the calorific power of coal which appears as electrical energy in the very biggest of coal-driven stations.

From hydro-electric energy, heat may be derived with advantage for heating purposes and for metallurgy, but to use electrical energy, which has been steam generated, as a heating agent is outside the range of economical practice where the heat is allowed and required to flow freely. Cooking—so dear to the power-station man—is an illustration of the possibility of using such heat with economy. But regular house warming is out of the practicable range.

Much of Mr. Martin's article—notably, the third paragraph—is, by way of argument, against himself. With him it is not a case of "live and let live," but of "you promptly die that I may gnaw your bones."

As conditions now are, especially in America, there is a very strong case for the independent station. In the first place, its suitability to live is to be measured by a set of rules quite different from what properly hold good at the big power stations. In the big power station, the labour cost may be small per unit, but every hour of paid labour must count. In the private station no labour can be counted against the cost of energy if that labour would be employed, whether the private plant worked or stopped. The private owner of a plant must count the cost of heat, light and power. If he must have heat, it may cost him very little to take power energy out of the steam *en route*. He cannot buy his heat from the big power station miles distant. In America, as here, central station men are working upon very narrow lines; they take no broad views of facts, and can see costs only from the ledger. Central station men, we are told, are acting from their convictions. But plenty of people do this—burglars not excepted—but conviction is not of necessity a proof of right. It may be a case of bad judgment, after the manner of the bull which charged the locomotive, arousing admiration for his pluck, though his judgment was to be despised.

Absolute ignorance of everything appears to be the characteristic of Mr. Martin's slaughtered friend, who has ventured to criticise the central station craze—if it may be permitted to call the idea by that name. But let Mr. Martin be assured that all America is by no means enamoured of the central station.

Especially in the big cities, the isolated plant is not small, and is capable of being managed on a good principle. Our nearest comparison here is probably the cotton factory, and it has yet to be shown that an electrically-driven cotton mill cannot better produce its power and heat and light by means of its own power plant than such can be produced by the supply station. Advocates of the power station ignore that such things as heat are needed, or they attempt to include heating a factory in the same category as the cooking of a chop or the toasting of a bit of bread. Surely it ought to be too late at this hour to claim quantitative electric heating as a suitable field for expending energy.

B.

A Question of Etiquette.

It afforded me great pleasure to peruse Mr. A. W. Kimber's interesting letter in this week's REVIEW; it is a subject in which I am keenly interested, and nothing would be better for the trade generally than some sterner supervision, such as is advocated by Mr. Kimber. I, of course, cordially agree with his statement that all supply authorities are not tarred with the same brush; in fact, the most successful station I know is Sheffield, where they had, until recently, a wiring department which did first-class work at a reasonable price, and I do not doubt that the said wiring and sales departments have been mainly responsible for the successful development of the electrical industry in Sheffield.

On the other hand, I know another supply station that does all the installation work in a certain borough and most of the country house work in the surrounding districts; just under £800 net profit was made from installation work during the year prior to my going there.

The extremely energetic chief told me that he had never had any opposition, and did not intend to have any, and I must say he did his very best to prevent anyone else even trying to get any work.

When I asked the above-mentioned chief why he did not earth the motors he supplied and fixed, and protect wires and cables which he installed in hollow partitions, he replied that anyone cleaning the commutator of an earthed machine was very liable to get a shock across the wrist to frame, whilst if the frame was only partly earthed the shock would not be severe; he also said that there could not possibly be any hurt done to any wires or cables installed in such a small space as there is in a lath and plaster partition—it made me stare pretty much. I have come across several firms and companies that do bad work, and I often wonder who is supposed to see that the B. of T. regulations are adhered to, and whether any insurance companies employ an electrical inspector of any kind. I can't think that the work in that particular place

E

has been inspected by anyone, unless it is the engineer himself.

I am taking Mr. Kimber's advice of this week, writing the Board of Trade and about a dozen insurance companies, and trust something will soon be done to put a stop to some of the awful work that I know is being done.

J. Riley.

Inverness, *August 24th*, 1913.

Mr. Kimber is, I expect, only one amongst many who were astonished to read the results of the recent arbitration case. The case is particularly piquant, bearing in mind the undertaking concerned.

There is no doubt that when a supply authority itself carries out wiring work it should resolutely set its face against doing any but first-class work, otherwise its position in dealing with contractors must be most invidious.

The company with which I am connected has for many years conducted a very considerable wiring business, but we have always made it our first principle that on no account will we carry out any but first-class work. This, of course, means that we lose a considerable amount of business which would otherwise pass through our hands, as we are constantly being undercut by contractors, who use non-association wiring and cheap accessories. We prefer, however, to lose the work rather than lower the standard we have set up.

If a consumer comes to us and wants us to carry out work at a price which will not allow of the use of first-class material, we tell him openly that while we will not carry out the work ourselves, he will find plenty of contractors who will be pleased to do it. Of course a supply authority has no power to refuse to connect up work simply because it does not comply with its rules or those of the I.E.E. The position we take up is simply this : We have a standard of work to which we adhere ourselves, and which we recommend consumers to insist on for their own sakes. If they choose to have inferior work installed, it is entirely a matter for themselves, and they must take the risk of it. They will be doing it at any rate with their eyes open.

Personally, I think it is a mistake for a supply authority to set up the I.E.E. or other rules as hard and fast conditions which must be adhered to. There is any amount of quite good wiring done which does not comply with the I.E.E. Rules, and I would be the last to refuse to connect it. The I.E.E. Rules should be considered as a model specification which all contractors should aim at and comply with as far as circumstances and the customer's pocket permit.

In expressing these views, however, I am afraid I shall be considered most heretical.

M. Farrer.

Twickenham, *August 22nd*, 1913.

Lightning.

Mr. Austin's contribution on the "Vagaries of Lightning," though of interest, unfortunately fails to give some rather important details which are necessary to explain the observed effects during that lightning storm. It is essential to know on what voltage the two lines were operated, and what was the voltage for which the horn arresters were set. It frequently happens that arcing over is not so much due to elevated potential as to an unfavourable distribution of the potential, and this particularly happens when such arcing over is observed whilst lightning takes place between clouds and earth (as in the present case), and not between cloud and line, or the system itself. In such cases the effects are due to induction, and everything can be explained without having recourse to assuming "terrestrial disturbances." I presume that the lightning arresters which showed no sign of operation were set at considerably above the line voltage, and in this case it is quite feasible that a disturbance on the line caused by the inductive effect of a distant lightning discharge might have had a potential considerably below that for which the horn arresters were set, and therefore they could not operate.

As Mr. Austin himself remarks, the use of a condenser would, in all probability, have been sufficient to level out the abnormal potential distribution which I mentioned above, and thus would have prevented the damage. The idea that atmospheric disturbances must of necessity be of an extremely high potential is too commonly assumed : in practice it is far more frequently the abnormalities produced by such inductive discharges in the potential distribution which break down the insulation and this in turn introduces surges which may be of very high potential.

A. W. Isenthal.

Neasden, *August 22nd*, 1913.

Shift Engineers : A Proposal.

I do not see why women should not study engineering as they study medicine or the law. M.I.E.E. is no harder to get than M.D. or LL.B. The suggestion that women are irrational or hysterical does not seem to carry much weight. Mr. Brown's suggestion, that baboons would do as well as women, seems to indicate a mind so warped by prejudice as to be incapable of rational thinking. His judgment on any subject on which he had any prejudices or feelings would be liable to be biased, and so worthless. Science has no feelings and emotions. "Shift Engineer" seems to think that typewriting, clerical work and window smashing are all that women are suitable for—prejudice again—at least, I hope it is prejudice ; one hesitates to accuse one's kind of invincible ignorance. In fact, all the letters in this week's Electrical Review show prejudice, emotion, and even hysteria (the baboon suggestion is obviously hysterical), and suggest that these are a poor mental equipment to bring to the solution of any problem. Whether women could study and make themselves efficient engineers is arguable, but not in the nursery.

Engineer.

Judging by the views expressed by the correspondents on this subject, it would appear that either they have been rather unfortunate in their acquaintance with women—not only as workers, but in general—or else they are selecting specific types of women, and amusing themselves by supposing what would happen if they were employed in central stations. This method of argument is neither logical nor just ; undoubtedly there are many women quite unfitted for central-station work or anything like it, but are there not many men of whom the same might be said ?

That central station work is at the present time unsuitable for women, most people will agree, but capability is another question altogether ; women are more adaptable than men as a whole, and given equal opportunities—well, time will prove. Already witness what has been done, and is being done, in various parts of the world by women ; one example : Madame Curie, apropos electrical science.

J. Halliday Borland.

High Wycombe.

"A Mere Woman" promises in to-day's issue what she cannot guarantee. The well-educated women who are positively afraid of an electric radiator generally have the good sense to stay away from it. I could introduce you to a gentleman who holds a position of responsibility in a city bank, who left his own house while I was visiting it because I, at his wife's request, ventured to replace a melted fuse to supply current to the drawing room. After the fuse had served its purpose for 15 minutes, he was induced again to occupy his armchair in the drawing room.

Similarly, a shift engineer in charge under me visibly shivered in his trousers when a fuse became white hot, and "wished he had" my nerve when I maintained the supply by wrapping some wire around the terminals. He went to a more suitable appointment in the fish market, and is there a success.

Women are handling switching operations in telephone work, and there is no reason why properly-trained women

should not do central station switching work, and I give them credit for knowing how to keep men in their places, if they neglect their work, as suggested by "A Mere Woman."

The only reason why women in the past have let men keep them out of the many occupations is that men had the control of the education of the daughters, and the daughters were trained for home work only. So long as there are unmarried women who need to earn their living and who have the energy and courage to train themselves, there is no reason why they should not compete with men in every occupation. Capacity and training are the limits.

I think, for instance, that the average woman, trained to electric work, would do better than the men who wired the house of the City banker, mentioned above, using no tube, no casing, but simply dropping wires between rafters in a most irregular way. Several years of use has done no damage, and the banker keeps cats to keep away rats. Who is responsible for calling the Insurance Co.'s attention to the way men did that work?

A Man who Believes Woman his Equal.

London, *August 22nd*, 1913.

[We have received from Mr. Cooper, on his return from holidays, a further letter on the prevention of accidents in electric lifts, in reply to Messrs. Smith, Major & Stevens; but as no new points are raised, we do not think it necessary to reopen this correspondence.—Eds. Elec. Rev.]

BUSINESS NOTES.

Consular Notes.—Palestine.—The German Consul at Beirut reports that with the extension of the use of electricity for lighting purposes and the growth of industrial activity in the towns of Beirut and Damascus, a growing demand for electrical materials has sprung up. Transmission wire, which is imported in diameters of from ¼ to 4 mm., comes from Germany and France. Incandescent lamps, of from 16 to 200 c.p., for 105 or 110 volts, are imported from Germany, Great Britain and France. Electric fans, which find an increasing demand owing to the heat of the summer, come chiefly from Italy, which supplies a cheap article. In Beirut, ventilators for 110 volts, with a wing diameter of from 25 to 40 cm., are used. Table ventilators cost from 25 to 70 marks at the works, and ceiling ventilators from 100 to 150 marks.

Philippine Islands.—The British Consul at Manila reports that a system of wireless telegraphy composed of stations at various points connecting all the more important places in the Archipelago, is now working under the direction of the Bureau of Posts. The stations already in operation are at Jolo, Zamboanga, Davao, Malabang, Cuyo and Puerto Princesa. The Bureau is also installing one at Mangarin, Mindoro. The army wireless stations are at Fort Wint on Grande Island, at Fort Mills, at Corregidor, and at the Government ice plant at Manila. The two inter-island transports are also fitted with the apparatus, and keep in touch with one land station or another during the whole of their voyages round the islands. The most powerful station is that at Corregidor, which has a range of 1,000 to 1,500 miles, according to weather conditions. Those of least range are on the inter-island transports *Warren* and *Merritt*, which do not require a message radius of over 400 or 500 miles.

Brazil.—The American Consul at Bahia, in a recent report, states that a telephone system, American throughout in equipment, and providing a service equal to that of any city in the United States, has recently been installed in Bahia, and is giving complete satisfaction to subscribers. The new service was inaugurated in 1912, under a concession held by Guinle & Co., one of the largest public utility and holding companies in Brazil, who administer the local telephones under the name Companhia Brasileira de Energia Electrica. The telephone concession for the city of Bahia was orginally granted to the Empresa Telephonica in 1884 for a period of 50 years. Six years ago Guinle & Co. bought out the Empresa Telephonica, paying about £27,000, and for a time operated the service along the old lines and with the inadequate equipment then on hand. The instruments at that time were of American make, and of the kind in use in the United States about 25 years ago. The system, aside from the American instruments, was German throughout. Under the terms of the Guinle concession, it was provided that a thoroughly modern service, representative of the latest improvements in telephone devices, should be installed and in actual operation by July, 1912. American experts in telephone construction were secured, and a complete outfit of modern devices for central-exchange use and materials for outside construction work was purchased from the United States. The result is that to-day Bahia possesses a telephone system comprising the latest accepted type of instruments and other apparatus such as are now in use in the larger American cities. The instruments in use and most of the other equipment are of the type manufactured by the Western Electric Co. The switchboard in the local exchange is made by the Kellogg Co. There is only one exchange at present, but two others are to be opened within the year to care for outlying sections of the city. The old company operated about 500 telephones; the new service already has 860 subscribers, and it is planned to extend and improve the service until 2,000 telephones are installed in the city and immediate suburbs. At present the lines extend about 6 miles to the outskirts of the city. There is no long-distance service. Important work is under way to place all wires, now overhead on poles, in concrete conduits underground. The outlay to date for changing the old outfit for the new has been over £125,000, and when the service is perfected (within the next 12 months) the total cost will approximate £200,000. The annual subscription for the present service has just been fixed at £12 for business houses, and £11 12s. 6d. for residences.

France.—The British Consul at Havre reports that the Chamber of Commerce there has decided to establish a wireless telegraph station in their Magasin de Sauvetage for the reception of the time signals sent by the Eiffel Tower station. Navigators will thus find in the port the exact time. The Chamber is waiting the authorisation of the Administration of Posts and Telegraphs to commence the construction of the necessary installations.

Italy.—A German official report states that there is a great future in Italy for electrical cooking, &c., apparatus for household use, as electric current is available not only in the large towns, but also in many small villages, owing to the extended service from the overland power stations. These goods are already being imported from Germany, and their production in Italy in small quantities has been started. The classes chiefly in demand are electrically-heated irons, cooking stoves, food warmers, table utensils, such as kettles, coffee urns, heating plates, toasters, &c., nickelled or silvered, also cooking utensils, such as kettles, stoves, pans, &c., of brass, nickelled or of iron, enamelled inside.

United States.—The British Consul at St. Louis reports on the large hydro-electric plant on the Mississippi at Keokuk, about 200 miles from St. Louis, which city will be supplied by overhead wires. The company obtained a perpetual licence and were required to build a lock and dry dock to be the property of the United States Government. The dam will hold up the river and deepen the channel for 65 miles. This new electric supply will not reduce the price to householders, as it requires special equipment to change the high-tension current at 13,200 volts, which will necessitate a complete equipment of transformers, lightning arresters and special switches. Factory owners and other users will each have to install the necessary apparatus. The rates to be charged are either by the kilowatt demand, the average amount of current the customer's equipment can call for in any consecutive 15 minutes or the actual amount of current used. The present rate per kilowatt demand varies from £7 8s. 5d. for the first 10 KW. to £3 14s. 2d. for over 120 KW. The energy rates per KW.-hour vary from 1¾d. for the first 1,000 hours to ⅜d. for excess of 50,000 hours. The Keokuk dam rates vary from £4 2s. 5d. per year per KW. for a 200-KW. demand to £2 9s. 5d. for a 1,000 or more KW. demand. The smallest amount to be supplied to any customer will be a demand of 150 KW. and 25,000 KW.-hours in a month, but it is stated that the cost will be one-half that at present, plus £2 a month, for maintaining switches. &c.

Norway.—The American Consul at Christiania reports that the manufacture of electrical machinery and apparatus, which was unknown in Norway only a few years ago, is now increasing very rapidly, not only in extent of output but also in variety of goods manufactured. Germany formerly sent nearly all such goods used to Norway, and still supplies a large part, but home manufacturers have decreased the amount imported very materially and each year furnish a larger part of the demand. Telephones have been exported in large quantities for many years, and the factory where they are made has been forced to enlarge its plant several times.

Book Notices.—"The Water Works Directory and Statistics, 1913." London: Hazell, Watson & Viney, Ltd. Price 10s. 6d. net

"Oil." By W. Antrobus. Manchester: From the Author. Price 3s. 6d. post paid.

"Leeds Chamber of Commerce Year-Book." 1913. Derby: Bemrose & Son, Ltd.

"Underwriters' Requirements." By D. Pierce. 1913. London: Crosby Lockwood & Sons. Price 4s. 6d. net.

"Calendar of the Royal Technical College, 1913-14." Glasgow: The College.

"Prospectus of the South-Western Polytechnic Institute, 1913-14." London: The Institute. Price 1d.

"*Proceedings* of the Physical Society of London." Vol. XXV, Part V. August 15th, 1913. London: *Electrician* Printing and Publishing Co. Price 4s. net.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 6. June, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the American Institute of Architects." Vol. I, No. 7. June, 1913. Harrisburg, Pa.: The Institute. Price 20 cents.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. July, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 27, July, 1913. Paris: Gauthier-Villars.

"*Boletin* de Ingenieros." Vol. III, No. 11. July 16th, 1913. Mexico: Secretaria de Guerra y Marina.

The June issue of the *Telefunken Zeitung* celebrates the tenth birthday of the Telefunken-Gesellschaft with a review of the history and achievements of the company, and gives a map of the world, showing the long-distance schemes projected by the leading nations; these include seven crossings of the Atlantic, four of the Indian Ocean, and three of the Pacific. A diagram shows the rapid progress of the company's business since the adoption of the singing-spark system in 1909. Nearly 2,000 stations had been supplied on the Telefunken system up to last month. Successful communication in July between Sayville, U.S.A., and Nauen, a distance of 6,400 km., is put on record, a Telefunken high-frequency machine of 6 KW. being employed.

Patent for Disposal.—A patent for improvements in electric induction furnaces is open for licence. See our advertisement pages.

Germany.—The Westerwald Electricitätswerk Gesellschaft is the name of a new company which has just been formed at Höhr, with a capital of £140,000, to establish a large electricity supply station. The Gesellschaft für Elektrische Unternehmungen, of Berlin, is interested in the new concern.

Bankruptcy Proceedings.—JACK FRANCIS BARNES, electrical and mechanical engineer, picture house proprietor, &c., Oldbury, Worcester, and Cradley Heath, Stafford.— The first meeting of creditors herein was held on August 20th, at Ruskin Chambers, Corporation Street, Birmingham. The statement of affairs disclosed liabilities totalling £465 and assets estimated to produce £40 odd. It transpired that the debtor about 19 years ago started cinematograph exhibiting at Blackpool and had continued this in nearly every city and large town in the country. Fourteen years ago he settled in London and worked his business from there, removing to Smethwick six years ago. He had also been owner or part owner of the picture houses at Cradley Heath, Bromsgrove, Halesowen and Oldbury since 1909, but at the present time he only had a half share in the lease of a picture palace at Spinner's End, Cradley Heath, estimated to be worth £25. No books of account had been kept, only letter books being forthcoming. The Official Receiver remains trustee.

JAMES EDWIN STOTT, electrician, Huddersfield.—Notice is given in the *London Gazette* that the bankrupt's discharge is suspended for three years.

Restoration of Patent.—An order has been made restoring patent No. 3,300 of 1907 granted to Maurice Goudard for "Improvements in and relating to radiators for the cooling systems of explosion systems."

Lamp Works in Spain.—La Sociedad Wolfram, Fabricade Lampara Electricas is the name of a new company which has just been formed in Barcelona with a capital of £8,400, to manufacture metal-filament lamps for the Spanish market.

Catalogues and Lists.—MESSRS. SCHAFFER & BUDENBERG, LTD., Whitworth Street, Manchester.—Section 5, catalogue (44 pages) containing fully illustrated information respecting their iron, steel and gun-metal valves; prices are indicated. Section 22 is a leaflet showing their patent "Concentra" oil pump, and No. 29 deals with "Jena" water-gauge glasses and gauge glass protectors.

MESSRS. FERRANTI, LTD., Hollinwood.—Illustrated price list fully describing their electric cookers.

MESSRS. BONECOURT SURFACE COMBUSTION, LTD., Parliament Mansions, Victoria Street, London, S.W.—Four-page illustrated leaflet relating to the application of Bonecourt heating diaphragms to industrial purposes. Prices of standard sizes are given.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Two new illustrated lists; No. 190 relates to and shows their three-phase 600-volt draw-out type ironclad switchgear; and No. 52 is an account of the Merz-Price system of automatic protection for high-tension circuits, including a reprint of our own article of 1908 on the subject. We referred to this subject also in our June 20th issue, page 1043.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, E.C.—Booklet on "Industrial Lighting," containing 28 pages of well illustrated descriptive matter relating to the scientific illumination of textile mills, engineering works, warehouses, &c. The contents are of an exceedingly interesting character, and include data and curves which will appeal to those who are taking up the question of industrial illumination.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Manchester.—Pamphlet, being one of the "envelope series" entitled "Why Waste Watts?" describing and illustrating the Westinghouse portable watt-hour meters.

WESTINGHOUSE COOPER-HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—Two reprints; one relating to the progress of the mercury vapour converter, and the other to "Mercury Vapour Converters," by Maurice Leblanc, Jun.

WALTHAM MANUFACTURING CO., 2, Jackson Road, Holloway, London, N.—Illustrated price leaflet respecting Waltham arc lamps of flame, enclosed, lantern, printing and studio types.

MESSRS. SIEBE, GORMAN & CO., LTD., Neptune Works, S.E.—Catalogue E, relating to air compressors and vacuum pumps, and desiccating apparatus; also leaflet regarding their "Oxacet" plant for welding and cutting metals by the oxy-acetylene process.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 18 B (24 pages), in their standard style and size, giving particulars of large size open-type continuous-current dynamos and motors. Machines of the open type are exclusively dealt with, smaller continuous-current machines forming the subject of another publication; besides giving a full detailed specification and a number of half-tone illustrations, it contains approximate weights and dimensions of the different frame sizes, lists of ratings with technical data, &c.

THE POWER PLANT CO., LTD., West Drayton, Middlesex.—Price List No. 7 of their insulating and reversible flexible couplings, types "L" and "C," of which they make a speciality. Full details of dimensions and prices are given.

THE BRITISH ALUMINIUM CO., LTD., 109, Victoria Street, E.C.,—Pamphlet No. 143 just issued, dealing with the use of aluminium in the electric railway world. The pamphlet is illustrated, and covers cables, collector bows, field coils, coach panels, &c.

MESSRS. OZONAIR, LTD., 96, Victoria Street, S.W.—Leaflets describing new portable Ozonair apparatus, type No. 28, for A.C. only, and types 26 and 27 for tropical climates.

Trade Announcements.—THE RECORD ELECTRICAL CO., LTD., of Caxton House, Westminster, wish to notify their Scottish clients and friends that Mr. C. E. Hart, late of Standard Buildings, has joined partnership with Messrs. Edmiston, Brown and Co., of 219, St. Vincent Street, Glasgow. This firm will from now be their accredited agents for the whole of Scotland. Its telephone number is 1189 Central, Glasgow.

The offices of *Gas and Oil Power* have been removed from 3, Oxford Court, Cannon Street, London, E.C., to Weavers' Hall, 22, Basinghall Street, London, E.C., to which address all communications should in future be sent. New telephone number, 4856, London Wall.

It is announced that the business of ROBERT BRENARD AND BRENARD & CO., electrical engineers, of 12, Cloth Hall Street, Huddersfield, has been closed.

MR. J. MONTAGUE WOOLNOUGH, who for the last five years represented the General Electric Co., Ltd., has now joined the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., as one of the supply department representatives in the London district.

Dissolutions.—W. T. AKED & CO., motor and electrical engineers and dealers, St. Anne's-on-Sea, Ormskirk and Penrith.—Messrs. F. A. Scholes and W. Aked have dissolved partnership. The business and assets have been sold to W. T. Aked & Co., Ltd., who will attend to debts, &c., and continue the business.

Calcium Carbide in Brazil.—An American Consul states that within a few months there will be in operation at Palmyra a plant manufacturing carbide of calcium under the most advantageous conditions, with abundant water power capable of generating 4,500 H.P. Most of the equipment will be furnished by the Sociétá Italiana Westinghouse, of Vado, Italy.

LIGHTING and POWER NOTES.

Acton.—In his annual report on the finances of the U.D.C., the accountant to the Council says that a settlement has been arrived at of all the outstanding matters in connection with the transfer of the Council's electricity undertaking to the Metropolitan Electric Supply Co., Ltd., and that the final accounts disclose a surplus of £2,696, which has been transferred to the credit of the district fund account. This surplus is additional to the sum of £2,500 paid by the company as part consideration money for the transfer of the undertaking, and credited to the district fund account in the previous year. The Council will, in future, pay the instalments and interest on the electricity loans as they become due, and the amounts so paid will be reimbursed by the company.

Atherton (Lancs.).—Mr. C. T. Astbury, electrical engineer to the U.D.C., has been authorised to negotiate with the tramway company with a view to obtaining an amended agreement with the Council for a supply of electrical energy.

The L.G.B. has sanctioned the borrowing of £6,300 for electricity purposes.

Australia.—The Sydney City Council has agreed to a bonus scheme, proposed by the engineer, with a view to securing decreased fuel consumption at the power house. This provides for a monthly bonus depending on a reduction in the standard rate of coal consumption, which is taken as 2·8 lb. per unit generated. The standard will, of course, vary with the class of fuel used.

The North Sydney electricity scheme is still undecided. The Council has passed a resolution not to proceed with the proposed agreement with the Northern Sydney Electric Light and Power Supply Co. as drafted. Negotiations are still being carried on, and the company has purchased a 300-KW. generating set.

An application has been made by Messrs. Hoadley & Lawton, Moe (V.), for a licence to divert water from Narracan Creek, for a

hydro-electric plant, in the interests of a company which proposes erecting extensive works in a neighbouring town.

Another hydro-electric scheme, according to the *Australian Mining Standard*, has been submitted to the Victorian State Government by Mr. V. J. Crowley, for a plant at Dights Falls, to supply Melbourne, and is being considered by the Public Works Department.

The Camberwell (V.) T.C. has adopted an agreement for five years for street lighting, with the Melbourne Electric Supply Co. at a cost of £900 per annum for 251 lamps; the present gas lighting costs £969 for 212 lamps.

Basingstoke.—New Plant.—The T.C. has authorised the borough engineer to advertise for conditional tenders for Diesel generators, balancer set, booster set, storage batteries, main switchboard, cables and cable laying, and an overhead travelling crane, in connection with the proposed E.L. scheme. A site in Brook Street has been secured for the erection of an electric light station.

Battle (Sussex).—Workhouse Lighting.—The Board of Guardians on August 22nd decided to have the workhouse premises lit by electricity, and to ask Mr. A. E. Ticehurst, of the Bexhill electricity works, to draw up the necessary specifications for the work. At present oil lamps are used.

Bedlington.—Street Lighting.—The Lighting Committee has reported to the Council that the Bebside Coal Co. has arranged to light the streets at Choppington colliery by electricity on similar terms to those which applied to Bedlington colliery.

Belfast.—The Tramways and Electricity Committee has conferred with the Harbour Commissioners in regard to the suggested site for the new power station near Mulgrave Channel. The Commissioners are prepared to grant a 10-acre site, forming part of reclaimed land on the south of the Channel, at a rental, and will fill it up to building level if approved.

Blackpool.—During the past four months the electricity department has recorded an increase of 129,766 units in the output, and 129 new consumers have been added, or 55 more than during the corresponding period of last year.

For the autumn season the Corporation is to expend about £2,000 on electrical illuminations along the whole of the three miles of sea front. No fewer than 60,000 electric lamps will be used.

Brymbo.—Public Lighting.—The P.C. has decided to adopt the Lighting and Watching Act, 1833, which will give it power to undertake public lighting. Electricity, to be supplied by the Brymbo Steel Co., will be utilised, and the scheme provides for 38 lamps at a capital cost of £200, and from 10s. to 12s. per lamp per annum for lighting.

Chartham (Kent).—A proposal is on foot to form a company with the object of supplying electricity in Chartham and district.

Continental Notes.—Norway.—It is reported that the municipality of Trondhjem has recently voted a sum of £43,333 for the erection of a new auxiliary power station. The main portion of the energy from this station will be employed for the heating of houses.

The harnessing of the Sonde Waterfalls, belonging to the A/s Skallenborg has now been completed and the cable to the town of Tönsberg was tested recently, although the ordinary supply will not commence before a few weeks' time.

The town of Horten will also get electric light in the near future, and the energy will be supplied from the same source as soon as the transmission lines are in order.

Germany.—As a result of negotiations between the Nuremberg Schuckert Co. and Brown, Boveri & Co., of Mannheim, on the one hand, and the Government of Bavaria on the other, a concession has been granted to the two former companies to establish electricity works for the supply of electrical energy in the greatest portion of Lower Franconia and the western portion of Upper Franconia. The first instalment of the new works, the erection and equipment of which are expected to occupy a period of three years, is to comprise four units of a total of 30,000 kw., and the service is to be rendered available in 20 towns and about 1,200 communes. The transmission is to be effected at exceptionally high pressure, and the expenditure on the overhead network alone is estimated at £1,000,000, independently of the cost of the generating station and equipment, and sub-stations. It is possible that the station will be worked in conjunction with the Franconia power station and the Palatinate station of the Rhenish Schuckert Co., in Mannheim, which aims at the supply of the whole of the Palatinate. The promoters of the scheme state that the report is incorrect that they have acquired lignite mines at Wustersachsen for the purpose of using brown coal as fuel in the station, no details having yet been decided upon. Apart from the capital which will be raised by the two promoting companies for carrying the scheme into effect, it is mentioned that various local authorities will co-operate in the matter by the grant of loans, but not by the subscription of shares or bonds.

Dewsbury.—Proposed Bonus Scheme.—Reporting upon the past year's working of the electricity department, the electrical engineer, Mr. R. H. Campion, stated that the number of units sold had increased by 274,272, and the receipts from the sale of current for lighting, power and tramways showed an increase of £1,354. The total expenditure, however, increased by £639. The reserve fund stands at £2,596. Mr. Campion advocates the establishment of something in the nature of a bonus or co-partnership scheme in which the employés of the department might take part. For the present he puts forward the following details, failing a general co-partnership system. A bonus to be paid to all men employed in the department. A bonus of 2½ per cent. downwards according to responsibility on so much of the amount certified by the borough accountant to be net surplus profit for the next financial year ending March, 1914. Men who are absent from any cause whatever, except annual holidays, to have a corresponding reduction made in their bonus. Men engaged during the above period to be paid a proportionate sum if they have been employed six months. Any employé going on strike or discharged for insubordination to forfeit all rights to any bonus. Any man discharged for slackness or who leaves to better himself to obtain the amount due to him at the end of the financial year.

The Electricity Committee has not adopted this bonus scheme, but has decided to give the workers an increase of a ½d. per hour.

Dudley.—Sale of Undertaking.—The terms of the agreement for the sale by the Corporation of its electricity undertaking to the Birmingham District Power and Traction Co., Ltd., and the Shropshire, Worcestershire and Staffordshire Electric Power Co., have now been published. The agreement provides:—The purchase money is:—(1) £63,400, together with the balance of loans (and interest) raised by the Corporation for the purchase of the undertaking; (2) the sum of £10,500, of which £7,000, with interest, shall be made by the Power Co. in 17 equal annual instalments of £550 each; (3) £3,334, the amount expended by the Corporation on capital account for the purposes of the undertaking since March 31st, 1912. The agreement dates from April, 1912, from which period to the completion of the purchase, the Power Co. takes the income due from the consumers. The accounts of the Corporation are to be made up to within a month of the completion of the purchase, and if a profit is shown, it is to be paid to the company; if a loss, the latter pays. The purchasers are to take over the engineers, clerks, workmen, and other persons in the employment of the Corporation exclusively for the purpose of the undertaking. It is stipulated that the prices for electricity to be charged to the consumers by the company are not to exceed those at present in force, but they may be increased at the end of three years with the consent of the Corporation. If that consent is withheld, the matter will be referred to arbitration. The Corporation has the power to repurchase in 42 years. There is nothing in the agreement making it obligatory on the part of the company to keep the present generating station.

Harrogate.—Plant Extensions.—The T.C. has applied to the L.G.B. for a loan of £6,939 for a turbo-alternator and condensing plant for the electricity works.

Haslingden.—The new sheeting looms which have been placed in Messrs. James Lambert & Son's Carr Hall Mills, are being electrically-driven. These are the first looms in Haslingden to be electrically-driven.

Hinckley.—The U.D.C. has approached the Leicestershire and Warwickshire Electric Co. for terms for supplying current to the new hospital to be erected, for a term of 20 years.

Hull.—Loan Refused.—The L.G.B. has declined to sanction borrowing powers to the Corporation for various furnishings, which include four electroliers for the Council Chamber of the Guildhall, which were to cost a total of £500.

Launceston.—Public Lighting.—The T.C. has received from the electric supply company an offer to light six public lamps, from November to February, to 4 a.m. at £5 10s., and to 7 a.m. at £8 10s. The offer has been referred to the Lighting Committee.

London.—According to the *Standard*, 50 firemen, with engines, &c., were called in on Thursday, last week, to put out a fire which occurred through a gas main leaking in Fenchurch Street, involving the electric light and telegraph cables near by.

Preston.—Remedial works and extensions in connection with Penwortham's sewerage system formed the subject of an inquiry before a L.G.B. inspector on August 21st, when the R.D.C. made application for sanction to borrow £6,800 to cover the cost. It is proposed to discontinue the use of two oil engines at the outfall works, replacing them by electrical plant to be erected at the ejector station. In regard to the substitution of electric for oil power for ejection purposes, counsel for the authority said the cost of oil power was estimated at £670 a year, and that for electricity would be £150 per annum, or a saving of £520. The total capital expenditure for the purpose of electricity, including the erection of a new engine house, motors, land, cables, &c., would be about £400, so that it would be saved by the change in the first year. Mr. T. Kitson (chairman of the P.C.) thought it would be well for ratepayers to know the great saving effected by substituting electric for oil power. The rate would be no less than 11d. in the £ for oil power, and 2d. for electric power. On that ground alone the ratepayers should be agreeable to the change. No opposition was advanced to the application.

Rawtenstall.—The lighting superintendent has been instructed to make arrangements for the lighting of Hall Carr Road by electricity.

Owing to the increase in the number of consumers, an extension of the cables in the Waterfoot district is contemplated. The H.T. cable to Bacup is heavily overloaded, and an additional length of feeder is to be provided to join up with the length which is being laid by the Bacup Corporation.

Rishton.—The B. of T. has made an order to permit the Accrington Corporation to supply electricity to the Rishton paper mills.

Sandiway (Cheshire).—In response to a request from the Weaverham Electric Supply Co., which stated that it was being pressed on all hands for the electric supply to be available in November in the Cuddington and Sandiway district, the Northwich R.D.C. has consented to the erection of overhead mains in Sandiway and Cuddington.

Scarborough.—Workhouse Lighting.—The Guardians are proposing to light the whole of the workhouse with electricity, but progress is delayed by wrangling over the estimates of cost of a heating scheme which is to be carried out at the same time.

South Africa.—At a special meeting of the Cape Town City Council, held on August 2nd, a report of the Electric Committee, recommending increased generating plant, was brought up for adoption. The Committee reported that the total output of the power station on July 11th, 1913, was 2,554 kw., while the total capacity of the available plant, without the new turbine set, was only 2,600 kw.; and that, in addition to the ordinary expansion of the undertaking, the following additional demand had to be provided for before next winter, viz.:—Salt River Works, 500 kw.; Claremont Power Station load, 250 kw.; Messrs. Ohlsson's Cape Breweries, Ltd., 150 kw.; Messrs. Daniel Mills & Sons, 50 kw.; Messrs. Verster & Co., 50 kw. The Committee recommended the purchase of a Thomson-Houston generator, Allen condenser, and Kinetic pumps, including spares, switchgear, &c., for £6,982; also a Peebles converter, including A.C. and D.C. switchgear, for £2,740; the total cost of plant, including foundations and erection, being estimated at £11,000. The Council agreed to the recommendations of the Committee.

The tender of Messrs. Cunningham & Gearing for the wiring of the new pier, pavilion, tea rooms, bandstand, &c., has been accepted by the City Council.

Sturry (Kent).—Electricity Scheme.—At a meeting of the Bridge Rural District Council, on August 21st, a letter was read from Mr. G. Stainton, of Whitstable, stating that a company was about to be formed to carry out an E.L. scheme for Sturry and district, and intimating that, when ready, the engineer's report, with details of the project, would be laid before the Council. The Council decided to defer consideration of the matter pending the arrival of the report.

Weaverham (Cheshire).—The Electricity Supply Co. has applied to the B. of T. for consent to the use of 220-volt overhead lines; five lines are proposed to be erected forthwith, and six others as occasion requires.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation has adopted a revised scheme for the extension of ½d. distances on the tramways.

Acton.—The clerk to the U.D.C. has prepared a report with reference to a conference between representatives of the Council and the Middlesex C.C. concerning the proposed linking-up of the Middlesex Tramways with the London United system. The engineer and tramway manager of the County Council, he says, submitted a plan for a connection between the two systems by way of King Street. After considering the advantages and disadvantages of this route, the members inspected a suggested connection by way of the Steyne, either through Rectory Road or Steyne Road. Another suggested connection through Market Place was considered, but it was felt that the cost of this route would be prohibitive. The report will come before the Council at its first meeting following the vacation.

Ashton-under-Lyne.—At the time of going to press, no settlement had been arrived at with the workers on the Ashton Corporation, Stalybridge Joint Board and Oldham Ashton and Hyde tramways, and as the men's notices are being handed in, there is every prospect of a tramway strike in this district.

Asiatic Turkey.—According to *Commercial Intelligence*, English engineers are surveying routes for an electric tramway from Moazzam, 5 miles north to Garova, 5 or 6 miles south of Bagdad. The concession is held by an English firm; a 50-year-old horse tramway is in operation in another part of the city and suburbs.

Australia.—Advent of Motor-'Bus.—According to the *Australian Mining Standard*, the 30 years' monopoly of the Melbourne street passenger traffic by the Melbourne Tramway Co. is being seriously threatened by the motor-'bus. The initial experiment was so successful that the first 'bus company has been followed by a second, which also is doing very well, and numerous other schemes are proposed. According to our contemporary the tramway company has persistently ignored the demands of the public in the past, secure in the belief that the terms of its concession protect it from all serious opposition.

The same journal gives particulars of public meetings which have been held at Camberwell and Hawthorn, to insist on steps being taken to supply the tramway needs of these suburbs.

Batley.—The Works Committee of the Corporation has agreed upon terms with a company for the construction of tramways to Shawcross and Dewsbury Moor.

Blackpool.—Growing Tramway Receipts.—A report presented to the Corporation Tramways Committee on August 21st showed increased receipts to date of £6,150. From April 1st to August 14th the receipts were £42,250, or £5,049 more than in the corresponding period of last year. The receipts per car-mile averaged 1s. 11¼d., or 3d. per car-mile more than last year.

Continental Notes.—Germany.—After being under consideration for a period of six years, the scheme promoted by the A.E.G. for the construction of an electric railway between the Berlin district of Gesundbrunnen and the suburban town of Neukölln has just received the sanction of the supervising authorities. Almost four years of this term have been occupied in negotiations with the municipal council, the balance of two years representing the time devoted to securing the approval of the Government departments concerned. As projected, the railway is to be a combination of the overhead and underground type, as in the case of the existing Berlin Elevated and Underground Railway, but the municipal authorities have insisted upon a longer portion of the railway being constructed underground than had been contemplated by the A.E.G. As this variation will necessitate a larger expenditure than was expected under the original scheme, the municipal authorities have decided to defray a portion of the additional expense by undertaking to make a contribution of £295,000 towards the cost. The agreement made to this effect was concluded on February 1st, 1912, and would have expired on August 18th, if the Government consent to the railway had not been granted by that time—or, at all events, the municipal authorities would have been entitled to withdraw from it. The railway is to have a total length of 5¾ miles and is expected to involve an expenditure of £4,500,000. The traffic is estimated at 60,000,000 passengers per annum, and the fares will range from 1¼d. up to the fourth station, 2d. to the eighth station and 2½d. to the fourteenth and terminal station. It is assumed that the authorisation of this railway indirectly implies the rejection of the rival scheme for the construction of a suspended electric railway also between Gesundbrunnen and Neukölln.

Switzerland.—According to the *Times*, the difficulties connected with the working of the Lötschberg Electric Railway have been sufficiently overcome to enable a full train service to be run from September 18th onwards.

Colwyn Bay.—The Llandudno and Colwyn Bay Tramways Co., whose present Colwyn Bay terminus is in the centre of the town, has decided to continue its lines in a westward direction through the village of Old Colwyn, a distance of nearly two miles. The work will be commenced in October.

Dublin.—On Tuesday morning a large number of drivers and conductors on the Dublin United Tramways struck work, leaving the cars on the streets. The city police have been reinforced, and the military are being held in readiness. The greatest confusion prevailed on Tuesday, the streets being crowded from the Horse Show. Inspectors and clerks had to work the cars back to the sheds. Other vehicles reaped a big harvest. A number of men who left their cars on the streets were charged by the manager of the Tramway Co., and taken into custody. A temporary service was established by the officials of the company and outsiders who volunteered their services.

Glasgow.—The Tramways Committee proposes to increase the wages of certain classes of motormen, conductors, and other workers, involving an additional annual expenditure of £9,500.

Representations having been made by the district secretary of the Electrical Trades Union regarding handy men in the department doing electricians' work at Caplowhill Car Works, conferences with Union officials and men have taken place, and the T.C.'s Committee now recommends that handy men should continue to perform the work at present done by them, with the exception of the work of making the connection at the coupling between the trolley-pole and the trolley base, which work should in future be carried out by a wireman.

Keighley.—At a meeting of the T.C. last week, it was reported that the B. of T. had consented provisionally to the use of electrical power for three months from August 1st on the railless trolley system already opened. The Electricity Committee also reported receipt of sanction to extend the period for the commencement and for the completion and opening for traffic of the tramways authorised by the Keighley Tramways Order, 1909, until September 20th, 1914, and September 20th, 1915, respectively, and to extend the time for completion and opening for traffic of the tramway from Dale Street to Stockbridge, authorised by the Order of 1903, until August 11th, 1914.

Leeds.—New Tramways.—The sub-Tramways and Electricity (Extensions) Committee of the Corporation has resolved that application be made for powers to make the following extensions: Tramways—from Burmantofts Road to Compton Road; from York Road to junction with present line in Easy Road; from present terminus in Dewsbury Road to Old Lane; from junction of Swinegate with Bishopsgate Street, to Lower Briggate; from Sovereign Street to Swinegate; from present terminus in York Road on Selby Road route to Hollyshaw Lane; from present terminus in York Road to Seacroft Hospital. Railless—From junction of Wellington Road and Tong Road, to Low Road; from junction of Whitehall Road to Chapel Lane, near Recreation Ground.

Little Hulton (Lancs.).—Official Inspection.—On Friday last Col. von Donop, of the B. of T., inspected the new tramway of the South Lancashire Tramways Co. The new line is from Long Causeway, Farnworth, through Little Hulton, to the Monument at Walkden. It was proposed to open the line for traffic last Saturday, but Col. von Donop refused his sanction for an immediate opening on account of the fact that an objection was made by the L. and N.W. Railway Co. on the ground that two of their bridges, which the track crosses, were not sufficiently strong to bear the strain of the new traffic.

Longridge (near Preston).—The Council has resolved that in the event of the Preston Corporation asking for powers for the extension of its tramway system, the Longridge Council should approach the Corporation with a view to including Longridge in its area.

Manchester.—All-Night Services.—The Corporation Tramways Committee on Tuesday had before it a report by Mr. McElroy (general manager) upon the subject of all-night services of tramcars, and it was decided to recommend to the City Council that such services be inaugurated on eight routes. Mr. McElroy, in his report, said that after careful analysis of the petition from the night workers of the city, it was now possible to gauge the extent of the demand for all-night services of tramcars. The greatest demand was in Cheetham Hill, Harpurley, Moston, Newton Heath, Moss Side, Rusholme, Longsight and Levenshulme. In his opinion an hourly service of cars on eight routes which he suggested ought reasonably to meet the demand at the present time. From the point of view of the tramways department, there were objections to the running of an all-night service, the principal one being that it made the efficient maintenance of the track and overhead equipment more difficult. The department, however, would endeavour to carry out the minor repairs during the intervals between the running of the cars, and when more important repairs or reconstructions were necessary, the services would have to be run by means of motor-'buses. He recommended that the services be limited to week nights only. There was only one instance in the United Kingdom, said Mr. McElroy, of the running of all-night services, viz., in London, but in the U.S.A. it was quite a common practice to run such services. In New York City there was a 10 minutes' service running all night. In Manchester the fares will be the same as in the daytime, but there will be no workmen's tickets.

The employés of the Manchester Tramways Committee on Tuesday applied to the Committee for an advance in wages, an extended holiday, and improved conditions of service. The men state that the cost of living in Manchester has increased to such an extent, that they feel justified in asking for the advance.

Morecambe.—Electrification Scheme.—By a majority of a single vote the Electricity Committee of the Corporation has instructed the electrical engineer to prepare a scheme for the electrification of the tramways, and this resolution has been approved by the Council. This question is a very sore point in Morecambe, one of the few towns in this country which still depend entirely upon a horse tramway service. It has been time and time again urged that the present antiquated system stamps the town, in the eyes of visitors—its chief mainstay—as unprogressive. On the other hand, it has been held that the visitors like the easy-going slow jog-trot ride along the sea-front on the horse cars, and look upon it as a cheap char-à-banc ride. Four years ago, at a town's meeting, the ratepayers declined to allow the Corporation to proceed with a Bill for electrifying the tramways. Though the resolution does not commit the Corporation, it is thought necessary to obtain all possible information in view of a future need if not an immediate change.

Ramsbottom.—During the first week of the running of the new railless trolley cars, two of which have been in service, 10,600 passengers have been carried.

Southend-on-Sea.—The T.C. has applied to the B. of T. to extend the limit of the amount the Council is authorised to borrow under the Light Railway Orders, 1899 to 1912, by a further sum of £16,900, to cover the cost of laying double lines in Southchurch Road and Southchurch Beach Road.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—A decree has been signed granting a concession to Marconi's Wireless Telegraph Co. for the establishment of international stations at Rio de Janeiro, Belem, Trinidade, Santa Martha and Fernando de Noronha.

Isle of Man.—The Postmaster-General has notified a large number of telephone subscribers in Douglas that their service will be discontinued, in consequence of the Douglas T.C. having refused the terms he has offered for wayleave over municipal property. The rent offered was £5 a year; the Town Council demanded £25.

Japan.—Wireless telephony is making progress in Japan, a system invented by a Mr. Torikata having been adopted by the Government, and by the Nippon Yusen Kaisha on their mail steamers.

London Telephone Service.—In reply to a request for statistics showing the relative efficiency of the London telephone service during the present year as compared with the year 1911, when the service was partly in the hands of the National Telephone Co. as well as of the Post Office, Mr. Herbert Samuel recently gave the following table, showing the percentages obtained by the special observation of about 50,000 calls in each half-year:—

January to June.	National Telephone Company. 191[illegible]	Post Office. 1911.	Post Office controlled system. 1913.
Average speed of answer ...	5·[illegible] sec.	5·1 sec.	5·1 sec.
Percentages of total calls—			
"Engaged" calls	15·[illegible]	14·9	17·4
"No-reply" calls	1·5	2·9	1·1
"Cut-offs"	·7	·4	·6
Effective calls	65·9	6[illegible]·7	7[illegible]·5

He stated that the number of complaints during the last 12 months had very largely diminished.

New Cable.—The Post Office has decided to lay a new telegraph cable to Germany, to meet the growing demand on the intercommunication between the two countries. The cable will contain four wires, and will start from a point in Norfolk. There are already four similar cables in use.

Telegraph Rates.—The Great Northern Telegraph Co., Ltd., announce that on and after September 1st next the rates to the undermentioned places in the Far East will be as follows:—To Hong-Kong, China and Manila, 3s. 6d.; to Japan and Formosa, 3s. 11d.; to Dutch Indies, 3s. 7d. The rates now in force are:—Hong-Kong, China and Manila, 4s. 5d.; Japan and Formosa, 4s. 10d.; Dutch Indies, 4s. 5d.

The following reduced rates are to be brought into effect by the Eastern Telegraph Co. between Europe and the Far East on September 1st:—China, 3s. 6d.; Japan and Formosa, 3s. 11d.; Dutch Indies and Dutch Borneo, 3s. 7d.; Philippines, 3s. 6d. to 4s. 3d.; Straits Settlements, 2s. 10d.; British North Borneo, 3s. 2d.; French Indo-China, 3s. to 3s. 8d.; Siam, 3s. 6d.

Telephone Wires Cut.—A number of telephone wires connecting public call offices at Tube and District Railway stations in the Metropolis were cut by Suffragettes last week.

Trunk Telephones.—According to a statement issued last week, last year the Post Office controlled 3,180 trunk lines, aggregating 117,900 miles; the receipts were £912,342, and the calls averaged 38·8 per trunk circuit per day. In the previous year a slightly higher average was registered. The average cost of operating each call is 1·26d. The average fee per call is 6·11d. The total number of calls was over 35 millions.

Wireless Telephony.—The statements of Mr. Godfrey Isaacs at the meeting of the Marconi Co., which are reported elsewhere in this issue, regarding the company's work in connection with wireless telephony, have led Mr. H. Grindell Matthews to write to the Press, challenging the Marconi Co. to a test of the respective systems under conditions to be laid down by an independent authority.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Brisbane.—September 24th. Ironwork, cast-iron pipes, iron poles, galvanised iron wire, for the P.M.G. See "Official Notices" August 15th.

Perth.—October 8th. Bolts for the P.M.G. See "Official Notices" August 22nd.

September 10th.—For the P.M.G.; nine sections of a trunk line switchboard.

November 12th.—Lamp signalling trunk line switchboard, of five sections, &c.

Melbourne.—October 7th. Electrically-driven machinery for operating pneumatic tube services. See "Official Notices" August 22nd.

November 4th.—Automatic switchboards for exchanges in metropolitan network. See "Official Notices" August 22nd.

September 9th.—City Council; electricity meters and maximum demand indicators. See "Official Notices" August 22nd.

September 16th.—For the P.M.G.; a common-battery or an automatic switchboard.

September 16th.—Corporation. 175 yd. 0·25 sq. in. three-core lead-covered cable; 5,471 yd. 0·15 ditto, and 3,500 yd. ·05 ditto. Also three 250-K.V.A. three-phase transformers. See "Official Notices" to-day.

September 23rd.—Sulphate of copper, for the P.M.G. Specifications from the Commonwealth Office, 72, Victoria Street, S.W.

October 14th.—A common-battery multiple switchboard.

November 4th.—Eight automatic telephone switchboards.

New South Wales.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

Sydney.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

Basingstoke.—September 17th. Corporation. (Section *a*) Diesel generators, balancer set and booster set; (*b*) storage batteries; (*c*) switchboard and instruments; (*d*) cables and cable laying; (*e*) overhead travelling crane. See "Official Notices" August 22nd.

Belgium.—The municipal authorities of the little town of Henri-Chapelle (province of Liége) have just invited tenders for the concession for the supply of electrical energy for lighting and power purposes.

Bradford.—August 30th. Machinery and timber, for the Corporation Tramways Department. See "Official Notices" August 8th

Cardiff.—September 12th. Corporation. (1) One 2,000-KW. turbo-alternator, with surface condensing plant and auxiliaries; (2) one 700-KW. rotary converter; (3) boiler house plant. (*a*) Water-tube boilers, super-heaters, stokers, &c.; (*b*) turbine-driven feed pump and heater; (*c*) fuel economiser. See "Official Notices" August 22nd.

Costa Rica.—LIMON.—Installation and working of an electric light service in the city and its suburbs. Plant required: Two 414-H.P. Pelton turbines, two 400-KW. generators, and six transformers. The date when tenders will be adjudicated upon will be settled on September 18th. Particulars and plans from the Ingeneiro Municipal, at Limon.

Dartford.—September 16th. U.D.C. (*a*) Water-tube boiler, economiser, fan, steel chimney and accessories; (*b*) inverted rotaries, transformers, switchboard and cabling. See "Official Notices" to-day.

Edinburgh.—September 8th. Electric light and power installation at the new Town Hall, High Street, Portobello. Particulars from Mr. Newington, electrical engineer, Dewar Place.

September 22nd.—Corporation. Two mixed-pressure steam turbines and direct-current generating plants, each of 1,500 KW. capacity. See "Official Notices" August 22nd.

Egypt.—October 31st. Egyptian Ministry of the Interior. Machinery and plant required for the installation of electric light in the town of Damanhour.

Germany.—September 20th. The Prussian State Railway authorities at Konigsberg are inviting tenders for the supply and erection of several electrically-operated high-pressure pumps.

Lancashire.—September 9th. Tell-tale clocks, telephones, electric clocks and fire alarms, for the Visitors for Whalley Asylum. See "Official Notices" August 22nd.

London.—L.C.C.—September 1st. Electrical installation (100 lighting points), for the Royal Hill Central Elementary School, Greenwich, S.E. See "Official Notices" August 15th.

September 23rd.—Main high-tension switchgear, including the reconstruction of existing main high-tension switchgear, at Greenwich generating station. See "Official Notices" August 22nd.

Manchester.—September 2nd. The Corporation Tramways Committee invites offers for scrap materials as follows:—Copper, gun-metal and brass; cast-iron, wrought-iron and steel; steel girder rails; points and crossings; rubber, wood, deals, &c.; lamp tops, spent dry cells, &c. Forms from Mr. J. M. McElroy, general manager, Piccadilly.

September 3rd.—Electric light fittings at the Municipal School of Domestic Economy, High Street, Chorlton-on-Medlock. Specifications, &c., obtainable from Director of Education, Education Offices, Deansgate. Deposit £1 1s.

Roumania.—September 4th. The municipal authorities of Tecuci are inviting tenders for the establishment of a central electric lighting station in the town.

Skewen.—September 1st. Electric lighting installation at the Free Library, for Coldfranc Parish Council: The Librarian.

South Africa.—September 10th. Supply and delivery of electric bed lifts, New Hospital, Port Elizabeth.

Spain.—September 11th. The municipal authorities of Castellon de la Plana are inviting tenders for the establishment of a central electric lighting station in the town, and for the laying of supply mains both in Castellon and De Grao.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear, for the Corporation. See "Official Notices" August 1st.

Warrington.—September 9th. The B. of G. invites tenders for electrical sundries required at the Workhouse, or the Cottage Homes, from October 1st, 1913, to March 31st, 1914. Forms from Arthur Bottomley, clerk, Bewsey Chambers,

West Ham.—September 4th. Electrical fittings for six or 12 months, for the B. of G. Mr. Thomas Smith, Clerk, Union Road, Leytonstone, N.E.

Wimbledon.—September 1st. One 1,500-KW. turbo-alternator, condensing plant, auxiliaries, and 20-ton crane, for the Corporation. See "Official Notices" August 8th.

CLOSED.

Australia.—TASMANIA.—The P.M.G.'s department has placed the following contracts:—Various telephone cables, British Insulated and Helsby Cables, Ltd., Melbourne; battery parts and materials, India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Melbourne; jointing sleeves, F. B. Cook, Chicago; 5 miles wire, twisted pair, Theodore Zwicker & Co., Melbourne; 5 miles wire twisted pair, and 20 miles wire V.I.R, Armorduct Manufacturing Co., Ltd., London; 5 miles cable, two-wire V.I.R., Callender's Cable and Construction Co., Ltd.; 490 protectors, British General Electric Co., Ltd., Melbourne; telephone supplies, J. Bartram & Sons Pty., Ltd., Melbourne; copper tapes, jointing sleeves, G.I., bronze and steel wire, F. Vanderkelen & Co., Melbourne; copper binders, India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Melbourne.

QUEENSLAND.—The P.M.G.'s Department states that the contract for copper tapes, announced in June as given to the Australian Metal Co., Ltd., has been placed with Messrs. Brabant & Co., Brisbane.

CANBERRA.—The Department of Home Affairs has ordered the electric protective apparatus for the overhead lines in connection with the power supply for Canberra from the Australian General Electric Co., Melbourne.

WESTERN AUSTRALIA.—The Postmaster-General's Department has placed orders for metal-filament lamps with Messrs. Dick, Kerr and Co., Ltd., Sydney, and for various telephone cables with the Imperial Electric and Engineering Co., Perth.

A contract for 20 miles of tinned copper wire, rubber-insulated, at £3 19s. per mile, has been placed with Messrs. W. T. Henley's Telegraph Works Co., Ltd., Melbourne.

The Public Works Department has ordered an electric lift for the Perth Hospital, at £428 16s., from Messrs. Unbehaun & Johnstone.

VICTORIA.—The town of Northcote has placed a contract for underground electric cable, at £1,015 with Messrs. W. T. Henley's Telegraph Works Co., Ltd.

The Melbourne Electric Supply Co., Ltd., has placed an order with the A.E.G., of Berlin, for two 5,000-KW. turbo-generating sets.—*Tenders* (*Australia*).

NEW SOUTH WALES.—Three 82-K.V.A. motors for Newcastle workshops, Walsh Island, have been ordered from the Australian General Electric Co.—*Australian Mining Standard.*

Belgium.—Four German concerns and one each Belgian and French last week submitted tenders to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cables in the Namur district, the lowest offer being that of the A.E.G.-Union Electric Co.

Eccles.—The Corporation has accepted the tender of Triumph Stoker, Ltd., Leeds, to equip four boilers with the "Triumph" mechanical stoker.

France.—The results of the adjudication on the tenders sent in on July 20th for telephone and telegraph material for the French Government were: Lots 1 to 4, wall apparatus, Association des Ouvriers en Instruments de Précision, 57·95 fr. each. Lot 5 and Lots 6 to 10, 1,000 wall fixtures, no adjudication. Lots 11 to 13, 1,000 portable apparatus, the same tenderers, at 49·95 fr. each. Lots 14 to 18, 2,000 combined apparatus, type 1910, Compagnie Générale de l'Electricité: Lot 16, 9·98 fr.; Lot 17, 9·48 fr.; and Lot 14, 9·98 fr. Lot 19, 3,000 combined apparatus, type 1910, no adjudication. Lots 20 and 21, 2,000 magnetic coils, Compagnie Générale de l'Electricité: Lot 20, 23·50 fr.; Lot 21, no adjudication. Lots 22 and 23, 15,000 telephone receivers—Société Ind. des Téléphones, Lot 22, 3·99 fr.; Société Française des Téléphones, Système Berliner, Lot 23, 3·96 fr. Lots 24 to 26, 6,000 microphone capsules, Compagnie Générale d'Electricité: Lots 24 and 25 at 1·48 fr., and Lot 26, 1·43 fr.

The results of the adjudication on the tenders returnable on July 31st for 8,000 telephone panels for the French State Railways was in favour of the firm of Wich, of Paris, at 9,400 fr.

Glasgow.—The Tramways Committee recommends acceptance of the offers of the Lorain Steel Co. and Hadfield's Steel Foundry Co. for special track work.

Keighley.—The T.C. has accepted the tender of Messrs. E. Bennis & Co., Ltd., Bolton, (£130) for a Bennis stoker for the electricity works.

Liverpool.—Messrs. Fred Wilkins & Brother, Ltd., Liverpool, have obtained the contract for the electric lighting of the new Arts Building at the Liverpool University.

London.—In connection with the South-Western Railway electrification, 16 Lescole electric distance thermometers have been ordered from the Lescole Co., Ltd., for superheat readings on the boiler fronts at the new power station.

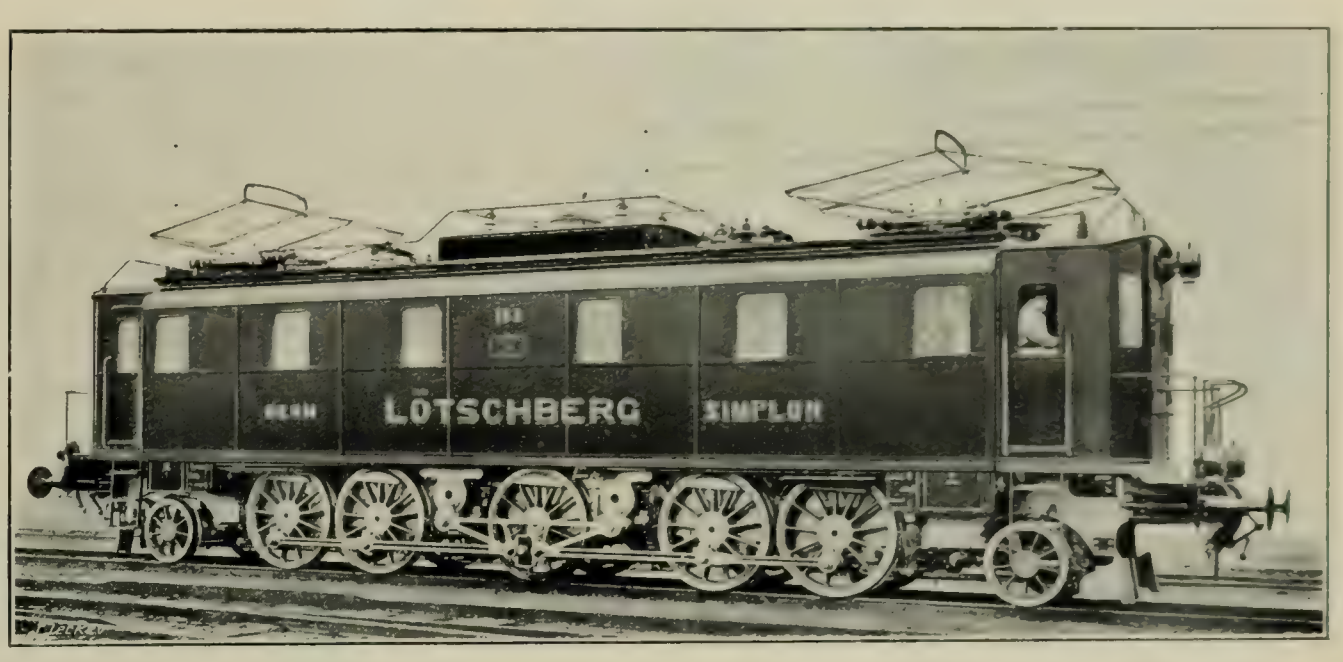
(*Continued on page* 345.)

ELECTRICAL LOCOMOTIVES OF THE LÖTSCHBERG RAILWAY.

[BY OUR BERLIN CORRESPONDENT.]

The recent opening of the Lötschberg Railway marks an important event in international railway working, as the line affords a more rapid connection between Italy on the one hand, and Western Europe on the other. The new railway appeals especially to electrical engineers in view of the fact that electric traction has been adopted at the outset, the locomotives used being not only the largest electrical locomotives so far constructed, but, generally speaking, the most powerful locomotives in the world.

It will be remembered that experimental operation on the Spiez-Frutigen section showed the suitability of the single-phase system for the operation of trunk railways, and electrical operation was definitely introduced in 1910 on this portion of the Lötschberg Railway, the trolley line pressure being 15,000 volts, and the periodicity, 15 cycles. The Oerlikon Co. supplied the first locomotive with an output of 2,000 H.P. during an hour's working at a speed 42 km. per hour, and this was equipped with two motors each of 1,000 H.P. The satisfactory results obtained with this locomotive during the last two years induced the railway company to entrust the Oerlikon Works with the design of 13 locomotives equipped with motors of even greater power, for the through service on the Thun-Spiez-Brigue Line; the electrical part of these locomotives was to be supplied by the Oerlikon firm jointly with Messrs. Brown, Boveri, and the mechanical part by the Swiss Locomotive Works.



2,500-H.P. Single-phase Locomotive for the Lötschberg Railway.



Locomotive and Train, Lötschberg Railway.

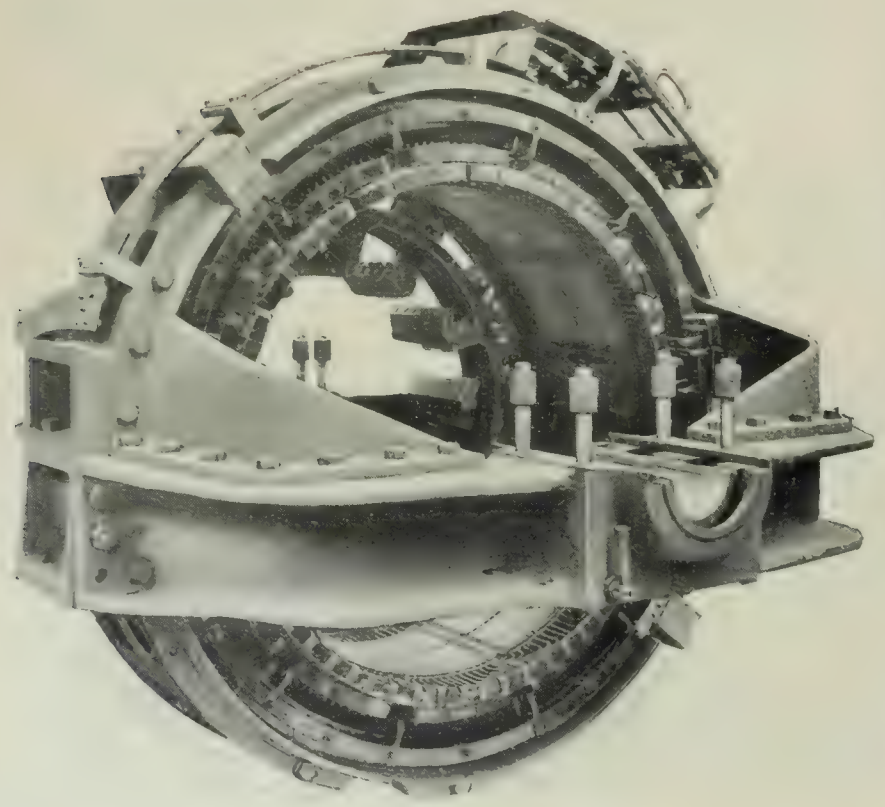
These new locomotives, of which some interesting particulars appeared in our issue of July 12th, 1912, are designed to develop 2,500 H.P. during 1½ hours' uninterrupted service, at a speed of 50 km. per hour, and have five coupled axles and two free axles. The pull on the drawbar at normal speed is 10,000 kg., which suffices for hauling a train of 310 tons over a gradient of 27 per cent., or a train of 530 tons over a gradient of 17 per cent., at a speed of 50 km. per hour, the pull at the wheel circumference being 13,500 kg. The maximum speed has been fixed at 75 km. per hour. The locomotives are able in starting to develop a pull 30 per cent. above the normal figure, that is, of about 18,000 kg.

As regards the mechanical part, the longitudinal frame carries the body of the locomotive, which comprises three compartments, viz., the engine room and the drivers' cabins, which are separated from the former by partition walls and doors. In order to ensure the greatest possible freedom on curves, the central (driving) axle has been given a side-play of 25 mm.; the two inner coupled axles are located rigidly in the frame, and each of the two outer ones, having a side-play of 40 mm., is connected with the corresponding free axle, thus forming what is called a Krauss-Winterthur bogie. In the case of the free axle an even greater side-play has been provided, thus allowing curves of only 120 m. radius to be negotiated in spite of the considerable length of the locomotive. The central axle has spiral springs and the coupled and free axles plate springs.

The hand brake in each driver's cab acts on the free and coupled axles situated near by and on a brake block on the driving axle. In view of the considerable gradients on the line, the locomotives have been equipped with the Westinghouse automatic brake and a regulating brake. From

the driver's platform are also controlled the whistle and sanding device which, like the collector bow, and part of the safety devices, door locks and ladders, are operated by compressed air.

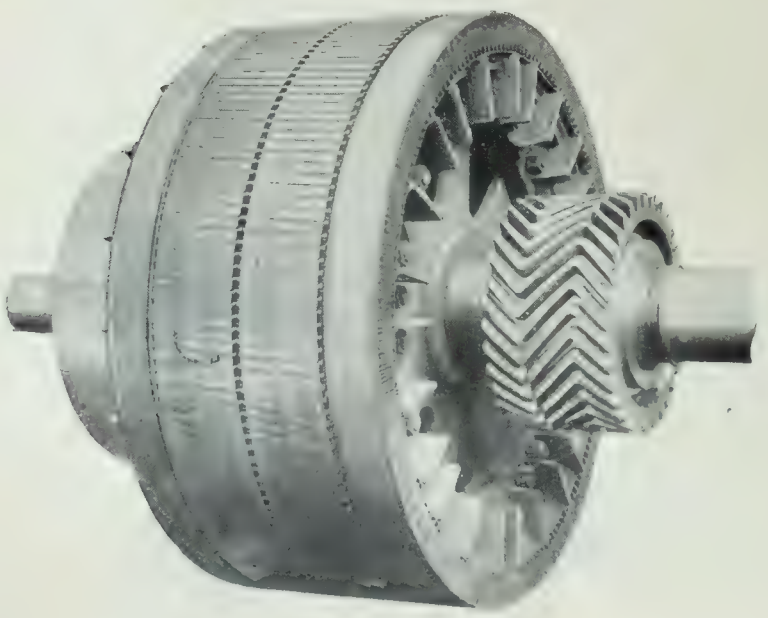
All the electrical equipment has been duplicated, thus allowing the locomotive to be operated with half of its equipment, that is, with one transformer and one motor and accessories. Provision has also been made for the two halves of the equipment to work either in series or in



Stator for 1,000-h.p. Motor on Experimental Locomotive.

parallel, the two motors being fed from either transformer, so that the locomotive will, for instance, develop its full tractive effort with a single transformer and controller, and both motors arranged in series, and be able permanently to keep up its full speed with one motor.

The current goes from the 15,000-volt line through the two bow collectors over two choking coils, to the two halves of the electrical equipment, viz., through two high-tension oil switches to the two transformers and two earthing slip-rings fixed on the rigid axles, to the rails.



Rotor of 1,000-h.p. Motor on Experimental Locomotive.

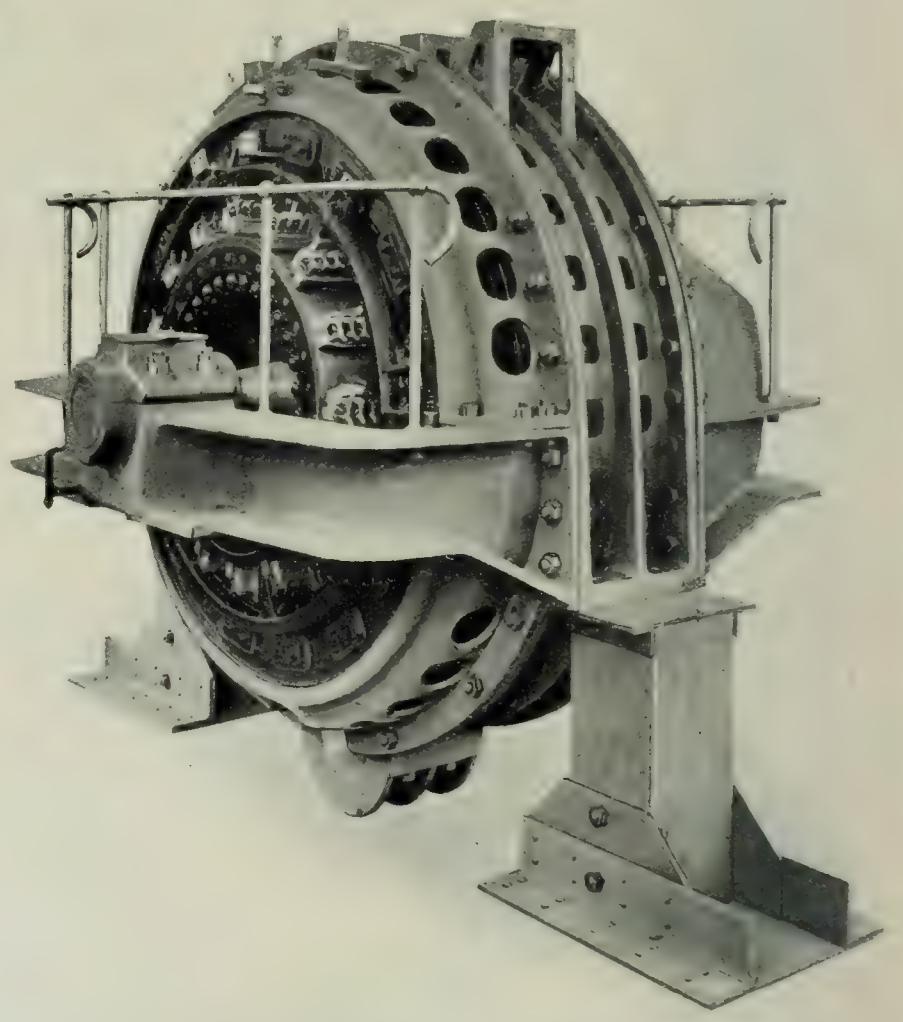
The high-tension oil switches allow the whole of the machinery to be switched off. For the sake of safety there have been fitted on both sides of the oil switches, earthing switches which are closed while the doors of the high-tension compartment are kept open.

The transformers are air-cooled, the low-tension coils having 12 tappings for controlling the speed. A special fan fitted to each transformer ensures thorough cooling.

In operating the controller, perfectly smooth starting with a practically constant pull is obtained, on account of the low pressure difference (45 volts) between the various steps, the power factor being about ·95 with all loads at normal speed. These favourable starting conditions are, of course, of the utmost importance to the power station supplying the line, especially during the simultaneous starting and shunting of several trains.

Fitted on the transformer, and combined with it, is the controller, the contacts of which are connected directly with the low-tension windings of the transformer. All parts of the switch subject to wear are readily exchangeable. Current interruption proper takes place on a secondary drum with magnetic spark damping, whereas any alterations in the connections of the main-switch drum occur under no-voltage conditions. The switching is effected mechanically by a small auxiliary motor fed with direct current, which, through the intermediary of a wormgear, actuates a pawl mechanism. The pawls are controlled by electromagnets energised from the driver's platforms. According as one or other of the pawls is actuated, the switch drum will rotate in either direction, thus making or undoing the connection.

These controller switches, as well as the low-tension oil



Oerlikon Motor for 2,500-h.p. Lötschberg Locomotive.

switches, are designed for a maximum current of 3,600 amperes.

The two motors, each designed to give 1,250 h.p. on the rails during $1\frac{1}{2}$ hours' uninterrupted operation, are of the Oerlikon compensated series type, rigidly fitted into resilient frames. They drive through tooth-wheeled gearing with a ratio of 1 : 2·23, fitted into the motor housing, on to the motor shaft, which is a loose axle connected by the driving gear to the coupled driving axle. The cranks of the two main shafts of the motors are connected by a triangular rigging to the cranks of the driving axles. This arrangement avoids practically any non-resilient part, the spring action in the triangular rigging with the central driving axle being accommodated by a vertical rubbing plate.

The motors are of the 16-pole open type, the air being allowed free access everywhere. They are fed at a maximum pressure of about 430 volts, and are designed to absorb about 3,000 amperes, at their maximum output. A ceiling fan fitted above the motors ventilates the whole of the motor compartment. This motor system which has also been used in connection with the 2,000-h.p. experimental locomotives previously referred to, shows most favourable

starting conditions, thus greatly facilitating the shunting of the locomotives. In starting at full power, the locomotive only requires about a third of the normal overhead line current. Another advantage of this system is its practical independence of the number of cycles and of any speed limitation by synchronous number of turns. The normal speed of the locomotive is reached with four times the synchronous number of turns of the motors. The power and speed of the motor are also independent within wide limits of the overhead line voltage, any considerable drop in the line voltage being compensated by suitable transformer winding, while the motor with only one-third of its normal voltage, is able permanently to develop its full power. This provides for great overload capacity of the motors at normal pressure.

Fitted direct on to each motor and electrically connected with it, is the controller for reversing the direction of travelling. This alters the current direction in the exciter coil, and is controlled through electro-magnets from the driver's cabin. In case of emergency these controllers, as well as all the remaining apparatus, can be operated by hand.

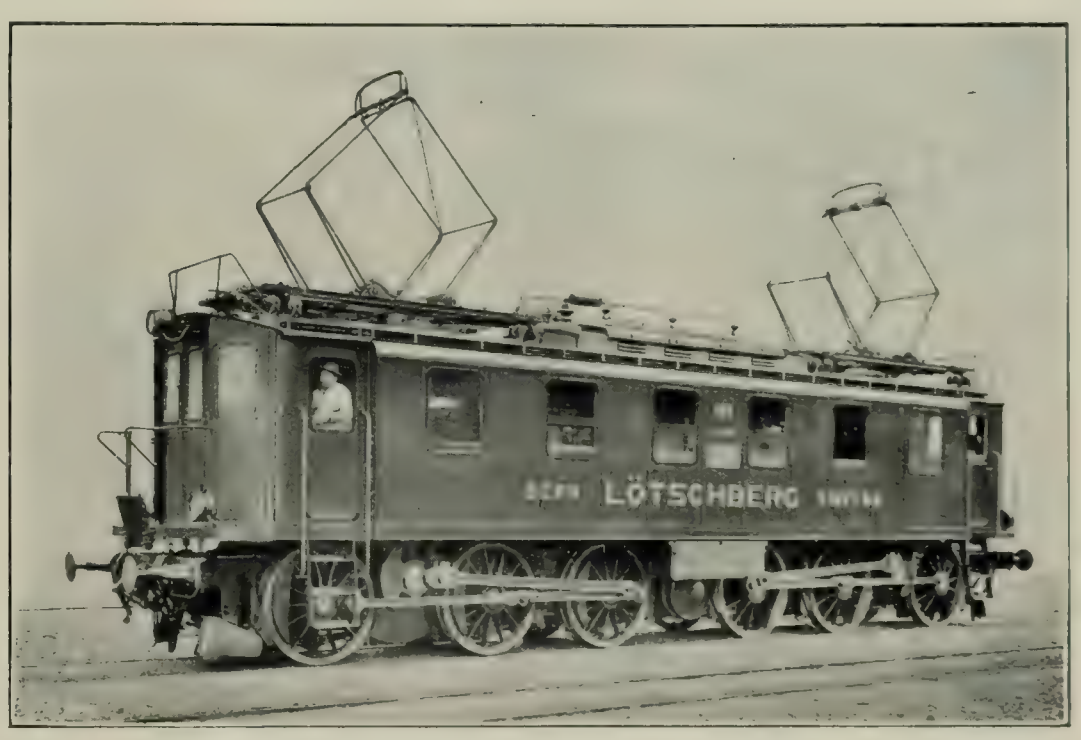
Current for the auxiliary motors and for heating, can be derived from either transformer by means of switch fuses, the heating current being switched in from the drivers' platforms.

A converter set supplies continuous current to the remote control and the lighting, in parallel with four ordinary train lighting batteries, and is also controlled from the driver's cabin. All the requisite switches and instruments are installed in the drivers' cabins.

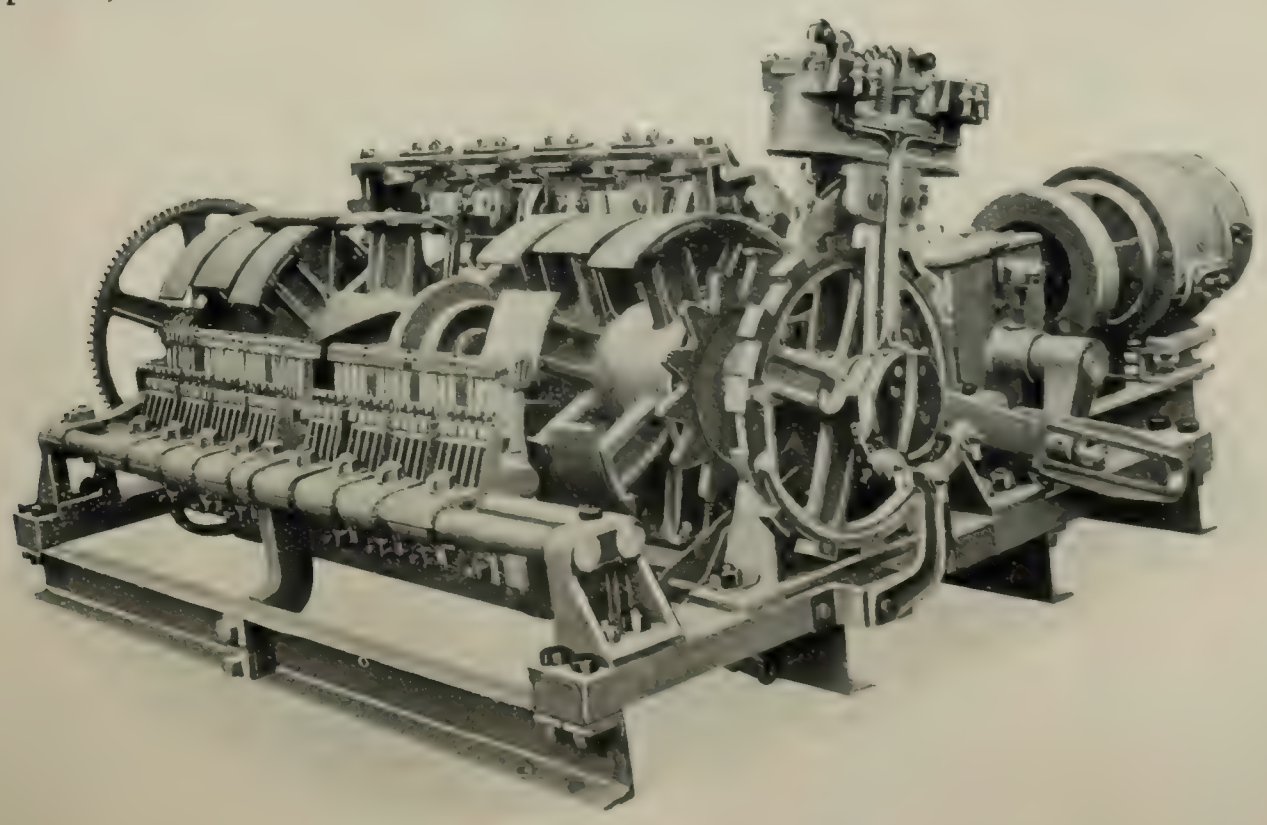
The two high-tension compartments in the motor room of the locomotive are closed by lattice-work doors, which are so locked that the high-tension circuit in front of and behind the high-tension oil switch has to be earthed before opening them. The key used in undoing this lock is arranged on a tap connected to the bow air conduit and cannot be removed unless the tap is opened, thus causing any air in the bow conduit to be discharged. This key cannot be withdrawn from the lock before closing all the doors, thus preventing the high-tension compartment from being opened while "alive." Means have also been provided for the oil switches to be operated by hand only while under no-voltage. In order to keep the operator informed of the actual position of the apparatus in the case of hand operation, signal lamps have been provided for the controller and direction of travelling. The folding ladders for climbing to the roof are mechanically connected with alarm whistles, which are actuated in the event of there being any compressed air left in the bow air conduit on lowering a ladder.



Entrance to Tunnel, Blausee-Mitholz Station.



2,000-h.p. Experimental Single-Phase Locomotive, Lötschberg Railway.



Motor-Operated Controller, 2,500-h.p. Lötschberg Locomotive.

The following is a summary of the principal data :—

General data: Single-phase alternating-current system, 15,000 volts and 15 cycles per second.

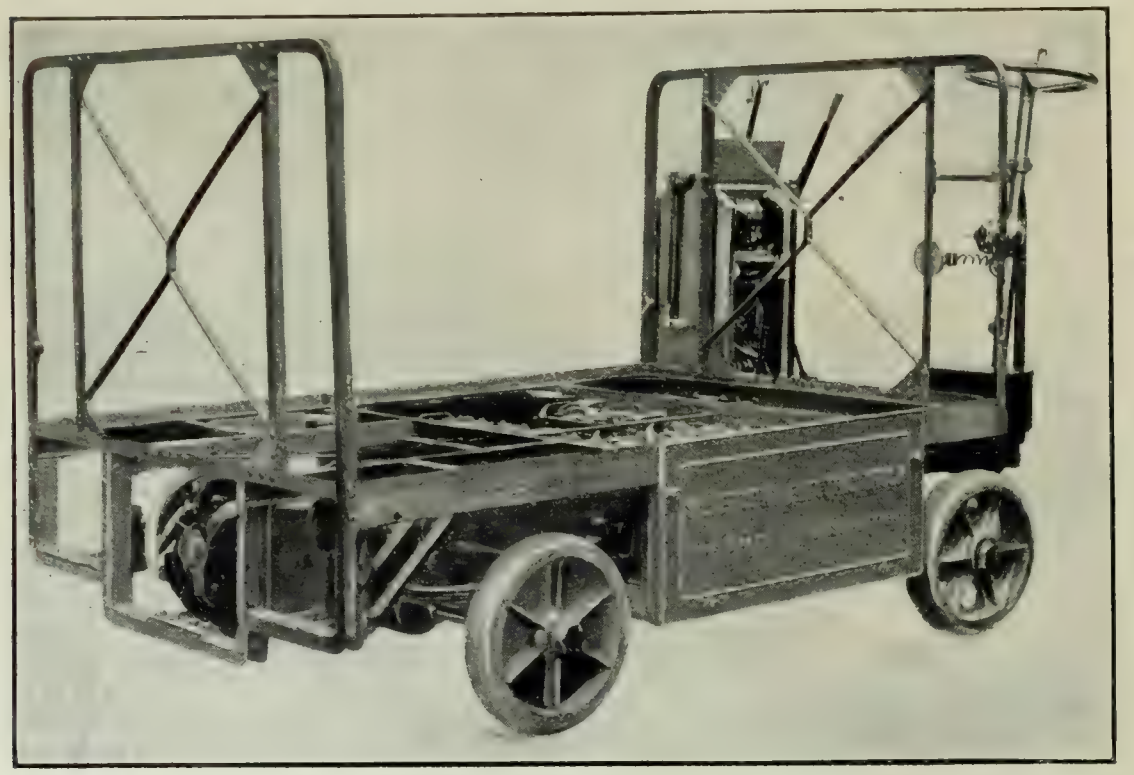
Gauge, 1,435 mm.; maximum gradient, 27 per mille.

The principal data of the locomotives themselves are as follows: Maximum

length between buffers, 16,000 mm.; total wheelbase, 11,340 mm.; rigid wheelbase, 4,500 mm.; diameter of driving wheels, 1,350 mm.; diameter of free wheels, 850 mm.; maximum axle weight, 16·6 tons; friction weight, 78·2 tons; total weight, 104 tons; output during 1·5 hours, 2,500 H.P.; pull on wheel during 1·5 hours, 13,500 kg.; speed for 1·5 hours, 50 km. per hour.

AN ENGLISH-BUILT ELECTRIC TRUCK.

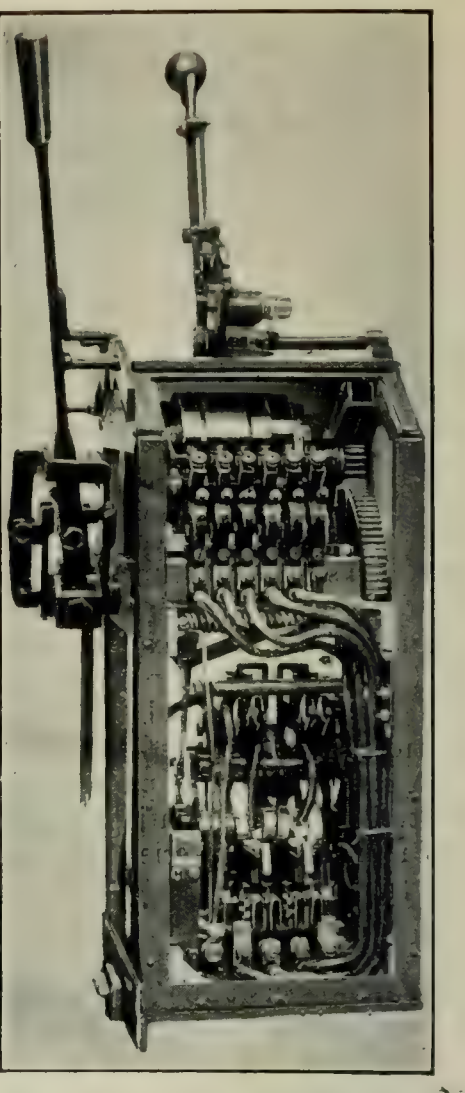
The fact that electrically-propelled vehicles are coming to the front in Great Britain, is shown by the recent construction of electric trucks by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., in regard to which some details may be of interest. The truck frame is built up of channel and angle steel riveted together with cross members and stays arranged so as to give ample strength for the load to be carried, and to withstand the road shocks without undue weight. The two side members running continuously from end to end are bent so as to form a pocket to take the battery, and the spring shackle brackets are fixed to a point at the bottom of the battery box so as to take the weight of this part without straining the frame. The latter has an extension at the front end to take the driver's platform, and steel angle ends with easily detachable side rails running from one end to the other in order to secure the load.



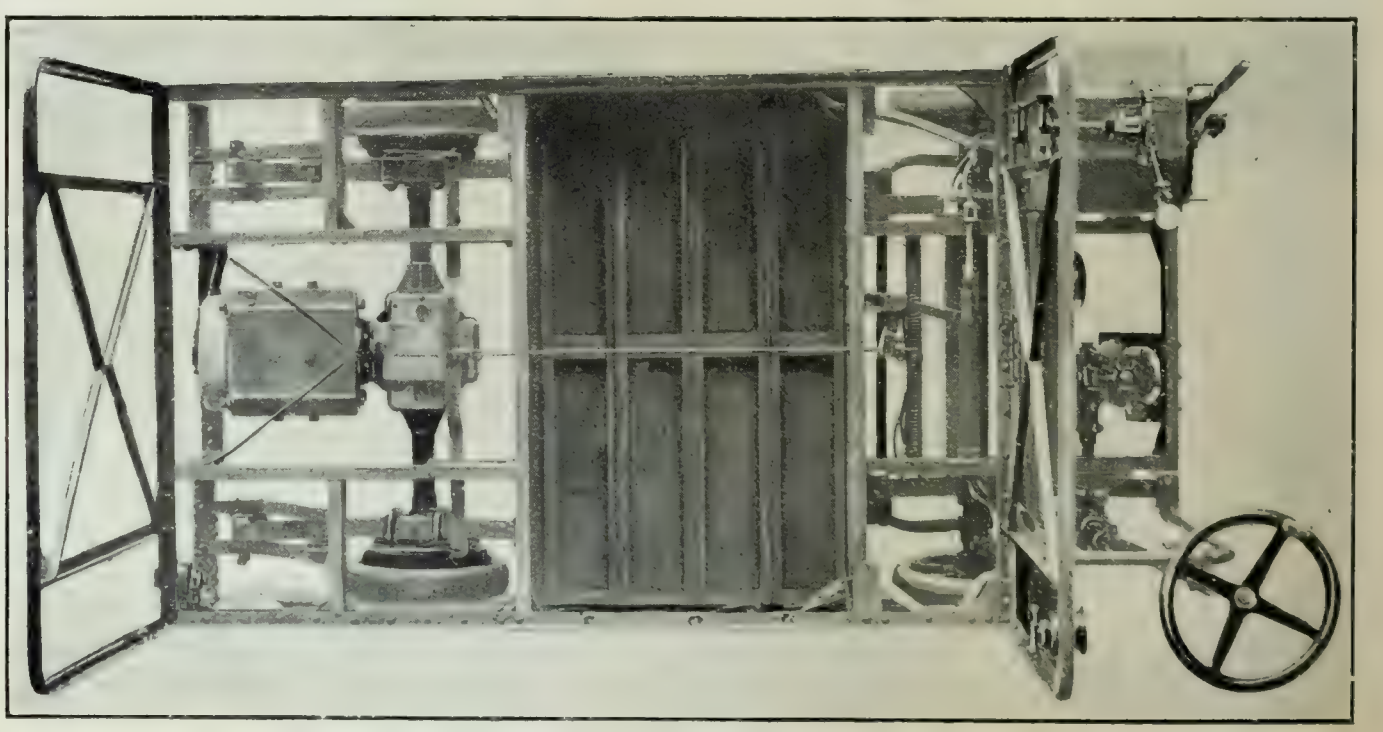
General View of Silvertown Battery Truck.

The floor boards which are let into a rectangular channel frame are divided into three parts to allow of convenient removal. The central part covers the battery, the end pieces covering the motor and back axle and the brake adjustments and front axle respectively. The motor is of the four-pole series-wound type with the armature run on ball bearings. The normal rating of the motor is 16 amperes, 40 volts, at 1,430 R.P.M.; it will, however, take a 300 per cent. overload for short periods without injury. The motor is dust and waterproof, but by removing one nut a large aluminium cover can be removed in order to give access to the commutator and brush gear. The connections from controller to motor are made by four sliding spring contacts mounted on one base; these are so arranged that if they have to be removed at any time they can only be replaced in their correct positions.

The motor is bolted directly to the gear-box of the back axle and supported on a hinged bracket fixed to the rear cross member. The springs connecting the rear axle to the frame are shackled at both ends and mounted on free spring saddles, so that the motor acts as a combined torque and radius rod. The drive is taken from the motor by a bevel pinion on the end of the armature shaft gearing into a crown bevel wheel mounted on the outside of the balance gear-box, and thence by a spur wheel reduction to the driving shafts, which do not have to carry any weight, but simply transmit the drive to the road wheels. The rear axle casing is built up with a centre steel gear-box, having weldless steel tubes extending through either end carrying the spring saddle, the brake gear brackets and the road wheels. The latter are steel castings, the rear wheel being cast complete with the brake drum. The gearing and road wheels run on ball bearings. The brake shoes are compensated, the brake being applied from a compensating



Controller for Battery Truck.



Silvertown Truck Arrangement from Above.

bar by a rod running through the centre of the truck. The whole of the back axle, motor and gearing forms a complete self-contained unit and leather and felt washers are used to prevent dust from entering the gear or grease exuding from it. The steering pivot is a hardened-steel pin working in hardened-steel bushes, and the weight is taken on large ball thrust washers. The steering is operated by a steering wheel on the driver's right, and the steering gear is irreversible, being of the worm and worm-wheel type. One handle operates the controller and mechanical brake, and is so arranged that the brake cannot be put on unless the controller is in the off position. Another handle operates the switch having forward, electric brake and reverse positions. This switch is interconnected with the controller so as to allow the electric emergency brake to be applied irrespective of the position of the controller, but movement cannot be made from the forward to reverse positions, or *vice versâ*, unless the controller is in the off position.

The controller drum is built up of gun-metal segments, the controller brushes having renewable contact surfaces. The brush holder is designed so that the current passes to the cable thimbles through flexible copper braid, and the controller cannot be moved from one position to another without the current first being broken on a carbon switch. This prevents sparking on the controller segments and brushes, and overheating troubles arising therefrom.

In order to prevent any unauthorised person from handling the truck when the driver is away, a screw plug is provided which, when removed from the car, locks the reversing switch in the electric brake position, in which position the main switch is held open. This same plug has to be inserted in another position in the car before any charging can be done. The truck illustrated has an overall length of about 7 ft., and a width of about 3 ft. 10 in. The clear platform space for goods is 5 ft. 8 in. × 3 ft. 9 in. The wheelbase is 4 ft. and the track 3 ft. 4½ in. The truck was designed to take a 10-cwt. load, and weighs complete with the battery, but without load, 14·5 cwt. The truck has been tested with 14-cwt. loads up gradients of 1 in 5, which it negotiated quite satisfactorily. We understand that a truck of this design has been constructed for the requirements of the General Post Office, and the type is adaptable to special designs for individual requirements, and for different carrying capacities. The trucks can also be adapted to run on rails.

WIRELESS TRAIN CONTROL.

The Prentice Automatic System.

The majority of the systems hitherto proposed for automatically controlling railway traffic have necessitated the employment of ramps and track contacts on the line, together with such mechanical contrivances as tripping levers on the locomotive or the carriages. Others have depended either partially or entirely on magnetic action, and have been electrically worked either directly or by induction. In most methods of inductive signalling hitherto proposed, a momentary warning is given to the signalman in his box as the train passes. Automatic inductive signalling systems have been devised which have answered more or less well in practice, but in almost every instance it has been found necessary to make use of heavy currents in the transmitting circuit which have had a disturbing influence on neighbouring telegraph and telephone systems, thus rendering it impossible to employ them under modern conditions where a large amount of traffic has to be dealt with.

An arrangement has been come to with the London and South-Western Railway whereby the Prentice automatic system of wireless train control is being exhaustively tested on the branch line to Hampton Court. This is not the first test which the new method has undergone, as it has already been installed on a portion of the permanent way of the Canadian Pacific Railway, where it has been found to work satisfactorily.

The chief requirements of an automatic signalling system are that it should give the required indication positively, or if a "normal clear" indication is allowed there must be adequate safeguards ensuring a danger intimation in the event of any failure occurring, or adverse influence being at work. The apparatus on the track must not be affected by any climatic or atmospheric conditions which may obtain; the apparatus on the engine must give a continuous indication as long as the section ahead is blocked, and the system must provide for a direct intimation as soon as "line clear" conditions are restored, whether a train has reached the end of the obstructed section or is still running under control at normal or reduced speed. The apparatus must also allow the driver reasonable freedom as regards controlling his train, and although fixed signals may continue to be employed, the system must satisfy the conditions which would exist were they dispensed with. The apparatus, both transmitting and receiving, must be devoid of complication and reliable, and it is claimed that the Prentice system fulfils all these requirements.

Briefly, it is a method of communicating between the permanent way and the engine cab, which is carried out by means of apparatus similar to that used in ordinary wireless telegraphy. There is no direct electrical connection between the locomotive and the rails, and the connections are such, that as long as the line is free from other traffic, the high-tension current is maintained, and a "line clear" indication given to the driver; should a section ahead, however, be occupied, by means of a track current the oscillating current is broken, and not only are audible and visible signals given to the driver by means of a red light and a buzzer in the cab, but the brakes are applied.

The system includes an ordinary track circuit arrangement, whereby the presence of a train or engine in a section short-circuits a relay; a high-frequency plant, the current from which is controlled by the track circuit relay, and a wave wire of silicon-bronze strung on insulators and protected by troughing of creosoted wood, placed in the centre of the track, for the high-frequency current. An arrangement of antennæ, consisting of a frame on which a number of wires are strung, and termed a "harp," is fixed beneath the engine, and it is by means of this that the radiant energy from the wave wire is received on the engine.

There is also a coherer and a decohering device and relay in synchronism therewith, and a "time" relay to cover the time for decoherence, whereby a continuous holding action is realised as long as radiant energy passes from the wave wire. There is also a master relay and devices whereby the release of the master relay by the cessation of the high-frequency current, causes the exhibition of the danger signal on the engine, the application of the brakes, and the sounding of the audible alarm.

The track circuit is supplied from any suitable source of supply through the transformer. In the experiments witnessed by the representative of the Electrical Review, 110-volt 60-cycle alternating current was used. The secondary is connected to the running rails which are devided into sections of convenient length by insulated joints. The track circuit of one section passes through the relay of the section behind, so that the presence of a train or vehicle causes short circuiting and releases the relay for the section in which the alarm is to be given. The primary of the high-frequency plant is controlled by the relay, and the apparatus consists of transformer, spark-gap, condenser and helix. From the description it will be seen that the wave wire continues to receive high-frequency current unless the de-energising of the governing track circuit relay, by short circuiting, puts the plant out of action.

On the engine the radiant energy from the wave wire is collected by the harp and passes to the coherer, which is continuously rocked by means of a solenoid and a co-operating latch device, the oscillations being at the rate of 80 per minute. The relay which works in synchronism with the coherer is closed when the waves break down the resistance of the coherer, and opened when they cease to act. This causes the master relay to act which controls the solenoids operating the whistle and brake and the lighting of the danger lamp in the cab of the locomotive. The holding relay is provided with a push button whereby the driver

can release the brakes to control the running of the train at discretion through the remainder of the section, but he cannot shut off the red light or stop the blowing of the whistle or the sounding of the buzzer. When the section ahead becomes clear the corresponding track circuit relay is again actuated, re-establishing the high-frequency circuit and restoring the indicator, brake and whistle to the normal "line clear" conditions. It is claimed, and certainly the experiments witnessed by our representative bear out the contention, that the installation meets all requirements as regards safeguards against the non-observance of signals under any conceivable conditions.

REVIEWS.

Wiring Diagrams of Electrical Apparatus and Installations. London : Hill Publishing Co. Price 8s. 4d. net.

This volume contains a fairly complete collection of connection diagrams illustrative of practically all branches of electrical engineering, with the exceptions of telegraphy, telephony and armature windings.

Some of the diagrams are of the most elementary character, whilst others are representative of the latest modern practice. Many of the diagrams are not at all new, but these have been apparently included for the benefit of the switchboard attendant and the like. As the authors state, the reader will obtain information from the book in proportion to his previous training and experience.

The scope of the volume is really remarkable, extending as it does from quite simple generator diagrams, burglar alarms, &c., to the really complex multiple-unit traction diagrams.

The book is well printed, the figures (439 in all) being very clear and to a good scale. The text is reduced to an absolute minimum, being, in fact, practically only a title, the idea being to make the diagrams self-explanatory.

After several laborious hours spent in checking the more extensive diagrams, we are able to say the book is accurate —a most important condition, of course, for a work of this character. The volume should fulfil a useful purpose.—H. G. S.

Wireless Telegraphy. By C. L. Fortescue. Cambridge University Press. Price 1s. net.

The author's aim has been to inform the reader (possessed of a general scientific knowledge) of the accomplishments of "wireless," and the means by which they are obtained. The first four chapters of the work are devoted to an explanation of the electrical terms and apparatus involved; hydraulic and mechanical analogies are used freely and with unusual clearness and accuracy. The author's excellent sketches and clear phraseology should make clear, even to lay readers, the general nature of electromagnetic induction and electrostatic capacity and oscillations. The treatment of the latter is particularly clear, and the reader is neatly led up to an appreciation of resonance, tuning and interference. Chapter III—dealing with electromagnetic waves—includes a number of striking analogies, among which is one giving a rather more accurate conception of electromagnetic radiation than does the time-honoured pond-ripple analogy. Wave-length and methods of varying it are discussed, and in Chapter IV the phenomena of absorption, as affected by light and darkness and atmospheric conditions, &c., are dealt with as lucidly as is possible in the present state of knowledge. The author favours the hypothesis that waves are reflected and refracted on passing from one layer of the atmosphere to another more or less completely ionised. In connection with the avoidance of trouble due to atmospherics, the author refers to the Marconi differential arrangement of two rectifying detectors.

Chapter V deals with transmitting circuits, and the reader is led rapidly from a consideration of the original plain aerial to the more efficient coupled aerial working with a rotary spark-gap. The principle and advantages of the quenched spark are explained, and an excellent *résumé* of the Poulsen and high-frequency alternator systems is given, though, of course, in general terms.

Chapter VI is devoted to receiving instruments, chief among which are naturally various forms of detectors. No attention is paid to the actual apparatus used for tuning nor, indeed, is the actual form of any apparatus illustrated and described in detail. A number of line drawings are included in the illustrations, and though these are only diagrammatic, it is a pity that several of them about this point should be carelessly drawn. Their very simplicity renders the crudity of their execution less excusable.

Chapter VII and the remainder of the book is devoted to a general survey of the uses to which wireless telegraphy is now applied. Wisely enough, the author has not indulged in prophecies, but it is stated that the Marconi Imperial stations will be erected. The uses of wireless on board ship lend themselves to very interesting treatment. It is estimated that nearly 5,000 lives have already been saved by this agency. The operator of the *Republic* hardly achieved "notoriety" by his exploit. A point which may not have occurred to readers is that the repair ships of submarine cable companies are now instructed as to their movements by wireless—a state of affairs very analogous to the installation of electric lighting in gas works.

It will be remembered that the 1912 conference suggested that the operator or other competent person should listen (for distress signals, &c.) for the first 10 minutes in every hour—consider the effect of this on even a five-day voyage, assuming the duty to devolve entirely upon the operator. A reliable call-device is badly needed.

In the later chapters of the book, the Marconi and Telefunken ship stations are well described. Chapter VIII on Land Stations is little more than a readable list of the chief land stations of the world. In the following chapter the author compares the relative merits and prospects of cable and wireless telegraphy. The services rendered by wireless in the development of South America deserve the mention which they receive.

We agree with the author's views as to the great risk of using wireless for naval communications during manœuvres or in time of war. This danger was actually illustrated during the Russo-Japanese conflict. The chapter on wireless for air craft is interesting and satisfactory. The same can be said for the chapter on wireless telephony, and we are inclined to share the author's pessimism concerning the probability of any startling advances in this field in the near future. The volume, which is well worth the price asked, concludes with an historical survey and an excellent abridged bibliography and index.

Prüfungen in Elektrischen Zentralen. By Dr. E. W. Lehmann-Richter. Part I. Second Edition. Brunswick : Fried. Vieweg & Sohn. Price 20 M.

This comprehensive volume should prove of value as a reference book to central-station engineers and others interested in the control and maintenance of electrical plant of every description. The writer is a well-known consulting engineer, who has had ample opportunity to collect data as to the performance and test results to be expected from modern steam and electric machinery, and the book embodies the results of this experience, together with numerous fully-worked and tabulated test figures obtained in actual practice. By the plentiful use of worked examples in this way even non-technical readers, or at least those unacquainted with the *minutiæ* of electrical design, are enabled to follow the whole test fairly readily, although, no doubt, in some cases a little more detail as to the method of actually making the test would be an advantage.

Practically the whole plant of an electric supply station is covered, including boilers, steam piping, steam engines, gas and oil engines, gas producers, mechanical and electrical power transmission, pumps, continuous and alternating-current generators and motors, transformers, accumulators, distributing networks, arc lighting installations and electricity meters.

Besides these there are useful chapters on the economical use of exhaust steam for heating and other industrial purposes, on the use of electricity in agriculture, on photometric measurements and on electricity supply for special

purposes such as X-ray work, ozone preparations and the manufacture of bleaching powder.

The treatment given to the various parts of the subject is a little unequal, and it is doubtful whether the rather detailed theoretical information given about some of the apparatus is necessary in a book like this, which does not profess to take the place of text-books on design. On the other hand, some particulars as to the testing of steam turbine plant should have been included.

On the whole, however, the book is clear and to the point, and the good illustrations and the complete index add to its value for reference purposes.

Fire Protection in Buildings. By H. G. Holt. 1913. London : Crosby Lockwood & Son. Price 8s. 6d. net.

A number of buildings for the use of electrical manufacturers have in the past been designed by the engineers of the firms concerned without any assistance from qualified architects, and for this purpose the whole of the work under review is of interest. It is very doubtful, however, whether this practice is advisable, as there are "tricks in every trade," and certainly the building industry forms no exception to this rule. Provided an architect is employed, he will probably be conversant with the latest practice in fire-resisting construction, hence, excepting for certain sections of the book dealing with internal fittings and the provision of an adequate water supply, we do not think our readers will find much of practical interest. Of these sections the consideration of internal openings and fire-resisting doors offers much information which might often be useful, but the main interest to electrical engineers centres round the descriptions of fire-resisting office furniture and strong-room fittings. The section on fire alarms should, however, be of value to those specialising in electric fittings and equipment of this nature.

Although actual works fittings, such as stores equipment, &c., are not dealt with, a great deal of useful information is given in connection with the fire-resisting value of various materials and constructions which will enable the designer to obtain the maximum of safety from fire risks.

CONTRACTS CLOSED.

(*Continued from page* 338.)

Mexborough.—The Council has accepted the tender of the Dalton Main Collieries, Ltd., for the supply of 1,000 tons of coal for the electricity works, at 12s. 3d. per ton. The tender of Messrs. Herbert Morris, Ltd., of Loughborough, for the supply of a travelling crane, at a cost of £172, has also been accepted.

Peterborough.—The T.C. has accepted the tender of Messrs. Crompton & Co., of Chelmsford, at £576, for a new switchboard.

Stockton-on-Tees.—The Corporation has accepted the tender of Triumph Stoker, Ltd., Leeds, for a "Triumph" mechanical stoker for one boiler.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge. — Wednesday, September 3rd. At 7.30 p.m. At St. Bride's Institute. Annual meeting.

Municipal Tramways Association.—September 24th, 25th and 26th. Annual Conference at Sheffield.

NOTES.

South Magnetic Pole.—Observations made by the staff of Dr. Mawson's Australasian Antarctic Expedition last year, published by *Nature* last week, indicate that the south magnetic polar area lies in the neighbourhood of latitude 71-72° S, and longitude 152° E. The dip at points reached to the N.W. and S.E. of this area was about 89¾°.

Appointment Vacant.—Shift engineer for the Stockton-on-Tees B.C. (32s. to 40s.). See our advertisement pages to-day.

American Railway Electrification.—In referring to the forthcoming electrification of the Canadian Pacific mountain sections, the *Canadian Engineer* gives the following statement of electric railway work proposed and accomplished in the States. The Pennsylvania Railway is contemplating electrifying its line between Pittsburg and New York, a distance of over 400 miles, which will be at least double-track, and which will cost approximately $40,000 per single-track mile.

In the Western States the Great Northern Railway, and the Chicago, Milwaukee and Puget Sound Railway have planned the electrification of 530 and 440 miles respectively, contracts having already been let for road-bed, power, &c. This revolutionary step is occasioned by the poor coal and water conditions with which steam locomotives have to contend in North Dakota, Montana and Idaho, and with hydro-electric power in abundance.

The Denver, Rio Grande and Western Railway is electrifying one of its mountain divisions, 114 miles in length. Some 73 miles of mountain electrification for heavy coal haulage is a very interesting application of electricity in railroading which the Norfolk and Western Railway is planning in West Virginia. The new suburban electrified section of the Pennsylvania, extending from Philadelphia to Paoli, will comprise 70 miles of single track.

Electrifications which have already been made in the United States by steam railroads are as follows in miles of single track :—

Baltimore and Ohio... ... ... 7·4
The original electrification of the steam railroad. The pioneer user of heavy electric locomotives.

New York, New Haven and Hartford ... ...594·8
Including 22 miles on the Hoosac tunnel route of the Boston and Maine, the lines from New York to Stamford, and Providence to Warren (38·5 miles and 109·3 miles); the Harlem River Branch, 141·4 miles; the line from Stamford to New Haven, now nearing completion, 210 miles, besides more than 50 miles of short lines, including a very complete system about Hartford.

New York Central ... ...371·6
Two hundred and thirty-four miles out of New York City, 19 miles on the Michigan Central (Detroit River tunnel), and 118 miles on the West Shore Railroad between Utica and Syracuse.

Pennsylvania... ... ...135·5
Comprising 186·8 miles on the Long Island Railroad, 98·4 miles on the Pennsylvania's approach into New York, and 150·3 miles between Camden and Philadelphia.

Butte, Anaconda and Pacific ... ... 90·0
An ore-carrying mountain line.

Southern Pacific ... ... 96·0
Suburban lines at Berkeley, Oakland and Alameda, Cal., close to San Francisco Bay.

Grand Trunk... ... ... 4·0
Four miles of tunnel track (St. Clair tunnel) at Port Huron, Mich.

Erie ... ... 40·0
In Central New York to the south of Rochester.

Great Northern ... ... 6·0
The electrification of the Great Northern Railway's cascade tunnel, between Leavenworth and Skykomish, about 100 miles east of Seattle.

Inquiry.—Makers of electric fountains are asked for.

Association of Electrical (Station) Engineers.—London Section.—An open general meeting was held on Tuesday last at Chandos Hall, Maiden Lane, W.C., at which the Hon. Secretary (Mr. W. J. Ebben) read a paper entitled "Low Salaries: the Reason and Remedy." The secretary, in his paper, enumerated a number of reasons for the prevailing low salaries in electrical stations, and emphasised the fact that the chief were lack of organisation and the difficulty of overcoming the antagonism to a fighting organisation. He also stated that a large number of station engineers were in the habit of comparing themselves with lawyers and doctors, and yet at the same time accepting less than a labourer's wage for their services; and the low salaries prevailing at present were, in the greater part, the fault of the men who were in receipt of them, because, up to the present, they had done nothing to get an increase. The remedy was that station engineers should rouse themselves from their apathy and that nervousness of combining with their colleagues for what is every man's right—a fair and equitable salary.

A good discussion ensued; amongst other things a member suggested that in a society such as the A.E.S.E, the statement that it was a fighting organisation should be kept in the background, and the hon. secretary, in his reply, wanted to know what should be put in the front. No answer was received.

The next general meeting will be held as above, on Tuesday, September 23rd.

It was reported by the hon. secretary that the A.E.S.E. had obtained several increases in salaries and less working hours in one or two electrical undertakings where there was from 98 to 100 per cent. membership, with very little trouble; the reasons for which, no doubt, were that practically every man in these undertakings was a member of the A.E.S.E., and the moral effect of organisation.

A Strike in London.—On Monday last an extended strike of painters, and other men employed in the building trades, began in London; the employés of the Office of Works came out

on Tuesday, and the electricians on the permanent staff, on learning that non-Unionist painters employed at the Admiralty were at work, decided to join the strike. The electrical staff, which embraces South Kensington, the Eastern Division, Somerset House, the Admiralty, and the Western Division, numbers 700 men. It was stated on Tuesday that, in addition to the departments named above, the General Post Office, the Colonial Office, the Foreign Office, St. James's Palace, Buckingham Palace, the Tower of London, and the Museums would be involved, but this forecast proved incorrect. The origin of the strike was a demand made by the National Amalgamated Society of Painters and Decorators for increased wages, which the Master Builders' Association was not able to grant in full. The employés of the Office of Works demand an increase of ½d. an hour.

The Mazda Half-Watt Lamp.—Although the production of a half-watt lamp has been forshadowed for some time past in electrical circles, the actual demonstration of a series of these lamps in operation by the British Thomson-Houston Co., on Wednesday last, marks a great and generally unexpected development in electric lighting progress. Most of our information up to the present on this subject, has been derived from Continental sources, but we are informed that the new lamp really originated in the research laboratory of the General Electric Co., U.S.A., at Schenectady, New York, the lamps shown, however, being manufactured at the Rugby Works of the British Thomson-Houston Co., under the patent rights to which they are entitled from their association with the American company.

The English company have now produced a number of these lamps at their works, but, of course, some months must elapse before they will be regularly produced on a commercial scale.

The first lamp to be placed on the market will be of high candle-power, from about 300 C.P. to as high as 1,500 C.P. (depending on the voltage of the supply), and possibly still higher candle-power sizes will be developed in the near future. The energy consumption, with a useful life as high as 1,000 hours, will be half a watt per candle-power. The British-made lamps on view were of 1,300 to 1,400 C.P. British standard, and consumed about half a watt per candle-power, as shown by the instruments attached to the exhibit.

An interesting feature of the exhibit was one of the earliest experimental half-watt lamps made at the laboratory of the General Electric Co. This is a 25-volt lamp, taking 20 amperes, and giving 1,200 C.P. at 0·4 watt per candle. It will be seen that the new lamp promises to be a serious rival of the electric arc lamp and high C.P. gas lamp.

The lamps shown were constructed with two thick leading-in wires, from the ends of which hung in a half loop, a relatively short filament about 3 in. in length, composed of a compact closely-wound coil of fine drawn tungsten wire, which operates at a very high current density. The bulb is roughly 8 in. diameter, being the same as employed for the standard 600-watt Mazda lamp, but it is in this case filled with an inert gas; an ordinary screw or other suitable cap can be provided. A very white light is obtained, beside which the light of the ordinary tungsten lamp looks decidedly yellow.

The following data refers to the lamps shown:—

Lamp No.	Amperes, at 80 volts.	C.P. (British standard).	Efficiency: watts per candle (British standard).
1	9·2	1,400	0·52
2	9·15	1,375	0·53
3	9·1	1,260	0·535
4	10	1,600	0·50

The Situation of Trade in Germany.—According to reports in circulation in Germany, the activity in the electrical industry continues very brisk, although it is not uniform in all departments, but new orders are more difficult to obtain and a further depression in prices in the case of certain manufactures has begun. These reports are, however, not fully confirmed by information published by the *Voss. Gazette*, which has made inquiries into the matter, as a result of statements alleging the discharge of workmen by electrical firms. The A.E.G., for instance, states that whilst dismissals have taken place in one department, further workmen have been engaged in other departments, and in so far as discharges have occurred, they have been substantially due to improvements made in labour-saving machinery. It is added that the orders coming to hand are materially greater than in the previous year. In the case of the Siemens-Schuckert Works, the company intimates that not only have no men been discharged, but that additional workmen are being enrolled, as the activity in all departments is very great. The third undertaking which receives consideration is the Bergmann Co., concerning which it was recently reported that fresh orders seemed to be declining. Nevertheless, the total of stock orders on the company's books shows an increase over the corresponding period in 1912, although the turbine branch in particular is less active than a year ago.

Institution and Lecture Notes.—The annual meeting of the German Tramway and Light Railway Association is to be held in Cologne from September 3rd to 5th. Among the papers to be read are one on "Experiments with Metal-Filament Lamps for Tramcar Lighting," and another on "Current Conductors for Electric Tramways." Visits are also to be paid to a number of the engineering works in the district.

Victorian Institute of Electrical Engineers.—On July 24th a paper on "Electric Cookery," by Mr. W. H. Alabaster, was read and discussed.

Educational Notes.—University of London.—The session opens in the Faculty of Engineering, at University College, on September 30th. Particulars are given in our advertisement pages to-day of the degree and diploma courses, special courses and research work, &c.

South-Western Polytechnic Institute.—Particulars of the new session, which begins on September 29th, are given in our advertisement pages to-day.

University of Leeds.—The session begins on September 30th. See our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The electricity staff at Sale (Cheshire) and the officials of the U.D.C. have presented a 14-day clock to Mr. A. R. Fox, of the Electricity Works staff, on his marriage.

The Aldershot U.D.C. has appointed Mr. Walter Ellis, of Farnham, to the position of shift engineer at the electricity works.

Tramway Officials.—Mr. G. F. Upcott, of Leyton, has been appointed chief traffic inspector by the Light Railways Committee of Walthamstow U.D.C, at a commencing salary of £130 per annum, rising by annual increments of £10 to £160 per annum.

General.—Mr. W. H. Booth, of 8, Queen Street, E.C., who has in hand the water supply of the Australian Commonwealth building in the Strand, has also in hand that for the new building of the Port of London Authority, Trinity Square, E.C. The deep borehole at Ottersham Park recently carried out by him to the Lower Greensand continues to flow at over 4,000 gallons per hour at the surface. This borehole is 1,585 ft. deep, and discharges at 82° F. temperature. The water will rise to 76½ ft. above the surface. There are only three successful boreholes to the Lower Greensand, near London. That at Ottersham is probably at the lowest part of the trough, for it is 400 ft. deeper to the water bearing stratum than it is at the deeper of the other two borings. All three boreholes give practically the same head, showing how very free the Lower Greensand formation is.

The marriage took place at St. Mary's, Cadogan Square, S.W., on August 21st, of Mr. John Price Strange, A.M.I.E.E., of Tunbridge Wells, and Miss Elise Marie Reding. The bridegroom, who is well known in Tunbridge Wells, is the manager of the Electrical Installation Co., Monson Road, and is the third son of Mr. Chas. M. Strange, Tunbridge Wells, the bride being the daughter of the late John Reding, Esq., High Sheriff of Luxembourg. Mr. John Petrie, manager of the electrical department for Messrs. J. & F. May, London, attended the bridegroom in the capacity of best man. After the ceremony the party adjourned to Tricity House, Oxford Street, where lunch was partaken of.

Mr. F. Heppenstall, of Messrs. Johnson & Phillips, Ltd., sailed on the 27th inst. for Canada, for the purpose of attending to the firm's rapidly increasing business in that country.

NEW COMPANIES REGISTERED.

Betulander Automatic Telephone Co., Ltd. (130,717).—Registered August 20th, by Coward & Hawksley, Sons and Chance, Mincing Lane, E.C. Capital, £400,000 in £1 shares. Objects: To acquire from Marconi's Wireless Telegraph Co., Ltd., the several existing rights and patents of Nya Aktiebolaget Autotelefon Betu'ander (of Stockholm), Gotthilf Ansgarius Betulander, Oscar Carlson and Carl Magnus Wessling in various countries in or in connection with the automatic telephone system invented by the said Gotthilf Ansgarius Betulander, and the full and exclusive benefit of and all rights in connection with the system; and all improvements therein throughout the world (except Sweden) and all other (if any) rights, patents, property and details; to adopt an agreement with Marconi's Wireless Telegraph Co., Ltd., for the acquisition of the rights, property and details mentioned in an agreement dated January 18th, 1913, between the said Nya Aktiebolaget Autotelefon Betulander of the first part, Gotthilf Ansgarius Betulander and Oscar Carlson of the second part, Carl Magnus Wessling of the third part and Marconi's Wireless Telegraph Co., Ltd., of the fourth part, as modified by a supplemental agreement between the said parties, dated June 28th, 1913; to carry on the business of proprietors, manufacturers and managers of and dealers in telephonic and telegraphic works, systems, lines, stations and exchanges of all kinds, electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity and electrical energy for telephonic and telegraphic communications (whether wireless or otherwise), and for lighting, heating, traction, motive power or other purposes; newsagents, proprietors, publishers and vendors of newspapers, books, magazines and other literary works and undertakings, advertising agents, receivers, transmitters, carriers and distributors of telephonic and telegraphic messages, telegrams, news, intelligence and messages of all kinds; managers, conductors and performers of all business and service connected therewith: mechanical, electrical and general engineers, &c. The signatories (with one share each) are:—A. S. Birch, 21, St. Andrews Road, Golders Green, N.W., assistant secretary; A. A. Cappelacre, 52, Ellesmere Road, Neasden, N.W., accountant; F. Atkin, 104, Woodside, Wimbledon, Surrey, secretarial assistant; W. W. Bradfield, 40, Albert Hall Mansions, Kensington, W., manager; C. J. Ketteridge, 8, The Gables, Old Town, Clapham, S.W., transfer clerk; H. W. Corby, 81, Cecile Park, Crouch Hill, N., assistant secretary; A. H. Brewster, 20, Eastcourt Road, Woodside, Surrey, private secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are A. S. Birch, A. A. Cappelacre, F. Atkin, W. W. Bradfield, C. J. Ketteridge, H. W. Corby and A. H. Brewster (provisional directors); qualification, £100; remuneration, £2,000 per annum, and a further £500 for every 5 per cent. dividend paid on ordinary shares in excess of 7 per cent. (maximum in any year, £3,000) divisible. Every certificate numbered 1-70,000, which shall be issued within a period of 12 months from July 31st, 1913, otherwise than to Marconi's Wireless Telegraph Co., Ltd., or its nominees, shall have endorsed thereon express notice that such shares are not transferable during the period aforesaid except with the previous written consent of the said company. Registered office, Marconi House, Strand, W.C.

Portarlington Electric Light and Power Co., Ltd. (130,714).—This company was registered on August 19th, with a capital of £3,500 in £1 shares (3,250 preference), to carry on at Portarlington and elsewhere the business of an electric lighting and supply company in all its branches, and to adopt agreements (1) with the Rural District Council of Cloneygowan; and (2) with Foote & Milne, Ltd. The subscribers (with one share each) are:—E. J. Owen, 66, Victoria Street, S.W., electrical engineer; K. P. J. Jolward, 41, Lyndhurst Road, Thornton Heath, secretary; G. W. Robinson, 64, Adelaide Road, West Ealing, electrical engineer; H. A. Manning, 53, Armitage Road, Greenwich, S.E., electrical engineer; F. W. Cundall, 66, Victoria Street, S.W., electrician; W. J. Richardson, 2, Nunhead Lane, Peckham Rye, S.E., clerk; A. L. C. Brugguneyer, 164, Victoria Street, S.W., merchant. Minimum cash subscription 1,750 shares; no directors had consented to act up to August 13th; qualification, £25; remuneration, £25 per annum, divisible. Registered office, 66, Victoria Street, Westminster, S.W.

Lisnaskea Electric Light Co., Ltd. (4,031).—This company was registered in Dublin on August 21st, with a capital of £1,000 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers of and dealers in electricity, motive power, light, &c. The subscribers are:—G. Arnold, J.P., Lisnaskea, 10 shares; T. Maguire, "Munville," Lisnaskea, horse dealer, 20 shares; J. Bryson, Lisnaskea, merchant, 10 shares; J. McBrien, Lisnaskea, shop assistant, 10 shares; B. Dunne, Lisnaskea, merchant, 10 shares; D. McCalden, Lisnaskea, draper, 10 shares; T. Gavin, J.P., Lisnaskea, 10 shares; W. J. Armstrong, Lisnaskea, hotel keeper, 10 shares. The first directors are G. Arnold, T. Gavin, B. Dunne, W. Armstrong, J. McBrien, D. McCalden, T. Maguire and J. Bryson; qualification, one share; remuneration as fixed by the company. Registered office, Main Street, Lisnaskea.

Kingolite Co., Ltd. (130,753).—This company was registered on August 22nd, with a capital of £10,000 in £1 shares (3,000 6 per cent cumulative preference), to take over the business and assets of the Kingolite Co. and that of W. B. Coupier & Co., to carry on the business of manufacturers of electrical accessories and lamp shades of all kinds, electrical engineers, &c. The subscribers (with one share each) are:—C. M. Escare, 9, Osborne Road, Thornton Heath, art metal worker; C. Damey, 24, Upper Marylebone Street, Portland Place, W., electrical engineer. Private company. The number of directors is not to be less than three; the first are C. M. Escare (permanent), H. G. Bennett, P. F. Escare, C. Damey and W. J. Owen; qualification (except first directors), 25 shares; remuneration as fixed by the company. Registered office, Pyke House, 19-23, Oxford Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Westinghouse Engineers' Club, Ltd.—Particulars of £3,000 debs., created August 12th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Clones Electric Light and Power Co., Ltd. (4,026).—This company was registered in Dublin on August 15th, with a capital of £2,000 in £1 shares, to acquire and carry on the business of electricians, electrical, mechanical and general engineers, formerly carried on by Chas. Ferguson, at Fermanagh Street, Clones, Co. Monaghan. The subscribers are:—C. Ferguson, Fermanagh Street, Clones, electrical engineer, 500 shares; H. Gunn, J.P., Diamond, Clones, 100 shares. Private company. The number of directors is not to be less than four or more than six; the first are C. Ferguson, H. Gunn, E. Tierney, A. B Henry, D. Levinson and W. F. McCoy; qualification, £100; remuneration as fixed by the company. Registered office, Fermanagh Street, Clones, Co. Monaghan.

Omega Electric Lamp Co., Ltd.—Particulars of £900 second debentures created August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Aron Electricity Meter, Ltd. (58,650).—Return dated July 15th, 1913. Capital, £350,000 in £1 shares (225,000 ord. and 125,000 pref.). 125 000 ord. and 124,896 pref. shares taken up. £124,948 10s. paid on the pref., including £52 10s on 104 forfeited shares. £125,000 considered as paid on the ord. Mortgages and charges: £100,000.

A. Hirst & Son, Ltd. (57,889).—Return dated June 7th, 1913. Capital, £5,000 in £10 shares (100 pref.). 100 pref. and 320 ord. shares taken up. £10 per share called up on 100 pref. and 20 ord. shares. £1,200 paid. £3,000 considered as paid on 300 ord. shares. Mortgages and charges: £3,600.

A.E.G. Electrical Co. of South Africa, Ltd. (79,666).—Return dated July 31st, 1913. Capital, £100,000 in £5 shares. All shares taken up. £5 per share called up on 10,000 shares. £50,000 paid. The remaining 10,000 shares are unaccounted for in the return. The Allgemeine Elektrizitäts-Gesellschaft, of Berlin, holds 19,995 of the shares. Mortgages and charges: Nil. The nominal capital was increased from £50,000 in December, 1911.

J. W. Brettell, Ltd.—Debenture, dated July 23rd, 1913, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: G. E. Corfield, Balfour House, Finsbury Pavement, E.C.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

THE annual ordinary general meeting of the shareholders of the above company was held on Friday last at the Hotel Metropole, Commendatore G. Marconi presiding over a large gathering.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 308), said that he had little doubt that the report and accounts would afford the shareholders as much satisfaction as they did him. When he had the pleasure of presiding at the meeting last year, he was able then to congratulate them upon the substantial development of the company's business for the preceding year, and to inform them that he anticipated that the business of the year 1912 would show further increase, a prophecy which was fully justified and which he was sure they would agree had been substantially realised. They had endeavoured in the report to dispose of the misunderstandings which seemed to have prevailed in some directions respecting the patents and shares in associated companies, and he hoped they had now made it quite clear that there was no such thing in the accounts as profits derived by means of writing-up shares. He trusted the explanation which they had given was sufficiently full and lucid, and that the system which they adopted was now thoroughly understood by all shareholders. There was another matter with regard to the accounts to which he would like again to refer, and that was the item which appeared under balance of contracts, sales and trading in the profit and loss account. They set out one item only, because, as they had explained on previous occasions, it was not expedient, in fact it would be against the interests of shareholders to give any more detailed information. This question had been fully considered by the board, and it had been decided that it would be most inadvisable for several reasons to furnish more information than they did. There was, however, one thing which it was desirable should be said in order again to dissipate some erroneous impressions which would seem to be in the minds of some shareholders respecting the sales of shares. He wanted it to be clearly understood that the company did not buy and sell shares in the ordinary sense of the words. Such share transactions as they entered into were closely allied with, in fact it would be difficult to separate many of them from, business which would come under the heading of contracts. To give an example, speaking in a general way they might enter into an agreement to erect certain stations, or do certain work, all of which, of course, was the legitimate business of the company, for which it might not be convenient at the time to pay them in cash. In such cases they might receive payment in shares. In due course they would dispose of a number of these shares and turn them into cash. The fact, however, was that the money which they had received for those shares was a payment for contracts executed, services rendered, or whatever the particular consideration might have been. If they were fortunate enough to dispose of shares higher than the par value, or the price at which they had represented payment to them, so much the better for their profit and loss account. During the past year, as was well known, and as they had stated in the report, they benefited in this way, and accordingly they thought it prudent to take advantage of the occasion and allocate £100,000 to a general reserve account. When he addressed them last year and referred to the contract which they had entered into with His Majesty's Government with respect to the Imperial wireless scheme, he little thought that they were on the eve of a campaign, of a nature which he should think had never before been experienced by any private enterprise. He would not for a moment have believed that the spirit of fair play in this country could have reached so low an ebb. Nor would he have believed that for such considerations which obtained in connection with the whole of this campaign a British industry, such as theirs, should have been so imperilled. He would remind them that wireless telegraphy had become an industry of considerable importance, and they were, and for many years had been, the only British company maintaining British supremacy throughout the world in this industry, and always in the keenest competition with foreign companies. They manufactured on a very large scale in this country and gave employment to an immense number of British subjects. He thought that it should not be so easily forgotten that while the company was carrying on a remunerative business for its shareholders and establishing a large British industry, it was also accomplishing work of the highest importance for civilisation, by facilitating and cheapening telegraphic communication between England, its Colonies and foreign nations, besides greatly reducing the peril of ships at sea. Had it been their fault and had they been deserving of the treatment to which they had been submitted because they had been the only company to maintain British supremacy in this wireless industry? It had required the most strenuous efforts on the part of their managers and administrators to protect their interests abroad during all this period, and he was glad to say that they had succeeded in doing so. But it must not be supposed that much of the programme which they had in immediate contemplation when he addressed them last year had not suffered some delay. Their accounts spoke of the progress which they had made, but that progress would have been far greater to-day had it not been for the circumstances to which he had just referred. When their tender for the construction of the Imperial stations was accepted in March last year they considered, as they had every right to do, that they had entered into a definite contract requiring only such minor modifications, if any, that they might be willing to agree to in the actual wording of the agreement itself, and the formality of ratification by Parliament. He used the word "formality," for he could not learn of any instance when a contract had been negotiated by a number of Government departments, all of which were in continuous consultation, each putting forward proposals and suggestions and doing his utmost to obtain everything he thought he could reasonably demand and support, and finally all being parties to the striking of a definite bargain—he could not learn of an instance where Parliament had ever before had recourse to the sledge-hammer power which it possessed of placing a private enterprise in such a position that its only alternative to making further concessions demanded of it, would be the imperilling of its reputation and business throughout the world. Such had been the anxious and responsible position which the directors had had to face, and it was, therefore, with no small degree of relief and satisfaction that they had been able to inform them that, notwithstanding Parliamentary intervention, they did not believe that the altered conditions of the contract would prove of any material disadvantage to the company, but thanks only to the strong position which the company held. They had also great hopes that the company having emerged successfully from such a severe and ruthless attack, its reputation abroad would have been not only maintained but enhanced

Their business generally continued to make most satisfactory progress, and he had the greatest satisfaction in being able to inform them that since the issue of the report, they had received a cable from their representative in Brazil informing them that a concession to which they attached the greatest importance had been signed by the President. Ever since the commencement of 1910 when their negotiations were opened, they had devoted themselves assiduously to securing the means of opening up telegraphic communication between Rio de Janeiro and other busy commercial centres of the great Brazilian Republic and Europe. There was no telegraphic service to which they attached greater importance, and they would be pleased to learn that they had obtained this concession for 50 years. At the earliest possible moment they would form a new Brazilian company which would purchase from them their long-distance rights, together with this concession, and every effort would be made to construct the stations with the least possible delay. The new company would, no doubt, enter into an agreement with the American company, by which the station to be built at Para would conduct a service with New York and other parts of the United States. They hoped that this work would be the start of a new network of stations opening up cheaper telegraphic communication between the South American States, Europe, the United States and other parts of the world, which should not only secure to this company a substantial, increasing and lasting revenue, but add considerably in value to their interests both in the American and other of their subsidiary companies. They regarded the completion of these negotiations as the laying of the foundation stone of one of the most important edifices in the world of wireless telegraphy, which would further cement the business which the company was creating independently of any competition and irrespective of all patent rights. The steady progress of their several subsidiary companies to which they had referred in the report was most satisfactory, and they were each year coming nearer to the time when with the completion of long-distance stations either under construction, or about to be constructed, they would realise the principal source of profit and the one to which they attached most importance to be derived from wireless telegraphy. In this connection shareholders would be pleased to learn that the construction of the long-distance Norwegian station had been commenced, and the consideration and whole-hearted assistance which they were receiving from the Norwegian Government and the officials in its employ would not only enable them to complete the work within the shortest period possible, but added zeal and pleasure to all those who were employed in carrying it out. The report issued recently of the Marconi International Marine Communication Co., Ltd., had placed shareholders in the position of having all information in respect of the progress of that company. Their works were supplying them with installations as quickly as they could turn them out, and it was no easy matter for them to keep pace with the demand. The continuous increase of business necessitated the issue of a further portion of the authorised capital of that company. The shares to which this company was entitled were issued to the shareholders at the price of 5s. premium and were well applied for. The business of the company was sound and continuously increasing, and he had every hope that the dividend for 1913 would show an increase over the 10 per cent. paid for the preceding year. He had reason to believe that the directors of that company intended in the future to pay six-monthly dividends, an interim at the end of the year and final upon completion of the accounts. Their Russian company was also making most satisfactory progress. Its business had far outgrown its capital, and for some time past they had had to give it considerable financial assistance in order to enable it to carry out its orders. A resolution had been passed authorising the increase of the capital, but under the terms of Russian company law, Government consent had first to be obtained. The necessary authority had now been given to the extent of 600,000 roubles, and further authority was asked for a like sum. The shares of the company being of 100 roubles the directors had in contemplation arrangements under which the shares would be available for conversion into £1 shares in a trust company, in order to have a market value for them in this country. A new subsidiary company had been formed in Australia, in respect of which they expected to be in a position to give them more information of an interesting nature shortly. They had other important negotiations pending about which, however, they could not give any particulars at present. Shareholders might rely, however, that as and when they were completed, full information would be immediately communicated to them. The company having agents and representatives in almost all parts of the world and business with nearly every foreign Government, the directors resolved to avail themselves of the opportunity of securing the patent rights of what they were advised and believed to be the best automatic telephone system. That a very considerable business was to be done in automatic telephones there could be no doubt, and the world-wide organisation which they possessed should be an asset of considerable importance to the development of such a business. A new company was about to be registered under the style of "The Betulander Automatic Telephone Co., Ltd.," which would purchase from this company the patent rights and take over the contracts and negotiations which had already been entered into in numerous countries. The system would shortly be in full operation at Marconi House, and those desirous of inspecting it would be welcome. Although there was no doubt that wireless telegraphy was in a condition of rapid development, he thought that it could safely be said that this method of communication was based, and would continue to be based, on the production and utilisation of electric waves. Now, there was no mystery about electric waves to his mind. They could vary in length and intensity, or they might be continuous or discontinuous. There seemed to be a prevalent misconception in the lay mind that continuous waves were in some way essentially different from the discontinuous waves produced by what were called spark systems. Such a view was quite erroneous. The Marconi Co. possessed methods of its own which permitted it to utilise wherever it thought desirable either a spark system or a continuous-wave system, and this was demonstrated to the members of the Advisory Committee during the tests carried out for them between Clifden and Glace Bay. His system of continuous waves was now installed and in working order at the trans-Atlantic station at Clifden. Important tests were now being conducted, but considerable work and time were required before it would be possible to determine in a definite way whether the continuous-wave system possessed advantages for long-distance transmission over the spark system. In any event, he thought it well to make it quite clear that the company possessed efficient methods for utilising either system. As in the past, they had this year applied for several, and what he believed to be, valuable patents which embraced further important improvements in the transmitting and receiving apparatus. He would like, without in any way desiring to belittle the attempts made by others to establish communication by means of wireless telegraphy across the Atlantic, to point out to shareholders that the achievement of telegraphing across the Atlantic was not such an easy matter as it might appear, and he thought that the public, and even distinguished inventors, had erred on the side of optimism with regard to what they expected would shortly be done. During the last few months they had read in the public Press that communication was shortly to be established between Europe and America by means of the Poulsen or the Goldschmidt system. He would like to remind them that Prof. Fessenden, writing in the *Electrician*, issue of February 22nd, 1907, said that in January, 1906—that was well over seven years from this date—he received messages in Scotland from Massachusetts with an expenditure of less than 1 KW. Again, Dr. Poulsen, in the *Electrician* of November 15th, 1907, nearly six years ago, said:—"The engineers of the company are very confident that they will succeed in printing trans-Atlantic messages, and are positive that they will not be limited to telephonic reception." Then, again, with regard to the De Forest system, they had the following extract from the ELECTRICAL REVIEW of April 6th, 1906:—"The daily Press announces that the De Forest Wireless Telegraph Co. has sent messages from its station at Coney Island to Ireland, a distance of 3,200 miles. On one night 1,000 words were transmitted, of which 572 were received and recorded. It is further added that 'when the correct pitch to use for Ireland has been ascertained, commercial work will be started across the Atlantic.' It is then proposed to send messages from San Francisco to Ireland, with two relay stations." None of those systems had succeeded in establishing a service of any kind across the Atlantic. In view of what he said at the meeting last year, no doubt there was some little disappointment at their not declaring a second interim dividend in December last, and also that they should have decided to recommend a final dividend for last year of 10 per cent. on both classes of shares, which, as they knew, represented 17 per cent. for the preference and 20 per cent. upon the ordinary. The unforeseen circumstances, however, which occurred since his last address had dictated a policy of prudence, with which he felt sure shareholders would not quarrel. In a new industry such as theirs, developments were continuous, and led frequently to sudden and substantial demands upon their resources, and they had thought it wise, therefore, not only to carry to reserve the sum of £100,000, but also to carry forward to next account £146,000. They hoped that circumstances such as had prevailed this year would not recur, and they would, therefore, be able in the future to hold their general meeting a month or two earlier than they had been able to do on this occasion. The final dividend of the year must, of course, be declared at the general meeting, when the accounts had been passed by the auditors. At the end of each year, however, they would be in a position to estimate approximately the profit earned during the year, and so decide upon any interim dividend which should be declared and paid at that period. By adopting this course, assuming the business continued to progress as they hoped, distributions would take place six-monthly. Their managing director, Mr. Godfrey C. Isaacs, had been subjected to a great number of most ungenerous insinuations which never could have been made by anyone personally acquainted with him, and which could not be and were not believed by anyone who knew him or who had worked with him. But it would appear that in this country, as in most others, when politics were introduced, an atmosphere prevailed in which there would seem to be let loose some pernicious element destructive of the equilibrium of an otherwise well-balanced mind. He thought Mr. Isaacs merited the most sincere congratulations of the shareholders on having carried on the business so successfully during the past year under the great difficulties which he had referred to, and considering what a great amount of time was taken up in defending the interests of the company, and even in protecting his own honour and reputation, all of which he had done so effectively. Mr. Samuel, the Postmaster-General, speaking in the House of Commons, stated:—"I could wish no worse fate for any of my critics than that in the next world they should be condemned to conduct in perpetuity negotiations of this character under these circumstances." He (Mr. Marconi) could truthfully state that he was sure that Mr. Isaacs on his part could express identical feelings.

MR. GODFREY ISAACS (managing director), in seconding the motion, said he would like to say a word or two upon matters to which the chairman had referred. It would be idle for him for a moment to pretend that the troubles which they had gone through during the past year had not been of an extremely painful nature to him. They were perfectly well aware that all manner of suggestions and insinuations of the most sinister nature had been

levelled at him and it had required all the assistance, the support, the confidence, the loyalty and the encouragement which he had received, first, from their illustrious chairman; secondly, from every single member of the board; thirdly, from every manager and head of department throughout the whole of the organisation, and, fourthly—to which he attached no small degree of satisfaction—the enormous number of letters which he had received from shareholders, not only throughout this country but throughout the whole world, in which they had expressed their deep sympathy and their absolute confidence in him. In those circumstances, and largely due to those circumstances, one had been able to face a condition of things which otherwise became well nigh intolerable. They had had during the past year a trouble far more serious and which occasioned to him and to many of the directors much greater anxiety than the trouble to which he had first alluded—he referred to the most unfortunate accident which befell their chairman. He was quite sure that everybody present sympathised with Mr. Marconi in his accident, and were as anxious as were the board to hear of his progress. It was with a very considerable degree of satisfaction he could say that the chairman had returned to them not only none the worse for the accident, but as far as he (Mr. Isaacs) had been able to gauge, with even greater inspiration than before. During the last six or eight months Mr. Marconi had taken out a very large number of very important patents, patents which he (the speaker) felt were at least as important, if not more important, than the patents which he had taken out in the past. They would no doubt see further important developments in the industry in which they were engaged, and which they looked to the chairman to continue to pioneer, and he was quite confident that as long as Mr. Marconi was with them the company would continue to pioneer that great science of which he was the inventor. They all knew that through Mr. Marconi's genius when they went to sea they were able to receive telegrams with their morning cup of tea from those they had left behind. He (Mr. Isaacs) was not fond of prophesying, but he was going to venture on this occasion to prophesy that the date was not far distant when with their cup of tea in the morning they might hear the ring of a bell, and taking their telephone from its stand might talk to those whom they had left behind. The company had not made a habit of boasting at any time of the work which it was doing, but he supposed they had all read in the newspapers of the wonderful things which were being done by persons, most of whom they did not know, in wireless telephony. Whatever they had read in the newspapers as being done by wireless telephony, the Marconi Co. had done more, but until they were prepared to say exactly what definite results in a practical way could be obtained from wireless telephony it would remain silent. They would, perhaps, at an early date be able to turn wireless telephony to practical commercial account, and it would then be time enough to speak about it. Some of the shareholders had been perhaps not unnaturally disappointed or a little impatient in connection with the progress which had been made by one or two of the Associated Companies. He would ask them to remember that in an industry of that nature a little time was required in any country for its development and the turning of it to a profitable and commercial account. There were innumerable difficulties to be surmounted when they remembered that for the most part one had to negotiate with Governments abroad, and like Governments at home they did not move very quickly. A little time was required for those Associated Companies to pull themselves together and to become profitable investments, and a little consideration and patience was wanted from the shareholders. Personally, he had intended to give some assistance to some of those companies by paying visits to them. He had arranged to leave England early this year and spend a little time in America and in Canada, and also to pay a short visit to Spain, but the circumstances which they had had to meet during the last 12 months had made it quite impossible for him to leave England. He hoped, however, to be able to go both to America and Canada during the coming month. Having thanked the managers, the heads of departments and the whole of the staff for the services which they had rendered the company during the past year, Mr. Isaacs said some shareholders might wonder why they had not allocated a certain sum to the staff as bonus as in previous years. The reason was that at the last meeting the shareholders authorised the directors to dispose of such a sum as they might think necessary for the purpose of establishing a pension scheme. The board had been at work on that scheme, and they were on the eve of completing it. In conclusion, he said he could only repeat what the chairman had told them—that the company continued to progress, and that their attention was being devoted to what they believed would be the most profitable side of wireless telegraphy in the shape of constructing and conducting long-distance telegraph services throughout the world, and every month they came nearer to realising that end. In the course of a little time, when many of the stations now in course of construction were completed, he believed it would be found that they had created a sound, substantial, and a profitable business, which would be entirely independent of whether or not others were able to introduce something which Mr. Marconi had not previously thought of in connection with wireless telegraphy.

A short discussion ensued, and, in replying thereon, Mr. Godfrey Isaacs said that the directors knew nothing whatever of a rumour that the company was going to pay a dividend of 30 or 40 per cent. at that meeting. Such a rumour did not emanate from the board, nor from anyone connected with the company. The remuneration of the directors was £3,000 per annum according to the Articles of Association. With regard to the American company, the Chairman at the last meeting gave the shareholders a very complete statement showing exactly the nature of the business which he (Mr. Isaacs) and Mr. Marconi conducted in America.

The report was carried unanimously.

Austrian Works.

The *United Glow Lamp and Electricity Co., of Bielo Potok*, earned larger profits in 1912, as a result of the considerably increased turnover and the saving in interest which was effected through the augmentation in the share capital. After placing the sum of £14,000 to depreciation as in the preceding year, the accounts exhibit net profits and balance forward of £41,000 as compared with £42,000 in 1911. It has been decided to distribute 10½ per cent. for 1912, being the same rate as in the previous year.

The report for 1912 of the *Austrian Siemens-Schuckert Works Co., of Vienna*, states that the orders received experienced a substantial increase over the preceding year; they included equipment for 34 supply works, extensions of 122 supply works, and 10 electric tramways. Nothwithstanding the enlargement of the works, the company's plant was occupied to the limit of its capacity throughout the year. An unfavourable influence was exercised in the final quarter by political events, and the exports to the Orient, which until then had considerably increased, came to a standstill, whilst the domestic trade also became slower towards the end of the year, and continued slacker in consequence of the general economic and political conditions. After allocating £58,000 to depreciation as compared with a similar sum in 1911, the accounts indicate net profits of £95,000 as against £75,000, and a dividend of 7 per cent. has been declared on a share capital of £1,000,000, as compared with 6 per cent. in 1911.

Stock Exchange Notices.—The Stock Exchange Committee has appointed a special settling day as under:—

Thursday, September 4th.—Melbourne Electric Supply Co., Ltd.—Scrip, fully and partly paid, for £100,000 5 per cent. consolidated debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Buenos Aires Lacroze Tramways Co.—£500,000 5 per cent. consolidated mortgage debentures of £100 each, Nos. 1 to 5,000, in lieu of the scrip.
Melbourne Electric Supply Co., Ltd.—Scrip, partly paid, for £100,000 5 per cent. consolidated debenture stock.

Electric Welding Co., Ltd.—The report states that the accounts for the year to November 30th show a loss, after charging debenture interest, of £1,583, increasing a debit balance brought forward of £36,544.

Newcastle and District Electric Lighting.—The directors have paid an interim dividend at the rate of 3 per cent. per annum on the ordinary shares for the half-year to June 30th.

Escher Wyss & Co.—The report for 1912-13 of Escher Wyss & Co., of Zurich and Ravensburg, whose ordinary share capital is entirely held by the Felten & Guilleaume Co., states that both orders and turnover reached an unprecedented total. Apart from hydraulic turbines and other departments, the business in steam turbines again experienced an exceptional development, and orders for over 50 turbines of 250,000 H.P. are at present in hand. A noteworthy delivery in the year was a turbine of 30,000 H.P. for the Rhenish-Westphalian Electricity Works at Essen, and this has been followed by an order for a second machine of the same size. After defraying interest on loans, and placing £29,000 to depreciation, as against £25,000 in 1911-12, the accounts show net profits of £17,300, as compared with £400 in the previous year. It is intended to pay a dividend of 6 per cent. on the share capital of £260,000, whereas the finances of the undertaking were reconstructed in 1911-12, and consequently no distribution was made.

John Spencer & Sons, Ltd.—The accounts for the year to June 30th, including £4,103 brought forward, show a profit of £74,601. The directors recommend a further dividend of 3½ per cent., making 6 per cent. for the year; the appropriation of £13,160 to renewals and improvements expenditure, setting aside £10,000 for depreciation, and carrying forward £11,667.

Lancashire Dynamo and Motor Co., Ltd.—The *Financier* states that the directors have declared a dividend at the rate of 5½ per cent. per annum, less tax, on the preference shares, payable September 1st.

Mackay Companies.—The directors have declared the usual quarterly dividend on the common shares at the rate of 5 per cent. per annum.

Continental.—Norway.—The Société Norvégienne de l'Azota et des Forces Hydro-Electriques, of Notodden, in which Swiss and German financial interests are participants, proposes to pay a dividend of 6 per cent. for 1912-13 on the fully paid ordinary shares as compared with 5 per cent. in the preceding year, and 8 per cent. on the preference capital as in 1911-12. It is now intended to increase the share capital from £2,340,000 to £3,950,000, the issue to be made at a time which is regarded by the directors as appropriate.

Belgium.—The General Electric Co., of Belgium, reports a profit of £3,426 for the last financial year.

France.—The report of the Compagnie Française des Cables Télégraphiques, of Paris, for the last financial year shows a net profit of £17,525.

STOCKS AND SHARES.

Tuesday Evening.

Throughout the Stock Exchange business remains on a very small scale; but, of course, this is only to be expected at this time of year, and signs are not wanting that the public requires only a little encouragement to buy back those stocks and shares that were thrown away during the period of nervousness recently gone through. Even the demand that has sprung up in the last week or two has caused a shortage of stock, and it is only with considerable difficulty that any large amounts can be picked up at the ruling levels. Actually, prices have fallen, in many instances, to such an extent chiefly because the dealers have marked them down—not caring to take more stock, except at these reduced quotations. Any sustained restoration of confidence, however, would be quickly followed by a general marking up, for there are not a great number of sellers to be found at the present prices.

But it is chiefly this restoration of confidence that is required. If it could only be proved that, after the alarums and excursions of the last six months, there would follow a period free from the fears of international complications, little doubt would remain that money would flow back freely into speculative, and what may be termed "semi-speculative," securities. Still, it is not certain that further nerve shocks will not be administered by the mismanagement of affairs in the Balkans; while the Mexican dispute, though not of universal importance, must necessarily affect the many English-owned concerns operating in that country.

Speaking generally, it may be said that the result of the last week's operations has proved a tendency for prices to work towards a higher level; though not a little irregularity has been seen on account of the very natural reaction which followed some of the recent rises. Mexican issues are mostly lower, though here it is worth noting that the falls as a rule have by no means wiped out the rises formerly established.

In the better feeling that came into evidence in the Stock Exchange at the beginning of this week, Home Railways have been one of the first to share, and that to as great an extent as any other market. The Underground issues, which are always favourite speculative media, have come in for their share of attention, and the 6 per cent. Income Bonds of the Underground Electric Railways have been one of the most prominent. The rise here has been helped by the discovery of a bear account in the stock. The First Income Debenture has met with support from investors, and has improved a point to 113. Metropolitans and Districts have been very much to the fore in this movement, and have both made considerable recoveries. As a matter of fact, the market in these two stocks is rather peculiar, as at certain times it will take very little buying or selling to move the quotations a point or even more. Central London issues have moved somewhat irregularly, investors still apparently exchanging their holdings from non-assented into the assented stock. There has been a good deal doing in British Electric issues, which nearly all show substantial rises. The chief honours go to the 6 per cent. and 7 per cent. Cumulative Preferences, which have got up to 87½ and 47½ respectively, about 7 to 8 points above the prices ruling only a fortnight ago. The Second Debenture and the Preferred and Deferred have also shared in the improvement.

The Marconi meeting, which was so eagerly looked forward to, at first caused a little disappointment, as the speech of the Chairman did not contain—as the Stock Exchange had hoped it would—any points on which to found a bull campaign. Certainly the reference to the proposed Brazilian subsidiary is regarded favourably, but as yet not sufficient is known to enable a competent opinion to be formed as to its effect on the parent shares. After being up to about 4½, the shares dropped back at first to 3 15/16, but further consideration of the speech led to fresh purchases, with the result that the shares are only 3/16 down from the highest point at 4 1/16; while the Preference shares, which had been up to nearly 3⅞, fell sharply at one time, though on balance they are only ⅛ lower.

Other shares in this department have in several instances shown a disposition to react after their recent rises, Anglo-American Deferred going back ¼ to 23½, while falls were also registered by Cuban Telegraph and West India and Panama Ordinary. The search for cheap investments—to which we have previously referred—has led to an advance of another ¼, following upon the rise already established, and the Bonds now stand over par. The same factor has caused improvements in Amazon Debenture and Globe Telegraph Preference.

All Mexican securities have, as was to be expected, been affected by the dispute between that country and the United States, though a recovery from the lowest points has in nearly all cases been made. Mexican Tram Common and the two classes of bonds are all lower on the week, though, at the same time, in the case of the Common shares the fall is only one of 3 points, against a rise of 4½ a week ago; while the 5 per cent. bonds have only lost 1 point of the 5 that they gained during the previous week. Mexican Light and Power Common have been similarly affected, having lost as much as 4 points on balance to 66; as this goes against a recent improvement of considerably greater extent, however, it is not of so much importance as at first appears. The Preference and the second Mortgage Bonds have also been lowered, both losing a point—to 97½ and 80 respectively.

On the whole, the tendency among Foreign and Colonial Electric Tramways has been towards higher levels, British Columbia Electric Deferred and Preferred both following their rise of last week with a further improvement of a point; while some increased activity has been noticeable amongst the Debentures and Preferences of the Anglo-Argentine Tramways Company. On the other hand, Rio de Janeiro first and second Mortgage Bonds are lower, and also the 5 per cent. Debenture of the Southern Electric Tramways of Buenos Ayres. One of the good features of the week has been an improvement of 5 points to 115 in the Common stock of the Canadian General Electric Company; but among other stocks in this department may be noted a fall of 2 in Monterey Light and Power First Mortgage Debenture.

There has been a fair number of rises amongst the English Supply and Manufacturing Companies, several Debentures and Preferences being picked out by the investor on the look-out for high-yielding shares. Also among the Ordinary issues the tone has been better. Westminster Ordinary are ¼ higher at 8½, while St. James' and Pall Mall have risen ⅛. British Westinghouse Pref. have again been picked up, and have risen ⅛ to over 1, while the Debentures are also better at 66½. Telegraph Construction improved to 38, which follows upon a rise last week. British Insulated and Helsby Cables have improved; but Babcock and Wilcox, after their recent advance, have reacted to 3⅛. At this week's plantation sales a record amount of rubber was put up, and, very naturally, the price fell still further. The depression has been accentuated by the fear that the trouble of an American firm is of a worse description than was originally suspected.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21 10	..
a Lead, Nitrate	„	£27 10	..
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	100/-	15/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£95	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8⅛d.	⅛d. inc.
c „ Tube (brazed)	„	10⅜d.	⅛d. inc.
c „ „ (solid drawn) ..	„	9½d.	⅛d. inc.
c „ Wire, basis	„	8⅛d.	⅛d. inc.
c Copper Tubes (brazed)	„	11⅜d.	⅛d. inc.
c „ „ (solid drawn) ..	„	11½d.	⅛d. inc.
g „ Bars (best selected) ..	per ton	£86	£1 inc.
g „ Sheet	„	£86	£1 inc.
g „ Rod	„	£86	£1 inc.
d „ (Electrolytic) Bars ..	„	£78	..
d „ „ Sheets ..	„	£91	..
d „ „ Rods ..	„	£78 10	..
d „ „ H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	dec.
h India-rubber, Para fine	„	8/9	1d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	54/9	2d. dec.
l „ Wire, galv. No. 8, P.C. qual.	„	£14	..
g Lead, English Pig	„	£20 15 to £21	10/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	8/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	1d. inc.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£195 to £196	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	1d. inc.
p White Anti-friction Metals ..	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 5	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	£10	5½	6	9¼ — 10¼ xd	..	5 17 1
Do. 4½ % Pref.	£10	4½	4½	8¾ — 9½ xd	..	4 14 9
Do. Second 6 % Pref.	£10	6	6	9⅞ — 10⅝ xd	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord.	£5	10	10	8½ — 8¾ xd	..	5 14 3
Do. 7 % Cum. Pref.	£5	7	7	8⅞ — 8⅞ xd	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	£100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	£5	5	5†	4⅜ — 4⅞ xd	..	5 2 7
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 4⅜ xd	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	£5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	£100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	£5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	£10	8	9	15 — 16	— ½	5 12 6
Do. 6 % Cum. Pref.	£10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb.	£100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	£10	6	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	£10	6	6	11⅜ — 12¼	+ ¼	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	£5	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref.	£5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	£100	4½	4½	80 — 83	+1	5 8 5
Folkestone	£5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	£5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	£100	4½	4½	88 — 90	..	5 0 0
Hove	£5	9	9†	7¾ — 8⅛	..	5 9 1
Kensington & Knightsbridge, Ord	£5	9	8†	7⅛ — 7⅜ xd	..	5 18 8
Do. 4 % Deb.	Stock	4	4	83 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	£1	2½	2½	1¼ — 1⅜	..	4 7 9
Do. 6 % Pref.	£5	6	6	4½ — 5⅛	+ ⅛	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	£5	4	4†	3⅛ — 3⅜ xd	..	5 10 4
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 8
North Metropolitan Power Supply, 5 % Mortgages (Red.)	£100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	£10	6	6	9½ — 10½	..	5 14 3
Oxford	£5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	£5	10	10†	8½ — 9	+ ⅛	5 11 1
Do. 7 % Pref.	£5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	£100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	£1	5	5½	2⅞ — 3⅛	..	7 0
Do. 5 % First Mort. Deb.	£100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	£1	7	7	1 7/16 — 1 9/16	..	5 17 11
Do. 4½ % First Deb. Stock	£100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	£5	2	2	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb.	£100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	£5	10	10	8¼ — 8½ xd	+ ¼	5 14 3
Do. 4½ % Cum. Pref.	£5	4½	4½	4⅛ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	£5	5	5	5 — 5¼	..	5 14 3
Calcutta, Ord.	£5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	£5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	£100	5	5	90½ — 92½	..	5 8 1
Canadian Gen. El. Com.	$100	7	7	118 —117	+5	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	£1	3	5	⅝ — 13/16	..	6 8 1
Do. 5 % Deb.	£100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	£100	5	5	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	£100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91½ — 93½	..	5 6 11
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 5/32	..	Nil
Do. 6 % Pref.	£1	6	6	⅜ — 9/16	— 1/16	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	£5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	£100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4†	64 — 68	—4	5 17 8
Do. 7 % Cum. Pref.	$100	7	7	95 —100	—1	7 0 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	90 — 92	..	5 8 8
Do. 5 % 2nd Mort. Bonds	£100	5	5	79 — 81	—1	6 3 5
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	£100	5	5	74 — 77	—2	6 9 10
Montreal, Lt., H. and Power	$100	8	9†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	£100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5	5½	134 —139	..	3 19 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	£100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref.	£1	11¼d.	17½d.	1/16 — 1/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	£100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 96	+ ½	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	132 —135	..	5 18 6
Do. Collat. Trust	$1000	4	4	90 — 92	— ½	4 7 0
Anglo-American Telegraph	Stock	8	8	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	8	8	108 —109	..	5 10 1
Do. Def.	Do.	30/-	30/-	23½ — 23⅝	— ½	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	£100	5	5	104 —106	..	4 15 3
Chili Telephone	£5	7	8	7 5/16 — 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	£10	6	6	8½ — 9½	— ½	6 9 9
Do. 10 % Pref.	£10	10	10	15⅝ — 16⅝	..	5 19 4
Direct Spanish Telegraph, Ord.	£5	4	4†	8½ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	£5	10	10	6¾ — 7¼	..	6 12 0
Direct United States Cable	£10	5	4	6¾ — 7¼	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	£100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 8½ % Pref. Stock	Do.	8½	8½	75 — 77	— ½	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	..	4 2 11
Eastern Extension	£10	7	7	12⅞ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	£25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	£10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	£10	6	6	12⅛ — 12⅜	+ ⅛	4 15 1
Great Northern Telegraph	£10	18	20	30 — 32	..	6 13 0
Indo-European Telegraph	£25	13	13	55½ — 57½	..	5 13 1
Mackay Companies Common	$100	5	5	82 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	£1	20	..	4 — 4⅛	— 3/16	4 17 0
Do. 7 % Cum. Partic. Pref.	£1	17	..	3⅜ — 3⅝	— ⅛	4 17 2
Monte Video Telephone, Ord.	£1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	£1	5	5	¾ — ⅞	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	£100	4½	4½	100 —101	+ ½	4 9 1
Oriental Telep. and Elec.	£1	8	10	1 3/16 — 1 5/16	..	5 8 6
Do. 6 % Cum. Pref.	£1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	..	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	£10	10	10	9¾ — 10¼	..	9 17 6
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	£5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	£5	5	5	5 — 5½	..	4 11 0
West Coast of America	£2	2½	..	1 3/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel.	£100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	£10	1½	1½	2⅜ — 2⅝	— ⅛	4 6 11
Do. 6 % Cum. 1st Pref.	£10	6	6	9⅝ — 10⅜	..	5 18 5
Do. 6 % Cum. 2nd Pref.	£10	6	6	9⅜ — 9⅝	..	6 1 6
Do. 5 % Debs.	£100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd.	£10	7	7†	12⅜ — 12¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92⅝	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	5/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	6 3/32 — 6 5/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	10 — 11½	+1 3/4	..
Do. Do. Deferred ..	100	..	..	4½ — 6	+ ¼	..
Do. Do. 6 % Cum. Pr'f	100	6	6	85 — 88	+5	6 16 4
Do. 7 % Non-Cum. Pr'f.	100	..	3	46 — 49	+3	6 2 5
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	74 — 78	+2	5 15 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	..	81 — 83	..	4 16 5
Do. Pref.	100	4	4	76 — 78	—2	5 2 7
Do. Gtd. Assented	100	..	..	83 — 85	+1	4 14 2
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2 1/16 — 2 3/16	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 1/8 — 2 3/8	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	1/2 — 3/4	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	9/16 — 11/16	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 61	..	6 5 0
Metropolitan Railway Consol. ..	100	1 7/8	1 5/8	48 — 48½	+ 3/4	3 7 0
Do. Surplus Lands	100	2 3/8	2 3/8	60 — 62	..	4 8 9
Do. 8½ % Deb.	100	8½	8½	83 — 85 xd	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	81 — 83 xd	..	4 4 4
Do. 8½ % Con. Pref.	100	8½	8½	77 — 79 xd	..	4 8 7
Metropolitan District Ord. ..	100	Nil	Nil	35½ — 35¾	+ 3/4	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 8½ % Gtd.	100	8½	8½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	4½	3⅓	3/32 — 13/32	..	..
Do. 5 % Pref.	1	6	5	17/32 — 21/32 xd	..	7 12 5
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3 7/8 — 4 1/8	..	Nil
Do. "A"	1/-	4½	..	1/8 — 3/8	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	112 —114	+1	5 5 3
Do. 4½ % Bonds	100	Nil	4½	99 —101	..	4 9 1
Do. 6 % Income	100	3	6 †	94½ — 95½	+1	6 5 8
Yorkshire (West Riding), Ord.	5	..	..	1/8 — 3/8	..	Nil
Do. 6 % Pref.	5	..	8†	8½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/8 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	95½ — 97½	+ ½	4 12 4
Do. 5 % Deb.	100	5	5	97½ — 99½	..	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	95¼ — 96¼	+1¼	6 4 8
risbane Trams Invt., Ord. ..	5	8	8	7 — 7½	+ ⅛	5 6 8
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	126 —131	+1	6 2 2
Do. Pref. Ord.	100	6	6	111 —116	+1	5 3 5
Do. 5 % Pref.	100	5	5	102½ —105½	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7	5†	5 3/4 — 6 1/4	..	5 12 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	95½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1/16 — 1/8	..	6 8 1
City Buenos Aires Trams (1904)	5	5	5†	5 5/16 — 5 9/16 xd	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90¼ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 85	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	1 29/32 — 1 31/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	4½d.	1 3/32 — 1 11/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1 1/4	..	4
Do. 5 % Deb.	100	5	5	91 — 96	..	5
Madras Elec. Tr. 6% Cum. Pref.	5	..	5	4 3/4 — 5 1/8	..	5
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	..	5 12
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99 xd	..	5 1
Mexico Trams Com.	$100	7	7†	97 — 99	—3	7 1
Do. Gen. Con. 5 % Bonds ..	..	5	5	92½ — 94½	—1	5 5
Do. 6 % Bonds	100	6	6	92½ — 94½	— ½	6 7 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 3/32 — 6 7/32	+ ⅛	7 12 9
Do. 6 % Pref.	5	6	6	4 13/16 — 5 3/16	+ 1/16	5 15 8
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1 1/8 — 1 3/8	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100		4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..		5	101 —103	— ½	4 17 1
Do. 5 % Mort. Bonds ..	100	5	5	95 — 97	— ½	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	£500	5	5	102 — 104	+1	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	—1½	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4½ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	+1	4 7 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Aug. 26th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Aron, Ord.	1	5	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	25/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	28	16	3 1/16 — 3 3/16	—1/16	5 0 5
Do. Pref.	1	6	6	1 1/4 — 1 3/8	..	4 7 3
British Aluminium, Ord. ..	1	Nil	..	1 5/16 — 1 7/16	..	..
Do. 6 % Cum. Pref.	1	Nil	6	2/4 — 5/8	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	82 — 85	..	5 17 8
B.I. & Helsby Cables	5	10	10	7 3/4 — 8 1/4	+ ½	6 1 3
Do. Pref.	5	6	6	5 3/4 — 6 1/4	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	95 — 98	..	4 11 10
British Westinghouse, Pref. ..	8	Nil	Nil	15/16 — 1 1/8	+ ⅛	Nil
Do. Deb...	100	4	4	65 — 68	+ ½	5 17 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10 3/4 — 11½	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	31 1/16 — 31 3/16	..	5 4 11
Do. Deb...	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	54½ — 59⅓	..	8 8 0
Dick, Kerr	1	5	Nil	5/8 — 9/16	..	..
Do. Pref.	1	6	6	31/32 — 35/32	..	7 13 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1 1/4 — 1 3/8	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1 — 1 1/4	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	5	9 3/4 — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12½ — 18½	..	5 18 2
Do. Pref.	5	4½	4½	4 7/8 — 5 1/8	+ ⅛	4 7 10
Do. Deb...	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	12 3/4 — 13 3/4	..	5 9 1
Do. Pref.	10	5	5	9 3/8 — 10 1/8	+ 1/8	4 18 9
Telegraph Construction	12	17½	20	37 — 39	+1	6 3 1
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 1/2	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1913.

The returns of electrical exports and imports for July, which we publish below, show a considerable improvement on the figures of the previous month.

Thus the exports reached £660,363 in value, as against £499,995 recorded for June, the increased total, however, being traceable more particularly to a large telegraphic export to the United States. The imports for the month were valued at £217,415, which compares with £211,256 the total for June, while the re-exports reached the high total of £34,462, being some £8,000 in advance of the previous month's figure.

As regards the individual sections of the exports, the machinery total compared badly with the previous month, and the value of cable exports was only slightly in excess of the previous month's figures—in fact, the improved export total was solely due to activity in the telegraphic section.

The imports, on the other hand, showed small increases in value in several directions, and the only notable drop was in telegraphic and telephonic imports. Apart from the U.S.A., which, owing to the circumstance mentioned above, was our most prominent customer during the month, India, New South Wales and Argentina contributed substantial amounts to our export business, while as regards the importers to this country, the position remains substantially the same as in previous months.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,282	685	149	78	1,739	546	12,177	49	34	41	1,036	2,079	19,895
Germany	2,284	4,706	77	354	606	928	4,424	38	25	...	27	119	13,588
Netherlands, Java and Dutch Indies ...	695	979	294	75	...	1,071	1,022	19	7	12	33	17	4,224
Belgium	689	558	160	30	159	19	1,801	763	286	...	1,493	226	6,184
France	210	...	3,493	21	...	32	6,180	1,215	6	16	373	155	11,701
Portugal	159	21	25	...	...	...	363	...	8	18	316	31	941
Spain, Canary Isles and Spanish N. Africa...	1,420	644	215	...	470	...	4,735	66	19	2	583	407	8,461
Switzerland, Italy and Austria-Hungary ...	797	1,156	565	...	138	...	2,332	...	48	473	237	3,962	9,708
Greece and Turkey	197	107	305	...	...	...	476	...	98	...	6,896	3,007	11,086
Channel Isles, Gibraltar, Malta and Cyprus...	27	22	55	64	...	132	53	...	16	...	...	938	1,307
U.S.A., Philippines and Cuba	262	101	66	38	76	47	1,555	...	22	...	500	191,574	194,241
Canada and Newfoundland	419	2,832	793	792	...	1,804	15,333	87	693	...	2,170	903	25,826
British West Indies, British Honduras and British Guiana	372	...	303	22	23	43	225	...	42	...	71	192	1,293
Mexico and Central America	97	43	19	...	25	...	1,453	9	4	31	...	154	1,835
Peru and Uruguay	1,117	196	156	250	...	5	291	154	3	26	...	1,475	3,673
Chile	770	217	503	415	125	...	2,673	...	137	36	171	6,899	11,946
Brazil	2,714	1,161	701	427	11	792	6,892	684	255	23	609	11,930	26,199
Argentina	3,267	7,417	404	773	670	1,069	8,419	591	1,344	123	9,454	3,213	36,744
Colombia, Venezuela, Ecuador and Bolivia...	56	...	115	12	...	...	668	...	...	...	...	65	916
Egypt, North Africa and Persia	219	560	151	223	...	3	1,169	226	23	...	40	16,294	18,908
British West Africa	73	145	13	21	...	...	669	68	185	...	238	238	1,650
Rhodesia, O.R.C. and Transvaal	1,137	372	413	881	...	472	4,576	251	163	...	175	720	9,160
Cape of Good Hope	996	2,090	711	457	13	984	1,544	3,150	763	...	...	799	11,507
Natal	1,225	10,285	510	347	153	...	4,796	...	193	7	134	57	17,707
Zanzibar, Brit. E. Africa, Mauritius & Aden	443	179	37	77	...	33	849	...	33	...	136	844	2,631
Azores, Madeira and Portuguese Africa ...	426	414	34	74	36	86	3,922	99	78	...	108	1,389	6,666
French African Colonies	20	...	...	...	...	18	...	...	20	...	...	...	58
China and Siam	580	1,007	1,444	163	32	3,531	1,745	303	93	...	3,871	15,805	28,574
Japan and Korea	497	496	36	30	...	346	5,238	...	1,597	...	82	357	8,679
India	6,117	11,185	1,551	2,189	336	760	19,643	6,773	7,323	140	1,011	2,111	57,139
Ceylon	118	211	120	37	...	27	842	52	278	...	228	49	1,962
Straits Settlements, Fed. Malay States, Brit. North Borneo and Sarawak... ...	412	545	358	155	31	1,429	1,418	3,572	1,186	56	1,649	15,993	26,804
Hong Kong	825	955	106	51	...	...	1,830	8	210	...	43	427	4,455
West Australia	853	12	36	421	...	367	484	...	82	...	891	105	3,251
South Australia	617	707	202	164	...	19	2,728	15	88	3	50	74	4,667
Victoria	1,780	2,689	616	778	217	177	4,238	...	240	...	344	77	11,126
New South Wales	2,791	21,338	655	1,390	380	499	8,925	897	484	22	2,184	2,023	41,588
Queensland	220	12	54	385	103	25	614	...	71	...	13	...	1,497
Tasmania	74	295	...	...	...	1	93	...	...	...	...	...	463
New Zealand and Fiji Islands	1,478	1,315	639	107	134	706	2,333	...	455	13	2,472	2,451	12,103
Total, £	37,735	75,657	16,084	11,301	5,477	15,971	138,728	19,089	16,582	1,042	35,648	287,059	660,363

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	115	...	...	33	...	...	6,936	40	639	...	9,277	17,040
Germany	4,562	35,613	1,550	10,242	6,857	2,718	29,568	163	...	7,383	6,961	105,617
Holland	...	520	...	354	1,033	...	34	...	...	...	47	1,988
Belgium	854	2,094	35	272	162	20	2,940	40	512	...	4,840	11,769
France	1,170	...	731	774	177	231	210	...	642	4,097	1,048	9,080
Switzerland	291	1,014	40	...	...	379	1,368	...	...	15	42	3,149
Italy	...	3,218	...	...	...	...	...	...	...	...	164	3,382
Austria-Hungary	...	360	...	154	167	...	26	...	42	10	...	759
United States	6,352	632	2,158	55	181	78	15,400	34,389	577	790	3,512	64,124
Total, £	13,344	43,451	4,514	11,884	8,577	3,426	56,482	34,632	2,412	12,295	25,891	216,908

Additional imports: Spain, carbons, £367; Canada, electrical machinery, £140.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	18,935	853	...	2,533	957	...	7,323	...	728	1,659	1,474	34,462

TOTAL EXPORTS: £660,363. TOTAL RE-EXPORTS: £34,462. TOTAL IMPORTS: £217,415.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

NEW FRENCH CAR-LIGHTING DYNAMOS.

The problem of producing a dynamo for motor-car electric lighting purposes that shall give not only a constant voltage, but also a constant output, notwithstanding the ever-varying speeds at which it may be driven, is one that is engaging the attention of electrical engineers both at home and abroad. Already several very efficient machines have been produced, but this does not prevent the introduction of

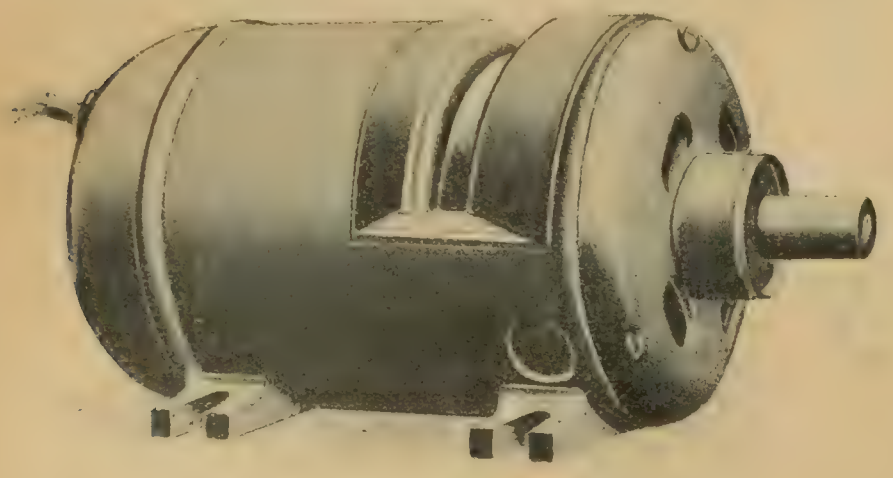


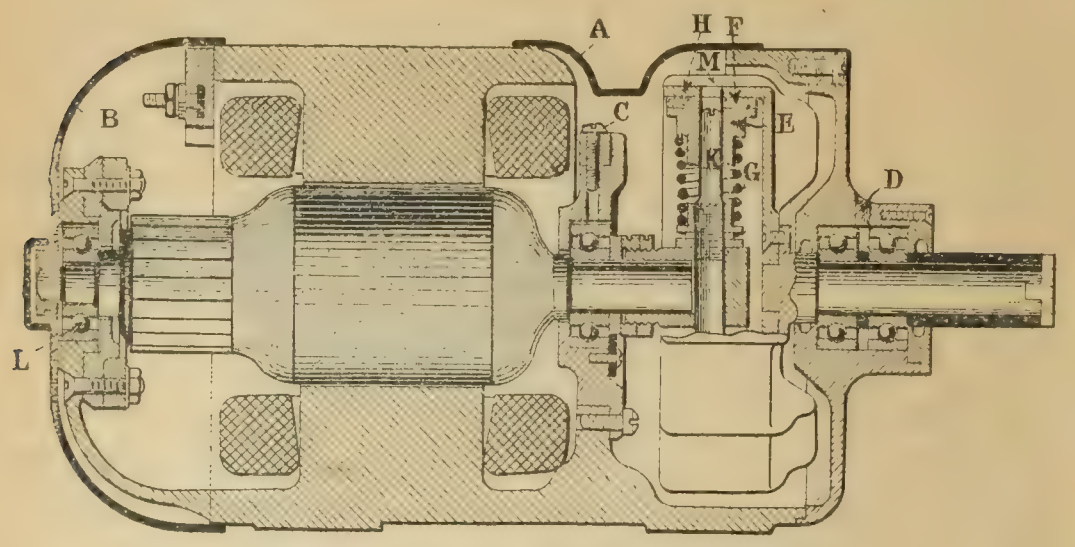
Fig. 1.—"Grada" Car-Lighting Dynamo.

new designs, and this week we propose to describe two interesting machines which have recently made their appearance in France.

The "Grada" dynamo, which is made by M. Perez, of 50, Rue de Paradis, Paris, possesses a bi-polar field, built up with an aluminium casing which encloses all the various parts. Between the poles rotates the usual armature, having at one end the collector and brushes, and at the other a clutch. It is the provision of the latter which forms one of the main features of the Grada system, for by its means a constant voltage is assured by arranging for a constant speed of the dynamo—about 1,200 R.P.M.—although the shaft which drives it may be running at anything from 2,000 to 3,000 R.P.M. It will be seen from the longitudinal section (fig. 2) that in addition to the armature spindle, a second spindle is provided at one end, this being driven by any suitable means off the engine of the car. On the second spindle is keyed a steel drum—marked A in the transverse section, fig. 3—so that the two rotate together. Connected with the armature spindle are two male clutch sections or shoes E, held in position by guides, and in contact with the inner face of the drum by the spiral springs B. Two weights D are also mounted on the armature spindle, they being connected by the links F to the clutch shoes. As the speed of the armature increases, the weights, by centrifugal action, tend to move away from the spindle, this movement being transmitted through the links F to the clutch shoes, which, as the pressure of the springs is overcome, become disengaged from the drum A.

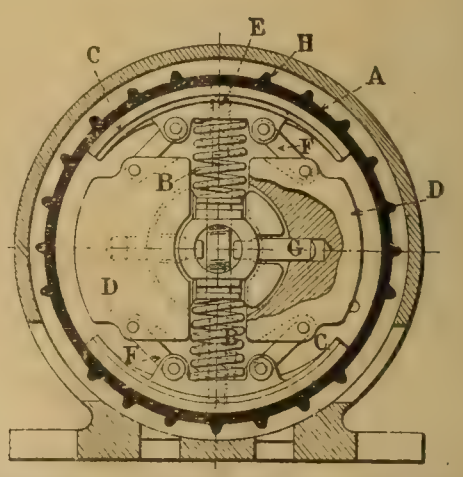
When the engine of the car is at rest, full contact is made between the drum and the shoes, so that when the engine is set in motion, the drum and, consequently, the armature, are caused to rotate. As soon as the speed increases, the pressure of the springs, counterbalanced by the effort transmitted by the links F, is reduced, and when the drum has attained a speed in excess of that for which the clutch is adjusted, the contact between the drum and the clutch shoes is broken, this taking place, as already mentioned, at a speed of about 1,200 R.P.M. The speed of the armature then diminishes until the centrifugal force of the weights becomes less than the strength of the springs, when contact between the drum and the shoes is again made.

In practice, the drive through the clutch is practically constant, a degree of slip taking place, varying in accordance with the speed of the engine. One of the Grada machines was recently submitted to two hours' test at the laboratory of the French Automobile Club at Levallois, near Paris, when the speed of the engine ranged from 464 to 1,371 R.P.M., and that of the clutch shaft from 1,302 to 4,114 R.P.M. Notwithstanding this wide variation, the speed of the armature spindle only fluctuated between 1,198 and 1,332 R.P.M., the voltage between 6·4 and 7·2, and the amperage between 7·9 and 8·5. Except for the blowing of a fuse near the close of the test, the lowest speed of the dynamo recorded would have been 1,248 R.P.M., the minimum voltage 6·7, and the lowest output 8·1 amperes. The tests were made directly, that is, without the intervention of a battery, and the report states that no heating of the dynamo was observed. It may be added that the face of the clutch shoes is lined with special material, which permits the clutch to be run dry, without danger of seizing or firing. With the object of keeping the clutch drum as cool as possible, its exterior face is provided with vanes H (fig. 3) which cause it to act as a fan.



A, Clutch casing; B, Commutator casing; E, Clutch shoes; G, Clutch springs; H, Clutch drum; M, Vanes of drum.

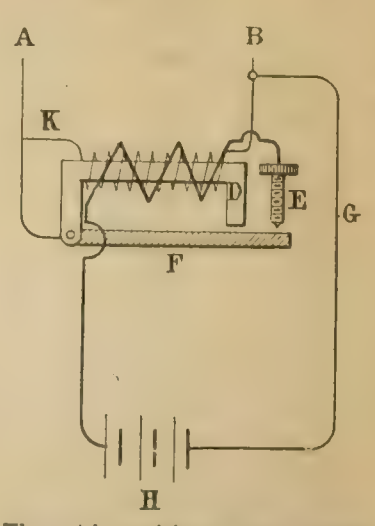
Fig. 2.—Sectional Elevation of "Grada" Dynamo.



A, Clutch drum; B, Clutch springs; C, Clutch shoes; D, Weights; F, Links; H, Clutch drum vanes.

Fig. 3.—Transverse Section of "Grada" Dynamo.

In a shunt-wound machine running at a constant speed, when the output of the machine is increased, the voltage at the terminals falls.



The cut-in exciting current passes by A, K, B, and the battery charging current by A, F, E, H, G, B, when the cut-in is engaged.

Fig. 4.—Diagram of Automatic Switch.

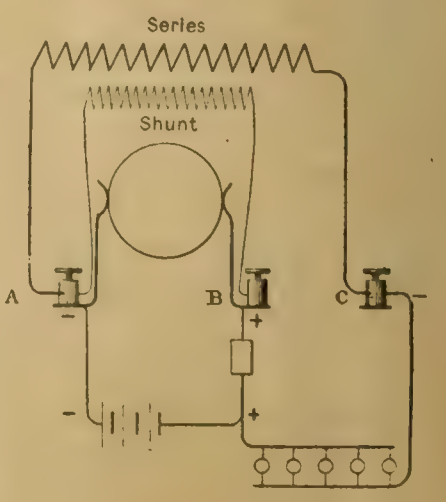


Fig. 5.—Diagram of Connections.

By using a compound winding, however, it is possible to obtain a uniform voltage, notwithstanding the varying amperage. This is the plan followed in the Grada dynamo, the arrangement being shown diagrammatically in fig. 5. The result is that, whatever the number of lamps in use, the brilliancy—which depends on the voltage—of each remains the same, and this without the assistance of the battery. In fact, if the engine ran continuously and at a sufficiently high speed the battery could be dispensed with, but as these conditions do not exist in automobile work, a set of accumulators is used.

The battery employed in the Grada system consists of three cells, having a total capacity of 60 ampere-hours, at a discharge rate of 8 amperes, or sufficient to run the whole of the lamps of a car for a period of $7\frac{1}{2}$ hours. In use, however, the battery is always kept fully charged, for when the dynamo is running, its capacity is sufficient not only to run all the lamps, but also to give a slight charge to the accumulators. As regards overcharging the battery, it is well known that the voltage of a cell rises very quickly to 1·8 volts, and then very slowly to 2·2, finally making a quick rise to 2·5 volts. For a battery of three cells, the pressure at the approach of the period of overcharge is, therefore, 7·5 volts. From the figures relating to the tests already mentioned, it will be seen that the voltage of the dynamo never exceeds 7·2, so that there is no danger to be feared in this regard.

Passing now to the automatic cut-in and cut-out device, this, as will be seen, is not called upon to perform any function in preventing overcharge of the battery, but serves merely to prevent the accumulators discharging themselves through the dynamo, when the speed of the latter falls, and its voltage becomes less than that of the battery. The cut-in device, which is shown diagrammatically in fig. 4, consists merely of a bar of soft iron wound with fine wire, and placed in shunt to the terminals of the dynamo. When the voltage at the terminals becomes greater than that of the battery, the soft iron armature is attracted and closes the circuit. If, however, the speed of the engine varies considerably at about the number of revolutions at which the cut-in device works, the result will be a constant cutting in and out of the battery, accompanied by the usual sparking. To overcome this difficulty, the apparatus, in addition to the shunt winding already referred to, is also provided with a second winding of thick wire arranged in series with the battery-charging current. On open circuit,

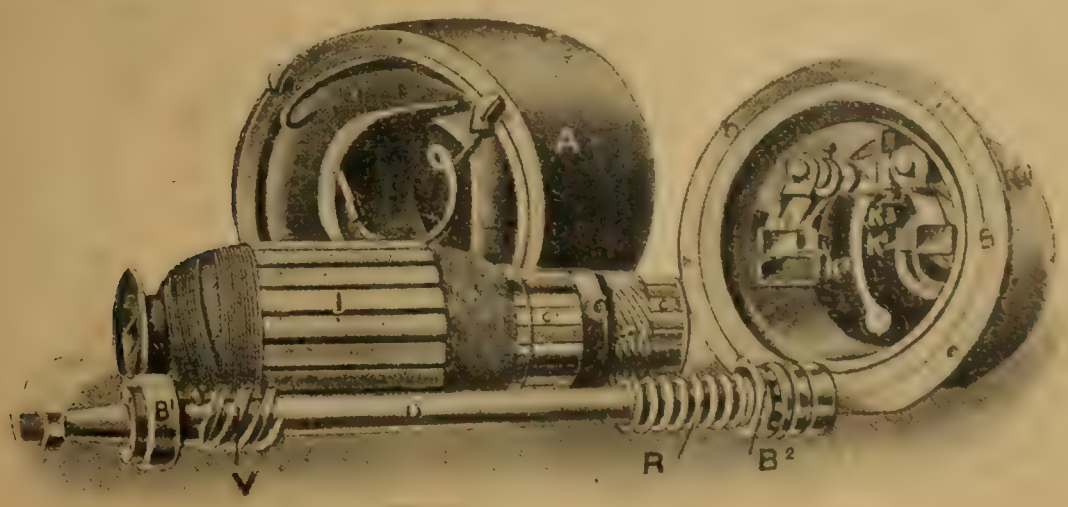


Fig. 6.—Details of "Stereos" Car-Lighting Dynamo.

the current passes through the shunt winding, but as soon as the cut-in device has closed, current passes in the same direction through the series winding, increasing the magnetism of the core. The cutting-out operation is, therefore, effected at a voltage less than that which brings about the cut-in. In other words, if the cut-in operates at a difference of potential of 7 volts, the battery will only be disconnected when the difference falls to 6·5 volts.

In the "Stereos" machine made by the Société des Etablissements Stereos, of 18, Rue Guersant, Paris, the problem has been attacked in quite another manner, neither centrifugal governor nor clutch nor automatic cut-out being employed. Reference to fig. 6 will show that the machine consists of a round shell or casing, on the inside of which are fixed the exciting coils, the shell being closed by end pieces which carry the bearings and the carbon brushes. The armature I, instead of being fixed to its spindle, as usual, is mounted thereon in such a way that while it must rotate with it, the relative position of the two, as the speed increases, is varied by means of the worm threads V cut on one end of the spindle. A light spring R maintains the armature close up to the driving end of the spindle when the dynamo is not being driven.

Another feature of the arrangement is that the collector is divided into four sections, the object of which is described below. The brushes K_1, K_2 convey the current to the battery of accumulators in the usual way, while a small



Fig. 7.—"Stereos" Dynamo, with Cover removed to show Commutator and Brushes.

vertical brush K_3 is also provided to pick up the exciting current and convey it to the field coils.

In action, when the engine is started up, and is running slowly, the brushes rest on an insulating ring C; no current is then taken off the machine, there being, in fact, no connection between the dynamo and the battery. As soon as the engine of the car attains its normal speed, the armature, under the influence of the increased speed, tends to move to the left away from the driving end of its spindle. The brushes then come in contact with the commutator strips C_1, and the exciting brush with the oblique strips C_2, connection with the battery and with the field coils being thus established. The oblique strips connect the two parts of the commutator C_1, C_3, which are identical except that the bars of the latter are set slightly out of line with those of C_1. When, due to the acceleration, the small brush K_3 is at the front end of the oblique strips, a maximum degree of excitation is attained, enabling the dynamo to produce its maximum output. As the speed increases, the armature continues its movement to the left, but any increase in voltage is prevented by the small brush coming in contact with the more oblique part of the strips, so bringing about a reduced excitation proportionate to the speed. This reduction of excitation has been carefully designed with the view of securing a constant voltage.

When the engine of the car slows down, or is stopped, the difference of potential between the battery and the dynamo converts the latter into a motor; the armature is then displaced to the right until, when the main brushes pass on to the insulating ring C, the connection between the battery and the dynamo is broken, the arrangement thus fulfilling the function of a cut-out in preventing the accumulators from discharging themselves through the dynamo.

Another feature of the machine may be mentioned: the exciting brush is arranged to slide in its support, so that it is possible so to set it, that the moment of its contact with the oblique strips C_2 shall be such as to furnish the necessary current required for any particular battery.

CENTRAL STATION ADVERTISING.

FROM A VETERAN PIONEER.

It is gratifying to learn from the leaderette in your issue of August 15th that there are signs that the managers of central electric supply stations are becoming keenly alive to the fact that there is a commercial side to their business. However perfect may be the arrangements for supplying the electricity, unless the public can be induced to use it, all the inventive engineering and financial skill available will not suffice for making the enterprise successful. If the time arrives, as it may do some day, when electric light and power is supplied, like wireless telegraphy, without the aid of coal, oil, or water-falls, high or low-tension cables, every one able to supply themselves direct from the ether, there will still be the necessity for commercial management in pushing business.

Having had nearly forty years' experience on the commercial side of the electrical industry, including the supply of many towns from central stations, I am familiar with the difficulties that attended the introduction of the new system; in the present day, it is mere child's play in comparison with the early efforts of those who had to deal with inefficient materials, as well as with the prejudices and conservatism of so large a portion of the community.

When I was engaged in supplying electricity to the only town under powers obtained through the Electric Lighting Act of 1882, I had to contend against many initial difficulties. The electric light was becoming known through experimental street lighting, exhibitions, public buildings, factories, places of amusement, &c., but in the case I refer to, it was the first attempt to supply in a town, from a central station, by means of underground mains, and following the ordinary conditions of the existing gas supply.

The first difficulty was to fix the terms of supply, and to prove that the electric light was in all respects superior to any other means of illumination. In one case I satisfied a pioneer consumer by agreeing to light his shop at a fixed sum per annum, based upon what he had paid in the previous year for gas, giving him all the benefit of the indirect economies arising from cleanliness, facility of lighting and extinguishing, &c., and I think that in the present day, when the metallic-filament lamps consume so little current, the same system would be worth testing. It would dispose at once of the question whether light for light electricity is cheaper than gas, as I have proved by the testimony of consumers in every town I have supplied, but which is even now disputed by some managing electrical engineers.

The charge for electricity, like that for gas, necessarily varies with local conditions—the price of coal, for instance, being the important factor—so that price must be based upon working out in each locality how the charge for gas compares with the proposed tariff for electricity, the advantages of health, safety, cleanliness, &c., being important points for use in canvassing.

In dealing with the Publicity Department, I have found that the most successful appeals are in the form of testimonials from consumers, who can speak from their personal experience, which should be published periodically in local pamphlets and circulated to the residents on the line of mains.

The ordinary canvasser, when listened to, is looked upon as an interested party, and his appeals and recommendations are received *cum grano salis*, but the testimony of a neighbour is quite another matter—the satisfied consumer being the best canvasser. Circulating the ordinary printed matter which is furnished for general distribution is of very little value in adding to the number of consumers.

There are two classes to consider, viz., those whose premises are situate on the line of mains, and the residents where no mains have been laid. I only remember one town (Weybridge) where the mains of the electric supply company are laid throughout the town, and I found in that case the number of consumers on the mains in proportion to the residents was greater than in a number of other towns where the mains were only laid in certain localities.

Of course the gas companies, whose mains, as a rule, are laid throughout the towns, have a great advantage over the electric companies, which are only prepared to supply certain localities, and this not only concerns the individual residents, but especially the street lighting.

The local pamphlets should contain not only testimonials but all matters of interest connected with the supply of electricity, and I have found especially useful a table showing the actual cost of the lighting quarter by quarter, and for the whole year, under the maximum-demand system, showing the advantage obtained by the long-hour consumer, and how the method of charge works out under varieties of use, the figures being taken from the consumers' accounts. Forms of the contracts for supply of energy, and local information bearing upon the business of the company, should be included, and these pamphlets circulated among all residents on the line of mains are of great value as business getters.

Every supply company should have showrooms in one of the leading streets of the town, where lamps, fittings, fans, cooking utensils, electric irons, &c., should be displayed, and price lists should be sent with the quarterly accounts to the customers of the company.

In addition to the local pamphlets intended for residents on the line of mains, it is useful to issue a monthly magazine to educate the public in the progress of the industry, which should circulate throughout the country, with a view to the creation of a general interest in the industry. In this magazine, not only should the advantages of adopting electricity be kept well to the front, but also the costliness, dangers, unhealthiness, inconvenience, dirtiness and extravagance of using gas, oil, candles, &c., should be illustrated by reports of the accidents constantly occurring from explosions, fires, suffocation, &c.

The local newspaper should be a valuable aid in pushing the business of the central station, not through the advertisement columns only, but in the publication of news relating to the progress of the undertaking, with which the general manager should keep the editor constantly supplied.

The contracts for street lighting should be obtained where possible, and in this matter the arrangement made by the local authority of the Metropolitan Borough of Holborn is of especial interest. In the case of Holborn, a joint contract by the electric lighting and the gas company has been carried out, the leading thoroughfares being lighted by electricity and the side streets by gas.

Arrangements of this kind would be convenient especially in towns where the electric company's mains were laid only in the principal streets.

THE ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1912.

By EDWARD S. HODGSON.

This institution continues to report considerable progress both in routine test work and in research of importance to the electrical industry. The following notes give information as to the more interesting investigations carried out, for fuller details of which readers are referred to the annual report.*

During the year, the Reichsanstalt constructed a second set of standard air condensers on the model of those described in the last report, the individual parts being made up of aluminium or nickel-aluminium castings intead of the brass and gunmetal castings employed previously, thus keeping down the weight.

Fused quartz insulation was used in place of amber: this renders it possible to age the condensers artificially by heating, and quartz has the advantage of being uninfluenced by temperature changes.

A simple method was devised for testing the phase-angle of high-capacity decade resistance sets. For this purpose a liquid resistance of Mannit-boracic acid solution was used as the comparing resistance, the angle of this resistance being infinitely small. The measurement was carried out on an equal-arm, absolutely symmetrically-built bridge arrangement in which all disturbances from earth-capacities and mutual induction of the individual bridge arms were obviated.

* See *Zeitschrift für Instrumentenkunde*, for March, April and May, 1913.

The measurement of the 1,000-ohm coils of a bifilar resistance set wound by the Chaperon method, and their combinations with smaller resistances, showed that simple relations exist as regards the phase-angles, and thus they can be determined for the whole set by comparatively few measurements. A paper dealing with the subject is in print.

In connection with the increasing use of platinum resistance thermometers and the interest that this subject possesses for manufacturers of such thermometers, mention may be made of some measurements (now concluded) on the comparison of platinum resistance thermometers with the hydrogen thermometer between 0° and −190° C. Since over this range the resistance of platinum is a somewhat complicated function of the temperature, thermostats were constructed capable of maintaining constant any temperature between 0° and −150° C. A large number of comparisons were carried out, the absolute accuracy of the gas thermometer measurements attaining at least 0·04° C. Four platinum resistance thermometers compared with the hydrogen thermometer yielded values agreeing within 0·1 per cent. for the relation $R = r/r_0$, r and r_0 being the resistances at the temperatures $t°$ and 0°. Callendar's quadratic relation between resistance and temperature was proved to be valid to −40° C., yielding too-low temperatures below this range. With the four platinum thermometers mentioned above others were compared, the latter being made of older and less pure platinum. It was found that the quantities R of the individual thermometers at low temperatures differed from each other the greater the difference in their mean (measured) temperature coefficient α, where $\alpha = (r_{100} - r_0)/100\ r_0$. For comparing various thermometers with each other, the relation $(t'_p - t_p) = ct_p\ (t_p - 100)$ was established between their observed platinum temperatures. This relation satisfies the condition that at 0° and 100° C. the platinum temperatures of all thermometers are in agreement. c is a constant which must be determined by experiment. From the foregoing equation we get for the difference $R' - R$ of the resistance ratios of two platinum thermometers, the expression—

$$R - R = A\,(R - 1) + B = a'\,c/a^2.$$

By writing

$$A = a'\,(1 - 100c)/a - 1, \text{ and } B = a\,c/a^2,$$

this relation enables a calibration table for any platinum thermometer compared with another at only one temperature to be drawn up after the former has been thoroughly calibrated.

The Reichsanstalt has again actively co-operated with the German Society of Electrical Engineers and the Electrotechnical Society. At the instigation of the sub-committee on insulating materials, the Reichsanstalt has worked out, as the result of experiments, a simplified method for testing insulating materials at 750 volts, in which only the surface resistance under different conditions is determined. A number of firms have already requested the Reichsanstalt to test their insulating materials in this manner.

In determining the dielectric constants of solid insulators—such as porcelain, &c.—sent to the Institution in the form of plane parallel disks, it was found that the most usual method, and also the most convenient, of determining the dielectric constants from the difference in capacity of a double-plate condenser before and after inserting the insulating disk left much to be desired. The resultant errors are attributable to neglecting the "edge" correction and the capacity to earth. The three-plate condenser with earthed outer coating is preferable to the two-plate condenser for determining the dielectric constants of solids, since the capacity of the former is independent of the surroundings, and is thus clearly defined. A formula has been derived and experimentally verified for calculating the capacity of the three-plate condenser having plates of any thickness. The results of these experiments have been published.

A short account is given of a magnetic potentiometer, which will be useful in the magnetic testing of materials, and a paper is in preparation showing how the instrument may be used for testing the magnetic circuit of electrical machines. In connection with last year's experiments on electrolytic valvular action, the electrochemical behaviour of iron in sulphuric acid was investigated, with the following result. Iron shows in sulphuric acid both passivity and valvular action. With acid concentration of below 50 per cent., passivity only is present. From 60 per cent. onwards valvular action takes place before passivity when the iron is submitted anodically to a current of 3 milliamperes per sq. cm.; this valvular effect is, however, unstable up to a sulphuric acid concentration of 75 per cent. and changes to passivity when kept in circuit for some time. With higher concentrations, however, the valvular action persists. The maximum voltage is between 40 and 70 volts, according to the concentration of the sulphuric acid. Below the maximum voltage only a very small residual current flows through the cell. In concentrated and in fuming sulphuric acid, iron rectifies alternating current. The phenomena are the same as with aluminium. Nickel and cobalt behave like iron, while the following also show valvular action and rectification of alternating current: aluminium, tantalum, magnesium, cadmium, zinc, antimony, bismuth, copper and tin.

From experiments made at the Reichsanstalt, the following arrangement—a variation of that used by the Bureau of Standards—seems to afford a means of protecting shellacked wire resistances from the influence of moisture. The device can be fitted to resistance boxes as well as to single resistances. The wire coil, wound in the usual manner on a core tube, is inserted in a closely fitting thin-walled brass shielding tube; the space between core tube and protecting tube is closed off at the lower end by a brass ring, and at the upper end by an ebonite ring having two fine holes for the leads to the wire coil. The air-tight sealing is experimentally effected at the lower end, either by soldering or by coating with shellac, and at the upper end by covering the annular channel remaining above the ebonite ring with shellac or paraffin wax. As paraffin wax dissolves in petroleum, it is advisable to run shellac over it. The 1,000-ohm coils previously tested are packed with shellac, and not with paraffin wax. A table is given showing that no influence due to moisture was traceable.

In connection with magnetic sheet-iron, it was noted that the consignees invariably found the iron to be of poorer magnetic quality than did the consignors, and this led to the supposition that the gradual change in the magnetic qualities of such material due simply to storing might be considerably accelerated by the action of shaking arising from transit by rail. The Reichsanstalt has carried out tests—not yet concluded—which clearly show an influence due to the cause mentioned.

The method used for testing A.C. motor meters has been investigated with a view to determining the influence of upper harmonics on the calibration. The experiments made show the higher harmonics to exert but very slight influence.

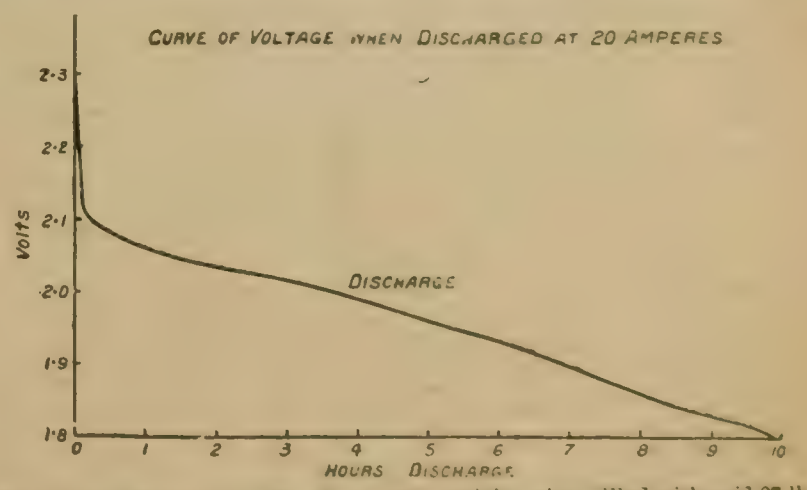
As regards the photometric work, it is stated that carbon filament lamps were not tested for life during the past year, but only metal-filament lamps, and practically only those having drawn filaments. Among the metal-filament lamps were four of special construction. In these lamps the filaments were not, as is usually the case, nearly parallel to the lamp axis, but arranged in one and two planes perpendicular to the lamp axis respectively.

Twelve lamps were sent from the National Physical Laboratory, Teddington, for international comparisons. They were measured in the prescribed direction, and at two voltages (1) at normal pressure, and (2) at so low a pressure as to give a light equal to the colour of normally burning carbon filament-lamps. Agreement to within 0·2 per cent. between the measurements of the Reichsanstalt and the National Physical Laboratory was obtained for the lower pressure, and to within 0·4 per cent. for the higher. Unfortunately, the filaments of the lamps were arranged about the lamp axis, as in the ordinary metal-filament lamps; the measurements would have been more reliable had the filaments been arranged in one plane. The lamps were sent on from the Reichsanstalt to the Laboratoire Central, in Paris.

The usual appendix containing a list of the papers published during the year is given, to which reference should be made for further information on experiments completed.

THE FULLER BLOCK ACCUMULATOR.

THE Fuller block accumulators, which we described in our issue of August 30th, 1912, are a comparatively recent introduction, but they have now been in use for a sufficient length of time to prove that they possess qualities which call for special notice and commendation. The defects under which ordinary plate accumulators labour are well known, the tendency to buckle, and the liability of the active material to drop out, being two of the most noticeable. In the Fuller accumulator the plate form has been discarded, and what is practically the strongest form with



Overall dimensions of cell 18" × 7" × 11·5"; weight when filled with acid 97 lb.

N.P.L. TESTS OF TRAIN LIGHTING FULLER ACCUMULATOR.

plane surfaces, namely, the triangular, has been adopted. An assemblage of blocks of this triangular form (like a sliced cake) forms the cell. Around each of these "slices" is wrapped glass wool (which is practically imperishable), and the slices so covered are separated from each other by corrugated celluloid separators, so as to allow free circulation of the acid solution. Although in this arrangement the outside surfaces of the assembled blocks are inactive, and therefore weight for weight the arrangement would apparently be much less efficient than the plate form, yet in actual practice this does not appear to be the case, there being little difference between the relative efficiencies of the new and old types. One result of the arrangement of the Fuller block accumulator—not an intentional one—is that the resistance of the cells is higher than that of the plate form, but this resistance is not so high as to be of consequence, whilst it has a very great advantage in that it prevents damage to the cells if they are accidentally short circuited; indeed, they will stand prolonged dead "shorts," even for hours at a time, without injury.

In regard to "sulphating" the record of the block accumulator is remarkable. The cell can be charged and left standing idle for 12 months, with no fear of sulphate forming or of the voltage

falling, and this although the cell has been partially discharged before being allowed to rest, a condition which ordinary accumulators will not stand, as is well known. The explanation of this property of the cells is said to be due to the fact that there is in the mass of material, and especially near the central core, a large amount of active peroxide which remains unaltered during discharge, even when the cell is discharged to 1·8 volts. As soon as the discharge is arrested, however, this latent energy in the cell immediately raises the voltage of the elements until the cell rapidly recovers to its full voltage, so that with an apparently discharged battery even a few minutes will show fair recovery, and on a voltage test it will appear to be almost fully charged. It is this recovery in voltage, owing to the cell in reality only being partially discharged, that prevents the chemical process known as "sulphation." This explanation seems reasonable and is a corollary of the fact that the amount of active material in the cells is exceptionally large.

Not only does the construction of the blocks ensure great rigidity, but their tight glass wool covering renders disintegration practically impossible, as even if flaking of the material were to take place the flakes could not fall away and cause short circuiting, and the deposit of mud at the bottom of the cells, so common in ordinary accumulators after long use, cannot take place.

It is satisfactory to note that no extravagant claims are put forward by Messrs. Fuller for their accumulators, which, indeed, if weight for weight they were markedly less efficient than the ordinary type, would still be, from their strong mechanical construction and durability, a very useful type indeed. Personal experience has proved, however, that such claims as are made are quite borne out by facts.

The results of tests made at the National Physical Laboratory are shown by the figure on p. 357 ; it should be mentioned, however, that although the height of the cell is given as 18 in., the actual height of the blocks themselves is but 7¾ in. ; the 18 in. height is really unnecessarily great, and must not be taken as an important dimension in comparing the block accumulator with others of the plate type in which the cells are smaller. Strict comparison between accumulators or batteries of widely different makes is not an easy matter, and great care has to be exercised to prevent either undue exaltation or undue depreciation of the various types for which certain claims are made.—H. R. K.

AMERICAN INSULATOR MANUFACTURE.

Twenty years ago people engaged in pottery manufacture in the United States used to look to England for their high grade clays, and it must be acknowledged that the enormous hills of comparatively pure clay or kaolin in England give it a natural advantage over the native producer, both as to quality and cheapness of production, but American push and ingenuity has given to the trade North Carolina and Georgia kaolins second to none in colour. In Florida, clay under water has been mined which was 75 per cent. sand, the clay has been separated from the sand, and the trade has obtained a clay which gives the colour of a china clay and the strength of a ball clay. It is these last qualities that appeal to the electrical porcelain manufacturers, as it gives them a strong piece of ware before and after burning without sacrificing the colour.

The Florida clays are mined by dredges under water or by other hydraulic methods, and clay, sand and water is sucked up through long lengths of pipe by means of big centrifugal pumps. The sand is settled out by means of various contrivances, while the clay is kept in suspension in the water. The clay and water is then run into settling tanks, where the clay settles and the clear water is drawn off. This leaves the clay about the consistency of very thick cream, and in this shape it is pumped by slip pumps into filter presses where the remainder of the water is forced out, and the cakes of clay are then taken from the filter presses and put upon racks of galvanised steam pipes to dry. The North Carolina and Georgia clays, are mined either in open cuts or from pits and shafts with pick and shovel, and then thrown into agitators or disintegrators where water is added, and then the process is practically the same as in the case of the Florida clay. The use of the filter press has done away with the necessity of the old evaporation tank largely used in England, which covers a great deal of space and is a very slow method of securing the clay in quantity and also gives opportunity for impurities from the air to get mixed into the clay.

Blunging.—When the clays are received the manufacturer first determines the percentage of moisture they contain. Knowing this, he proceeds to make up a mix consisting of the several kinds of clay, each in its proper proportion, and after adding the required amount of water, the mix is ready for the blunging process. The blunger is a tank-like machine, in the centre of which is provided a rotating member supplied with heavy blades for breaking up the lumps of clay and thoroughly mixing all the constituents to the consistency of very thin mud. In some factories a horizontal revolving steel cylinder containing the mix and heavy balls for grinding the clay, takes the place of the blunger. This machine is called a ball mill.

When the blunger or ball mill has ground the lumps all out of the mix, a valve in the bottom is opened and the mix is allowed to run out and through a very fine mesh copper lawn or screen into a pit under the floor of the room called an agitator.

Agitating.—The agitator is somewhat similar to, but very much larger than, the blunger. Its office is to keep the slip, as the mix is now called, in constant motion so that the clay will not settle to the bottom.

Pressing.—From the agitator the slip is pumped by means of high-pressure pumps into a press consisting of a framework holding about 50 iron disks or leaves so shaped that when pressed together by means of the screw at the end of the press, a disk-like cavity remains between each two leaves. Each leaf is provided with a hole in the centre, and also a canvas sack consisting of two pieces, one each side of, and the same size as, the leaf, each with a hole in the centre, the two pieces of canvas being sewed together around the circumference of the hole. When the disks are pressed together with these sacks between them, the slip is pumped in, and as the press fills up, the pressure rises and the superfluous water strains out through the canvas, leaving behind disks of moist clay, which can be removed when the press is opened.

After being taken from the press, the moist clay is put away in cellars and allowed to "age." This process takes from a day in some cases to several days in others, depending on the quality of the mix and nature of the ware to be made, but more particularly on the judgment of the foreman in charge of clay making. When the clay is taken from the ageing cellars it is ready for pugging.

Pugging.—The pug mill consists of a vertical cast cylinder, in the centre of which is a revolving member provided with projections similar to one of the blades of a boat propeller, and so arranged that when the clay is thrown into the open top of the mill it is constantly being worked or kneaded by these blades, and at the same time forced to the bottom of the mill. At the bottom, and on the side of the mill is provided a circular hole, through which the clay is forced. The cylinder of clay gradually being squeezed through the opening, is cut off into convenient lengths and is carried away to be made into ware.

Jollying.—The process of shaping the clay into the various forms is called jollying.

Moulds of plaster of paris having been previously made from prints or models, one of these is filled with the soft plaster clay and placed on the potter's wheel, which consists of a large drum fastened to the top of a vertical shaft. The wheel is caused to revolve, and the operator works the clay, using a sponge and a little water, into the shape of the "shoe" which forms the inside shape of the piece, the mould being made so as to form the outside shape. The arm carrying the shoe may be hinged at a point at one side of the wheel, or it may run on a guide vertically, counterbalanced by a weight, in which case the device is called a "pull down."

All high-voltage insulator parts are made in this manner, excepting the very small sizes. These are generally made in a machine so constructed that the mould is stationary. The shoe in this case is a revolving plunger, and operated through a split nut, having a thread of proper pitch, so that the plunger carrying a threader on its end will descend into the mould and thread the insulator at the same time as it forms the inside shape.

Drying.—As each mould is taken from the wheel it is placed in a hot room, where the drying of the piece begins. As soon as the piece has dried enough to cause sufficient shrinkage, the piece is taken from the mould, and the latter is ready to be used again.

In order to put through a large order for four-part insulators, at least 200 moulds for each part are necessary. It is, therefore, easily seen that the mould cost is an item of considerable importance in making up the ultimate price of the piece.

Finishing and Grooving.—When the piece approaches a state which may be called bone dry, the parts that were next to the mould have to be finished to remove surface or lap cracks made when the wad of clay was first put into the mould. This is done by mounting the piece on a revolving wheel and scraping the surface, then finishing with sand-paper. The grooving of the parts to be in contact with cement, and the turning of the side wire groove are also done at this time.

Glazing.—White glaze is made up of the same materials as the body with an extra quantity of flux, *i.e.*, feldspar. Brown glaze is simply a pure earthy matter in suspension. Manganese oxide is sometimes used. Oxide of cobalt is used to secure blue or slate colours.

In order to apply the glaze to the piece it is only necessary to dip the piece into the glaze, protecting those surfaces that are to be left unglazed. If this latter is impossible, it becomes necessary to scrape the glaze off such parts after dipping. All parts on which the piece rests when placed in the saggers for firing must be left unglazed to prevent the piece from sticking to the saggers.

Placing in Saggers and Setting Kiln.—The sagger is a fire-clay vessel serving two purposes (*a*) to contain the ware, thus protecting it from direct contact with the fire. This is of first importance in coal-fired kilns ; (*b*) to allow of piling up the ware in order to fill the kiln.

The pieces to be fired are placed in saggers of proper size and shape, and the saggers are piled one above the other in "bungs" placed in circles around the kiln one row within another until the kiln is full.

At intervals about the circumference of the kiln, and in front of spy holes, are placed pyrometric cones for gauging the temperature. These can be examined by the kiln burner from time to time through the spy holes.

Firing Gas-Coal.—The firing of the kiln is one of the most important parts, if not the most important in the manufacture of any ceramic ware, and it is of more importance in the manufacture of high-voltage insulators than in many other ceramic wares.

There are two common fuels used for firing kilns, coal and natural gas. Hard coal is used in some factories, but soft coal is almost universally used where natural gas cannot be obtained.

Besides many little advantages in the way of convenience of handling the fuel, extra room not available when coal is used, freedom from smoke, &c., natural gas firing is greatly to be preferred over coal firing for several important reasons.

(*a*) All soft coal contains more or less sulphur, and a portion of this is burned into the glaze of pieces fired in a coal-fired kiln. The presence of this sulphur causes the insulator to arc over at a lower voltage than it otherwise would.

(*b*) It being much easier to regulate the several fires round a kiln when using gas than it is when using coal, the temperature all through the kiln may be kept more uniform, thus ensuring that all the insulators in that kiln will be brought as nearly as possible to a uniform state of vitrification.

(*c*) The surface of the glaze on an insulator fired in a gas-fired kiln will show a much nicer gloss than one fired in a coal-fired kiln.

The actual firing of a kiln takes about 40 to 48 hours depending on the size of the kiln, and also somewhat on the nature of the ware it contains. The smallest kilns are 12 ft. diameter and the largest are 16 ft. 6 in.

Nearly as important as the firing of the kiln is the cooling process. This must be regulated as nicely as the firing, or the glaze will be "off colour," crazed, or even the ware itself may be badly damaged. The time of cooling depends on the size of the kiln; a fair average for "setting," "firing," and "drawing," or one complete cycle for a kiln is about 80 hours.

Drawing Kiln and Sorting.—When the kiln has cooled sufficiently the saggers are removed and the ware taken from them and carried to the sorting room. All ware that is not "high voltage" is here sorted, the perfect being packed for shipment, the rejected being scrapped.

The high-voltage ware is also sorted here and pieces having visible flaws are thrown out. All others are passed on to the testing room.

Commercial Tests.—Pin Type Insulators.—The commercial tests on pin type insulators usually consist in inverting the parts in a pan of water of such depth as to cover the unglazed portion of the piece (or on head parts up to the centre of the side tire wire groove) and filling the inside of the piece to a depth to cover the unglazed part (in pin parts to cover the thread) and applying the potential to the water outside and inside. It is the practice to test all parts to a voltage just under the arcing point for a period of one minute.

All parts found defective are scrapped and the balance are sent to the assembling room.

Nothing but neat portland cement is used by the best makers in the assembling of insulators. Assembled insulators are tested in the same manner as above indicated. It will be readily seen that an assembled insulator tested in a pan of water will not stand as great a test as would be the case if mounted in its proper position on a pin, due to the fact that its total amount of leakage surface is not available. This applies also to the testing of single units of the suspension type.

Suspension Type Insulators.—The commercial test consists in treating each porcelain unit in the same manner as described above. Electrical tests on complete strings of suspension insulators are not made except as described in B and C below.

Dry Arcing Tests (B).—*Pin Type Insulators.*—This test consists in mounting the insulator on a metal pin under as nearly as possible service conditions and applying the potential to the pin and a rod fastened to the line wire groove in a manner similar to that in which the line wire would be secured.

It will be found that the arcing voltage thus obtained will be considerably higher than that obtained on an assembled insulator. The user should not confuse these two values, that is the commercial test on complete insulator (which is slightly less than arcing voltage in the test pans), and the ultimate arcing value as obtained by the test described in this paragraph.

Suspension-type Insulators.—Dry arcing tests on suspension insulators are determined by fastening the required number of units together and suspending them in position and applying the potential to the cap on the top unit and the wire clamp beneath the bottom unit. It must be borne in mind that the arcing voltage for several units is not a multiple of that for one unit of the same kind, although it has been found that each additional unit after the second adds about the same amount to the arcing voltage as the second unit added to the first.

Rain Arcing Tests (C).—*Pin-type Insulators.*—The rain test is at the best a very poor way of comparing insulators, due to the many variables entering into it. Quality of water, quantity of water, pressure of water, distance of nozzles from the unit under test, fineness of the spray, angle of contact with the unit under test, barometric pressure, and other matters have a bearing on the results obtained.

It has been generally found by careful experimenters, even with laboratory methods and apparatus, that it is practically impossible to duplicate results.

However, as used, generally to-day the rain test consists in mounting the insulator as described under "dry test" and throwing a fine spray on to it at an angle of 45° with the horizontal, the precipitation being approximately 1 in. in five minutes. The accurate measurement of the quantity of water introduces another difficulty and chance of error.

Suspension Type Insulators.—The rain test on suspension type insulators is made in a similar manner, *i.e.*, by throwing on to the assembled string of units suspended in position, a spray of water at 45° with the horizontal, with a precipitation of approximately 1 in. in five minutes.

Mechanical Tests.—Pin Type Insulators.—The usual test applied to pin type insulators consists in mounting the insulator on a rigid metal pin and applying a pull at the side tie wire groove in a direction perpendicular to the vertical axis of the insulator. In general, it may be said that any high-voltage insulator will stand a pull that will bend or break any metal pin with which it is likely to be used: 2,000 lb. is a safe figure to use in general.

Suspension Type Insulators.—The mechanical tests on suspension insulators consists in applying tension between the metal cap on the top of the unit and the connecting link beneath the unit.

The ultimate breaking load for suspension insulators varies according to design and runs from 4,000 to 20,000 or 30,000 lb.

Packing of High-Voltage Insulators.—Pin Type Insulators.—Unless otherwise specified, pin type insulators are always assembled complete before shipment, and it may be taken as almost a general rule that with all insulators for voltages up to and including 35,000 the packing will be in barrels. Special cases may require special packing. Insulators for 40,000 volts and higher are generally packed in open crates containing three insulators each.

Suspension Type Insulators.—It has become general practice to pack each complete suspension insulator consisting of 3, 4, 5, or 6 units, depending on the operating voltage, in one crate of such design that the whole assembly may be swung up into position on the tower or pole, and the crate then removed. The advantages of this method will at once appeal to the superintendent of line construction.

The above description is by Mr. J. A. Sandford, electrical engineer to the R. Thomas & Sons Co., of East Liverpool, Ohio, U.S.A., and substantially covers the processes and tests employed by his firm.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

WEST INDIES.—With reference to the notice in the Electrical Review regarding certificates of origin required with goods shipped to the West Indies, in which it was pointed out that an attestation by a Notary Public or other authority of the signature of the firm was required, it is understood that at a conference recently held in Trinidad, at which delegates from all the West Indian Colonies concerned were present, a revised form of certificate of origin was drawn up for consideration by the respective Governments. The revised form provides for the acceptance of the certificate of the exporter without further attestation, where the goods are consigned direct from the country of origin.

AUSTRALIAN COMMONWEALTH.—The Customs authorities have decided that the Siemens' mercury contact treadle for railway signalling may be imported into Australia free of duty.

MOZAMBIQUE.—The Board of Trade have received information to the effect that for the purpose of providing funds for a railway in the Province of Mozambique, all goods imported through Customs offices in the district of Quilimane are to be subjected to a surtax of 2 per cent. *ad valorem*; goods re-exported or cleared in the coasting trade through the same Customs offices will also be subjected to a similar surtax.

CANADA.—The Canadian Customs authorities have issued the following decisions as to the duties to be levied under the preferentia tariff applicable to British goods:—Electric douches, also portable vibrators, such as Bee pedestal vibrators and Bee portable vibrators, adapted for scalp or body massage, 15 per cent. *ad valorem*.

NEW ZEALAND.—The New Zealand Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods; the duties quoted are those applicable to British goods under the preferential tariff:—

Air-compressor, for starting Diesel oil engine, being unsuitable for other purposes	Free.
Cranes, parts of, viz.:—	
Wheels for carriage of travelling electric crane, with projection in centre of tires and flanges on each side (claimed as locomotive wheels) ...	20 % ad. val.
Electric appliances, viz.:—	
Vulcanite cleats for holding electric wire (claimed as insulating material)	20 % „
Coil tester, the Simpson, for testing electric coils...	Free.

FRANCE.—The Board of Trade have received through the Foreign Office a copy of a letter which has been addressed by the French Minister of Commerce to the British Chamber of Commerce in Paris, dealing with the regulations as to the marking of merchandise imported into France by firms having branch establishments in that country. In this letter the French Minister states that British houses sending goods marked with their name to their own branches in France will be allowed to replace the expression "importé d'Angleterre" by the name of the place of manufacture which is considered to be a sufficiently clear indication of the real origin of the goods. This concession is, however, to be allowed only under the following conditions:—(1) That the name of the place of manufacture is not accompanied by any statement which may lead to the belief that the goods to which it is applied are produced in France, *e.g.*, the mark "John Brown & Co., London

and Paris" is inadmissible; (2) that the branch in France is a selling and not a manufacturing branch; (3) that the letter heads, advertising matter, price lists, &c., of the French branch clearly indicates its nationality.

UNITED STATES.—A paragraph in the ELECTRICAL REVIEW some little time ago showed the rates of duty proposed to be levied under the new American tariff on electrical and similar goods. Since this paragraph was printed the tariff has been under consideration by the Senate, and the following shows the fresh alterations which have been proposed by that body:—

	Rates previously proposed.	Rates as amended by Senate.
Mica unmanufactured:—		
Valued at not more than 15 cents per lb.	30 % ad val.	4 cents per lb.
Valued at 15 and not more than 75 cents per lb.	,, ,,	25 % ad val.
Valued at more than 75 cents per lb.	,, ,,	20 ,,
Cut mica, mica splittings, built-up mica, and all manufactures of mica, or of which mica is the principal part	,, ,,	30 ,,
Carbons for flame arc lamps not specially provided for ...	not shown separately	30 ,,
Manufactures of carbon not specially provided for	,,	25 ,,
Telegraph, telephone and other wires and cables composed of metal and rubber or of metal, rubber and other materials; iron and steel wire galvanised	20 % ad val.	15 ,,

HONDURAS.—A new tariff has been passed, which was to come into force on August 1st last; the following is a statement of the duties affecting electrical and similar goods:—

	Dollars per ½ kg.
Insulators of glass or porcelain	·05
Wire of iron or steel	·15
,, of copper or brass	·20
Electric bells	·15
Graphite in powder	·05
Scientific, &c., instruments not elsewhere mentioned	·25
Lamps of all kinds	·10
Miners' hand lamps	·05
Electrical machines	·15
Mining machinery	free
Motors for steam, electricity, &c.	·01
Electric batteries	·25
Tramway rails	·01
Telephones and accessories	·15

Note:—Dollar = 4s.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,250. "Trolleys for electric tramcars." H. H. S. FARMER. August 11th.

18,252. "Electric starting devices for internal-combustion engines." L. RENAULT. (Convention date, August 12th, 1912, Germany.) August 11th. (Complete.)

18,316. "Fluid pressure braking apparatus for electric railways and the like." J. W. CLOUD. August 12th.

18,321. "Telegraphy." UNITED TELEGRAPH AND CABLE CO., and W. M. BRUCE, jun. August 12th. (Complete.)

18,323. "Manufacture from refractory material of parts of electric glow lamps." E. PODZUS. (Convention date, August 12th, 1912, Germany. August 12th. (Complete.)

18,326. "Wireless telegraph receivers." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and H. J. ROUND. August 12th.

18,349. "Telephone systems." W. AITKEN. August 12th.

18,355. "Electrodes for electric arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 12th.

18,357. "Method of and apparatus for separating suspended particles from gaseous bodies by means of high-tension electricity." E. MÖLLER. (Convention date, August 13th, 1912, Germany.) August 12th. (Complete.)

18,367. "Means for and method of changing the frequency of alternating electric currents." A. M. TAYLOR. August 13th.

18,400. "Electric light ceiling fitting fitted with a special device to facilitate the fitting or removal of a glass or alabaster bowl or metal reflectors or the like." A. HIGGINS and S. GRIFFITHS. August 13th.

18,412. "Regulation of dynamo-electric machines." A. H. MIDGLEY and C. A. VANDERVELL. August 13th.

18,488. "Relays." R. ZEI and J. NARDIN. (Convention date, August 12th, 1912, Austria.) August 13th. (Complete.)

18,446. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 13th.

18,447. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 13th.

18,448. "Incandescent electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 13th.

18,474. "Mercury motor electricity meters. S. HOLMWOOD and CHAMBERLAIN AND HOOKHAM, LTD. August 14th. (Complete.)

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18,526. "Electromagnetic device for adjusting valves from a distance." B. BRUNS. (Convention date, August 14th, 1912, Germany.) August 14th. (Complete.)

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18,568. "Locking apparatus for locking electric light glow-lamps to holders." S. DAVIES and W. J. BODELL. August 15th.

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18,663. "Transformers." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 16th.

18,673. "Arrangements for exciting Röntgen-ray tubes." SIEMENS BROS. AND CO., LTD. (Siemens & Halske Akt. Ges., Germany.) August 16th. (Complete.)

PUBLISHED SPECIFICATIONS.

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ELECTRIC FURNACE FOR FIXING NITROGEN FROM THE AIR. E. K. Scott. 14,871. June 25th.

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APPARATUS FOR ELECTRIC WELDING. R. Haddan. (Cleveland Welding and Manufacturing Co.) 29,999. December 30th. (Divided application on No. 17,749 of 1912, July 31st.)

1913.

DEVICES FOR THE PRODUCTION OF INDUCED CURRENTS IN MAGNETO MACHINES, DYNAMOS AND OTHER INDUCTION GENERATORS. A. Keller-Dorian. 1,100. January 14th. (August 9th, 1912.)

PROCESS OF ELECTROLYSIS. H. M. Du Bois. 1,420. January 17th.

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MAGNETIC SEPARATOR. Fried. Krupp Akt.-Ges. Grusonwerk. 4,595. February 22nd. (March 15th, 1912.)

ELECTRODEPOSITION OF METALS. N. H. M. Dekker. 7,328. March 27th. (Divided application on No. 17,836 of 1912, August 1st.)

STARTING INTERNAL-COMBUSTION ENGINES. W. C. S. Chapman. (Chapman.) 7,575. March 31st.

LUMINOUS INDICATORS FOR ELECTRIC SWITCHES. H. Wade. (Voigt & Haeffner Akt.-Ges.) 7,581. March 31st.

MEANS OF HOUSING THE RECORDING STRIP OF ELECTROCARDIOGRAPHS OR THE LIKE. Siemens & Halske Akt.-Ges. 7,846. April 3rd. (April 6th, 1912.)

PRINTING TELEGRAPHS. L. Cerebotani. 9,833. April 26th. (April 29th, 1912.)

BEARINGS FOR ELECTRICAL MEASURING INSTRUMENTS AND THE LIKE. Aron Elektricitatszahlerfabrik Ges. 11,277. May 14th. (December 14th, 1912.)

ARC LAMPS. H. E. Moul. (Korting & Mathiesen Akt.-Ges.) 11,704. May 20th.

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SOUTH AFRICAN TRADE.

A REPORT on the trade of South Africa in 1912, prepared by Sir R. Sothern Holland, H.M. Trade Commissioner at Cape Town, has just been published by the Board of Trade. This report, which contains an exhaustive survey of present conditions and immediate prospects of trade in the Union and Rhodesia, should have the careful attention of all firms interested in the market. On another page we publish some extracts from the report itself, but, obviously, it would be impossible to reprint the whole of even the more important sections of a report which covers some 50 or 60 pages of foolscap print. We hope, however, that the extracts we publish will serve to induce our readers to obtain copies of the report for themselves, so that they may study the remarks and suggestions therein contained.

In an interesting table of trade and population of the countries which are the largest buyers of British goods, Sir R. Sothern Holland shows that with a population no larger than 6,603,000, of which only 1,280,000 are Europeans, South Africa is sixth in value as a market for British goods, the total exports to the Union in 1911 from this country being over £20,000,000. The larger markets are India, Germany, Australia, United States and France, all of which, with the exception of Australia, have populations many times larger than that of South Africa. Moreover, of the total imports into South Africa, British goods account for 58 per cent., the imports from this country having increased from £14,000,000 in 1907 to £21,000,000 in 1912. When it is remembered that our share of the trade consists almost entirely of manufactured goods, and that some at least of our competitors largely owe what position they have to the supply of goods such as oils, timber, rice, grain, &c., which the United Kingdom, for natural reasons, cannot supply, it will be seen that this percentage of 58 per cent. represents much more than the actual figure indicates. Sir Sothern adds: "So long as a country's trade provides such healthy signs of stability as is reflected in the figures I have submitted, there is every reason for satisfaction, though I have no desire to make little of the danger which threatens us from foreign countries in many directions. It is impossible in a single report to draw attention to all the weak places in our armour, and, moreover, in my opinion, an annual review of trade is not the place to afford much information. It unnecessarily advertises our rivals and fails very often to reach the ears of those for whom it is intended." For ourselves, we should be inclined to strengthen the first part of this statement, and to contend that holding 58 per cent. of the total trade which, as we have shown, includes a large volume of commodities which we do not produce, foreign competition at present, at any rate, in its total (*i.e.*, rather than in a very few particular classes of goods) is of little importance. Later in his report the Trade Commissioner himself points out that the total shares of Germany and the United States are only 9 per cent. each. The thing to guard against is that in new trade which arises these countries should get a greater share than ourselves. As regards the latter part of the Commissioner's statement, we may point out that the activities of the Trade Commissioners are very often first

brought to the notice of firms here through these annual reports, and that if they are made colourless (by this we mean if they do not contain special information about special trades rather than general statements) firms who do not know the Trade Commissioners' work, as we know it, are apt to consider that their assistance would be theoretical rather than practical. We are inclined to think that the Commissioner under-estimates the number of firms who read his reports, or, at any rate, extracts from them in the trade and general Press.

From the particular point of view of the electrical trade the report contains much information which will be of interest to our readers. Sir Sothern Holland refers at some length to the importance to the electrical trade of the installation of electric power on the Rand, and gives figures which show that whereas the imports of electrical goods in 1907 were only £308,513, they increased to £1,428,888 in 1910; as installations were completed imports subsequently showed a falling-off, but in 1911 and 1912 respectively they amounted to as much as £1,030,627 and £917,186. The Commissioner points out that, unfortunately, the great bulk of these enormous supplies has been, and continues to be, drawn from foreign firms. From time to time he has discussed with the representatives of the companies concerned the loss of this important trade to British firms. The following interesting statement summarising the reasons for placing these orders abroad has been supplied to the Commissioner, and is submitted by him for the information of British firms. We give this statement in its original form, but would add our own opinion that the financial arrangements therein referred to have had the greater influence in deciding the country of origin of the majority of the supplies :—

"The business of generation and supply of electric power in the United Kingdom has developed on the lines of a series of small supply undertakings, as an instance of which might be cited the supply of power to London, where there are 14 different companies, 13 municipal supplies, and at least six stations for supplying the railway companies.

"Similarly, throughout the country small power stations are to be found situated within a few miles of each other, each serving their immediate district. As a consequence, the demands on the manufacturing industry in England have led to factories and designs suitable for supplying the requirements of such a market.

"On the other hand, both in America and on the Continent, the economy and advantage of large bulk supply power undertakings has been fully realised many years ago, and the electrical engineering business has been developed on the basis of having huge power stations, which sell in bulk to the different districts and towns.

"The Victoria Falls Co. is similar to the bulk-suppliers in America and on the Continent, as, in spite of the fact that the district served is relatively small, the amount of power to be supplied is probably greater per mile than in any other district in the world. This fact has led to the factories abroad obtaining experience and laying down machinery for producing mammoth plant and for supplying apparatus to deal with extremely high voltages necessary for handling these large amounts of power. On the other hand, the demand for large steam plant and the experience in Great Britain with boiler plant (both ashore and at sea) has placed the British boiler maker in a favourable position and, indeed, in advance of other nations; this has enabled the Victoria Falls Power Co. to place their business in boilers in the United Kingdom.

"When the company was first started it was desired to negotiate the securities in Great Britain, but this was not found to be possible. In the first instance, the bonds were taken in Germany, leading to the earlier industrial orders for the electric portion of the plant being placed in that country. The later issue of bonds has been taken in Great Britain, and for some time all orders have been placed in competition, and the best offers have been selected. In the case of machinery and apparatus for voltages which are not employed in England, the tenders received from abroad, as might be expected in view of the above particulars, are more favourable, but at the same time many orders are being placed in Great Britain, for all such work as the manufacturers are able from experience to produce."

As a result of the completion of these power works, Germany's total trade with South Africa, which amounted to £3,512,909 in 1910, has decreased to £3,230,021 in 1912; the imports from Germany in 1907 amounted to only £1,923,085. In 1912, however, the imports of electrical machinery from Germany were nearly double those from the United Kingdom. We have often pointed out in our columns that, particularly in new countries, investment of capital and trade go hand in hand, and the position in South Africa, as above outlined, again emphasises this fact.

That the statement quoted above underestimates the capacity of British firms to supply the needs of the new Rand works is not a point that we need discuss now. It is obvious from the fact that the Trade Commissioner quotes it in full that it is the accepted opinion in South Africa, and that, if they are to introduce their goods on the market, firms should have expert representatives who can talk them up and meet adverse criticisms. It is only in this way that our firms can hope to reap the full advantages which the South African market offers for trade expansion. As Sir Sothern Holland points out, it would be idle to suppose that sentiment does not play an important part in influencing the course of trade in favour of the Mother Country, but this sentiment is not always strong enough to secure that the business offering will come to us unless our firms make strenuous endeavours to obtain it. The report with which we now deal brings before us once again the fact that firms here have the advantage of a Government organisation in South Africa which is ready to give them practical assistance in advancing British trade interests, and we can only trust that they will use this organisation to the full.

Copper.

The strong upward course of copper prices can hardly have taken by surprise any who have studied the market in the light of the information which has appeared in these columns from time to time recently. If on occasion the upward movement has been too swift, it must be remarked that it followed as a rather natural reaction from an undue depression, arising out of the disturbed political situation in Europe resulting from the Balkan war and from the friction between the United States and Mexico.

The copper market owes its present strength mainly to continually recurring labour troubles in the United States and to the revolution in Mexico, the tendency of all of which has been to bring about a reduction in output, which is now making itself very apparent. Following upon the strike at the huge Nichols refinery a few months ago, which left its mark very plainly upon United States production for the month of June, when a reduction was shown of 8,600 tons, the whole of the workers in the Lake Superior district have since been "out," and this entailed a loss of output of refined copper of something like 8,000 tons a month.

It is possible that production will not suffer to the full extent indicated by this figure, because the smelters treating the Lake ore naturally had certain ore reserves in their bins upon which they could run for a time, but even so, it was not long after the men had thrown down their tools before the smelters had to close. True, the men have been filtering back to work for some little time now, but full resumption of operations is delayed, and the complete restoration of activity in the area affected can hardly take place for some weeks at the earliest. Considerable damage has been done to the mines by the suspension of pumping operations, and a good deal of new timbering and clearing up will have to be done ere they present the pre-strike appearance.

Meantime the statistical position of copper grows from strength to strength. Already at the end of July the world's visible supply was down to a record low figure at 60,700 tons against 98,000 tons at the end of January, and the European figures just issued show a further improvement, while all the trade anticipations are that the next United States returns due in a few days will reveal a further strengthening process. This must bring the world's visible supply of unsold copper to about the minimum below

which it cannot fall, and from then onwards, unless there should be some additional, and at present unforeseen, restraining influence upon production, a gradual increase in the stocks, and a slow return to more comfortable conditions should be seen. Last year low-water mark in this matter of visible supplies was reached at the end of August, and history has a knack of repeating itself.

The conditions which have recently beset the copper market must sooner or later give place to the normal, when, with a growing supply on hand, lower prices will prevail. It is fortunate indeed that with the statistical position indicating opportunities for prices being rushed up by speculators, there has been so little buying of the mere manipulative description. There is yet time for this to develop, but, in the best interests of the market, it is to be hoped that the gambling elements will remain in the background, for the consumer's position is sufficiently difficult and complex without the prices of his essential commodities being manipulated at the whims of the Stock Exchanges of London, New York and Paris.

Train Lighting.

From the reports published in the daily Press, it seems certain that the fire which added so greatly to the horrors of the railway disaster at Aisgill Moor, was caused through the fracture of the gas tanks or connections beneath the rear coaches of the train. The cases are far too numerous during recent years in which the use of gas as an illuminant has contributed to the loss of life and property, and has added nameless horrors to the sufferings inevitably accompanying a railway collision. It is less than three years ago since a train met with a similar accident within a mile or so of the scene of the present collision, and fire, originating from the system of gas lighting used, caused the death-roll to be far heavier than otherwise would have been the case. Surely it is high time that the Board of Trade should hold an inquiry into the methods of train lighting at present in vogue, with a view to bringing about the compulsory adoption of one which would prove harmless to the travelling public in the event of collision or derailment.

The matter has already been taken in hand in other countries, and in the Council of the Austrian State Railways a resolution was moved some time ago to the effect that the Ministry for Railways should be requested to discontinue the use of incandescent gas for the lighting of passenger trains, and to use electricity exclusively for lighting all future passenger cars, as well as those already on order. A great number of accidents had taken place, which were marked by the same feature—that fire immediately broke out, caused by the employment of gas lighting, and the lives of passengers who had not otherwise suffered by the accident were sacrificed. Since the request was made a series of tests have been carried out, showing that from the commercial as well as from the public safety point of view, train lighting by electricity presents many advantages. As a result of the tests made the Austrian State Railways largely adopted electric lighting on their trains, although from financial reasons it was impossible to convert the whole of the rolling stock to the newer system immediately. Many of the Prussian railway authorities, all the Swiss railways and the large French systems now use the electric light on their trains, and in Italy gas lighting for railway carriages is being discontinued and electric lighting substituted. In this country the whole of the tube and the underground railway trains, as well as many of the main line and suburban trains, are lighted by electricity, and there is no technical reason why it should not be adopted for lighting, heating and cooking on all the great trunk lines. That being the case, the public have a right to insist on their safety being considered in the matter, and a safe and efficient modern system substituted for one which is admittedly dangerous.

We note that, as usual, the railway company draws a red herring across the path by ascribing the fire to the live coals from the locomotive; the utter futility of this suggestion is evident to anyone who knows the construction of a locomotive fire-box, from which live coals cannot possibly be ejected. Hot ashes from the ash-pit might certainly be scattered, but there is one feature common to all these train fires—the instantaneous outburst of flame, leading immediately to a violent conflagration. It is inconceivable that so rapid and thorough an ignition should be caused by hot ashes. Without the slightest hesitation we characterise the statement as nonsensical, and declare our firm belief that, as in previous cases, the fire was started and nourished by the escaping gas. Reporting on the former accident at Hawes Junction in 1910, Major Pringle said it could not be denied that gas was the origin of the fire. In 1905 the Cudworth disaster was accompanied by a fire due to gas, and in the same year, reporting on the accident at Witham, followed by a gas fire, and that in the Catesby Tunnel, where gas escaped but most fortunately was not ignited, Colonel von Donop strongly urged the use of electricity in preference to gas. Again at Grantham, in 1906, a gas fire took place, and at Ditton Junction in 1912 there was a similar catastrophe, regarding which Lieut.-Colonel Sir H. A. Yorke recalled the recommendations of Major Pringle that electricity should be adopted and repeated them with added emphasis. Reporting on the disasters at Aylesbury, in 1906, and Saltley, 1912, the Board of Trade inspectors in each case renewed their advocacy of electric lighting. We can cite, in addition, at least a dozen instances of similar disasters due to gas lighting on foreign railways. As Col. Yorke stated in connection with the Ditton accident, the Board of Trade only awaits the support of public opinion to enable it to make the electric lighting of passenger trains compulsory. We trust that that pressure will now be applied—and in view of the unanimity with which the daily Press has attacked the system of lighting by gas on this occasion, we hope that at last something will be done to render such frightful occurrences impossible in the future.

A Chinese Contract.

The correspondence which we publish on another page with regard to the machinery installed at the British Legation at Peking, while it explains the facts of the case, will also justify the "grave dissatisfaction" which was felt by some of the competitors for the contract. The explanation of the delay in placing the contract put forward by the Office of Works is reasonable enough; but if there was time to invite fresh prices from two of the competitors, surely there was time to request them all to submit fresh prices. That would have been in accordance with the universal practice in connection with tenders, and no reason is given to justify the plea of urgency.

The schedule of sub-contractors and their respective shares in the work certainly shows clearly that the plant is all of British manufacture, but the manner of carrying out this British contract leaves much to be desired; the supposition that work which was being carried out by a local German firm was German from start to finish was a perfectly natural inference, and in view of the importance of maintaining our prestige in the Far East, the Office of Works ought to have taken precautions to prevent any such misconception from arising. At the least an official statement should have been issued promptly, to make clear the circumstances of the case, but we are told that no such statement was published for months after the contract had been placed and the mischief had been done.

The importance of circumspection in such a matter, and of solicitude for the interests of British manufacturers, is immensely increased when the contract is of an official nature, and the adverse impression once created cannot be completely dispelled even by a prompt announcement of the facts—still less by so tardy an explanation as has been furnished in the present instance. We cannot afford to weaken our prestige in China, and it is very much to be regretted that the authorities in charge of the work so little appreciated their responsibilities to British manufacturers as to open the way to misrepresentation of the qualities of our engineering products.

D

PRESSURE REGULATION.

By C. TURNBULL, Tynemouth.

It is said that Edison declared that the best regulator was a nigger volt-boy, and for many years this dictum has been universally accepted, save that the volt-boy in Britain is a white man generally with a nigger's wages. In passing, one may note that the ordinary regulating resistance for electric generators is wasteful. Generators often are made with a wide range of voltage, sometimes giving from 400 to 560 volts to enable them to take both traction and lighting loads, and hence there is heavy loss in the resistance when the machines run at low pressures. In one actual case, the current on a 500-KW. generator is 15 amperes, and pressure drop on resistance about 200 volts, giving a total loss of 3 KW. Such a loss taking place for 9,000 hours in the year would get rid of 27,000 units, no mean figure, and in large stations these losses must come to an enormous amount. True, the cost per unit lost is not much, yet the total is quite worth consideration in almost any station. One method by which the loss might be reduced is shown in fig. 1, where the field is excited by two separate windings. The main winding is connected right across the brushes and regulation is done on a separate "teaser" winding, to borrow a word used for other purposes. The teaser winding is controlled by a "potentiometer" resistance which enables the current to be reversed. A comparatively small teaser winding is therefore required, because an increase of current in it will cause the generator voltage to rise, which will increase the current in the main field coils thus giving a compound effect, while the reversal of the teaser current will reduce the generator voltage by a large amount. This method of excitation does not appear to have been put into use, but it might be worth a trial, and would probably lend itself to operation by automatic regulators.

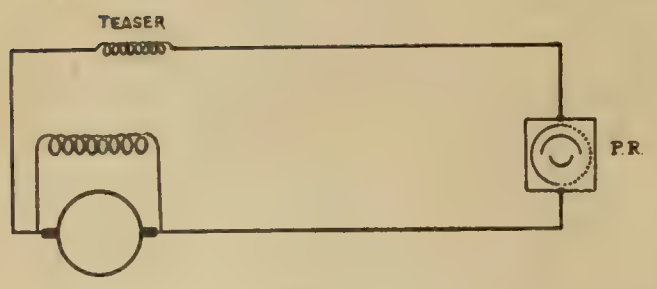


Fig. 1.

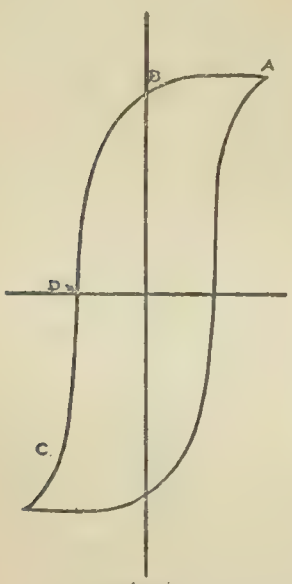


Fig. 2.

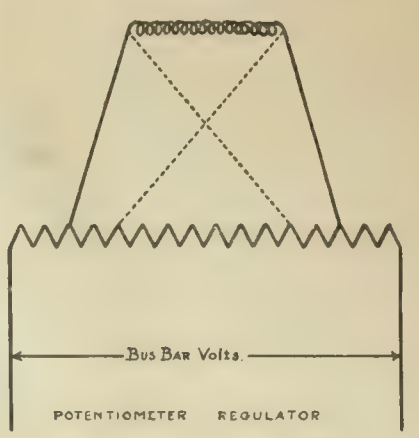


Fig. 3.

Direct-current generators are sometimes excited from a separate direct-coupled exciter, a method which is very suitable for control by automatic regulators. Compounding can be effected by one or two turns of the main leads on the exciter fields, this being economical, though having the disadvantage that the effect on the main fields would lag. A separate exciter is very necessary in the case of turbo-driven generators with compound winding on the main fields, for, when self-excited, these are liable to be driven to destruction should the supply of steam be shut off and the current come back on the generators from parallel machines, when the shunt field would disappear and the generator would run as a series motor with no load. Where a separate direct-driven exciter is used in such a case its voltage will increase with increase of speed, and so will strengthen up the main field sufficiently to limit the speed. The compound winding would, of course, be on the generator field. The separate exciter also has the advantage that it gives a more stable field where generators are worked with a long range of pressure, as self-excited machines often becomes unstable at low pressures where the iron is magnetised below the knee of the curve. The question is often asked, why not run

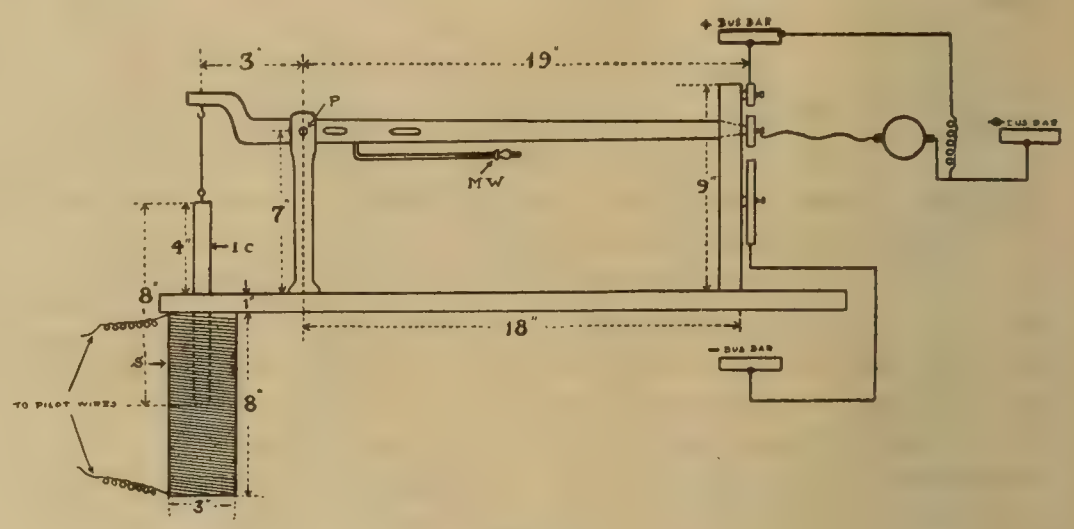


Fig. 4.

D.C. machines compound on lighting so as to steady the pressure? Certainly there are great advantages in doing this, but it introduces serious complications. The switchboard man must remember to cut out the compound coils whenever he parallels the battery in, but sometimes he forgets, and the battery current comes back on the compound coils and makes trouble. If the generators are run on traction, and there are three bus-bars for lighting, one must have equalising connections for every case, which makes a complex arrangement. Paralleling in or taking out of compound machines requires much care to ensure that current does not come back, even momentarily, through the series turns, so demagnetising the fields, while the closing or opening of the equalising switches produces disturbances on the other running generators. Taking everything into account, after several years of experience in the running of compound machines on lighting loads, the writer considers that it is a thing to be avoided if possible.

Commutating-pole generators occasionally suffer from a ripple in the voltage which produces a dithering effect on the light. This appears to be due to the time lag of the series turns, which produces a hunting effect on the series current, which in turn produces the ripple on the armature voltage. In the case of new machines it is desirable to specify that this shall be prevented. Balancers are responsible probably for most of the variation of pressure in D.C. supply; indeed, one would hardly credit the amount of variation that is due to the balancer until it is carefully looked into. It is, however, easily seen that a balancer must be sensitive when one considers that one side is acting as a motor and the other as a generator, and that there must be a considerable change of pressure with each variation of current, particularly if the out-of-balance goes from one side of the three-wire system to the other. Compound winding is particularly necessary on a balancer, but it must be applied with discretion. The usual method of compounding is to arrange that the motor field be weakened and the dynamo field strengthened, each one by its own current. With a severe rush of current the effect of this is to wipe out the motor field altogether, when the balancer stops with disastrous results to the supply. It is better to cross-connect the fields so that the motor current strengthens the

dynamo field while the dynamo current weakens the motor field, for as the motor current is greater than that of the dynamo, this gives a more stable arrangement. Probably the best method is to energise the compound coils entirely from the neutral connections, for this will enable the balancer to stand up to severe "shorts" on the mains, while the compounding can be cut out with a single switch when starting up in parallel with another balancer.

In some respects the most satisfactory method of balancing is effected by coupling the neutral to the mid-point of choking coils which are connected across slip-rings on the generator armature. Two rings may be used, joined to opposite points on the armature, so giving a single-phase connection, or three rings may be used with a three-phase arrangement, the choking coils being star connected, and the neutral led to the centre of the star, or else there may be four rings with choking coils having two-phase connections across each pair of rings, when the neutral is connected to the centre of each coil. After an experience of some years both with balancers and the choking coil method, the writer greatly prefers the latter. The pressure is much steadier than with even a compound balancer, while the convenience of operation is worth much. A comparatively raw switchboard man may be entrusted with the paralleling in and taking off of three-wire generators, while starting up after a shut-down (and such things take place in the best regulated stations) is easy, and does not require too much brain power. The generators may simply be run up on the board with all switches in, whereas in starting up with balancers one must first get a generator up to something like pressure, and then start the balancer, which cycle of operations requires some care on the part of a switchboard man flustered by the stoppage of the machines, with a feeling at the back of his mind that he may get the sack if his share in the trouble is found out.

This scheme does not enable one to adjust the pressure where feeder drops are to be compensated. People have suggested that the regulation might be effected by sliding the neutral wire to one side of the choking coil centre point, but a moment's consideration will show that this will not do, for each end of the choking coil is alternatively positive and negative, and the moving of the mid-point connection would merely produce an alternating current in the neutral wire. Regulation of pressure must be carried out by means of a mid-wire booster, but the solution of this problem is more difficult than appears at first sight, and a number of mid-wire boosters are on the scrap-heap through the neglect of simple precautions. The difficulty occurs through the fact that it is not easy to make the booster work at a very small voltage. If we consider the ordinary hysteresis curve for iron, fig. 2, this consists of a closed curve made up of approximately vertical and horizontal lines. If we apply this to the magnets of a mid-wire booster, it will be seen that we may magnetise the iron to give a small booster potential —say 3 volts one way—or may reverse it, but we cannot bring the voltage to nothing. For suppose that we are at a point A, we may come slowly back to B, without altering the potential. Then a slight further variation in the exciting current will bring us to C, but we cannot rivet the field to D. Whenever a current flows in the armature it will churn up a potential difference in the booster which will disturb the bus-bar pressure, and the booster will be unstable until the out-of-balance current is large enough to require the booster to be regulated to give sufficient voltage across its brushes to bring the field to a stable condition. The difficulty in working at low booster pressures may probably be overcome by making the air-gap very large, so that the residual magnetism of the fields will not affect the armature, while a large air-gap would reduce the effect of armature reaction on feebly excited fields. With a large air-gap, the armature would be entirely under the control of the field current, and its voltage could be made whatever was necessary. Commutating poles should be fitted to mid-wire boosters, as the armature often has to carry heavy currents with weak fields. The magnets should be compound-wound, so as to respond to sudden changes in the neutral current, the series turns being shunted by a variable resistance, while the fine wire shunt coils will enable the pressure to be adjusted accurately. These should be controlled by a "potentiometer" resistance which enables the booster voltage to be reversed, as shown in fig. 3. (For those who may not be familiar with potentiometer regulators, one may add that in this method of working, a resistance is connected across the bus-bars, corresponding to the potentiometer slide wire, and the fields are excited by being connected to suitable parts of same. The field may be reduced to zero by connecting both ends to the mid-point of the resistance, while reversal of field may be obtained by connecting as shown by dotted lines.)

A Cheap Automatic Regulator.—Many interesting and useful regulators are now on the market, but some of the best require a motor-generator to enable the fields of the main generators to be controlled, and this means expense. The following automatic regulator, shown in fig. 4 (for the main part of which the writer is indebted to Mr. S. J. Watson, of Bury) is cheap, simple and reliable, and may be made in the station at small cost. Of course, it is not so quick acting as a Taylor-Scotson or Tirrill, but it is much better than a switchboard man. The regulator consists of an arm, pivoted at P, from one end of which hangs an iron core, I C, which is attracted by the solenoid S. An old Schattner prepayment meter has very suitable parts which may be used with advantage. The solenoid is excited by pilot wires from the feeding point, thus compensating for feeder drop. Lamps in series control the current in the solenoid to the desired amount.

Regulation of pressure is effected by the moving weight M W, which should preferably be a nut and check-nut on a screwed spindle. The dimensions shown are from an actual regulator which is working satisfactorily. In this case the core is made up of soft-iron tubes out of an old arc lamp, the tubes being filled up with "stalloy" filings, which combination is free from hysteresis. It is important to use a core of good iron, as iron affected by hysteresis will cause the core to stick until the pressure has altered by a considerable amount, when it will suddenly move up or down

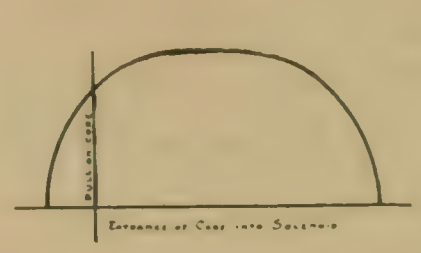


Fig. 5.

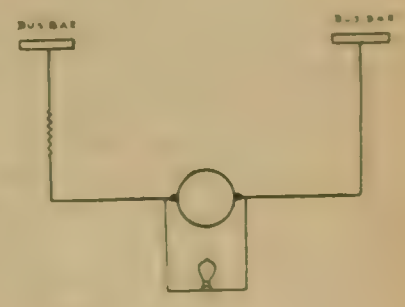


Fig. 6.

until the pressure has altered again, and it will continue doing this without ever settling to one position, causing the bus-bar voltage to hunt in a distracting manner. It is important also to get the core immersed in the solenoid to a proper degree.

The pull of a solenoid on a core appears to vary somewhat according to the curve in fig. 5; that is, if the core is entered but a short way, the pull will increase if it be drawn in a little further, simply through its change of position, while if it be withdrawn slightly it will tend to come out altogether. The core will, therefore, be unstable, and unable to control the regulator. When it is about half way in, the pull will have come to the flat part of the curve, when a slight change of position will not affect it. The pull on the core will now depend entirely on the solenoid current, and the regulator will work accurately. (Incidentally, one might suggest that the control of arc lamps would be improved if their cores and solenoids were arranged on this principle.) The core should be the same length as the solenoid to get good results. From the diagram it will be seen that the contacts on the end of the lever connect the regulator motor to either positive or negative bar, the other side of the motor being connected to the neutral bar. As the fields are permanently excited, the motor will rotate one way when the solenoid pulls the core down, thereby bring the lever contact to the top contact, while it will rotate the opposite way when the lever moves downwards to touch the bottom contact. The contacts are arc lamp carbons made of very pure carbon, which does not form slag, and, with weekly

cleaning, they may be depended on to work without trouble.

Lamps, in series with the motor, limit the current to what is necessary. A no-load cut-out is in series with the armature, to switch off the motor if current should go off the pilot wire for any reason, otherwise in such an event the motor would run until all resistance was cut out of the regulator so raising the bus-bar voltage to a dangerous extent. The no-load switch may be connected up to a bell if desired, which would give warning if the switch were to act. The motor may control either the main regulator, or it may actuate a subsidiary resistance in series with the main regulator. This latter is convenient in that it can be changed from one generator to another in a few minutes. The motor may actuate the regulator either by cords or belts, or it may be direct coupled through a worm gear.

In the last case, a reduction of at least 200 to 1 is desirable so that the motor will make two or three revolutions for each regulator step. Contacts should be arranged to check the motor should the switch blade run too far round so as to come against the stop; these contacts are connected to rotate the motor in the opposite direction, the result being that the motor stops as soon as the current gets through them, and it comes back a little as soon as the regulator contact allows it.

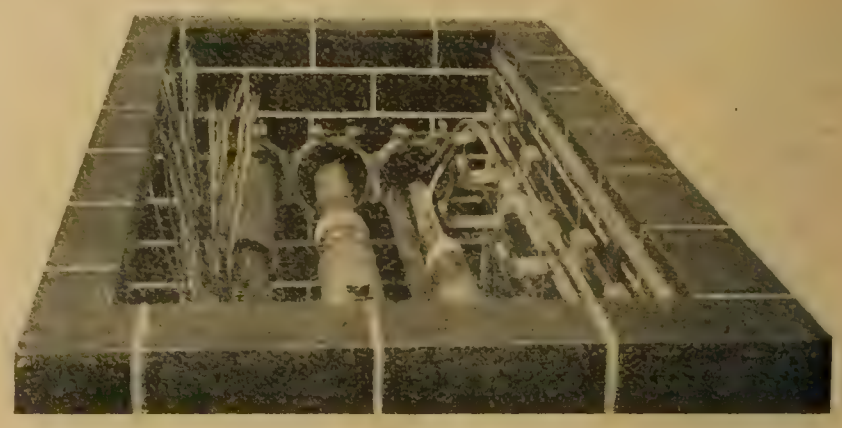
The speed of the regulating gear must be adjusted to give good results, and for this it will be found that the gear should either work very quickly or rather slowly. There is a considerable lag in the magnetic field of large generators, which is compensated for in instantaneous regulators by overshooting with a subsequent settling down to the correct position. A medium-speed regulator will continually overshoot the mark, but will not be rapid enough to settle promptly to the correct position and this will cause hunting, but a somewhat slow movement of the apparatus will prevent it from overshooting far enough to get very far from the normal position, and this will enable it to adjust the voltage without hunting. Where it is necessary to reduce the speed of the motor, it is not sufficient to put more resistance in series with the armature as this will unduly weaken the torque. In such a case one may put a lamp across the commutator, as shown in fig. 6, which will not divert any current at the moment of starting up, but will shunt the current as soon as the armature rotates and produces a back E.M.F. This arrangement reduces the motor speed in a very effectual manner, having the same effect as a dash-pot.

Power of Motor.—The power of the motor depends on the gear ratio, the efficiency of the gearing and the stiffness of the regulating gear. An admirable epicyclic gear has been put on certain remotely controlled regulating resistances by a German firm, and this is worked by a motor of $\frac{1}{4}$ H.P., or less, but the saving in the cost of the motor might be balanced by the cost of the gear if it had to be specially made up. To ensure starting power with a gear ratio of 200 or higher, a motor of about 1 H.P. will be found suitable.

ELECTRICITY AT THE GHENT EXHIBITION.

While the British Section, as a whole, at the Ghent Exhibition compares favourably with the Sections representing other nations, it cannot be said that the Machinery Hall offers many features of interest to electrical engineers; by far the most important exhibits are those of two famous manufacturers of textile machinery, namely, Messrs. Fairbairn, Lawson, Combe, Barbour, Ltd., of Leeds and Belfast, and Messrs. Platt Bros. & Co., Ltd., of Oldham, and while great credit is due to these firms for their magnificent displays, we can only add that the machines are electrically driven by well-known methods, and, for us, *voilà tout!* A noteworthy feature of the exhibition is the prominent part played by Government departments, which occupy a large proportion of the space, to very good purpose; in particular the work of the National Physical Laboratory in connection with aviation is well illustrated in the Machinery Hall, and the whole of an adjoining bay is devoted to Postal Administration — the latter being the largest exhibit in the British Section, and including every branch of the many services controlled by the Post Office.

The whole of the motive power used in the British Section is supplied by electricity, both D.C. and A.C. being available. The mains were laid throughout by the Exhibitions Branch of the Board of Trade, under the supervision of Mr.



Jointing Chamber, showing P.O Method of Bonding Pipes and Distribution.

Marchant, electrical engineer to the Branch; the Department also laid the foundations for the machinery exhibits, dug trenches, provided the floor and railings of the stands at a moderate charge, and furnished free signboards and free labour for unloading the exhibits. Most of the cables were run on insulators, but on the stands they were enclosed in screwed steel conduit. Bergmann tube was found very useful for making connections to motors, starters, &c., owing to the ease with which it can be bent and shaped to suit the needs of each case.

The Exhibition Committee provides a supply of three-phase alternating current at 6,000 volts, which is received in a detached sub-station outside the Machinery Hall, and transformed to 216 volts between phases. The Board of Trade has installed inside the Hall a 300-kw. rotary converter, made by the British Westinghouse E. & M. Co., Ltd., which enables a D.C. supply to be given at 440 volts on



Western Electric Co.'s Demonstration Board in P.O. Exhibit.

the three-wire system; energy is charged for at cost price, the Board paying the costs of transformation. The converter is of special interest in that it is of the new Rosenberg self-starting and self-synchronising type; we were informed that

the operation of starting and synchronising could be accomplished within 15 seconds, with ease and certainty. The 6,000-volt A.C. is transformed down to 310 volts for the converter by a Westinghouse oil-insulated water-cooled transformer of 330 K.V.A. The converter is of the six-phase type, with six poles, and runs at 1,000 R.P.M.

The plant in the Board of Trade sub-station includes a switchboard by Messrs. Ferranti, Ltd., of their latest type; this controls the supply to and from the rotary converter, the switchgear being mounted on black enamelled slate slabs carried on an iron frame. The main circuit-breakers are of the relay type, with inverse time element overload release. The equipment includes switches and meters for the control of three feeders, and the whole constitutes an admirable and typical exhibit of the company's standard switchgear. Messrs. Ferranti also exhibit a standard 6,000-volt three-phase ironclad switch panel suitable for use on consumers' premises, the doors being interlocked with the switchgear in a most complete fashion.

The principal engineering exhibit, apart from the textile machinery, is that of Messrs. Vickers, Ltd., together with the Electric and Ordnance Accessories Co., Ltd., and the Wolseley Tool and Motor-Car Co., Ltd. A Stirk 25-ton planing machine, driven by a 25-H.P. Vickers motor, is a prominent feature of the exhibit; other machines shown at work are a Greenwood & Batley turret



Peel-Conner Telephone Demonstration Board.

lathe driven by an 8-H.P. Vickers motor, and Archdale radial drills driven by 8 and 10-H.P. motors, with the Vickers standard heavy-duty control pillars.

The Stirk planer is equipped with the Vickers reversible drive and a motor-driven lift for the tool-holders. A Muir slotting machine for heavy work, driven by a 20-H.P. motor, is also shown at work. Vickers vanadium steel tools, and the firm's expanding reamer and a locking drill (with which the drill can be changed without stopping the machine) are other items of the exhibit. The Electric and Ordnance Co. show, besides their motors and controllers, a collection of electrical cooking apparatus, switchgear and ventilating fans; the last-named are driven at 24 volts from the train-lighting plant, which we shall describe in a later issue.

Messrs. R. A. Lister & Co., Ltd., exhibit their "Lister-Bruston" automatic electric lighting plant for country houses, for 40 12-C.P. lamps, with which our readers are familiar.

Messrs. W. J. Bates & Co., Ltd., Denton, showed their suction-gas, town gas and semi-Diesel oil engines, and Messrs. E. H. Bentall & Co., Heybridge, their petrol engines.

The British Post Office exhibit occupies an entire court, 110 yards long by 16 yards wide. Here have been assembled examples of all that is "Postal," a term which embraces telegraphs, telephones, carriers, recording apparatus, sorting tables, uniforms, postal orders, money orders, and apparatus and tools of almost every description used in the many departments of the Post Office.

The telegraphs are exceptionally well displayed, and form one of the most attractive exhibits. The apparatus is so arranged as to enable a visitor to withdraw a telegram form from the automatic box, write out the message and witness its transit by all the latest devices in general use in the British Post Office until it is delivered to the point where the messenger starts off to take it to its destination. A pneumatic tube worked by the maintenance of a low vacuum, and having a section of glass tube to show the carrier passing, would carry the message to the instrument room, where the A.B.C. instrument or any of the intermediate telegraphic contrivances up to the set of quadruplexed Baudot apparatus might be used to carry it onwards. A Helsby cord carrier or the Lamson "pick up" carrier takes its allotted part in the imaginary journey.

Double plate sounders, omnibus sounder circuits, duplex, quadruplex, Hughes, and Wheatstone sets are kept constantly working, whilst miles of Morse slip are run off by the Siemens motor-driven Wheatstone sets, and suitable phrases are carried away by visitors as souvenirs. The Gell perforator and the Oliver typewriter appeal to those who are familiar with the Morse code.

Water-level apparatus by Messrs. Gent & Co., illustrating the registration of the variation in the water level of a reservoir, and secret-service house telephones by this firm, are exhibited in working order; and the whole Court is clocked by a beautifully wrought turret clock with four dials controlled by a master clock supplied by the Silent Electric Clock Co.

Telephones are mainly represented by the working exhibits of the Western Electric Co. and the Peel-Conner Co.; their demonstration boards illustrate the latest types used for manual telephone exchange equipments, arranged in the form of model "A" and "B" operators' positions, which illustrate exactly what happens from the time the receiver is raised until the talk is finished. A variety of telephone parts and cables are also displayed by both these firms, in suitable cases.

Automatic telephone parts are placed in position for convenient examination, and a most interesting item, the step by step transmitter (Wheatstone, 1839), which is practically the same idea as the present automatic calling device, is conveniently near.

Telegraph poles, arms, and creosoting plant, and the chemicals resulting from the use of creosote, are shown by Messrs. Burt, Bolton & Hayward. Examples of the methods of terminating and protecting overhead wires, and also the latest devices for connecting paper-insulated cables to other types, and protecting underground cables from stray power circuit currents, and how the insulation of paper-covered cable is maintained by desiccating machinery, are fully illustrated.

Testing apparatus as used in the Post Office is grouped together; the latest Post Office testing device, known as Hay's fault locater, has a place of honour just beyond the automatic apparatus.

Postal items from a packet of pins to mail bags for Hong-Kong, with a thousand and one odds and ends, are arranged to catch the eye, whilst gold badges, coloured armlets and various good conduct stripes are freely patterned around: clever pictorial cartoons, show how the youth and his maid deposit their shilling or the contents of the home safe, with the Savings Bank, and what becomes of it; and in a similar manner the Money Order Department illustrates its work, and shows samples of the earliest money orders, and also those used for the payment of old age pensions.

Mansbridge's condenser winding machine in working order is another attractive item, with its huge reels of metal-covered paper.

The Board of Trade were wise in inviting the Post Office to take space, and certainly the Post Office officials are to be heartily congratulated upon the very complete exhibit they have assembled. Many old and familiar features are

included, but they are none the less welcome; probably the best known and most travelled veteran is the famous woodpecker, without which no Post Office exhibit would be complete.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Tariff Reformula.

As a consumer of energy exceeding one million units per annum, taken from the mains of 15 supply authorities, I have to look after the pence that the pounds may take care of themselves.

On a recent afternoon, when carefully considering the "scientific" tariffs by which various "Managers" extract 1·52d. per unit out of me, viz., the maximum damned, the discounts, two-rates, sliding scales, rateable values, fixed charge per kilowatt of maximum demand, telephone, and various other *systems*, it occurred to me that a simple formula like the following, which every consumer could easily understand, would automatically combine all the present systems :—

Price per unit =

$$\frac{1}{\int_0^{\pi/2} \text{T max sin } \psi \times \text{M sin } (\psi - \phi)\, dt\, \text{B}^{2\frac{n}{2}}}{\frac{3}{2}\sqrt{\text{E max F max } \psi \sin (\psi - \phi)\, d\psi}}.$$

Where T = time wasted in endeavouring to persuade consumer that the penny units are too strong when taken unadulterated, and must be freely mixed with the fivepenny ones; B = business lost to dissatisfied consumer; M = myster(y)isis of the demand indicator, a constant depending on the type of consumer; E = eddy currents circulating in the brain of the consumer after x^n hours' discussion with sales manager; F = the flux density of perspiration beads at the expiration of above period. (It is well to note that practically all the quantities are at a maximum value, as is indicated by balances paid to relief of rates, while 4½d. per unit is charged for lighting and 2d. for power in a few of our "modern" (!) business centres.)

Good luck to the Point Fives! May their lums reek lang!

Erg.

The Status of the Shift Engineer.

I notice on reading a report of the Holt Parliamentary Committee, who have been sitting on the question of Post Office servants, that one of the recommendations is that shift engineers, switchboard attendants, fitters, drivers and stokers shall all be classed as "skilled workmen."

If I remember rightly, the account of the G.P.O. electricity undertaking, which appeared in your excellent journal a year or two ago, proved this to be a thoroughly up-to-date E.H.T. system of considerable capacity.

I consider that to class as a "workman" a man who is responsible for the running of a shift in such a station is an insult to the profession, and can only be due to a lack of knowledge of the duties performed, and the engineering training required by a shift engineer.

At the present time, as proved by your "Correspondence" columns, shift engineers and switchboard attendants all over the country are asking for something more than a bare living wage, as their responsibilities, training and social status entitle them to do, and one naturally expects a Government Department to take a lead in these matters, by giving those doubtless efficient and capable men the rating that is due to them.

I maintain, and I am sure all other members of the profession will join me, that it is "up to" the Engineering Department of the G.P.O. to see that this is done.

Once a Shift Engineer.

It will be gratifying to many of those gentlemen who have recently ventilated their opinions upon the status and qualifications of central-station engineers, to learn the views of the Post Office Select Committee upon this matter. This body advises the Postmaster-General to rank shift officers as Class I, skilled workmen, and switchboard attendants as Class II. Fitters are to be divided between the two classes, whilst enginemen, stokers, &c., are to fraternise with switchboard attendants in Class II.

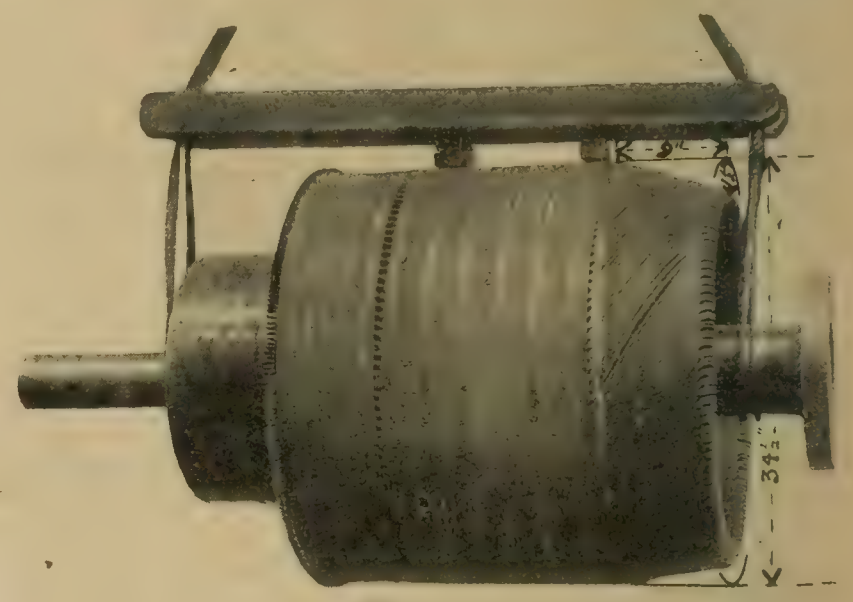
The writer has no personal knowledge of the staff, but as charge engineers and switchboard attendants were selected for the new Post Office electricity scheme but a few years ago from hundreds of applicants, it necessarily follows that the successful men must number in their ranks college, works and central-station trained engineers.

When a Government Department fails to recognise the fact that its responsible servants have entered an honourable profession in the hope of securing that monetary profit and social respect to which their training and position entitle them, how can municipal and private concerns be expected to treat their engineers with courtesy and justice?

Engineer.

Collapse of End Winding of a D.C. Armature.

Herewith photograph of armature of a 200-KW. 440-volt shunt-wound D.C. generator, showing the collapsing of the end overhanging winding nearest coupling. The original diameter of the armature at this end was 34½ in., and it has been collapsed to 31¼ in. The accident was brought about in the following way: the machine had been taken off load a few minutes previously, and was just on the point



of stopping, when the switchboard attendant accidentally closed the main switch again. As the machine was not fitted with reverse circuit breakers, but only with heavy copper links, a momentary heavy current passed—estimated from the section of the copper links which were fused at 7,000 amperes. The capacity of the other D.C. generators on load in the station at the time was 2,200 KW.

The collapsing is remarkably uniform, and the insulation remains nearly intact, as can be seen from the photograph. The commutator was only slightly damaged, due probably to its being in slow rotation at the time. I should like to know whether any of your readers have come across a similar occurrence in low-pressure generators.

F. W. W.

Olympic Games, Berlin, 1916.—The Duke of Westminster has opened a special fund, and will be glad to receive, and acknowledge personally, any donations, large or small, that may be sent to him at Grosvenor House, London, W., in support of the National appeal for £100,000, which was signed by Lord Grey, Lord Harris, Lord Roberts, Lord Rothschild, Lord Strathcona, and himself. Cheques and envelopes should be marked "Olympic Fund." The objects of the fund are not only to enable Britain to play her proper part in the Olympic Games at Berlin in 1916, but also to encourage amateur sports and athletics, and to raise the standard of physical efficiency of the youth of the nation.

RULES FOR INSULATED CONDUCTORS.

The 1912 German rules governing the construction, testing, and application of various classes of insulated conductors are so definite and instructive that readers will doubtless be interested in the following abstract, in which much of the repetition necessary in the original has been avoided, while the lengthy tables have been much curtailed.

I.—Rubber-Insulated Conductors; Not Tested under Water.

Class G B. includes rubber-taped conductors, suitable for permanent installation over plaster in dry rooms, for pressures up to 125 volts. Solid cores are permissible from 1 to 16 sq. mm., and stranded cores from 1 to 50 sq. mm. may be thus insulated. In constructing this class of wire, the copper core is hot-tinned, covered with cotton and over-wound with pure Para rubber, successive turns of which must overlap by not less than 2 mm.; the conductor is completed by a covering of cotton, and a braiding of cotton, hemp, or equivalent material which is impregnated according to standard rule. No puncture test is required, but the following table (abstract) must be satisfied :—

Copper section sq. mm.	Minimum number of wires in multiple conductors.	Mininum grams of Para rubber per metre run
1·0	... 7 ...	... 1·30
10·0	... 7 ...	... 3·40
25·0	... 7 ...	... 5·50
35·0	... 19 ...	... 6·50
70·0	... 19 ...	... 10 00
150·0	... 19 ...	... 15·00

The above weights to be the average of five 1 m. samples from different parts of coil.

Class F.A.—This grade is suitable for installation in and to lighting fittings up to 250 volts. A solid or stranded copper conductor of 0·5 sq. mm. section is hot tinned and covered with vulcanised rubber 0·4 mm. thick, and a braiding of cotton hemp or silk, &c., which may be impregnated. This type of conductor may be twisted to make double or triple cord, either before or after braiding. The rubber covering must have at least 33·3 per cent. caoutchouc (containing not more than 6 per cent. resin), and must not contain more that 3 per cent. of organic material (Zeresin). The specific gravity of the core rubber must be not less than 1·5. Lampholder conductors must, when dry, withstand 1,000 volts, A C, for 30 minutes. In testing a single core type two 5-m. length are to be tested together.

Class P.L. includes pendant cords for pressures up to 250 volts. Copper wires of not more than 0·3 mm. diameter are tinned and stranded together to a total wire section of 0·75 sq. mm. The conductor is covered with cotton and not less than 0·6 mm. of vulcanised rubber. Two cores are twisted together with the inclusion of a tension cord and the whole is braided. If a metal tension wire be used, it must be cotton-covered or braided with other insulating materials. The component parts of the cord must be so arranged that the outer braiding is not depended upon to hold them in place. Cord for adjustable fittings must be so flexible that single cord can be bent round 25 mm. rod and double cord round 35 mm. rod without injury. The finished conductor must resist 1,000 volts, A.C. test pressure for 30 minutes when dry.

II.—Rubber-Insulated Conductors: Tested under Water.

Conductors in this group are insulated with vulcanised rubber which must fulfil the above specification. The conductor itself is copper, hot tinned. After 24 hours' soaking, the conductor must withstand, for at least 30 minutes, the following A.C. test pressure between the copper core and water, at a temperature not exceeding 25° C.:—For working voltages of 1,000—4,000 volts, the test pressure = 2 × the working pressure. For higher working voltages, the test ratio gradually decreases to 1·5 for working pressures of 10,000—12,000 volts.

Class G.A.—Includes conductors suitable for use up to 1,000 volts in permanent installations and up to 500 volts in portable circuits. The copper section ranges from 1 to 16 sq. mm. (solid), or from 1 to 1,000 sq. mm., if stranded. The minimum number of wires in stranded conductors of various sections and the minimum thickness of rubber are as follows :—

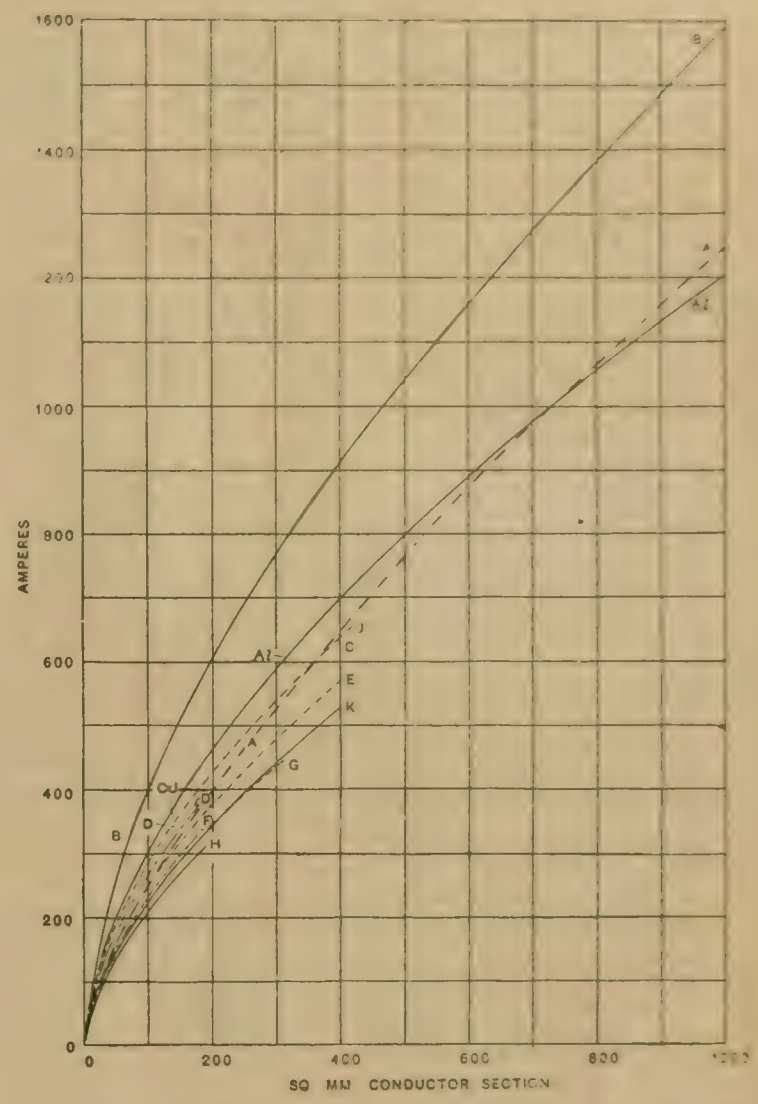
Copper section sq. mm.	Minimum No. of wires in stranded cable.	Minimum thickness of rubber. Class G.A. mm.	Class S.G.A. mm.
1·0	7	0·8	1·5
25·0	7	1·4	2·0
35·0	19	1·4	2·0
95·0	19	1·8	2·6
120·0	37	1·8	2·6
185·0	37	2·2	3·0
240·0	61	2·4	3·2
400·0	61	2·8	3·6
500·0	91	3·2	4·0
625·0	91	3·2	4·0
800·0	127	3·5	4·5
1,000·0	127	3·5	4·5

The rubber is covered with rubber tape and impregnated cotton or hemp; in multiple conductors a common braiding may be employed.

Class S.G.A.—This is a special grade of G.A. suitable for any permanent installation and for portable apparatus up to 1,500 volts; the rubber covering must now consist of several layers, to a total thickness not less than that shown in the table. Otherwise the stipulations for class G.A. again apply.

Class S.A.—This class includes rubber-insulated cords suitable for the same pressure ranges as Class G.A. The permissible rubber section ranges from 1 to 6 sq. mm., the rubber strands must not be more than 0·3 mm. diameter. The stranded conductor is cotton covered, sheathed with water-proof vulcanised rubber, which in turn is covered with yarn, silk or cotton. Round or oval multiple cords under an outer braiding, in addition to the covering on each core. The minimum thickness of rubber is 0·8 mm. for conductors of 1·5 sq. mm. or smaller section, and 1·0 mm. for larger conductors up to 6·0 sq. mm.

Class P.A.—This is S.G.A. wire with a braided or spiral metal armouring. The impregnated braiding for S.G.A. conductor must be replaced by an equivalent covering, which will also prevent the penetration of broken armouring. The armoured conductor may



Curve A, rubber-insulated copper cables. Curve B, single-core; 700-volt maximum, lead-sheathed copper. Curve C, twin-core; 3,000-volt maximum, lead-sheathed copper. Curve D, twin-core; 10,000-volt maximum, lead-sheathed copper. Curve E, three-core; 3,000-volt maximum, lead-sheathed copper. Curve F, three-core: 10,000-volt maximum, lead-sheathed copper. Curve G. four-core; 3,000-volt maximum, lead-sheathed copper. Curve H, four-core, 10,000-volt maximum, lead-sheathed copper. Curve J, concentric, two-core; 3,000 volts, lead-sheathed copper. Curve K, concentric, three-core, 3,000 volts, lead-sheathed copper. Curve A1, single-core insulated aluminium cables 700 volts.

Fig. 1.

be used up to 1,000 volts in permanent, and up to 500 volts in portable installations, and must, when dry, withstand 4,000 volts A.C., between core and armouring.

Class B.L.—No "Normalien" are applied to this class, which includes portable conductors for cranes, pit sinking, blasting, and so forth, but the following general recommendations are made :—Any rubber-insulated wire of suitable grade may be used, providing it is braided or armoured suitably. The conductor is to be stranded, and must contain as few joints as possible. At joints, the wires are to be separately soldered together, and the individual joints are to be so displaced that the flexibility and strength of the whole is affected as little as possible. For pressures below 250 volts the smallest permissible copper section is 2·5 sq. mm., for higher pressures no testing or auxiliary wires must be used in the cable, the copper section of which must be at least 6 sq. mm. In the latter case the conductor should be of class S.G.A., metal armoured. The diameter of individual strands must not exceed 0·8 mm. in conductors of total copper section = 50 sq. mm. or less. In larger conductors the diameter of strands must not exceed 1·2 mm. In the case of aerial lines, a special tension core, or the armouring may be depended upon for mechanical strength, and the total weight of the span must be carried with a factor of safety not less than 5. An impregnated fibrous covering must be provided, in addition to the braiding between the conductor cores and the armouring or tension core. If an earthing wire is used (Class B.L.E.), its section must be at least 4 sq. mm., and its use does not enable the armouring to be omitted from conductors otherwise falling under Class B.L.

TABLE A.—Constructional Data for Single-Core d.c. Lead-Sheathed Cables.

Copper core. Square mm.	Minimum No. wires. Without test wire.	With test wire.	Minimum thickness internal insulation.* mm.	Thickness of lead sheath. Single. mm.	Double. mm.	Thickness of covering over lead.† mm.	Thickness of strip armouring.‡ mm.	Thickness of covering over armour.§ mm.	Approx. overall diam. cable. Without test wire.	With test wire.
1-2·5	1	—	1·75	1·2	—	1·5	—	1·5	17-18	—
4-10	1	—	1 75	1·4	—	1·5	—	1·5	19-20	—
16-35	7	3-6	2·0	1·55	2×0·9	2 0	2×0·8	2·0	25-26	26-27
50-95	19	6-13	2·0	1·6-1·7	2×1·0	2·0	2×0·8	2·0	29-32	30-33
120-185	19-37	13-26	2·0-2·25	1·8-2·0	2×1·1	2·0-2·5	2×1·0	2·0	35-40	36-41
240-400	37	29-36	2·5	2·1-2·3	2×1·2	2·5	2×1·0	2 0	43-49	44-50
500-1,000	37	36	2·75-3·0	2·4-3 0	2×1·3-1·5	3 0	2×1·0	2 0	54-67	55-68

Good impregnated paper of fibrous material. † Good impregnated paper or acid-free impregnated jute. ‡ Wire = 1·8 mm. galvanised iron. § Good impregnated, acid-free jute. Test wire copper section to be 1 sq. mm. throughout.

III.—Lead-Covered Cables.

(*a*) *Rubber-insulated* conductors of Class G.A., or S.G.A., are individually braided, twisted together, covered with impregnated tape, lead-covered and armoured. The insulation tests are as outlined in Sec. II, and the current loading permissible is given in tables below.

(*b*) Single core d.c. lead-covered cables, with and without earthing wires (up to 700 volts), are subject to the above constructional regulations, and must obey cols. 1 to 5 (Table A), for bare lead cables; cols. 1 to 6 for asphalted cables; and cols. 1 to 9 for armoured and asphalted cables. For all three types, the testing pressure is 1,200 volts a.c. for 30 min. If aluminium is employed, the conductor section must be at least 4 sq. mm.

(*c*) *Concentric and Twisted Multicore Lead Cables.*—The rules cover paper or fibre cables for pressures up to 3,000 volts. The size of wires forming the outer conductor in concentric cables must not be less than 0·8 mm. diameter, but, subject to these restrictions, should be such that this conductor is as nearly as possible a closed ring (viewed in section). If aluminium is used, the minimum permissible section is 4 sq. mm. Tables are given in the rules fixing the minimum number of wires in the cores of these cables and fixing the minimum insulation between cores, and between cores and sheath. The alternating testing pressure is to be double the working pressure, applied for 30 min. at the works, and 1·25 × the working pressure applied for 1 hour after laying. Three-phase current may be used to test three-core cable. The following table shows in abstract the dimensions fixed for lead covering and armouring :—

Diam. cable under lead sheath (mm.).	Thickness of lead (mm.). Single.	Double.	Thickness of spun covering on lead (mm.).	Thickness of strip armouring (mm.).
10 — 18	1·5 — 1·8	2 × 0·9 — 1·1	2	2 × 0·8
20 — 35	1·9 — 2·4	2 × 1·1 — 1·3	2·5	2 × 1·0
38 — 70	2·6 — 3·6	2 × 1·3 — 1·8	3	2 × 1 0

(Thickness of covering on armouring = 2 mm.)

Permissible Current Densities.—(*a*) In rubber-insulated conductors the highest permissible current density per sq. mm. ranges from 15 amperes (0·5 sq. mm. wire) to 3 57 amperes (35 sq. mm. wire), and 1·25 amperes in 1,000 sq. mm. wire. Higher loading may be adopted in intermittent service providing the temperature rise does not exceed that which follows from the above continuous ratings. The highest permissible sustained current in fuses is 1·25 × normal current. (*b*) The permissible densities in lead cables in earth are shown in fig. 1. The current density is from 4 to 8 per cent. lower in 10,000-volt than in 3,000-volt cables of equal section. If the cables are in air, in ducts or grouped together in earth, the current densities allowed by fig. 1 should be reduced 25 per cent. The curves assume cables to be laid about 70 cm. deep, not more than two cables in one trench and a temperature rise of about 25° C. Colliery cables laid along galleries may be considered as laid in earth.

(*c*) *Insulated Aluminium Cables.*—As will be seen from fig. 1 (Curve Al), the permissible density in an insulated aluminium cable is about 23·5 per cent. lower than in the equivalent copper single-core lead-covered d.c. cable laid in earth. The highest permissible sustained current density in a single core d.c. aluminium cable for pressures up to 700 volts, laid in earth, range from 10·5 amperes per sq. mm. (in 4 sq. mm. conductors) up to 4·0 amperes in 50 sq. mm., and from 1·25 to 1·6 amperes in conductors of 1,000 to 500 sq. mm. effective section.—R. E. Neale.

TRADE OF SOUTH AFRICA.

The following are extracts from a report on the trade of South Africa by H.M. Trade Commissioner at Cape Town, just issued by the Board of Trade, to which we refer in our leader. Copies of the report itself may be obtained from Messrs. Wyman & Sons, the price being 6d.

British Trade with South Africa.

The following table gives the value of imports of general merchandise from the United Kingdom into South Africa from 1907 to 1912 :—

Year.	*Value.*	*Percentage of total imports.*
1907	£14,331,654	56·75
1908	13,313,289	56·19
1909	15,206,317	58·09
1910	20,048.158	59·05
1911	20,328,209	58·29
1912	20,850.970	58·03

It will be seen that there have been slight variations in the percental position of the imports from the United Kingdom in relation to the total imports of the country, but slight variations from year to year have no special significance. It must be remembered that the trade of the United Kingdom with South Africa is composed almost entirely of manufactured articles, and this fact must be borne in mind in considering any slight fluctuation in our percental position. The character of the imports of other countries cannot be disregarded in an attempt to gauge the relative standing of competing countries from year to year, especially in dealing with the trade of a country like South Africa, which imports such large quantities of non-competitive goods. The arrival of important shipments of timber, coffee, nitrates, rice, grain, butter, paraffin, &c., within a certain statistical period has a considerable effect on the total value of the imports, and thus introduces a disturbing factor in regard to the percental position of countries not concerned in supplying such articles.

The trade of South Africa may be divided into three classes, viz. (1) goods in which British trade is more or less supreme; (2) goods in which we hold our own though encountering keen competition; and (3) goods in which we are behind our competitors. In class 2 are included electric wires and cables, in which Germany is our only rival; and electric fittings and parts, in which Germany and America are both keen competitors, but particularly the former.

Electrical machinery is placed in Class 3, Germany holding a very strong position, and her imports being nearly double those from the United Kingdom; the United States is also a keen competitor.

American Competition.

The United States has considerably improved her position on the 1907 figures, as well as on those for 1911. The imports from the United States for the last six years have been :—

Year.	*Value.*	*Percentage of total imports.*
1907...	£1,991,119	7·89
1908...	1,941,154	8·19
1909...	2,115,236	8·08
1910...	2,663.086	7·85
1911...	2,828,025	8·11
1912...	3,233,396	9 00

I attach greater importance to United States competition than I do to that of Germany, though it must be remembered that, in addition to supplying manufactured goods of a competitive character, the value of the imports from the United States is considerably swollen by the shipment of natural products and non-competitive commodities, such as paraffin oil, paraffin wax, motor spirit, and raw timber, which together amount to a fifth of her total trade with South Africa. There is no doubt that the United States trade under a material advantage, in that their manufacturers have had to deal in their own country with very similar conditions to those which prevail in South Africa. They thus start equipped with the experience which British firms have to acquire by patient study and by experimental work. Moreover, in many cases, they simply have to increase the output of an article already in use in their own country, which at once meets similar requirements in this country. This, undoubtedly, has accounted largely for their success in all classes of agricultural implements and appliances, water-boring machinery, and fencing material, and it is now assisting them, to a great extent, in the motor-car trade.

Not only is their competition to be feared on these lines, but workshop practice and the vigour of their oversea selling arrangements make the United States a dangerous rival.

German Competition.

The values of the imports from Germany for the last six years have been :—

Year.	*Value.*	*Percentage of total imports.*
1907	£1,923,085	7·61
1908	2,048,523	8·65
1909	2,367,373	9·04
1910	3,512,909	10·35
1911	3,411,376	9·78
1912	3,230,021	8·99

It is thus seen that in the six years Germany increased her trade by £1,306,936, or 67·96 per cent. But it is of importance to note the steady rise which took place in her trade between the years 1908 and 1910, and the equally steady drop since 1910. This I attribute very largely to the starting up and the gradual completion of the contract for the erection of the enormous electric power stations on the Witwatersrand by the Victoria Falls and the Rand Power Companies.

I may be allowed to recall the comments contained in my report for the year 1910 in this connection :—

"In estimating the extent of Germany's competitive enterprise, both now and in the future, it must be remembered that the execution of the contracts referred to is a purely temporary matter, and that the present increase of German imports into South Africa cannot be regarded in the nature of a permanent growth, or the normal condition of her trade."

Subsequent events have, to a great extent, confirmed this statement, in that while the imports of electrical machinery and requirements from Germany increased by an amount of £719,000 between the years 1907 and 1910, in the last two years they dropped to the extent of £412,000, and one may reasonably anticipate a still further reduction. Her normal position, however, will not be reached until the contracts are wholly carried out.

But I have no desire whatever to make light of the vigour of German competition. On the contrary, it threatens us on many sides, and German manufacturers respond readily and eagerly to the requirements of South African buyers. They, moreover, take great pains in the selection of suitable agents ; they pay them well, and support their efforts in a ready fashion. German firms are ever willing to adapt their goods to the wants of individual merchants, and they give prompt delivery. They also never fail to include in their packages attractive samples of numerous other goods which they are capable of supplying. This unsolicited distribution of samples must certainly cost money, but it pleases, and very often results in the placing of initial orders. There is a determination and a thoroughness about German commercial methods which is deserving of imitation.

In addition to the efforts of individual manufacturers, German trade is greatly assisted by the well-organised Governmental aid connected with the export business of that country. I refer to the low rates at which the German State railways carry goods for export, and the advantages offered by their "through rates" (rail and sea), which are utilised in quoting prices to South African merchants, which, undoubtedly, is a convenience much appreciated by importers in this country. Finally, Germany has an extensive Consular service in this country, maintained at great expense. It is thus seen that both the Government and the manufacturers of that country are fully alive to the importance of the South African market, and are making great efforts to foster trade relations therewith.

Electrical Work on the Rand.

A report on the trade of South Africa would not be complete without special reference being made to the effect which the conversion from steam to electric drive in the mines has had upon the trade of the country. The figures given under the head of "Electrical Goods" make this clear. These figures are :—

1907	£308,513
1908	478,359
1909	631,865
1910	1,428,888
1911	1,030,627
1912	917,186

As is generally known, the Victoria Falls and Transvaal Power Co., and the Rand Mines Power Supply Co., have erected central power stations on which so many of the gold mines now depend for their supply of electricity and compressed air. It should, therefore, be interesting to manufacturers to have particulars of the rapid strides made by these two power undertakings since they started. These particulars have been provided by the Chamber of Mines in the following terms :—

"In 1907 the Victoria Falls and Transvaal Power Co. started by taking over the two then existing companies—the Rand Central Electric Works, with a plant capacity of 3,200 KW., and the General Electric Power Co., which had a plant capacity of 2,500 KW., or a total of 5,700 KW. Toward the end of 1908 the new station of the Victoria Falls and Transvaal Power Co. at Brakpan was started up, and supplied 6,000 KW. produced by two 3,000-KW. turbines. In 1909-10 this was augmented by the Simmer Pan station, with six 3,000-KW. turbines, so that by the end of 1910 29,700-KW. turbines were being supplied, 24,000 KW. of which constituted new supply. During 1911 and 1912 the Rosherville power station, owned by the Rand Mines Power Supply Co., was completed, consisting of five 10,000-KW. turbines and six steam-driven turbo-air-compressors of a capacity of 3,500 KW. each. The station at the Robinson Central Deep, consisting of six electrically-driven turbo-air-compressors, of a capacity of 3,250 KW. each, was also completed, and the advance made at the Vereeniging station allowed of two further 10,000-KW. sets being brought into operation, so that the combined plants of the two power companies at the end of 1912 had a capacity represented by the following large figures : 94,000 KW., electric plant : 40,500 KW., air-compressing plant.

"The following additional plant is on order and in course of erection :—

"For the Victoria Falls and the Transvaal Power Co., two 11,000-KW. turbines, to be erected at Simmer Pan.

"For the Rand Mines Power Supply Co., two 12,000-KW. turbines, to be erected at Vereeniging. One of the latter is almost ready to be placed in commission, while the other is expected to be ready in June.

"Finally, three 7,000-KW. steam-driven turbo-air-compressors will be erected at the Rosherville station, and it is interesting to state that these will be the largest air-compressors so far constructed. By the end of March next year, when the installation of all plant at present contemplated is anticipated to be completed, the combined capacity of all the power stations should be :—140,000-KW., electric plant ; 61,500-KW., air-compressing plant. These figures, it must be admitted, are enormous. Great credit is due to these power companies for their enterprise in initiating these works—calling for huge sums of money—to enable them successfully to cope with the large demand for power made by the mines and other industries on these fields."

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Simplex "Diamond" Suction Cleaner.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., are introducing a new form of machine which, on account of its specially shaped nozzle, has been named the "Diamond," and is marketed at a very low price.



Fig. 1.—"Diamond" Suction Cleaner.





Fig. 2.—"Diamond" Nozzle. Fig. 3.—Nozzle for Wood Floors.

The general appearance of the machine is shown in fig. 1. The nozzle is of peculiar construction, as shown in fig. 2, and has been fully protected by patents ; the actual working area is larger than that usually allowed for, and its shape is of advantage, in that by means of the sharp corners it can penetrate into crannies otherwise inaccessible. The design has also been adopted from consideration

of the wear and tear upon the carpets, &c., which it may be desired to clean. When using the ordinary form of nozzle, a portion of the carpet, equivalent to the area of the nozzle, is sucked right up into it, giving a distinct dragged effect when the nozzle has passed over the surface of the carpet. This effect has been especially noticeable with high-power vacuum cleaners, and is said to tend towards a considerable diminution in their useful life.

The attachment for cleaning hard wood floors is shown in fig. 3. The slot through which the dirt is drawn precedes the felt, which is pressed on to the surface of the floor, in whatever direction the machine may be moved, whereas with other forms of nozzle the dirt is continually being pushed away from the slot and rubbed into the floor. The machine is only 8 lb. in weight. A turn switch in the handle allows the motor to be started or stopped at any desired moment, and the "pistol grip" handle enables the machine to be easily operated with one hand, a great convenience on occasion. A simple form of spring clip allows the bag to be detached in a moment, without fear of spilling the contents.

Various accessories are supplied with the "Diamond" suction cleaner, and a very simple and effective device is adopted for the purpose of attaching them to the machine. The "Diamond Special" is a larger and more powerful machine, using a motor of ⅓ H.P., and designed for large establishments, hotel work and so forth.

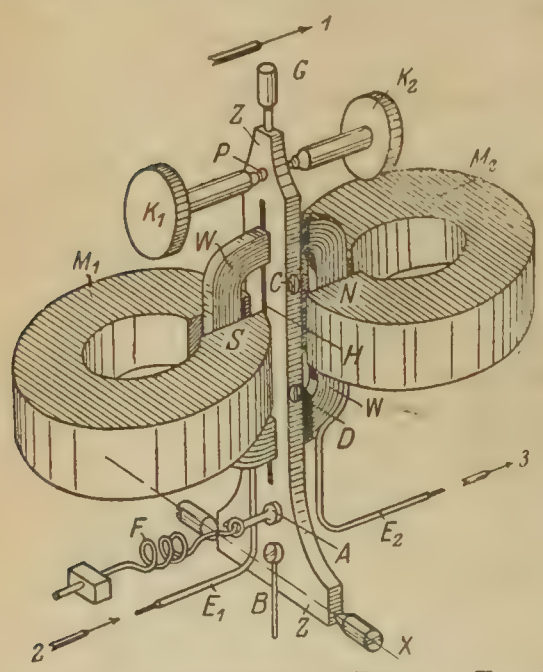
about 5 amperes, and is fitted with a quick-break action. The light remains on for one minute, and owing to the lost time between the pull-down movement and the switch, the circuit is not closed unless the operator gives a full traverse to the cord.

On a well staircase it is quite an easy matter to find the cord and actuate the switch again in the event of the light going out before the desired floor is reached. The apparatus is cheap, as is also the cost of installation.

New Veluria Glassware.

Some new Veluria designs have recently been placed on the market by the British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., three of which are illustrated herewith. As is generally known, Veluria is a white translucent glass, with remarkable properties of diffusion and reflection, which ensure a high degree of comfort and efficiency in the resultant illumination. Veluria reflectors are also extremely beautiful in themselves, and have thus bridged the gap which formerly existed between the merely pretty art glass shade and the purely scientific reflector.

One of the new patterns of Veluria (Cat. No. S 5,227) has the same contour and reflective characteristics as the standard intensive type, with the addition of an etched floral design which considerably enhances its appearance without impairing its efficiency. This



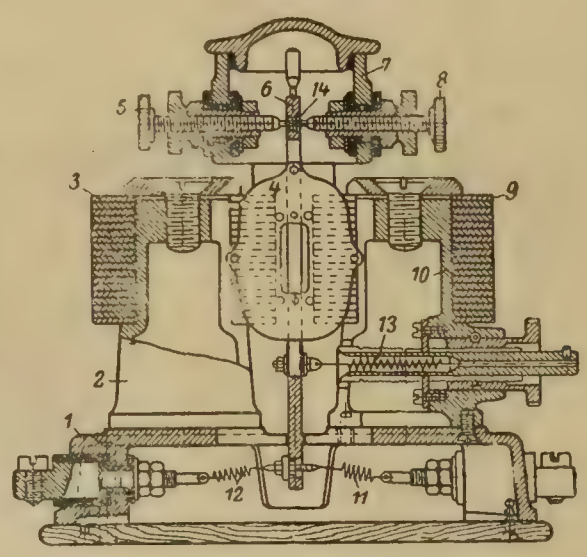


Fig. 4.—Arrangement of Relay. Fig. 5.—Sectional Elevation of Zelisko Relay.

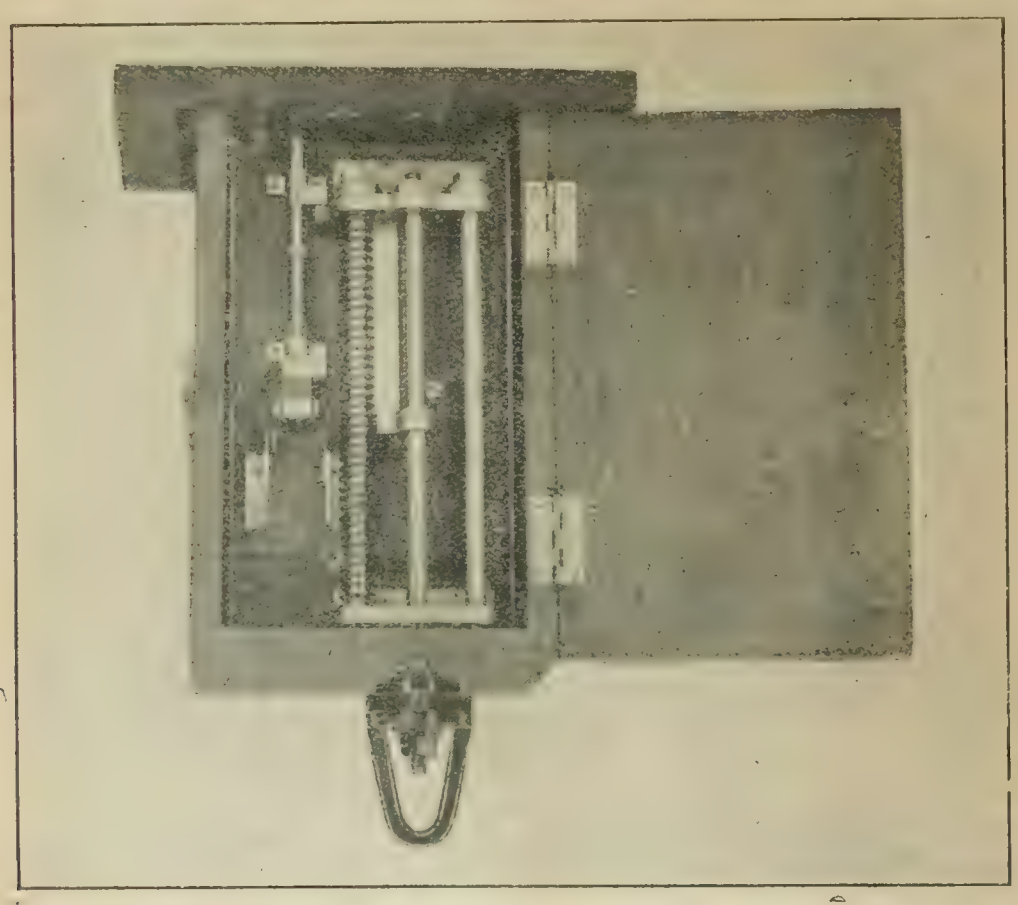


Fig. 6.—Staircase Lighting Switch.







Figs. 7-9.—New Veluria Glassware.

Staircase Lighting.

Writing with reference to the article on staircase lighting switches which appeared in our issue of August 22nd, Messrs. Ernest F. Moy, Ltd., of Camden Town, N.W., inform us that they have recently supplied a number of switches for this purpose which have been in use for some months past.

The switch, shown in fig. 6, is arranged for fixing on the ceiling at the top of a "well" staircase, and is operated by means of a flexible wire cord hanging vertically in the well, a handle being fastened to the cord at each landing. A pull-down of about 6 in. closes the switch and compresses the spring seen in the illustration. The spring drives a train of wheels through a rack and pinion, the control being effected by means of a brake after the fashion of a gramophone spring-motor control. The switch will carry up to

reflector is made in four sizes to take Mazda lamps ranging from 10 to 100 watts.

The other patterns (S 5,218 and S 5,219) have raised decorations of distinctly novel and attractive appearance, and, as they are intended solely for domestic purposes, are made in one size only, to take Mazda lamps of from 10 to 40 watts.

Zelisko Moving-Coil Relay.

An older form of this relay has been in use for several years past in the Austrian telegraph department. The latest model (see fig. 4, which shows the essential features of the instrument in perspective), is characterised by the perpendicular tongue Z pivoted on the spindle X. In the upper part of the aluminium tongue, platinum contacts P are let into the brass rivet 14 (fig. 5). The

flat moving coil W is wound in a plane perpendicular to the axis of rotation of the tongue Z, and is held by the screws C D. Two permanent ring magnets are arranged as shown, and the tongue is controlled by the spring F.

Referring to fig. 5, which illustrates the actual construction of the relay, a hollow magnalium bedplate 1 carries two vertical members connected by the box-shaped attachment 7. The bedplate carries three local and two line terminals as well as two bearing screws between which the relay tongue 6 is pivoted. The coil frame 4 moves in the narrow air gaps of the two permanent magnets, and flexible connections are carried from the moving coil to the line terminals. The relay tongue is connected to one local circuit terminal *via* 12, and the other two terminals are connected to the contact screws 5 and 8. The laminated permanent magnets are built up of stamped rings 3, 9, &c., screwed down on to cast-brass pillars, as shown. The air-gap of the field-magnet is 1·6 mm. greater than the thickness of the moving-coil, and the latter always moves parallel to the pole faces. It is an easy matter to remove the magnet pillars, thus completely exposing the relay tongue and moving-coil, &c. Naturally the electro-dynamic torque is in the same direction on both sides of the moving-coil. The chief advantages of the new, as compared with the older, type of relay lie in the easy accessibility of the local circuit contacts, and the impossibility of contact between the moving-coil and the field-magnet. The form of the magnet prevents the formation of deleterious stray fields, and permits cheap construction and the adjustment of the tension springs and the torque on the moving-coil are practically independent of the setting of the contact screws. The "latent period" of the relay is about 0·007 second, with a line current of 17 milliamperes, a spring tension corresponding to a current of 8·5 milliamperes, and a tongue stroke of 0·01 cm.—*E.T.Z.*

Mazda Half-Watt Lamp.

The accompanying illustration, fig. 10, shows one of the Mazda "Half-watt" lamps that were recently exhibited by the British Thomson-Houston Co., Ltd., as reported in our last issue (pages 322 and 346). This lamp takes 10 amperes at 80 volts, and gives

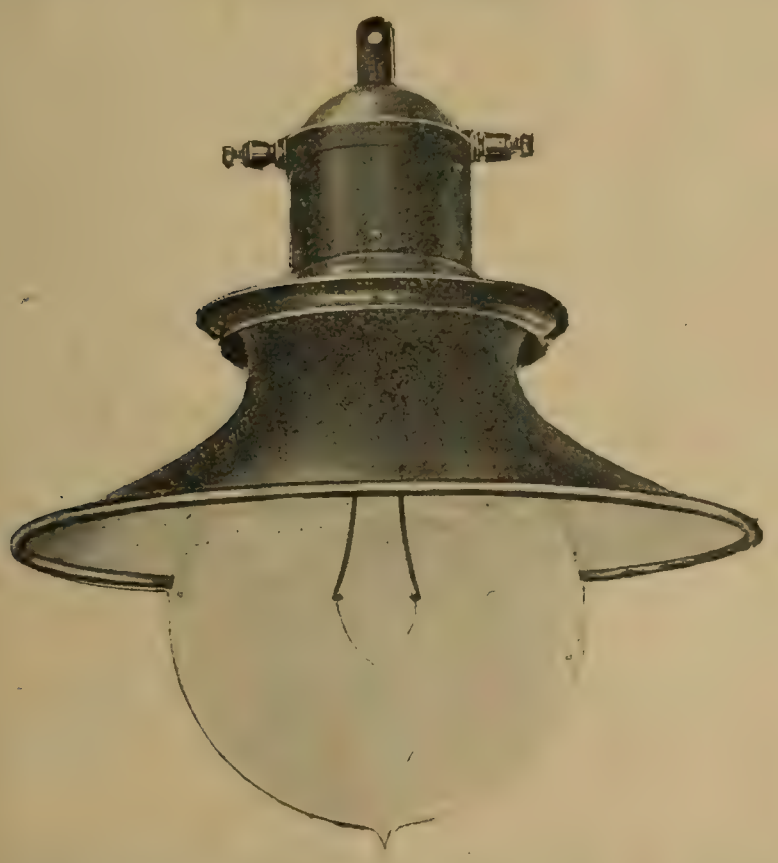


Fig. 10.—Mazda Half-watt Tungsten Lamp of 1,600 c.p.

1,600 c.p. at an efficiency of 0·5 watt per candle. The simplicity of the filament is the most striking feature of the lamp, as compared with the metal-filament lamps in ordinary use. These lamps are not yet on the market, but will be ready in three months or so.

"Beacon" Pipe or Conduit Clip.

Messrs. Smith & Davis, Ltd., of Hampton Street, Birmingham, have recently placed on the market the new hinged patent pipe clip, shown in fig. 11. This is made of heavy gauge sheet metal to



Fig. 11.—The "Beacon" Clip.

suit external pipe or conduit diameters ranging from ⅜ in. to 1½ in. diameter, and it supports them about ¾ in. clear of the wall. The hinged clip is fastened with a small bolt and nut, which allows for small variations in diameter of the pipe or conduit.

The E.A.C. High-Torque Induction Meter.

A new single-phase meter has just been introduced by the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., in which special attention has been given to the production of a high torque, with a view to ensuring permanent accuracy. The minimum value regarded by the makers as likely to give satisfaction is 7 gm. cm., but they go further and guarantee a torque of 9 gm. cm. In view of the impossibility of completely eliminating friction from a meter, and the certainty that the friction initially present will increase as time goes on, it is obvious that the only sure way to minimise its deleterious effects on the accuracy of the meter is to swamp it, and this is the course adopted by the company, who claim that their meter has a torque

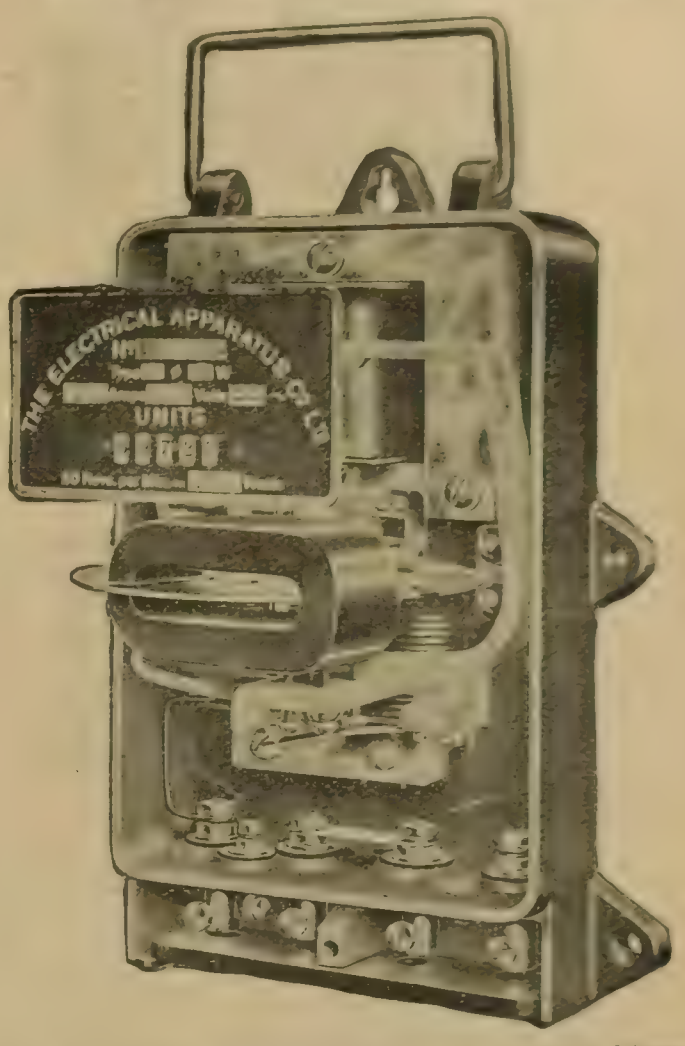


Fig. 12.—E.A.C. High-Torque s.p. Induction Meter.

30 per cent. higher than that of any other on the market. The efficiency of the meter, however, has not been sacrificed to this end, for the total loss in the shunt system is 1·4 watts, and in the series system 1 watt only. Separate magnetic circuits are provided for the shunt and series systems, which render the instrument practically independent of changes of voltage, wave form and frequency; an excellent calibration curve is obtained, and the accuracy of the record is maintained over a

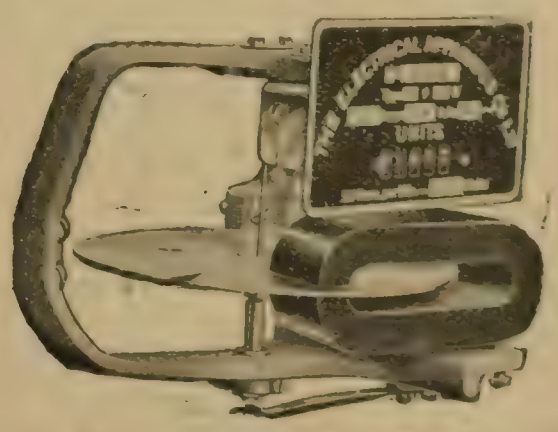


Fig. 13.—Mechanism Removed from E.A.C. Meter.

wide range of voltage, a meter designed for 110 volts giving results accurate within 2½ per cent. at any voltage between 170 and 50, without injury and without requiring recalibration. Temperature effects are negligible. By providing three holes in the disk, creeping on no-load is prevented, though the meter starts with less than ¼ of 1 per cent. of full load, and compensation for friction on low loads is provided.

The meter is insulated mainly with mica, so that the insulation does not deteriorate in tropical climates, and is housed in an iron case which shields it from external magnetic fields.

The general arrangement of the meter is shown in fig. 12, and fig. 13 shows the moving parts, which are carried, together with the brake magnet, in a cast-iron frame, and can easily be removed for inspection and adjustment. The magnet is of high-grade tungsten steel, well aged and tested, and is mounted so that the poles can be moved inwards or outwards to adjust the speed of the rotor.

Fig. 14 shows the magnetic circuits, which are of English charcoal transformer iron laminations, and are not in any way interlaced with one another or threaded through the shunt coil, so that the

latter can readily be removed. The shunt coil is exceptionally well insulated, the silk-covered wire being wound together with a silk braid which encloses the wire, and the whole being vacuum-impregnated with a damp-proof insulating varnish. The low-load and inductive adjustments are shown in fig. 14; the latter consists of a small copper frame round the centre pole of the shunt system, which can be moved up or down to regulate the speed of the meter

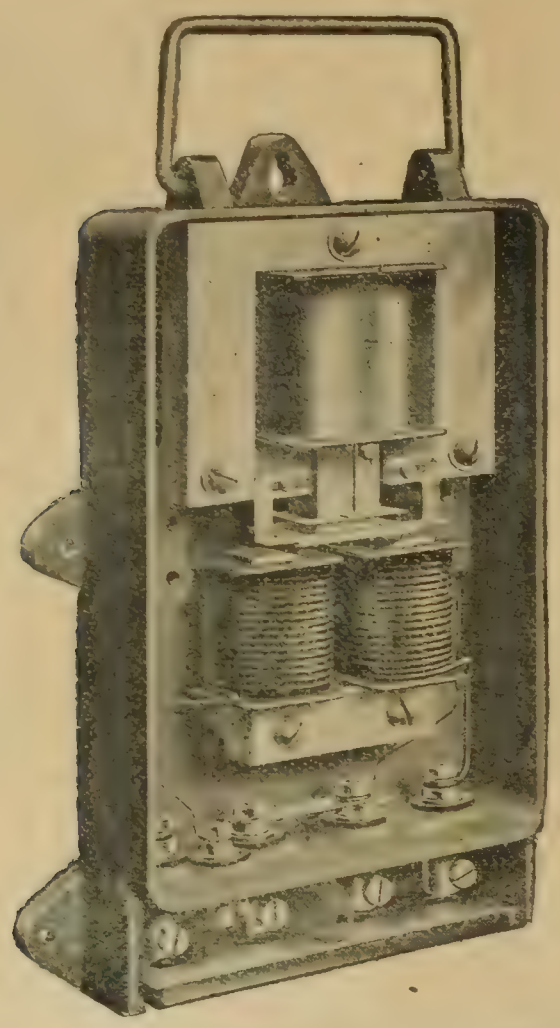


Fig. 14.—Magnetic Systems of E.A.C. Meter.

on inductive loads, while the former consists of a larger rectangle carried on a frame which can be moved to the right or left to vary the torque. Every effort has been made to improve the mechanical design of the meter, and all parts are standard and interchangeable.

BUSINESS NOTES.

Russia as a Trade Outlet.—On the outlet for electric material and machinery in Russia, the "Exposetur" of the Austro-Hungarian Commercial Museum at Warsaw writes:—The Russian electrotechnical industry stands at a very low level of development. Besides the wholesale firms of Siemens & Halske, Schuckert & Co., A.E.G., and Westinghouse, which either manufacture electrotechnical material or import them from their parent houses, very few undertakings exist in Russia concerned with the output of electrical wares, on account of which, to meet the rapidly rising demand, recourse must be had in overwhelming proportion to foreign works. Glow lamps are certainly made in Russia, but to so limited an extent as to be wholly inadequate to cover the enormous demand; so that for metal-filament lamps, which are coming more and more into use, Russia is thrown back almost wholly on to imports from abroad. These goods are mainly supplied from Germany and Austria, and only in inconsiderable quantities from England and France. This leading export article of the Bohemian electrotechnical industry totalled 25 per cent. of the aggregate exports to Russia, which is the best market for it. With intensive cultivation of the consumer, the export might, however, be greatly increased. Of glass goods the Bohemian industry exports considerable quantities, but the shipments of crystal ware might be greatly increased. Electric carbons are manufactured at Lüblin and Moscow, and cover the bulk of the Russian demand, so that the foreign article is only imported to a very restricted extent. Cinema carbons and transmission material are turned out by some well-equipped firms which are syndicated under the style of the St. Petersburg United Cable Works, Ltd., which allows of only a moderate foreign importation. Insulating tubes are made by a special factory at Warsaw, and another factory has its seat at St. Petersburg. Electrotechnical porcelain is made in Russian Poland by the Cmielow Co., whose output supplies the requirements. India-rubber and gutta-percha insulating materials are turned out by several monopoly concerns (the "Psowodnik," "Treugoldnik," "Kautschuk"). Installation accessories (switch and contact apparatus, brackets and fitments) are supplied from Germany, France and Sweden. Fans come from Germany and Italy. Dynamos, motors and transformers, and measuring and calculating instruments, have a great sale in Russia, and are principally supplied by Germany, Switzerland and Great Britain. The efforts of Bohemian manufacturers to extend their export relations with Russia are greatly facilitated by the fact that the wholesale trade is in the hands principally of solid Polish firms, who prefer Austrian goods. On the other hand, cash dealings with small consumers are beset with many difficulties. The Russian market is worth greater attention than has hitherto been bestowed on it, which attention will be crowned with success when the market circumstances are better understood and catered for. In particular, the sending of catalogues alone is useless, and the principle, cash on delivery, is neither in vogue nor practicable.—*Der Elektrotechniker.*

Lowering Gear for Metal-Filament Lamps.—The street lighting at Fulham is marked by a rather unusual feature, the metal-filament lamps being fitted with lowering gear. The London Electric Firm, of Croydon, have supplied about 200 brackets and sets of gear for this installation. The gear is of their well-known positive-acting, weight-relieving type, and the winches are of their self-sustaining type. The brackets are of the rectangular type, with pulleys and tubes fitted inside to prevent the rope from touching the electric cables, which are also inside.

Phœnix Mining Machinery.—On Saturday last a large body of mining electrical engineers, representing directly nearly all the collieries in Yorkshire and, indirectly, the Association of Mining Engineers of Great Britain, visited the works of the Phœnix Dynamo Co., Ltd., at Bradford, for the purpose of investigating the company's machinery and apparatus for employment in mines. The visitors were received by Mr. Pybus, managing director, Dr. Pohl, and others, and were shown all that the company has developed in the direction of decreasing the risks of the men in mines, and some designs for which a considerable element of novelty is claimed. One of the motors running, which was capable of developing 900 H.P., was employed for driving a large fan for ventilating a mine. Thirteen other machines similar in size, and used for this class of work, were seen in the works. Another machine inspected was a motor which embodied a device such that a violent explosion could take place inside the motor without the flame being communicated to the outside atmosphere. In the works of the Phœnix Co. there is a large explosion chamber, and very interesting experiments were carried out in the presence of the visitors in an endeavour to reproduce actual underground conditions. Replying to a vote of thanks, Mr. Pybus said that the commercial element was too powerful in buying plant, and the practical colliery engineer had far too little to say in matters often involving human lives.

Warner Non-Parallel Axle Trucks.—The "M. and G." Truck and Engineering Co., Ltd., have received the third repeat order from the Colombo Tramways for "M.G. Warner Trucks," making four consignments in all of Warner cars dispatched to Colombo. The company's agent, now in London from Colombo, states that the Warner cars require practically no attention and can always be relied upon. The wheel-base is 9 ft.; length over body, 18 ft. 8 in.; length overall, 28 ft.; gauge, 3 ft. 6 in.

Bankruptcy Proceedings.—A. E. Martin (trading as the Midland Electrical Supply Co.), Birmingham, electrical engineer.—Notice is given of release of trustees, June 19th, 1913.

A. E. E. Daniels (trading as Middleton & Co.), Canterbury, electricians.—Notice is given of release of trustees, July 2nd, 1913.

Private Arrangements.—The British Electromobile Co., Ltd., 5 and 6, Halkin Street, London, S.W.—In pursuance of the provisions of the Companies' (Consolidation) Act, a meeting of the creditors interested herein was held at the offices of Messrs. A. W. Barr & Co., 1, Queen Victoria Street, E.C. It was reported by the liquidator (Mr. R. B. Tyler) that the meeting was purely a formal one; the company had gone into voluntary liquidation, as it was desired to change the name of the concern to the Opel Motors, Ltd. The company was perfectly solvent, and those creditors who had not been paid would receive payment in full within a short time. The voluntary liquidation of the company is being continued with Mr. Tyler as liquidator.

M. Sims, 46, Leigh Road, and Milton Road, Southend-on-Sea, electrical engineer, &c.—The creditors interested herein were called together on Monday last, at the offices of Messrs. Osborn & Osborn, solicitors, Coleman Street, E.C. A statement of affairs was presented, which showed liabilities of £690. There were also partly secured creditors for £475, who held securities valued at £450. The assets were estimated to realise £362, less £27 for preference claims, leaving a deficiency of £355. The debtor had been in business for about 16 years. The present position was attributed to bad trade. The creditors decided that the estate should be realised under a deed of assignment, with Mr. Mortimer as trustee. A committee of creditors was also appointed.

Vitty & Hopper, Ltd., electrical, hydraulic and mechanical engineers, 96, High Street, Ramsgate.—A meeting of the creditors of the above was held on August 27th, at the offices of the liquidator, Mr. J. W. Scarlett, 36, High Street, Ramsgate. A statement was presented which showed liabilities of £852 15s., of which £538 9s. 9d. was due to trade creditors, and £146 16s. 4d. to a cash creditor, while the bank were also interested for £63 2s. 11d.

The assets were estimated to realise £890 6s. 10d., and as regarded the creditors a surplus was thus disclosed of £37 11s. 10s. The issued share capital of the company was £1,250, and as regarded the contributories there was a deficiency disclosed of £1,212 8s. 1d. The company, which was a private one, was registered in March, 1911, with a nominal capital of £1,500, to take over two businesses which had formerly been carried on respectively by Mr. Vitty and Mr. Hopper. The liquidator stated that he was in negotiation with parties who were likely to take over the business as a going concern. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Scarlett as liquidator, and a committee of the principal creditors was also elected.

Book Notices.—"Chronology of Aviation." By Hudson Maxim and W. J. Hammer. New York: From the Authors.

"Nouveau Guide Pratique de l'Usager d'Acetylène." Paris: Office Central de *l'Acetylène*. Price 1 fr. 50. 1913.

The September issue of the *Wireless World* contains an account of the part played by wireless telegraphy in the recent naval manœuvres, descriptions of Prof. Korn's process of transmitting photographs and drawings by wireless telegraphy, and the St. Kilda station, and an article on steam trawlers and their work. A good deal of space is allotted to articles of interest to amateurs and to the solution of other people's difficulties.

Trade Announcements.—Messrs. Brotherton Tubes and Conduits, Ltd., have now moved into larger premises situated at 4, Carr Street, Blackfriars, Manchester, where increased stocks will be available. This depôt will in future be under the management of Mr. T. A. Nunwick, who also represents The Wandsworth Electrical Manufacturing Co., Ltd., of Birmingham, and Messrs. Pritchetts & Gold, Ltd., of London, in Lancashire, Yorkshire and Cheshire.

Messrs. L. E. Wilson & Co., electrical engineers and contractors, sole agents for the Thomson electric lamps, aero fire alarm, &c., who have been for some years located at 20, Cross Street, Manchester, give notice that owing to the extension of business they are removing to new premises at 10, Corporation Street, Manchester (Telephone, City 344; Telegrams, "Telephony," Manchester) on September 8th next.

Messrs. F. B. Nathan and F. S. Allen have opened an office and showroom at Queen Anne's Chambers, Westminster, S.W. They represent the Kartret Engineering Co., who manufacture switchgear, and the Wardle Engineering Co., Ltd., makers of lanterns and fittings for streets, shops and works.

Messrs. Henrion Carbons inform us that as their output to England has grown more important, they have decided to open a branch office in London, at 34, Victoria Street, S.W., under the management of Mr. R. Serena. The firm, as is well known, specialises in electric carbons for open, enclosed, and flame arc lamps, brushes for dynamos, &c., and battery plates.

Messrs. Pyne, Hughman & Co., electrical and general engineers and contractors, of Calcutta, have opened a London office at Bank Chambers, 329, High Holborn, W.C., and have appointed Mr. F. M. Short as their manager for Europe with headquarters at the above address. Prior to this appointment, Mr. Short was for 14 years in charge of the electrical department of Messrs. Balmer, Lawrie and Co., of Calcutta.

Messrs. Saville & Walton, electrical engineers and contractors, of London and Cardiff, are opening a new branch business at High Street, Cobham (Surrey), where a supply of electricity is now available.

Henry Strafford & Son, Harrogate, electrical engineers.—Notice is given in the *London Gazette* that the business carried on by Henry Strafford and Fred Strafford under the above style has been sold to Mr. Albert Lappin, by whom it will be carried on under the same style, as from August 25th.

The new London address of Messrs. Rhodes Motors, Ltd., is Sanctuary House, Tothill Street, Westminster, S.W.

Liquidation.—Stoltz Electrophone Co. (London), Ltd.—At meetings on July 28th and August 19th it was resolved that the company be wound up voluntarily, and that Mr. Elliott Thorpe, 45, Chancery Lane, W.C., be appointed liquidator. Notice is given in the *London Gazette* that a meeting of the creditors will be held at Cannon Street Hotel on September 8th, at 3 p.m.

Catalogues and Lists.—The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, London, N.—List No. 39 B, just issued, of silica lamps for power circuits; it describes and illustrates the type Z5 lamp, which is distinct from other types in that it operates in parallel on high voltage and can be used where a D.C. 500-volt supply is available. The power consumption is given as ·37 watt per C.P.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, N.—Brochure describing the Westinghouse steam-driven air-compressors, vacuum pumps, water pumps and boiler feed pumps, with details of sizes and outputs.

Landis & Gyr, Ltd., 28, Denman Street, London, S.E.—Descriptive pamphlets relating to watt-hour meters for single and polyphase circuits; these are fitted with a special footstep bearing, and are claimed to have a high torque in spite of very small energy losses.

The Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Bulletin No. 25, containing 13 pages of illustrative and descriptive matter relating to large alternating-current motors for driving colliery fans and compressors. Detailed views are given to illustrate the robust construction employed, and views are included of turbine-driven machines, electrically-driven fans, explosion-proof motors, &c.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. Bell, the city electrical engineer, has outlined the scheme for lighting Aboyne, pointing out that it depends on the decision of Banchory, and will also affect the proposal to supply Ballater. The City Council would supply energy in bulk to the local authorities, who would carry out the distribution, &c.

Accrington.—Proposed Loan, &c.—The electric street lighting in Blackburn Road, Manchester Road, Peel Street, and Clayton-le-Moors is now completed, and similar work in Whaley Road is in progress.

The Electricity Committee was informed a few days ago that the gas plant continued to work satisfactorily, and that the sulphate of ammonia yield was giving steady returns. Some 17 tons had been sold, and there were about 12 tons in stock.

Application is to be made to the L.G.B. for sanction to borrow £3,050, £2,500 for the provision, extending over three years, of consumers' H.T. sub-station equipments, switchgear, transformers, and service cable; and £550 for the provision of water-cleaning plant and the necessary piping to deal with 6,000 gallons of river water per hour.

The L.G.B. has sanctioned the borrowing of £1,060 for extra-H.T. mains to be laid from Clayton-le-Moors sub-station to Rishton Paper Mill, to be repaid within 25 years, and of £940 for switchgear and transforming plant, to be repaid within 15 years.

In response to a request from Messrs. Lupton Bros., Ltd., the Electricity Committee has decided to couple both the works of the firm by one cable and aggregate the consumption of current.

Algeria.—La Société Les Exploitations Electriques has secured the concession for the supply of electricity for lighting and power purposes in the town of Assi-Bon-Nif. It is also in negotiation for a similar concession in the town of Mers-el-Kebir.

Argentina.—La Compania Italo-Argentina de Electricidad, which is establishing a large electricity supply station in Buenos Ayres, has placed a contract with Messrs. Franco Tosi & Co., for the supply of eight multitubular boilers, with superheaters and economisers, each of 500 sq. metres heating surface; a 7,500-H.P. steam turbine, and four 800-H.P. Diesel four-cycle engines.

The Mayor of Rosario has had an interview with the Mayor of Buenos Ayres, and has requested the services of an engineer to study the question of the public lighting in Rosario in connection with the tenders that have been received. Engineer Ernesto Newbery, the actual chief of the Public Lighting Department, has been appointed to act on behalf of the Rosario Municipality.—*Review of the River Plate.*

The Compania Anglo-Argentina de Electricidad continues to make steady progress, and it has recently acquired the electric light stations in San Juan, Resistencia, Bragada, Necochea and Trenque Lauquen. The company now possesses 17 electric light and power stations, two gas works, one electric tramway and one telephone system.

Australia.—The Sydney City Council, having arranged a special tariff for the supply of electric current to electrical contracting and supply houses for the purpose of demonstrating machines and appliances with a view to further enlarging the scope of electrical business, the Melbourne City Council has adopted a similar arrangement with local contractors. The rate proposed is 1½d. per unit for lighting, power and heat.—*Commonwealth Engineer.*

Bacup.—It is proposed by the T.C. to seek the sanction of the L.G.B. to the borrowing of a sum of £1,800 in connection with the electricity services of the Corporation.

Ballyconnell (Co. Cavan).—On September 10th, a L.G.B. inquiry will be held into the application of the Bawnboy R.D.C., in regard to the electric lighting of Ballyconnell.

Belfast.—The Corporation has confirmed the recommendation of the Committee to obtain a site on the Musgrave Channel from the Harbour Commissioners for the new power station.

Bingley.—L.G.B. Inquiry.—An inquiry by the L.G.B. was held on Thursday, last week, in respect of the application of the local U.D.C. to borrow £7,000 for an electricity sub-station with transforming machinery, distributing cables and mains. The evidence on behalf of the Council was taken by Major Stewart, R.E., and there was no opposition to the application.

Canada.—A hydro-electric plant is proposed at Big Eddy (B.C.) on the Columbia River, where it is said comparatively little work will be needed to impound sufficient water to develop 300,000 H.P.; 30,000 H.P. hydro-electric units are spoken of, and an estimated cost of 23 million dollars. The *Canadian Engineer* calls it "the world's largest power plant"—but then, of course, there are others.

The Vancouver (B.C.) city authorities are proposing to construct a municipal power plant, and efforts are to be made to secure a suitable water power site.

Continental Notes.—Norway.—The power station of the Hogstad undertaking at Stemdal, about 30 miles to the north-west of the town of Larvik, has recently been completed and run experimentally. The power is obtained from the Stemdal River, which contains a number of waterfalls which it is the intention of

the owners of the rights to harness in the course of time. The first step has now been taken in harnessing the Hogstad Waterfall, which comes from the Vannebu Lake, and has a height of 135 m. The work was decided on in 1910, and a start was made in 1911. One of the features of the undertaking was the running of a tunnel 2,300 m. long, through which the water is conducted to a distributing basin, from which it runs to the power station. In the latter are provisionally installed two units with a total capacity of 5,000 H.P., to which will be added a further reserve unit. This station has several novelties from a technical point of view. The water turbines run at 1,000 R.P.M.; the generators are coupled direct, and supply three-phase current at 6,000 volts, which is stepped up to 60,000 volts, the latter being the highest pressure that has ever been employed in Northern Europe. Energy is transmitted to the town of Larvik, the length of the cable being 34 miles. From Larvik a branch line runs to the town of Sandefjord, which is also to be supplied with light and power from this source.

GERMANY.—3,000-H.P. DIESEL ELECTRIC SETS.—An important extension is about to be carried out at the municipal central electricity station at Bremen, orders having just been placed for two 3,000-H.P. Diesel engines and alternators. The engines, which which will be supplied by Messrs. Sulzer Bros., of Winterthur, will be of the six-cylinder two-cycle vertical type, designed to work with tar oil. The generators will be supplied by the A.E.G.

RUSSIA.—It is reported from St. Petersburg that a French syndicate has made an offer to the Russian Government proposing to construct locks in the river Dnieper, provided that the former is granted a concession to utilise the waterfalls for the production of power. The expenditure on the works is estimated at £4,000,000.

FRANCE.—A Franco-Swiss syndicate proposes to establish hydro-electric works for the utilisation of the power of the Rhone on French territory at Chaney, which is less than a mile distant from the Swiss frontier. The municipal council of Geneva had projected a similar scheme, but has decided to abandon it on the promoters of the rival works granting certain privileges to the Council. The cost of the works is computed at £400,000.

A large electric generating station with a capacity of about 15,000 H.P. is to be established near Fourchambault (Nievre) with the object of supplying power for the cement and other works in the Beffes district.

SPAIN.—Representatives of a number of the commercial firms in the city recently met in Madrid in order to protest against the high rates at present charged for electricity supply in the Spanish capital. It was decided to send a letter of protest to the supply companies and to approach the municipal authorities with the view of inducing the latter to see that the electricity concerns fully comply with the terms of their concession.

SWITZERLAND.—There has just been installed at the Löntsch hydro-electric station, near Glauris, a 15,000-H.P. Pelton wheel, which is declared to be the largest of the kind erected in Europe. The equipment of this station already comprised six 6,500-H.P. Pelton wheels, totaling 39,000 H.P., and the latest addition raised the total to 54,000 H.P., making this station the largest in Switzerland.—*L'Industrie Electrique.*

Cirencester.—The U.D.C. has given the Cirencester Electric Supply Co., Ltd., permission to erect three routes of overhead transmission lines.

Dartford.—The chief electrical engineer (Mr. J. D. Pember) recently issued his report on the accounts of the electricity undertaking during the year ended March 31st last. These accounts show a loss of £1,272, such loss being attributed to the coal and Thames strikes, which occurred during the 12 months. As proof of this, the engineer states that he finds that there were 1,465 tons 13¼ cwt. of coal used during the period under review, which were supplied during the coal strike and the Thames strike, at an increased cost of £360, which equals about 4s. 11d. per ton over the contract prices for the year ended June, 1912. The deliveries under the new contracts actually started in September, 1912, the South Hetton being 3s. 6d., and the Rubbly Culm, 2s. 10d. per ton above the previous contracts. There were 2,281¼ tons delivered at these higher contract rates, involving an additional expenditure of £359, or an average of 3s. 1½d. per ton more.

Of the two strikes the Thames strike was possibly the worse, as it necessitate obtaining rail-borne instead of sea-borne coal, and having to pay the difference in the two rates of freights. The total amount paid due to these increases was £718, and the whole of it fell on the electricity department, as no increase was charged against the sewage department for the coal supplied for the sewage pumps.

Darwen.—Amongst the recommendations of committees to be brought before the T.C. this week is one to the effect that consumers of electricity for power purposes, having 100 H.P. and upwards installed and in use, be allowed electricity for lighting purposes at 1d. per unit net up to 5 per cent. of the monthly consumption for power purposes; any electricity taken in excess of the above 5 per cent. to be charged for at the ordinary rate of 4½d. per unit. The decision was arrived at in connection with the supply to St. Paul's Mill.

Doncaster.—The Corporation accounts for the year ending March 31st last, which have just been issued, bear striking testimony to the increase in the popularity of electricity in the borough. New customers are arriving every week, and the use of the current in business premises is becoming much more common. The electricity department has converted a deficit of £1 299 into a profit of £1,114.

Dundalk.—At the bi-monthly meeting of the Urban Council, Mr. P. A. Spalding, electrical engineer, reported that as regarded the street lighting, a number of extra 75-C.P. lamps were necessary in order to improve the lighting in certain main thoroughfares. The entire annual cost per lamp to cover the supply of current and maintenance would be £4 10s. The total number of services installed was over 280. The wiring of the artisans' houses in the town was well in hand.

Forres.—Mr. Purvis, of Edinburgh, has been asked to prepare a report on electricity supply in the burgh.

Galashiels.—The recently-formed company—the Galashiels and District Electric Supply Co., Ltd.—is applying for a prov. order, and intends as early as possible to build and equip a station. The Galashiels manufacturers are supporting the scheme, a municipal venture not having been carried out. In several of the mills the present engines are out of date, and failing electric power, new engines will have to be installed. The company has its head office at 23, Rutland Street, Edinburgh. The capital is £30,000, and leading manufacturers are among the subscribers.

Great Harwood.—In the course of a report on U.D.C. matters presented at the meeting of the Trades and Labour Council last week, Councillor J. Parker said that whilst the Council was in committee, the electricity question had been discussed, following a report of an interview with the Accrington authorities. There were two suggestions before the Council. One was to put down its own electrical plant and generate its own current, and the other was to obtain a supply from Accrington for a term of years. There had been much difference of opinion as to which course was the better, and nothing definite had yet been done. No doubt negotiations would continue for some time to come.

Haslingden.—Gratifying progress in regard to the consumption of electricity was reported at the T.C. meeting on August 27th. Councillor Waddington said they were justified in asking for authority to go fully into the question of a supply to Helmshore district. They had got a definite promise from the Park Mill, while Messrs. Whittaker Bros. and others proposed to take a supply. The supply on which they could already count was equal to more than a quarter of a million units per annum, which was more than was consumed in the borough of Haslingden at present. The Council gave authority to the committee to obtain specifications and estimates for the laying of the necessary cable.

Hebden Bridge.—LOAN SANCTION.—Having received the sanction of the L.G.B. to the borrowing of money for proposed extensions at the electricity works, the U.D.C. has decided to negotiate a loan for £3,250 on that account.

Hinckley.—HOSPITAL LIGHTING.—With reference to the lighting of the new hospital, mentioned in the last issue of the ELECTRICAL REVIEW, the Leicestershire and Warwickshire Electric Power Co. has informed the U.D.C. that it cannot give a guarantee for 20 years, but would give a guarantee for five years, taking the risk of any increase in the price of current. It would also give a guarantee for 10 years, providing the cost of coal did not go up; if there was any increase in the price of fuel, current would be advanced in price by $\frac{1}{10}$d. per unit on every increase of 2s. 6d. per ton. The present price of current, it was added, was 3d. per unit for lighting, and 1d. for heating. The architect has strongly recommended the installation of electric light as being more suitable than gas for a hospital, and the Council has further deferred its decision.

Holmfirth.—The U.D.C. has adopted new specifications in connection with the generating plant, &c., for the electric lighting scheme, and has called for fresh tenders from the three firms who submitted quotations. The Council has applied for permission to utilise a portion of the market site ground for the erection of the generating station.

Hungerford.—The R.D.C. has granted Messrs. J. and F. May, of London, contractors to Mr. H. E. Phillips, permission to use overhead wires for electric lighting purposes in the parish of Kintbury.

Kendal.—MARKET LIGHTING.—The T.C. has received tenders from the gas and electricity departments for lighting a portion of the fish market, and has accepted the quotation of the electricity department, amounting to £34 10s., for erecting a bracket lamp, fitted with three 200 C.P. lamps, and supplying same with current. The gas company's offer was for the erection of two 300-C.P. lamps at a cost of £31 12s. 4d. The B. of T. has approved the Council's proposal to erect overhead cables, and the work of putting these up is to be carried out at once.

Knottingley.—The U.D.C., on August 28th, confirmed a recommendation by the Electricity Committee to appoint Mr. J. W. Speight, of St. Anne's-on-Sea, as engineer to prepare a scheme of E.L. for the purposes of the prov. order which is being applied for, subject to his terms being satisfactory.

Leeds.—ROUNDHAY CO. ABSORBED.—Arrangements have been come to between the Roundhay and District Electric Lighting Co., Ltd., and the Corporation, whereby the former undertaking is to be transferred to the municipal authorities as from July 1st, 1914. The amount of the existing share capital is £12,390, and this, together with interest at the rate of £3 2s. 4d. per cent. on the ordinary share capital from the date on which the same was raised, and the sum of £500 for all the costs of the company incidental to the winding up and transfer of the undertaking to the Corporation, is to be paid on that date by the Corporation.

London.—Shoreditch.—The L.G.B. has sanctioned the proposal of the Guardians to enter into a contract with the Hackney B.C. for the installation of electric light at the Branch School, without in the first instance advertising for sealed tenders. The cost is estimated at £65.

Islington.—Workhouse Lighting.—At the last meeting of the Guardians, the Committee reported having had before it the subject of lighting the Workhouses, &c., by electricity. The Committee is to visit the Kensington, Hammersmith and Hampstead Workhouses, an institution at Barnes, and the Blind School, Leatherhead, Surrey, to view the E.L. installations there.

Mexico.—The contemplated harbour construction works at Tampico, to serve the petroleum oil fields, comprise, among other things, the erection of an electric generating station for the supply of lighting and power, the installation of electrically-worked loading appliances, and the construction of a railway, &c., across the Isthmus to the Pacific Ocean. A concession for the latter has been granted by President Huerta to an English syndicate which is also interested in the other schemes.

Navan.—At the recent meeting of the Urban Council a report was read from the Lighting Committee, recommending that application be made for a loan of £7,000 for the carrying out of the electric lighting scheme.

Newport (Mon.).—L.G.B. Inquiry.—An inquiry was held on August 27th, by Mr. T. C. Ekin, relative to the application of the T.C. for a loan of £10,600 for electricity purposes and the provision of a new turbine and other plant. There was no opposition.

Portishead.—Electric Supply Started.—The inauguration of the electric supply by the Clevedon, Portishead and District Supply Co. recently took place. The company has powers to supply the whole district between Portishead, Bristol and Clevedon, a triangular area of about 40 sq. miles, but is temporarily supplying Portishead alone. Formed with a nominal capital of £50,000, sufficient capital was raised last year to make a start with the work. The present plant consists of two Petter-Diesel engines of 100 H.P., which is ample for requirements in Portishead, but the existing engine room is large enough to permit two more engines of 200 H.P. being added. The streets will be lighted altogether with about 175 lamps each of 50 C.P. The engineers to the concern are Messrs. Christy Bros. & Co., and Mr. H. McLeod is resident engineer. It is expected before the end of next year to complete the supply over the whole of the area, at least so far as the principal villages are concerned, namely, Partbury, Pill, Abbott's Leigh, Leigh Woods, Long Ashton, Flax Bourton, Nailsea, Clevedon, Walton-in-Gordano, and Weston-in-Gordano.

Rothesay.—Proposed E.L. Plant.—The report of Mr. James Robertson, of Greenock, on the proposed destructor and electricity plant has been issued. The cost of the scheme is put at £13,000, and an estimated profit of £242 is shown for the third year of working.

Salford.—Subject to satisfactory terms being arranged, the city electrical engineer of Liverpool is to be appointed to report upon a proposal to modernise the generating plant of the Frederick Road electricity station. A special Sub-Committee has been appointed with reference to a proposal to supply three-phase current in the Ordsall district.

Trowbridge.—The question of allowing the local Electric Light Co. to use overhead wires in a portion of the town for the transmission of current was again discussed by the U.D.C. on August 25th. Mr. Edwards, representing the company, attended and explained that in the opinion of the B. of T. inspector there was no danger to the public from overhead wires up to a voltage of 460, and the voltage used in Trowbridge was only 230. He also explained that the existing cables laid from the power station were too small to carry the current necessary for the proposed extensions. The Council decided that no overhead wires should be allowed in Mortimer Street, Castle Street, and Newtown, the route desired by the company, and asked the latter to submit an amended route for overhead wires.

Tyldesley.—Street Lighting, &c.—It is reported that arrangements have been made for the lighting of the main streets with metallic-filament lamps, and also that a fairly large number of shopkeepers have decided to substitute electricity for gas in the immediate future.

Windsor.—Street Lighting Tests.—As the contract for street lighting terminates early next year, arrangements have been made whereby the respective values of electric and gas lamps shall be tested during the present month. The Electric Light Co. is to exhibit metal-filament and arc lamps, while the Gas Co. will erect special standard lamps, each being allotted certain places in the borough for that purpose. In this way the public will be able to estimate the value of each form of lighting.

York.—The City Council has decided to make application for a provisional order authorising the Council to supply the adjoining areas of Great Ouseburn, Bishopthorpe, Escrick, Tadcaster, Flaxton and Easingwold.

TRAMWAY and RAILWAY NOTES.

Ashton.—The threatened tramwaymen's strike at Ashton has been averted for the time being, the men having decided to postpone their notices and to take a ballot on the question as to whether or not the offer of the employers shall be accepted.

Australia.—A company under the name of the Townsville (Q.) Electric Tramway Co., Ltd., is being formed with a nominal capital of £60,000. The object of the company is to construct electric tramways in Townsville and suburbs.

The takings derived from the St. Kilda-Brighton electric tramways, managed by the Victorian Railway Department, for the financial year ended June 30th, amounted to £16,782, against £15,013 for the year 1911-12, and £12,852 for 1910-11.

The Midland Junction (W.A.) Council has recommended to the Government that, when providing for extensions and additions to the electric tramway system, the advisability of constructing a tramway to connect up Midland Junction with Bellvue, Greenmount and Swan View district be considered.

Continental Notes.—Austria.—The Ministry of Railways has granted concessions for a year for the preliminary studies in respect of a normal gauge electric railway from Pram-Haag, on the Austrian State Railways, to Station Haag, on the Lambach-Haag local line, Upper Austria; for a normal gauge electric line from Station Wels, on the Austrian State Railways, to Kleinmünchen, with a branch to a point near Linz, Upper Austria; and for a narrow gauge electric line from Abbazia, *via* Veprinaz, to the shelter house at the summit of Monte Maggiore (Küstenland).—*Der Elektrotechniker.*

Spain.—The last section of the electric railway between San Sebastian and the French frontier has now been completed and put into operation. The new line, which is about 12½ miles long, has been very costly, owing to the large number of bridges and tunnels that have had to be constructed; one of the tunnels is about 3½ miles long, while one of the bridges has a length of over 80 yards. The necessary current for the line is supplied from a large power station on the borders of the provinces of Navarra and Guepuzcoa, where the water-power of the Puerte Maria Falls is being utilised. There is some talk of extending the line at a later date to Biarritz, France, so as to give a direct connection between this well-known resort and San Sebastian.

Italy.—A scheme for the electrification of the railway between Genoa, Ovada and Asti is at present under consideration.

Russia.—A company is in course of formation in St. Petersburg, its object being to construct and work an electric railway between Moscow and Vosresersk, a distance of about 35 miles.

France.—La Compagnie des Tramways de Paris et du Departement de la Seine is at present establishing a new sub-station, which is to supply power for two systems of electric tramways—overhead trolley and conduit. To this end the switchboards will be fitted with two sets of continuous-current bus-bars. The plant for the station, which is being snpplied by the French B.T.H. Co., will comprise four sets of 750-KW. transformers. Each group will consist of a three-phase transformer receiving current at 10,250 volts, and 25 cycles. A series of six-phase rotary converters are also being installed; these will be provided with compound exciters. the ends of the shafts of which will be fitted with centrifugally-controlled safety devices.

Germany.—Work has been commenced on the electrification of about 140 miles of the State railway system in Silesia. The current necessary will be supplied from a privately-owned power station, which is being established at Mittelsteine, near Glatz, and which will have at first a capacity of 16,000 KW. The A.E.G. has secured the contract for the supply of two sets of 4,000-KW. steam turbines and single-phase alternators for 3,150 volts, 16⅔ cycles, and two 5,000-KW. transformers for stepping up the current to 80,000 volts. From the main power station the current will be transmitted at the last-named voltage to four sub-stations on the line of the railways, where it will be stepped down to 15,000 volts.

Lötschberg Difficulties.—The *Railway Gazette* correspondent, writing as regards the initial troubles on this line since its electrification, mentions that the collecting bows have had to be altered in shape owing to their sometimes losing contact with the overhead wire, apparently due to settlements in the tunnel arch.

Another trouble is said to have been due to the 15,000-volt trolley-line pressure being exceeded—this, again, resulting from atmospheric conditions and rapid changes in them. To remedy this excess pressure variation, water-jet pressure dischargers have been established at various points, in addition to the previous precautions taken.

Dartford.—The District Council has received a letter from Balfour, Beatty & Co., Ltd., stating that as their lease of the Dartford Light Railways expires in less than eight years, they will not be able to finance the construction of the connecting line between Horns Cross and the termination of the Gravesend tramways at Swanscome, unless such line is to be taken over by the Council at the same time as the lease of the light railways falls in, and asking if the Council will agree to take over the connecting line. The consideration of the matter has been deferred.

Darwen.—Dinner-hour Tickets.—It has been decided to issue a penny return dinner-hour ticket on all sections to or from the Circus between the hours of 12 and 1 on the outward journey, the return portion of the ticket to be available up to 2 o'clock. This will come into operation on October 1st, and will be given a three months' trial.

Doncaster.—From the Corporation accounts for the year ending March 31st last, just issued, it appears that the receipts of the tramways have grown from £17,302 to £20,346, another evidence of the growth of the outlying districts. A deficit of £53 has been converted into a profit of £1,290 though the expenditure is £19,000 against £17,855.

Dublin.—The tramway strike which occurred last week has, during the interval, degenerated into general rioting, in which idle members of the Transport Union and their sympathisers have played the principal part. According to reports some 600 persons have been injured and two killed during the week.

Dundee.—At a meeting of the Corporation Tramway Committee it was agreed to recommend to the T.C. that the Blackness line be extended from the present terminus along Blackness Road to Glamis Road, at a cost of about £500. A member asked whether there was any prospect of a permanent tramway being placed in Clepington Road in the immediate future instead of the railless system, but the manager said it would be a long time before they would be justified, from a commercial point of view, in putting down a permanent tramway line there. They were not earning half as much as the interest and sinking fund.

Halifax.—The T.C. has been recommended to double the existing tramway in Huddersfield Road, from the Punch Bowl to the Calder and Hebble, at an estimated cost of £1,140.

Huddersfield.—New Tramway.—The Corporation, the Elland Township Lands Trustees and the Elland and Greetland D.C.'s have now completed their arrangements for the extension of the Huddersfield tramways from Birchencliffe to West Vale, thus providing a through system from Halifax to Huddersfield. The Huddersfield Corporation has undertaken to have the tramway running before the end of the year. Considerable excavation work will be required at Long Wall—a rugged piece of ground—and it is proposed that when this is completed part of the ground shall be planted with trees, and the other laid out as bowling greens for Elland and Greetland.

Hunslet.—Information has been received by the Rural District Council that the Yorks. West Riding Electric Tramways Co. is seeking to abandon a portion of its agreement with the Council for the construction of a tramway from Rothwell to Oulton.

Leeds.—The Tramway and Electricity Committee has arranged to purchase land at Guiseley for the erection of a depôt and sub-station. Sanction has been received by the Corporation for the borrowing of £29,000 for a new tramway depôt in Sovereign Street.

London.—It was stated officially last week that the Metropolitan Railway had acquired the Great Northern and City tube as a going concern, and would take over the working of the line as from September 1st.

Future developments in connection with this line will be watched with interest, in view of the proposed connection with the Metropolitan Railway at Moorgate Street, and with the Great Northern Railway at Finsbury Park.

Newcastle-on-Tyne.—Annual Report.—The report of the general manager states that the past year established a further record in every way for the undertaking; the continuance of industrial prosperity in the locality was primarily the cause of the increase. The passengers carried showed an increase of 3 millons on the preceding year, and in every department there was an increase. The gross receipts increased from £223,565 to £235,321; traffic expenses from £60,663 to £64,493; general expenses from £17,730 to £18,674; general repairs and maintenance £27,122 (an exception), fell to £25,943; and power expenses increased from £13,004 to £15,508. The sum of £3,304 had been charged to revenue for the purchase of motor-'buses for the Westerhope route. A balance of £21,189 had been carried to the reserve and renewals fund, which then amounted to £119,407. The reserve and renewals fund would be heavily drawn upon during the current year, as it was necessary to renew considerable lengths of track and several junctions; additional plant had also to be provided at the power station to meet the heavy demands for power. The undertaking had reached an age when renewals must be encountered annually, and while there was no cause for uneasiness as to whether the undertaking could meet the expenses, so long as a firm policy was pursued in resisting all attempts to deplete the net annual revenue by saddling it with still heavier charges than it now carried, he pointed out that if such a policy was not pursued, the undertaking might eventually have to be supported out of the rates. In some statistical information it was stated that the passengers carried per car-mile were 10·92; traffic revenue per car-mile, 11·81d.; average fare per passenger, 1·082d.; cost per passenger, 0·593d.; power costs per car-mile, 0·779d.; traffic costs per car-mile, 3·238d.; repairs and maintenance, 1·302d.; total operating costs per car-mile (including public arc lighting), 6·477d.

Oldham.—A deputation has waited on the Tramways Committee to urge that instead of the motor-'bus service to Moorside, the tramway track should be extended at Grain's Bar so that a tramways service would be available. Mr. Dugdale reported to the Committee last week that at present the motor-'bus was the cheapest way of dealing with the traffic at this point. After a long discussion the Committee decided that the manager should get all the information necessary for a full discussion of the matter at a future meeting.

A Scotch Mountain Railway.—A scheme is proposed for the construction of a railway, about 4¾ miles in length, to the summit of Ben Nevis. The estimated cost of the work is £30,000.

South Lancashire.—The B. of T. has now given consent for the running of cars on the new track from Farnworth to Walkden, and a regular service was opened last week. A representative of the London and North-Western Railway Co. had objected to the running of the cars, on the ground that two bridges over the railway lines were not strong enough for the traffic. The cars are allowed to cross one of the bridges, but they cannot cross the other until it has been strengthened; this work is only a matter of a few days.

South Shields.—Proposed Tramway Extension.—At a meeting of the Harton P.C. on August 27th, it was unanimously decided to inform the T.C. that the Parish Council saw no objection to the proposed extension of the Shields tramways to Harton, and also to suggest to the Corporation the advisability of a further extension beyond the village, with a view of connecting the Shields system with that of Sunderland.

Tasmania.—The Launceston Tramways Committee has recommended that duplicate tram lines be laid down on the following routes:—Newstead—From Princes Theatre to the loop in Erina Street; estimated cost, £2,800. Mowbray—From loop in George Street to the loop at the Albert Hall; estimated cost, £875.

U.S.A. — 2,400-Volt D.C. Railway. — The Butte, Anaconda and Pacific Railway, which is the first 2,400-volt D.C. railway electrification in the States has recently been completed. The Butte-Anaconda section which has been equipped, comprises 30 miles of main line single track with sidings, yards, &c., bringing up the total to 90 miles. The haulage of copper ore, lumber, &c., amounts to 5,000,000 tons a year; trains weighing 3,400 tons made up to 50 loaded ore cars will be handled by two locomotives while single locos will be employed for shunting. The first equipment consists of 15 freight and two passenger 80-ton locomotives; pairs of freight locomotives will haul trains at from 15 to 21 miles an hour, while the passenger locos are geared for a maximum speed of 45 miles an hour. The locos are of the articulated double-truck type with all the weight on the drivers; each axle has a motor of the twin-geared type, fitted with commutating poles and wound for 1,200 volts, but insulated for 2,400 volts. The continuous rating of each motor is 190 amp. at 1,200 volts with forced ventilation, and 225 amp. at 1,200 volts for one hour. With a double locomotive unit this is equal to a continuous output of 2,100 H.P. Pantograph collectors are fitted and multiple unit control to operate four motors in series and series-parallel.

Wigan.—The statement of the tramway revenues for the past four months shows that the income exceeded the expenditure by £1,613. In the same period last year the expenditure exceeded the income by £1,255.

Wombwell.—Tramway Scheme.—The U.D.C. has considered the detailed estimate by Mr. Sellon (the consulting engineer for the joint authorities) of the cost of construction, capital cost, &c., of the proposed joint tramway service, by which the townships of Bolton-on-Dearne, Thurnscoe, Wath, Wombwell, and Darfield will be linked up. The Council decided to approve of the scheme so far as Wombwell was concerned.

York. — New Tramways. — Extensions involving an expenditure of £20,220 are under consideration by the Electricity and Tramways Committee, which has decided to recommend the Council to approve of the following suggestions:—Laying a new track from a junction with the existing system at Nessgate along Coppergate, Piccadilly, Walmgate, Lawrence Street and Hull Road to the Bee's Wing Hotel, the distance of the route being 1⅛ mile, and the estimated cost, including equipment and cars, £20,220; the extension from the present terminus at Acomb to the centre of Acomb village and from the Haxby Road terminus to White Cross Hill; to link up Heworth with York by applying for powers to run railless cars, and to obtain similar powers to run railless cars from Nessgate to Haxby Road, *viâ* Huntington Road.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—September 29th. The Königliche Lagernhausern authorities in Trieste are inviting tenders for the supply of a large floating electrically-operated crane, complete with Diesel engine generating plant.

Basingstoke.—September 17th. Corporation. (Section *a*) Diesel generators, balancer set and booster set; (*b*) storage batteries; (*c*) switchboard and instruments; (*d*) cables and cable laying; (*e*) overhead travelling crane. See "Official Notices" August 22nd.

Brighton.—September 9th. Electrical fittings, for the B. of G. Mr. H. Burfield, Clerk, Prince's Street.

(*Continued on page* 384.)

ELECTRIFICATION OF THE SALT UNION WORKS.

In a manufacturing process in which the coal cost is one of the heaviest items of the production charges, it is only natural that every step will be taken to minimise the fuel consumption. The present article demonstrates how the electrification of the Salt Union Works has assisted to this desirable end in the manufacture of salt.

The coal is utilised primarily for the evaporation of brine, but a considerable portion is also accounted for by the requirements of pumping and other machinery about the works.

At the Winsford Works, which extend for some two miles along either bank of the River Weaver, there is, in addition to the usual open evaporating pans, a triple-effect vacuum evaporator which was formerly supplied with steam through reducing valves from six Lancashire boilers operating at 60-lb. pressure. This inefficient arrangement has now been done away with by raising the boiler pressure and utilising steam engines to reduce the pressure to that necessary for the vacuum evaporator, the power developed by these engines being used to generate electricity for distribution all over the works.

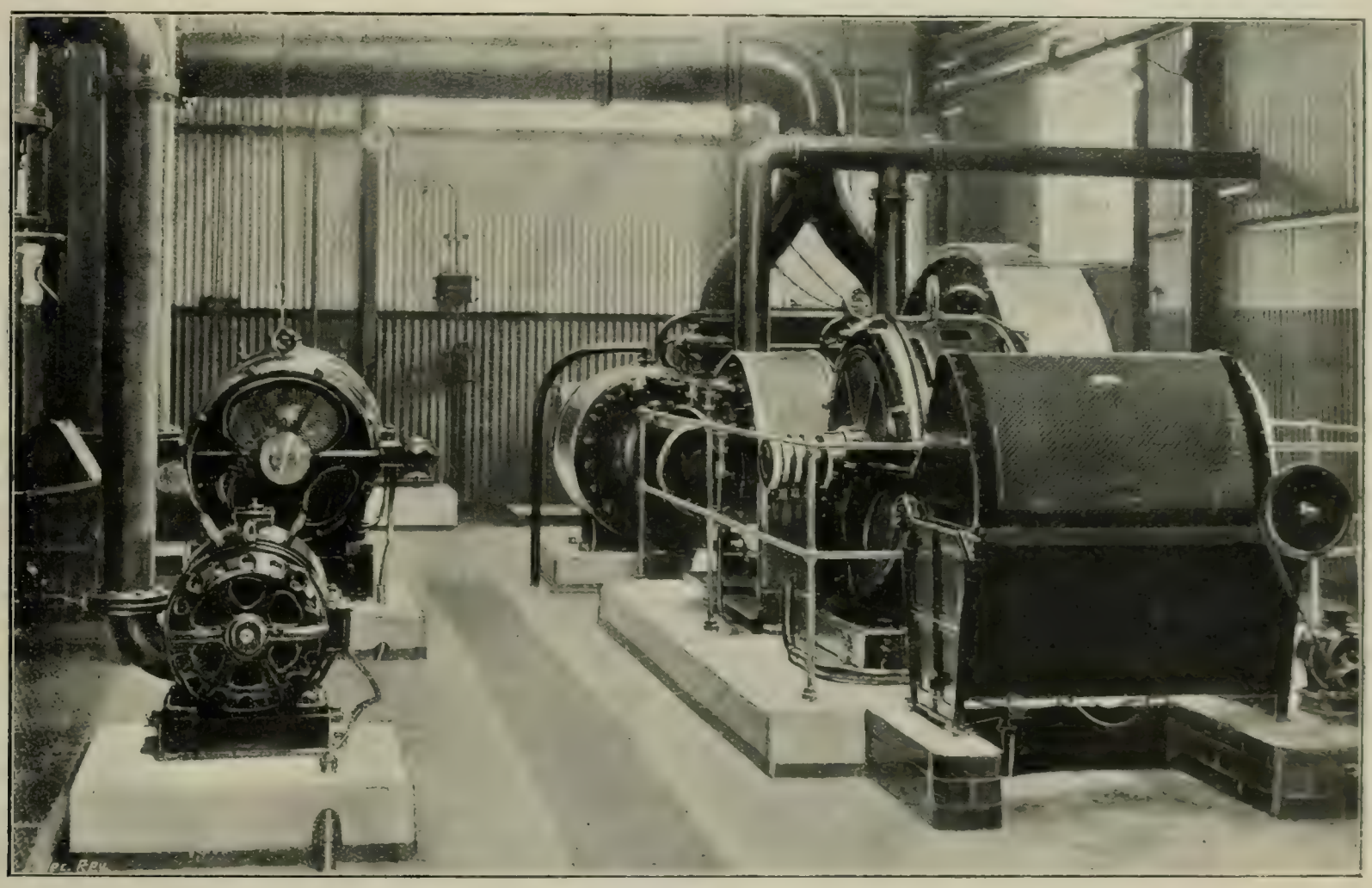
Mr. H. L. Riseley, of Newcastle-on-Tyne, was appointed consulting engineer to collaborate with Mr. G. W. Malcolm, chief engineer to the Salt Union, in the execution of this scheme. A specification was prepared and tenders obtained, and the order for the complete work including the provision of the generating sets, extensive overhead transmission lines, and motors with their necessary control gear, &c., and also the coupling up of these to the various drives, was finally placed with the British Westinghouse Electric Co., Ltd., at a cost of about £15,000.

A separate contract was placed with the Stirling Boiler Co., for three water-tube boilers to operate at 200 lb. pressure ; the steam from these boilers is passed through either one or both of two 375-kw. Browett-Westinghouse generating sets. The alternators supply three-phase, 50-period, 600-volt current, which is distributed throughout the works by means of overhead lines, which were erected by the British Insulated and Helsby Cables, Ltd., as sub-contractors to the Westinghouse Co.

Through the courtesy of the latter firm, we are enabled to illustrate the power station and various other plant about the works. In all, about 50 motors have been installed at the Winsford Works, 10 of these being in connection with brine pumps previously driven by small isolated steam engines, which latter, with their boilers and attendants, have been abolished with vast economy.

The question of how best to drive the brine pumps required considerable attention before their electrification was undertaken, since they run at speeds between 7 and 14 r.p.m., and a reduction in speed is therefore necessary between them and the driving motors. It was ultimately decided to leave the spur wheel and pinion, which had previously connected the steam engines and pumps, *in situ*, and to couple 720-r.p.m. motors to the pinions through double-reduction helical gears, made by the Power Plant Co., which arrangement has proved eminently satisfactory.

Before operative results were available from the electrification of the Winsford Works, it was decided by the directors of the Salt Union that a larger triple-effect vacuum evaporator, together with electrical generating plant, should be installed at the extensive works at Weston Point, Runcorn. These works are away from the brine fields, but the requisite brine is pumped through about 10 miles of 15-in. diameter piping from Northwich, where it is raised by means of two Westinghouse-Rateau turbine pumps, each capable of dealing with 35,000 gallons of brine (sp. gr. 1·2) per hour.



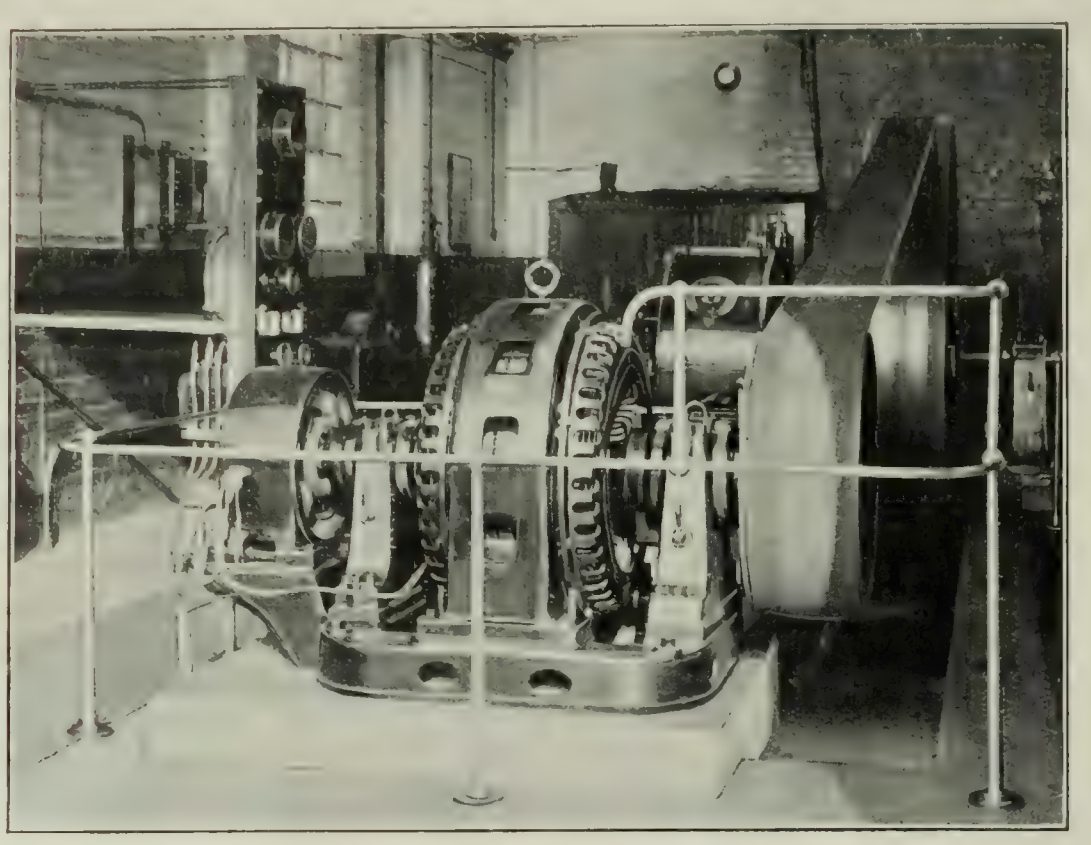
Westinghouse Motors in Pump Room of Vacuum Evaporator Plant, Weston Point Works.

The electrical power plant at Weston Point forms part of an entirely new works.

The boiler house, as at Winsford, contains Stirling boilers operating at 200-lb. pressure. Part of the steam raised was at first passed through either or both of two 725-kw. Browett-Westinghouse generating sets, and from the exhaust of the engines through a Baker oil separator to the vacuum evaporator. These engines each drive one 375-kw. three-phase 50-period 440-volt alternator and one 350-kw. 240-volt d.c. machine in tandem, the former for supplying current for power throughout the works, and the latter for electrolytic purposes. Since these sets were installed, the whole scheme has grown so rapidly that they now only form part of a far larger project.

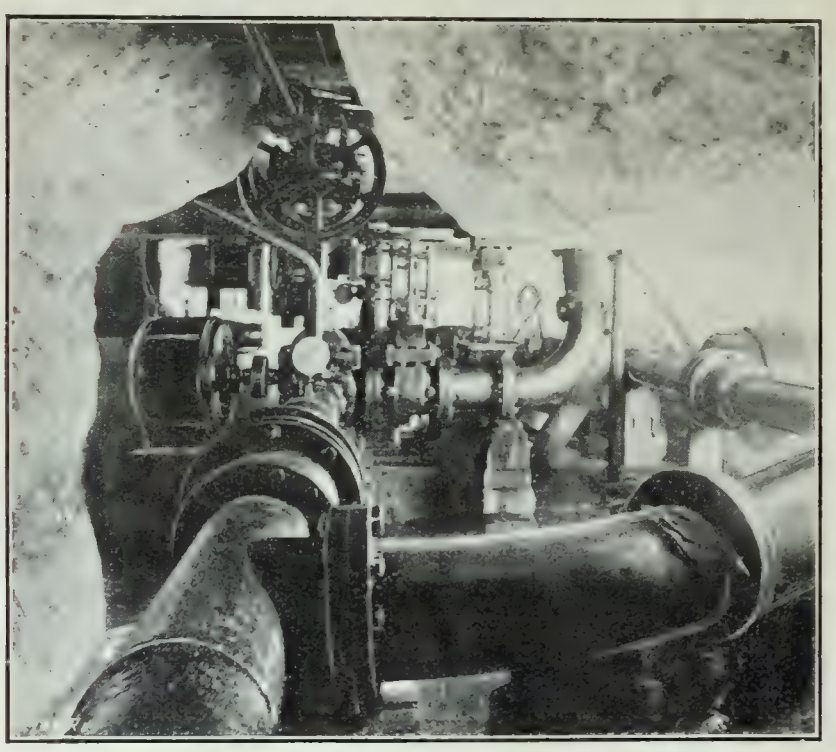
From the beginning it was realised that the amount of electrical energy available from the steam required for the

vacuum evaporator would be far in excess of the requirements of the works, and, therefore, steps were taken to obtain provisional orders for the urban and rural areas of Runcorn and the town of Widnes. These being obtained, a subsidiary company, known as the Mersey Power Co., was formed to deal with this part of the undertaking, and a further order was placed with the British Westinghouse Co. for two 1,500-kw. reducing turbines, the alternators being in this case designed for generating three-phase current at 50 periods and 6,600 volts. Static transformers with the requisite switchgear are provided to form a connecting link between these alternators and those coupled to the reciprocating engines mentioned above.



70-kw. Westinghouse Gas-Engine-Driven Alternator and Switchboard, for Supply to Brine Pump, Marston Pumping Station.

An accompanying view (p. 382) shows the appearance of the power station at present with the turbine-driven sets in the foreground, and the engine sets behind. A third turbine, similar to the two now installed, is in course of manufacture, and will be erected and put into operation in the near future.



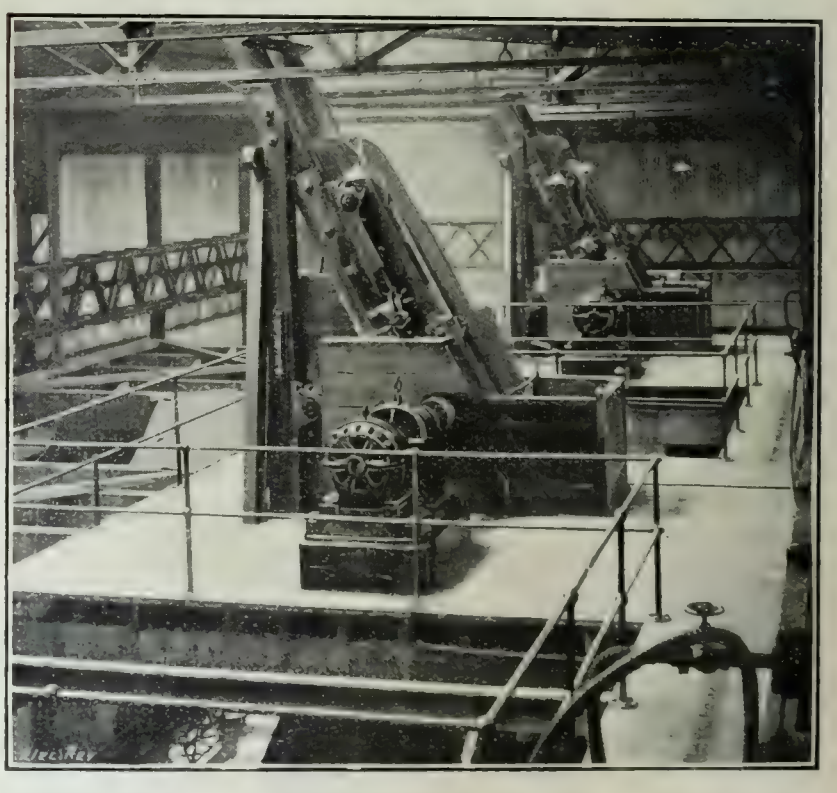
82-h.p. a.c. and 60-h.p. d.c. Motor-driven Pumps at Marston Underground Pumping Station.

A brief description of the reducing and governing valve gear will doubtless be of interest. A governor valve operated through an oil relay, in the usual way, controls the admission of steam to the high-pressure section of the turbine. This valve governs for speed alone, and is entirely independent of the reducing valve gear. The high and low-pressure stages of the turbine are divided by a solid diaphragm, the passage between the two parts being controlled by a balanced valve. This valve is opened and closed by an oil relay whose pilot piston is moved according to the position of a steam piston, one side of which is connected to the vacuum plant main. Suppose the vacuum plant to be taking all the exhaust steam, then the low-pressure section of the turbine is entirely out of commission, but if the supply of exhaust steam exceeds the demands of the vacuum plant, the pressure in the vacuum plant main arises, and moves the steam piston which shifts the relay pilot valve so that the oil relay opens the valve connecting the high and low-pressure casings. Steam then passes through to the low-pressure part of the turbine, and thence to the condenser. It will be seen that part or all of the steam may pass to the condenser or to the vacuum plant, according to the position of the valve connecting the high and low-pressure casings.

A central surface condensing plant with turbine-driven auxiliaries is installed below the turbines. This is kept continually in service, so that whenever excess steam over the above that required by the vacuum plant is called for by the generating sets, it is efficiently expanded in the low-pressure stages of the turbines. A second smaller surface condenser is being installed to act as a stand-by to that already mentioned; this is being erected on the ground level just outside the engine room.

There are some 45 motors installed at the new Weston Point Works, and of these 10 are used directly in connection with the vacuum evaporator; four for operating brine and air pumps; three for the stirrers in the brine pans; and three for the elevators which deal with the salt after it leaves these pans. The size of these motors varies from 12 to 150 h.p., and as it was desired to concentrate their control, as well as the control of the steam to the evaporator, at one point, a special centralised control platform was installed.

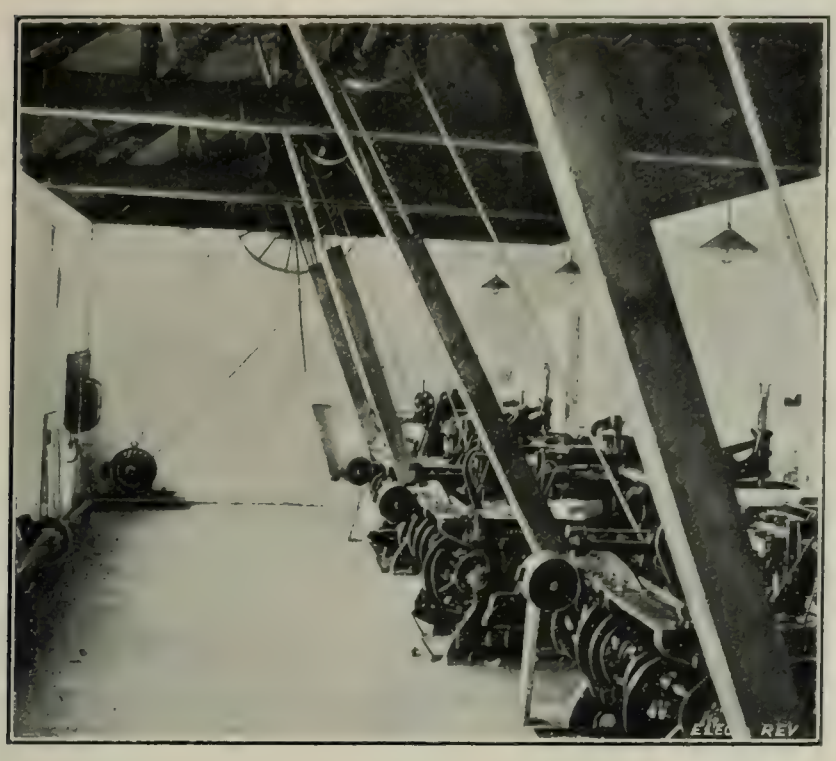
This centralised control platform is located at the operating level of No. 1 pan; a totally enclosed Westinghouse type "S" ironclad switchboard is placed on either side of this platform, there being one panel for each of the ten motors. Each panel includes an oil-type circuit-breaker, ammeter, indicating lamps to show when the motor is in operation, and in the case of the panels for the large motors



Squirrel-cage Motors driving Salt Elevators from Vacuum Pans, Weston Point Works.

in the pump room, an auxiliary switch for controlling motor-driven liquid starters, by means of which the large machines are started from the central platform. One of these small

motors is shown in the lower right-hand corner of the view on page 379, taken in the pump room. The 150-H.P. motor controlled by the liquid starter, to which this small motor is connected, drives the reciprocating air-pump for the



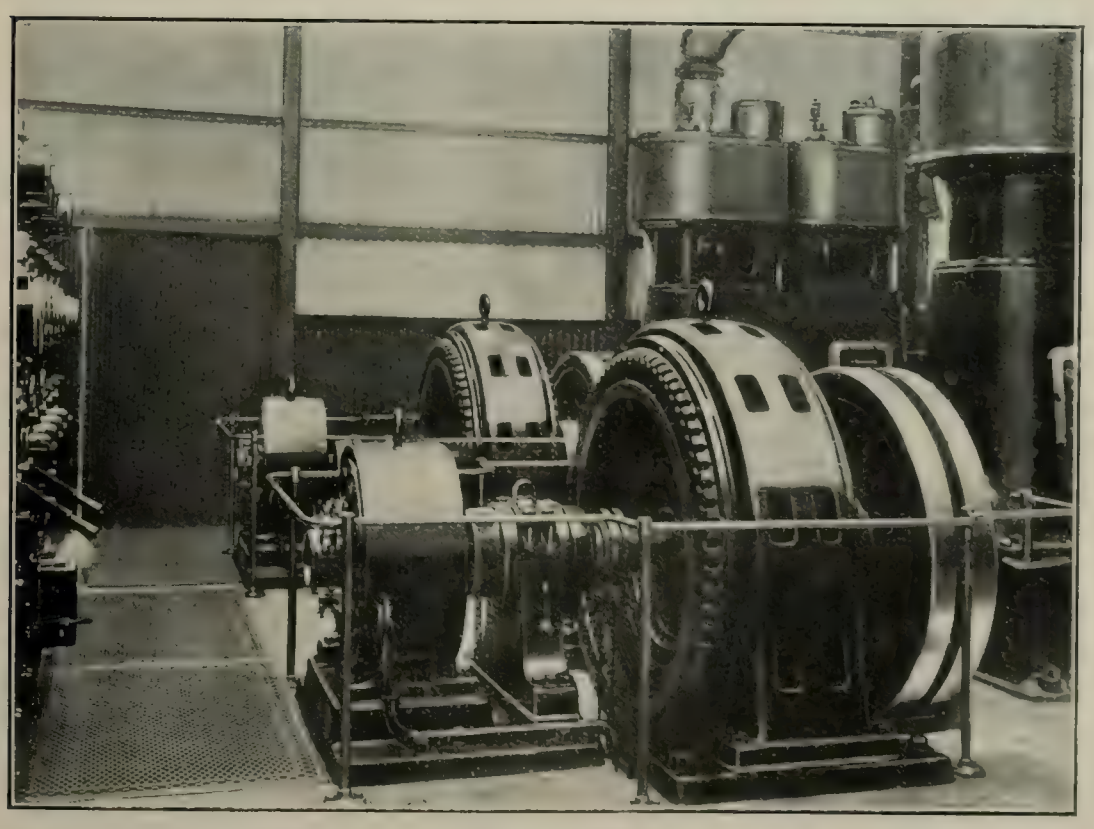
Squirrel-cage Motor driving Paper Bag Making Machinery at the Winsford Works.

vacuum plant. The 100-H.P. slip-ring motor shown at the left of this view drives the centrifugal injection pump, and the 17-H.P. squirrel-cage motor in front of it drives the feed pump for this plant.

The smaller squirrel-cage motors for operating the stirrers and salt elevators from the vacuum pans are controlled by auto-starters mounted on the control platform.

It might be mentioned that the old Western Point Works are driven by direct-current motors. A Westinghouse rotary-converter fed from the power station just described has been installed there to give the necessary direct-current supply.

Our thanks are due to Mr. G. W. Malcolm, chief engineer of the Salt Union, Ltd., and engineer and manager of the Mersey Power Co., and also to Mr. H. L. Riseley, consulting engineer, for the information given in this article, and to the former for permission to take the photographs here reproduced.



Westinghouse-Browett 375-kw. Three-phase Generating Sets, and Switchboard on the Left, at Winsford Works.

AN 80-TON CANTILEVER CRANE AT EAST COWES.

There has recently been put into service at Messrs. White's shipyard, East Cowes, Isle of Wight, a cantilever crane, manufactured and constructed by Messrs. Babcock and Wilcox, Ltd. The stanchion bases of the tower of the main structure of this crane are exceptionally heavy, and are tied together immediately above the foundations. The structure is braced with ties and struts connecting adjacent legs, there being no diagonal bracing from corner to corner in the horizontal plane. The tower terminates at the top with a mass of heavy girder-work, which carries the roller path and the casting holding the centre pin of the rotating boom. The top and bottom roller paths of the crane are formed of bent joist faced with steel; live cast-steel rollers are used, and the slewing rack is bolted to the web of the bent joist which forms the lower roller path.

The general construction of the boom is shown on page 382, and it will be seen that the two girders forming the boom are braced together crosswise by heavy bracing from a



30-H P. Squirrel-cage Motor driving Converted Brine Pump through P.P. Reduction Gear, Winsford Works.

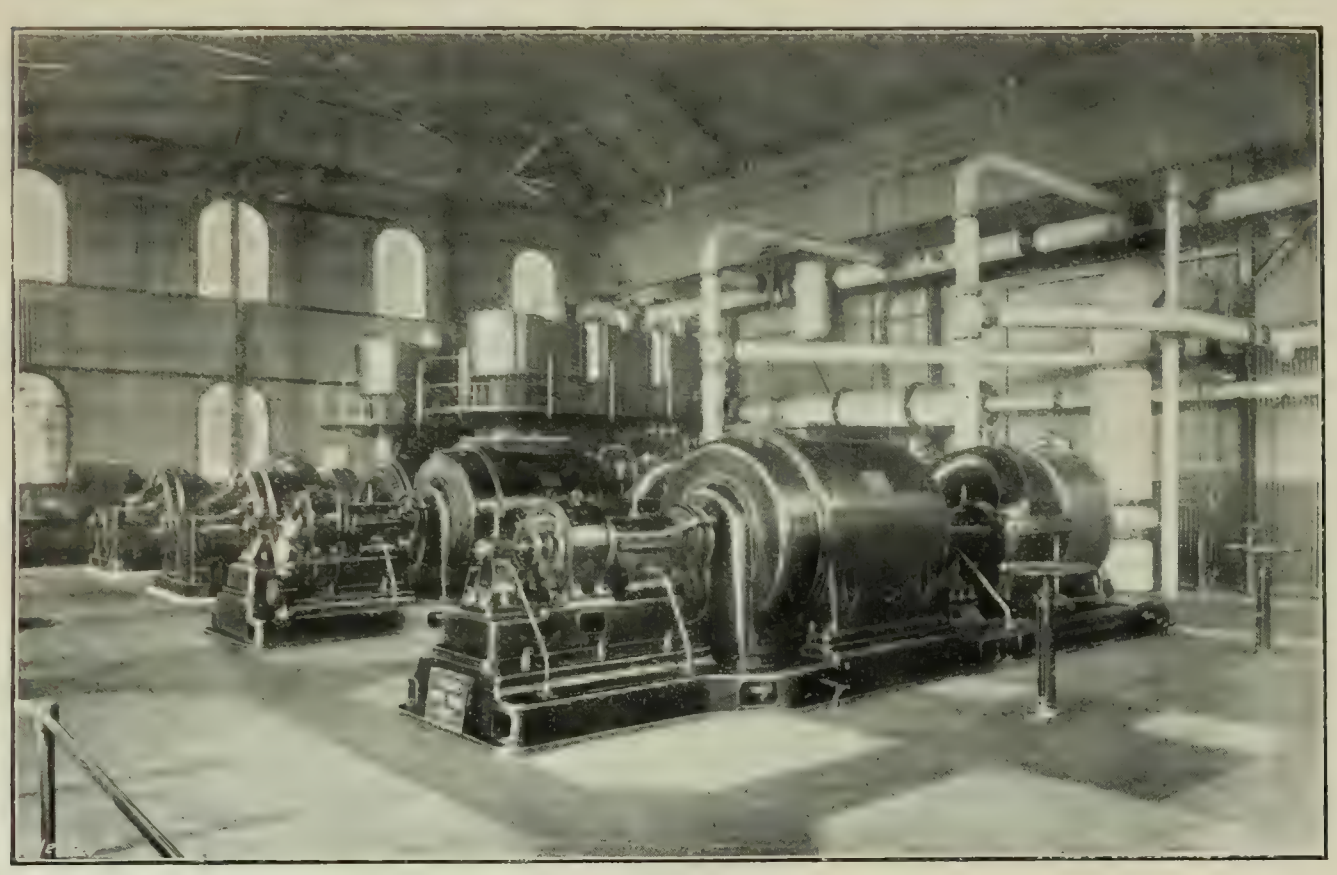
point near the minimum lifting radius, right to the extreme extreme end at which the hoisting gear is situated; they are also tied at the extreme lifting end. The ballast box is situated under the hoisting machinery. The main lifting machinery is situated at the extreme back end of the boom, and consists of two turned and grooved barrels mounted on the same shaft and driven through a suitable train of gearing.

Magnetic and hydraulic brakes are employed for sustaining the load and controlling the lowering motion. Change gear is provided for lifting lighter loads at higher speeds. Each barrel of the crane winds each end of the hoisting rope, which passes from one barrel and is reeved in two folds around the sheaves of the travelling jenny and the bottom block and then round the compensating sheave at the bend of the crane and back round the jenny and bottom block sheaves in two further folds to the other barrel.

Thus the load is lifted on eight falls of rope. The travelling jenny, which is mounted on eight wheels, has a separate motor for travelling, and this drives through spur and bevel gearing to spur racks on each wheel. The auxiliary crab runs in front of the main hoist jenny and is used for lifting loads up to 5 tons.

The slewing gear is mounted immediately above the roller path, and a separate electric motor drives through spur and bevel gear on to the slewing rack. The

operator's cabin is situated at the side of the boom near the edge of the race path.



Westinghouse Turbo-alternators, &c., at Weston Point Works (see page 380).

The large house above this constitutes a housing for the main jenny and the auxiliary lifting crab. A small hand crane travels over the main hoisting machinery and over part of the boom to facilitate operations when the crane is being overhauled. The height of lift from the dock level to the hook at the furthest end of the jib is 75 ft. and the distance from the centre of the crane to the hook in its farthest position outward is 102 ft. 6 in. The loads and speeds vary from 80 tons at a radius of 42 ft. 6 in. to 5 tons at a radius of 102 ft. 6 in., with speeds of 5 ft. per minute on the heavy trolley and 60 ft. per minute on the light trolley, respectively. The time taken to complete one revolution with 80 tons load is three minutes, and with a light load, 1½ minutes.



80-ton Electrical Crane at Messrs. White's Shipyard, Cowes, I. of W. (see page 381).

AN ELECTROLYTIC DETECTOR WITHOUT AUXILIARY E.M.F.

The introduction and successful use of crystal detectors, working without auxiliary E.M.F. and yet detecting Hertzian waves with a sensitivity exceeding that of the usual type of electrolytic detector (in which an auxiliary E.M.F. is employed and carefully adjusted to near the critical value at which electrolysis of the acid solution occurs) has led to the endeavour to realise a highly sensitive electrolytic detector operating without an auxiliary E.M.F. Could such be obtained, it would offer the advantage of being more robust and less easily deranged than crystal detectors, while it would facilitate the investigation of the, at present imperfectly understood, action of crystal detectors.

At the 1909 Congress of the Assoc. Franç. pour l'Avancement des Sciences, an electrolytic detector working without an auxiliary E.M.F. was described, in which the inactive electrode (the cathode) consisted of an amalgam of mercury and tin covering a platinum wire fused through the bottom of the detector tube. The amalgam was the seat of a small auxiliary E.M.F. capable of sensitising the electrolytic cell. This detector was found to be as sensitive as the ordinary electrolytic detector, but a trifle uncertain in action, and subsequent experiments have shown that a mercury-zinc amalgam provides a detector giving uniformly better results than the ordinary electrolytic detector, and one which is eminently suitable for the reception of musical oscillations.

The construction of the new detector, recently described by M. Jégou, is shown in fig. 1. Due to the internal E.M.F. of the cell, current flows from the amalgam (which is slightly attacked) towards the sensitive or active electrode, *i.e.*, in the opposite direction to that in which current flows in the ordinary electrolytic detector when the positive terminal of an auxiliary source of E.M.F. is connected to the active electrode of the detector. This essential difference is responsible for the extreme delicacy of the new detector.

It is necessary to distinguish in an electrolytic detector two critical voltages—the critical anodic voltage, which is

the one usually considered and which corresponds to the auxiliary E.M.F. in such direction that the active point of the detector is the anode; and the critical cathodic voltage which corresponds to the inverse application of current. These critical voltages are determined by the commencement of electrolysis in the cell and correspond to maxima of sensitivity; the cathodic sensitivity (active point as cathode) is often equal to the anodic sensitivity, which is the only one generally considered.

The critical anodic and cathodic voltages vary with the metal constituting the inactive electrode and also with the electrolyte employed; values quoted by M. Jégou are as follows:—

	Critical voltage. Anodic.	Cathodic.
Lead	2·8-2·9	ca. 2·3
Platinum	ca. 2·6	ca. 2·2
Mercury	2·1-2·2	ca. 0·5
Mercury-zinc amalgam ...	2·9	ca. zero
Carbon	2·5	2·0-2·1

The fact that the critical cathodic voltage of Hg-Zn amalgam is zero means that an optimum of sensitivity can be secured without the application of an auxiliary E.M.F. by using this amalgam for the inactive electrode of an electrolytic detector.

Though the amalgam is slightly attacked by the electrolyte, the cell is normally polarised, hence the amalgam need only be replaced at long intervals. As shown by fig. 2, the receiving circuit required is particularly simple. The passage of high-frequency current from the aerial A round the

FIG. 1.

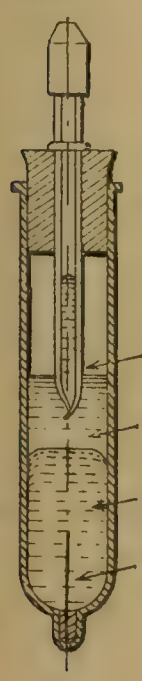


FIG. 2.

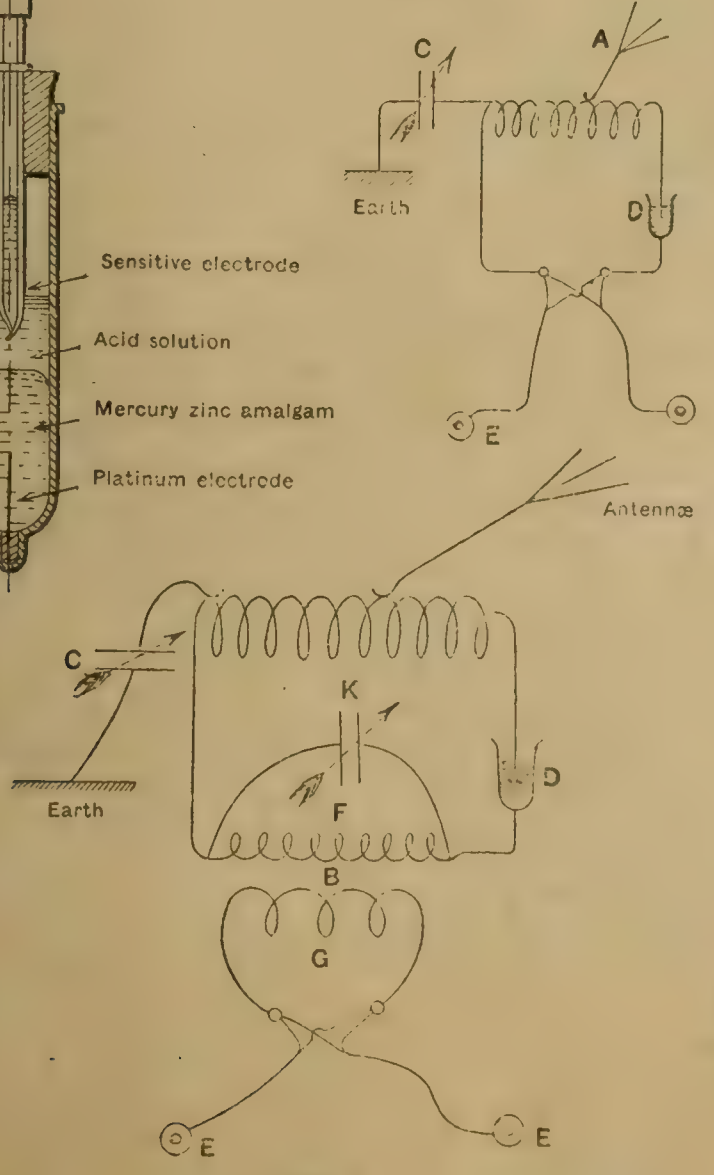


FIG. 3.

ELECTROLYTIC DETECTOR WITHOUT AUXILIARY E.M.F.

detector circuit momentarily depolarises the active electrode of the cell D, and permits the momentary passage of detector currents which produce corresponding sounds in the receivers E. By employing the slightly more complex connections shown in fig. 3, advantage can be taken of secondary resonance in the selection of musical oscillations.

PAYMENT OF INTEREST ON AND OUT OF CAPITAL DURING CONSTRUCTION.

COMMUNICATED.

IMPORTANT considerations arise when it is proposed to pay interest on capital (which has been obtained for the purpose of carrying out works) during the period of construction, or the time that intervenes between the date of commencement and the date of completion, usually called the non-revenue earning period.

When we refer to this subject, our attention is immediately directed to the doings of Parliamentary companies, that is, companies incorporated by special Acts, as it is with such special Act Companies that the payment of interest on capital during construction has been directly identified in the past.

The special Act to which they owe their legal existence, and in which are commonly incorporated various sections from the Companies' Clauses Acts, 1845, and any subsequent special supplemental or subsidiary Acts, constitute, it may be said, the Company's Memorandum and Articles of Association.

If the company, alluding entirely for the moment to Parliamentary companies, possesses power to pay interest on capital during construction, it derives its necessary authority from one or more of the clauses in one of its Acts. Such power, however, is usually accompanied by certain restrictions or disabilities, *e.g.*:—

1. The rate is limited to 4 per cent.
2. Interest generally can only be paid for the period authorised for the construction of the works.
3. A certain amount of the authorised or nominal capital must have been subscribed, say two-thirds.
4. It may be provided that notice of the power that the company possesses to pay interest out of capital is to be given in all invitations and documents in connection with obtaining subscriptions on capital account.

Perhaps one of the chief reasons urged for the payment of interest out of capital during construction is simply stated as follows:—

If certain works be constructed and a company wishes to purchase them, the seller in arriving at his cost of them for the purpose of sale would include interest on the capital expended before adding thereto the amount of profit desired. If the company constructed the works and retained them for its own use, is it not correct that any interest paid out of the capital subscribed during construction should be added to the fundamental cost of the property as being part of its total or entire cost?

But let us eliminate the introduction of the incident of purchase and sale, and assume that a Parliamentary company is formed with a capital of £250,000, of which there is issued £170,000, and actually paid up £160,000, that it constructs a certain line at a cost of £150,000, that the work occupies one year, and that interest is paid out of capital for that period.

Here the capital cost of the line is £150,000, and it is undoubted that £6,400, which represents 4 per cent. on £160,000 for the year, does not add to the value of the line. Literally, the £6,400 is simply a repayment to the shareholders of a part of the money which they have subscribed, though legally, of course, it does not operate as a reduction of capital. We, therefore, have:—

Capital cost of line	£150,000
Interest on capital or cost of capital ...	6,400
	£156,400

There are other views of a contrary nature, which we need not enter into here, but which are deserving of equal consideration.

In all such cases it may be argued that the interest represents no asset, and that it should not be included in the capital expenditure account, the accounts of Parliamentary companies being kept on the double account system; but that it should be included distinctly in the general balance-sheet, and written off in much the same way as financial expenses and discounts in connection with obtaining share capital, and money on debentures or debenture stock.

As is well known in the case of a company incorporated under the Companies' Act, where any shares are issued for the purpose of raising money to defray the expenses of the construction of any works or buildings, or the provision of any plant which cannot be made profitable for a lengthened period, the company may pay interest on so much of that share capital as is for the time being paid up for the period, and charge the same to capital as part of the cost of construction of the work, building or plant, provided that the payment is authorised by the articles or by special resolution, and that the previous sanction of the Board of Trade has been obtained, the result being that (1) the payment will be authorised only for such period as the Board of Trade may determine, which period will in no case extend beyond the close of the half-year next after the half-year during which the works or buildings have been actually completed or the plant provided: (2) the rate must not exceed 4 per cent. per annum; and (3) that the accounts of the company must show the share capital on which, and the rate at which, interest has been paid out of capital during the period to which the accounts relate.

This step was not taken until 1907, and, as in the case of Parliamentary companies, the payment of interest in such circumstances does not operate as a reduction of the amount paid up on the shares in respect of which it is paid.

But before 1907 and since, it has been, and is, an act of frequent occurrence for companies to capitalise a proportion of debenture interest paid, whilst works which are under construction cannot be made revenue-earning until after completion.

The usual practice is to show the whole of the debenture interest in the accounts, and the amount transferred to capital account, as

being part of the capital expenditure for the period (as below). In subsequent years' accounts, however, there is no visible record of the capitalisation of debenture interest.

REVENUE ACCOUNT.

Debenture interest	£39,220	
Less proportion of interest charged to properties and works account	10,148	
		£29,072

BALANCE-SHEET.

Tramways and light railways undertakings, property and works, as per last account...	£2,684,826
Add this year new construction works and equipment properties, &c.	220,268
	£2,905,094

The addition to the capital expenditure account includes the £10,148 interest indicated in the revenue account.

Though debentures or debenture stock form no part of the legal capital of a company, our observations in general in relation to Parliamentary companies may be applied when determining the destination of debenture interest in similar circumstances. On the other hand, "we may read that the interest on debentures recently issued was paid out of revenue, although this amount might well have been placed to capital account, as the money obtained by their issue has been expended on a new mill which will not be brought into use until a later period." A thorny problem does the subject, which we have been noticing, raise. So much depends upon the point of view, apart from its legal aspect.

It may be observed that there does not appear to be any provision in the Companies' Acts precluding a company from calling up a certain proportion of its share capital, and accepting the remainder as calls paid in advance, paying thereon interest at the rate presented by the articles.

CONTRACTS OPEN.

(*Continued from page* 378.)

Australia.—September 30th. Insulators at Sydney, Melbourne, Brisbane, Adelaide, Perth and Hobart.

PERTH.—September 10th. For the P.M.G. Nine sections of a trunk line switchboard.

November 12th.—Lamp signalling trunk line switchboard, of five sections, &c.

MELBOURNE.—October 7th. Electrically-driven machinery for operating pneumatic tube services. See "Official Notices" August 22nd.

November 4th.—Automatic switchboards for exchanges in metropolitan network. See "Official Notices" August 22nd.

September 9th.—City Council; electricity meters and maximum demand indicators. See "Official Notices" August 22nd.

September 16th.—For the P.M.G.; a common-battery or an automatic switchboard.

September 16th.—Corporation. 176 yd. 0·25 sq. in. three-core lead-covered cable; 5,471 yd. 0·15 ditto, and 3,500 yd. ·05 ditto. Also three 250-K.V.A. three-phase transformers. See "Official Notices" August 29th.

September 23rd.—Sulphate of copper, for the P.M.G. Specifications from the Commonwealth Office, 72, Victoria Street, S.W.

October 14th.—A common-battery multiple switchboard.

November 4th.—Eight automatic telephone switchboards.

NEW SOUTH WALES.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

SYDNEY.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

VICTORIA.—November 12th. For the Victorian Railways; flame arc lamps.

P.M.G.'s Department.—September 23rd. General stores for a period of two years, as per Schedule 913.—*Tenders.*

Belgium.—September 17th. Supply and erection of a 25-ton crane, with electric motor and accessories, at the Malines central machine shops. Deposit 1,700 fr. (Cahier des Charges Special No. 1,410 gratis); plan, 0·90 fr. It is advisable to send in tenders by September 13th. Salle de la Madeleine, Brussels.

Bingley.—September 15th. Corporation. Sec. A.—Rotary converters and transformers. Sec. B.—A.C., E.H.T. and L.T. and D.C. switchgear. Sec. C.—Low-tension cables. See "Official Notices" to-day.

Burnley.—September 22nd. The Guardians of the Burnley Union invite half-yearly tenders for the supply of electrical requirements

Canada.—October 1st. Regina City Commissioners require tenders for coal bunkers, ash hoppers, coal and ash conveyors and crushers. Deposit with tender. Specifications, Mr. E. W. Bull, Superintendent of Light and Power, Regina.

Cardiff.—September 12th. Corporation. (1) One 2,000-KW. turbo-alternator, with surface condensing plant and auxiliaries; (2) one 700-KW. rotary converter; (3) boiler house plant. (*a*) Water-tube boilers, super-heaters, stokers, &c.; (*b*) turbine-driven feed pump and heater; (*c*) fuel economiser. See "Official Notices" August 22nd.

Costa Rica.—LIMON.—Installation and working of an electric light service in the city and its suburbs. Plant required: Two 414-H.P. Pelton turbines, two 400-KW. generators, and six transformers. The date when tenders will be adjudicated upon will be settled on September 18th. Particulars and plans from the Ingeneiro Municipal, at Limon.

Dartford.—September 16th. U.D.C. (*a*) Water-tube boiler, economiser, fan, steel chimney and accessories; (*b*) inverted rotaries, transformers, switchboard and cabling. See "Official Notices" August 29th.

Douglas (I.O.M.).—September 15th. Good steam coal (about 521 tons), for the Tramway Department of the T.C. Mr. A. Robertson, Town Clerk.

Edinburgh.—September 8th. Electric light and power installation at the new Town Hall, High Street, Portobello. Particulars from Mr. Newington, electrical engineer, Dewar Place.

September 22nd.—Corporation. Two mixed-pressure steam turbines and direct-current generating plants, each of 1,500 KW. capacity. See "Official Notices" August 22nd.

Germany.—September 20th. The Prussian State Railway authorities at Konigsberg are inviting tenders for the supply and erection of several electrically-operated high-pressure pumps.

Greece.—September 30th. The Harbour Authorities at the Piræus are inviting tenders for the supply and erection of two electrically-operated cranes, one of 10 tons and one of 6 tons capacity.

Lancashire.—September 9th. Tell-tale clocks, telephones, electric clocks and fire alarms, for the Visitors for Whalley Asylum. See "Official Notices" August 22nd.

Leicester.—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" to-day.

London.—L.C.C.—September 23rd. Main high-tension switchgear, including the reconstruction of existing main high-tension switchgear, at Greenwich generating station. See "Official Notices" August 22nd.

HAMMERSMITH.—September 24th. Borough Council. Underground cables, and sub-station switchgear. See "Official Notices" August 29th.

Morocco.—October 13th. The Post and Telegraph authorities in Tangier are inviting tenders for the supply of 177 tons of bronze wire and 20 tons of telephone wire.

New Zealand.—November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire for two years. Specifications from Electrical Engineer, Dunedin.

Oldham.—September 17th. Steam coal for the Electricity Committee for three, six or 12 months, commencing October 1st. Specifications and forms of tender obtainable from Mr. S. W. Newington, Electricity Offices.

South Africa.—September 10th. Supply and delivery of electric bed lifts, New Hospital, Port Elizabeth.

Roumania.—September 12th. The municipal authorities of Roshiorlide-Vede are inviting tenders for the concession for the electric lighting of the town.

September 17th.—Lighting of the city of Tetuci with electricity, and construction of a generating station. Provisional deposit 25,000 fr. Offers to the municipality.

Spain.—September 11th. The municipal authorities of Castellon de la Plana are inviting tenders for the establishment of a central electric lighting station in the town, and for the laying of supply mains both in Castellon and De Grao.

September 21st.—The municipal authorities of Saldana (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Tunbridge Wells.—September 13th. Corporation. Supply and delivery during the ensuing 12 months of high and low-tension cables. Specifications and forms of tender from the Borough Electrical Engineer, Stanley Road, Tunbridge Wells.

Turkey.—Supply of 21,500 insulators with curved iron fitments, 1,350 ordinary iron telegraph posts, 150 iron telegraph posts 6 m. long, 150,000 kg. galvanised iron wire, diameter 2 mm. Imperial Ottoman Post and Telegraph Administration, Constantinople.

Warrington.—September 9th. The B. of G. invites tenders for electrical sundries required at the Workhouse, or the Cottage Homes, from October 1st, 1913, to March 31st, 1914. Forms from Arthur Bottomley, Clerk, Bewsey Chambers.

Whitwood.—September 8th. Electric lighting extension, overhead insulators, for the U.D.C. Specifications, quantities, &c., obtainable from Mr. G. Taylor, Surveyor, Council Offices, Whitwood Mere.

Wigan.—September 20th. Corporation. 1,500-KW. turbo-alternator, ejector condenser, pipework, and all accessories. See "Official Notices" to-day.

CLOSED.

Accrington.—The Electricity Committee has accepted the following :—

·1 sq. in. and ·05 sq. in. extra-H.T. three-core paper lead-covered armoured cable.—Messrs. W. T. Glover & Co., Ltd.
Switch panels at Clayton-le-Moors sub-station and Rishton Paper Mills terminus.—British Thomson-Houston Co.
250-KW. motor converter.—Messrs. Bruce Peebles & Co.
One 100-K.V.A. and one 800-K.V.A. static transformer and one oil switch.—British Westinghouse Co., Ltd.

Australia.—Victorian Railways Department. Miniature electric staff instruments, Messrs. M'Kenzie & Holland, Ltd.

MELBOURNE.—Spare armature for 500-KW. motor-generator, British General Electric Co., £200; insulated copper cables, British Insulated and Helsby Cables, Ltd., £1,361.

PERTH.—The following tenders for Perth power station have been accepted :—

Power station buildings, complete boiler house equipment and other plant.—Babcock & Wilcox, Ltd., £124,424.
Turbo-alternators, transformers and motors.—Willans & Robinson, Ltd., £30,982.
Traction rotary converters.—British Westinghouse Electric and Manufacturing Co., Ltd., £9,863.
Condensing plant, pumps and piping.—Willans & Robinson, Ltd., £23,251.

SYDNEY.—The Municipal Council has been recommended to accept the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for arc lamp carbons, and to purchase supply meters from Messrs. Lawrence & Hanson, Ltd., and from Messrs. Ferranti, Ltd., an additional 2,000 insulators from Messrs. Noyes Bros., fuse boxes and bare copper cable from the British Insulated & Helsby Cables, Ltd., and wood cross-arms from the Hudson Pole Co.

Bacup.—The Electricity Committee has resolved that the tender of Messrs. W. T. Glover & Co., Ltd., be accepted for the supply and laying of about 4,000 yards of ·1 H.T. cable, subject to the same being satisfactory to the consulting electrical engineer.

Barnstaple.—The T.C. has accepted the tender of Messrs. Williams & Co., of Barnstaple, for installing twenty 100-C.P. Osram lamps at the Market, at £29.

Belgium.—La Société Bruxelloise d'Electricité, of Brussels, was the only concern to submit tenders to the municipal authorities of Schaerbeek for the supply of high-tension current. The price quoted was 9 centimes per KW.-hour during the day, and 12½ centimes for night supply.

Bolton.—The Electricity Committee has accepted the following tenders for coal supplies, viz. :—Messrs. J. B. Scholes and Sons, 20,000 tons; Messrs. J. Briggs & Sons, 10,000 tons.

Canada.—The Regina (Sask.) City Commissioners have awarded a contract for a 1,200-KW. motor-generator to Messrs. Bruce Peebles & Co., Ltd., Edinburgh.

WINNIPEG.—The City Council has awarded the Fort Garry Construction Co. the contract for the new terminal power station for the light and power department. The contract price is $35,000.—*Canadian Engineer.*

Dartford.—The U.D.C. has accepted the tender of the Premier Accumulator Co., Ltd., for replating the battery.

Halifax.—The Tramways Committee has accepted the tender of Messrs. Bolckow, Vaughan & Co., Ltd., of Middlesbrough, for the supply and delivery of 200 tons of steel girder rails, and 7 tons of steel fishplates, at £7 per ton, subject to the rails being made in England.

New Zealand.—The Christchurch City Council has accepted a tender for converters, in connection with the Lake Coleridge supply, of Messrs. Turnbull & Jones, at £3,070.

Ramsgate.—The Ramsgate E.L. Co. has secured the order for installing the electric light at the premises of the local Constitutional Club.

Rotherham.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained, through Messrs. Smith Bros., Rotherham, the yearly contract for the supply of "Tantalum" traction lamps for the Rotherham Corporation Tramways.

Salford.—The T.C. has accepted the tender of Messrs. Halliwell & Co., at £512, for installing electric light in the Police Department at the Town Hall. The following tenders have also been accepted :—

Ferranti, Ltd. Three-phase to two-phase [illegible] transformers. £1,095, plus an amount not exceeding £10 for erecting and connecting regulators.
Switchgear & Cowans, Ltd.—Regulators for above switchgear, £2 3 10s.

Stalybridge.—The Joint Tramways and Electricity Board has accepted the tender of Mr. Grimson for pipework, and purchased a second motor-wagon from Messrs. Foden's, Ltd., for £521.

Tyldesley.—The Council has accepted the tender of Messrs. A. Hopps & Sons for the supply of lubricating oils for the year ending June 30th next.

Walsall.—Seven tenders were received for the electric lighting plant at the proposed new hospital for the Great Barr Hall Joint Committee, and that of Messrs. Whittaker Bros., Dudley, was accepted, at £680.

Warrington.—The T.C. has accepted the following tenders for supplies to the electricity and tramways departments :—

British Thomson-Houston Co., Ltd.—Feeder panel, £84.
Albion Clay Co., Ltd.—Annual supply of conduits.
Underfeed Stoker Co., Ltd.—Patent underfeed stoker, with forced-draught fan and motor, £258.
Veritys, Ltd.—Motor-generator, £52 10s.

The Premier Accumulator Co.'s tender has been accepted for the battery, booster and switchboard plant for the Corporation tramways.

FORTHCOMING EVENTS.

British Association.—September 10th to 17th. Meeting at Birmingham.

Junior Institution of Engineers.—Saturday, Sept. 13th. At 10.30 a.m. Visit to the works of Messrs. R. Waygood & Co., Ltd., Falmouth Road, London, S.E.

NOTES.

The Artificial Lighting of Schools and Libraries.—The preliminary report of a Joint Committee appointed in 1911 was recently issued by the Illuminating Engineering Society, from which the following extracts have been made: It is suggested that (*a*) for ordinary clerical work (reading and writing, &c.) the minimum illumination measured at any desk where the light is required, should not fall below 2 ft.-candles; (*b*) for special work (art classes, drawing offices, workshops, and stitching with dark materials, &c.) a minimum of 4 ft.-candles is desirable; (*c*) for assembly rooms, &c., and for general illumination a minimum of 1 ft.-candle measured on a horizonal plane 3 ft. 3 in. from the ground.

It was also recommended, in view of the general recognition of the prejudicial effect on the eyes of children of fine needlework carried on by artificial light, that only coarse work on white material should be executed by artificial light in elementary schools; the minimum in this case being the same as for (*a*) above.

The Committee decided that the above standards of illumination should be provisionally adopted, irrespective of the method of lighting.

The Committee recommends that an illumination on the blackboard, about 60 per cent. in excess of that prevailing in the rest of the room, is desirable.

As a rule, it would be necessary for the illumination on the blackboard to be carried out by special local lighting from lamps equipped with opaque screens, completely concealing them from the eyes of students.

It is a common defect in schoolrooms for the bare mantles or filaments to be within the range of vision of students when looking towards the blackboard. The Committee recommends that no lamps should come within the solid angle subtended at the eye by the blackboard and a space 2 ft. above it, unless they are completely screened from the eye by a shade impervious to light. In general it is desirable that no incandescent surface should be visible to the eyes of students or teachers, while carrying on their ordinary work.

The Committee advocates the use of shades in which the brightness of the source is spread out over a considerable area, and the judicious use of reflection from the walls and ceilings of the room. These should be of such a texture that any considerable regular reflection is avoided, glazed and shining surfaces above the dado being specially objectionable.

In the class-room the lights should be so arranged, that inconvenient shadows cast by the body on the desk are, as far as possible, avoided. The ceilings should be preferably of a warm white colour, and the walls and all woodwork above the dado should be light in tint.

Dealing with the artificial lighting of libraries, the Committee makes the following recommendations:—

1. *Table, Desk, or Newspaper Stand Lighting.*—The illumination where the light is being used should in no case be less than 2 ft.-candles. This value is understood to apply to reading ordinary type printed on white paper. When books printed in small type, or manuscripts, or surfaces having a low reflecting power are to be studied, a higher illumination is necessary, and a tentative value of not less than 5 ft.-candles is suggested.

2. *Book-case and Shelf Lighting.*—A minimum vertical illumination on the case or shelf of ½ ft.-candle.

3. *General Illumination.*—A minimum of ½ ft.-candle. Local illumination should be measured on the desk, slope, or table where reading is carried on. Measurements of general illumination should be made on a horizontal surface, 3 ft. 3 in. above the ground. In all cases the illumination to be expressed in foot-candles.

The Committee emphasises the importance of adequate methods of shading, with a view to avoiding glare from illuminants such as is apt to be trying to the eyes of readers. The filament of an electric lamp or an incandescent gas mantle should not be visible to the reader.

One of the disadvantages of arranging lights close to a reader is the production of troublesome reflections from the glazed paper, or from the tables. The position of lights should, therefore, be selected in such a manner that no rays are reflected *directly* off the polished surface of the paper into the eyes. It is also desirable, as a means of minimising this defect, that the source of light should be extended over a considerable area (either by means of suitable methods of screening, or by making use of the reflection of lights from white or light-tinted walls and ceiling).

Harmful shadows, particularly those thrown by the readers themselves, should be avoided by suitable arrangement of the lights.

Local lighting and general lighting have both their respective merits, but in general a combination of the two methods is most advantageous.

The International Illumination Commission.—The International Photometric Commission—sometimes spoken of as the Zurich Commission—held a session in Berlin from August 27th to 30th. This Commission was founded in 1900 by representatives of the gas industries of America, Austria, Belgium, France, Germany, Great Britain, Holland, Hungary, Italy and Switzerland, and has occupied itself up to now mainly with technical matters having a direct bearing on the gas industry. It has, however, been widely felt for some time, both inside and outside the Commission, that international matters relating to illumination should receive consideration by a body which is representative of electric and other interests, besides that of gas. This object might have been achieved by the formation of an entirely new international body, but it has happily been found possible so to enlarge and reconstitute the existing Photometric Commission, that it will now be representative in the broadest sense of all institutions and societies associated with the science or practice of illumination. The range of work is to be as wide as the subject of illumination itself, saving only those phases which may be described as commercial rather than technical.

The affiliated gas societies having previously agreed to the enlargement of the Commission, a very representative number of delegates, totalling 45 from all the affiliated countries, met in Berlin last week to discuss and agree upon the new statutes of the enlarged Commission.

The British delegates were Dr. Colman and Mr. Butterfield, from the Institution of Gas Engineers; from the Institution of Electrical Engineers, the President, Mr. Duddell, and Mr. Edgcumbe; from the Illuminating Engineering Society, Mr. Gaster and Mr. le Maistre; and Mr. C. C. Paterson from the National Physical Laboratory. Well-known delegates from other countries included Drs. Hyde, Kennelly, Bell and Sharp, from America; M. Vautier, the President of the Commission, Drs. Broca, Bünte, Brodhun, Prof. Feltman and many others.

After four days' discussion and hard work the new statutes were unanimously agreed upon, and it speaks well for the future of the Commission that the earnest desire to co-operate internationally in the cause of good lighting was strong enough to reconcile and harmonise so many divergent interests, both technical and national.

The Commission is now to be called "The International Illumination Commission." Representation is to be through the medium of National Committees on Illumination in all countries affiliated with the Commission. Each country has only one vote in all international decisions irrespective of the number of delegates sent, and the contribution from all countries is to be identical in amount.

Perhaps the greatest step forward from the point of view of international bodies, is on the language question, since one language (French) has been made the basal language in which all formal resolutions and documents are drafted and published. Translations from the French may be made into any language by a National Committee, but such translations are only of secondary importance. English, French and German are allowed in all discussions, in which the assistance of an interpreter will, of course, be required.

Arrangements were made at the close of the meeting for appointing Committees to consider various technical subjects, so that the real work of the Commission may begin as soon as the new constitution has been approved by the bodies which appointed the delegates.

The officers of the Commission, elected for three years, are the president, treasurer and hon. secretary, assisted by a paid secretary.

Mons. Vautier, of Lyons, was elected first President, a recognition of his arduous work as President of the old Commission. Herr Weiss, of Zürich, becomes treasurer, and Mr. C. C. Paterson, of the National Physical Laboratory, was elected hon. secretary, so that the Bureau of the New Commission will be located in London. The vice-presidents are Drs. Bünte, Hyde and Kusminsky.

The satisfactory result of the Berlin meeting was only achieved after much preparatory work by individuals in all the countries concerned, and by the sincere desire of the delegates to reach a solution which would generally be acceptable in all countries.

Trade with South Africa.—The London Chamber of Commerce is informed that in view of Secs. 102 and 103 of the Regulations under the South African Union Customs Management Act of 1913, invoices for goods shipped to South Africa must contain, in addition to the invoice value, a statement of the "current value for home consumption in the open market for similar goods at the place of purchase." The following is a copy of the Sections referred to:—

102. "The value of goods for Customs duty purposes shall be ascertained by a declaration at the foot of the appropriate bill of entry in the manner and form as follows:—

"I, the undersigned, ..., for importer, do hereby declare that the above is a true description and complete return of all goods contained in the above-mentioned packages and of the value of such goods, and that values are the true current values of same as defined by law, including the cost of packing and packages."

103. "The person entering goods at importation shall produce, if required by the proper officer of Customs, any document relating to the goods, and the invoice shall contain a statement in a prominent place made by the suppliers showing clearly the current value for home consumption in the open market for similar goods at the place of purchase bought in the ordinary manner from the manufacturer or supplier in normal quantities. The invoice and any covering statement shall also clearly show cost of packing and packages."

It has been suggested by the Durban Chamber of Commerce that the form of invoice in use in connection with shipments to Canada would meet the requirements of the South African Customs.

Fatalities.—An employé of the Yorkshire Electric Power Co. has died at the Dewsbury Infirmary as a result of injuries sustained at the Thornhill Power Station. It appears that the deceased—Samuel Hague, 49 years of age—was striding over a coal conveyor to get to the engine house, when he was caught in the machinery and sustained fearful injuries, which caused his death. At the inquest it was stated that it was a habit of the employés to stride over the conveyor instead of using the steps provided. A short time ago another man was injured through neglecting to use the steps, and an additional set of steps was then provided, together with an emergency switch to stop the machine in case of accident. Since this last accident, the conveyor has been fenced over so that the employés will, perforce, have to use the steps. A verdict of "Accidental death" was returned.

At the resumed Coroner's inquest at Eastwood, Nottingham, on Edwin Spaulton (31) and Edward Clarke (30), who were killed by electric shock at Moor Green Colliery while engaged in working a coal-cutting machine, the Coroner criticised the method of examination, and expressed the opinion that such workmen should have some kind of training.

Mr. Routledge, chief electrician, said he found a defect in the controller switch and a burned-out earth connection, which together accounted for the machine being alive. Mr. Nelson, Inspector of Mines, agreed with this explanation, and said it was a purely accidental occurrence which could not be guarded against. A juror suggested that such machines should be fenced in, as was required by the Factory Act, and the jury found that the men were accidentally killed.

On Friday last, when a labourer was engaged with a plumber in laying a water connection at Bonnybridge School, he struck the underground electric cable and was instantly killed.

Thomas Everritt (37) was killed on Monday in the bleach works of Messrs. Stevenson, McKellar & Co., Pollokshaws. A fellow workman found him dead with the "live" wire in his hand. He was in a standing position near a dynamo.

Educational Notes.—East London College.—Special facilities for research in electrical engineering are provided at this College on four evenings a week.

West Ham Municipal Technical Institute.—Full courses in electrical engineering, day and evening, are provided.

University College, Nottingham.—The next session of the department of electrical engineering opens on September 29th.

Particulars of the above are given in our advertisement pages to-day.

Electric Workers' Strike in Russia.—Two thousand five hundred workmen of the Allgemeine Elektrizitäts Gesellschaft at Riga ceased work last week.

Australian Wireless Stations.—Under an order by the High Court, representatives of the Marconi Co. have inspected the Commonwealth's wireless stations at Melbourne, Hobart, and Brisbane for the purpose of ascertaining whether there has been any infringement of the company's patents.

Legal.—X.L. Co.'s Affairs.—On behalf of the debenture-holders in the X.L. Electric Co, application was made to Mr. Justice Astbury, sitting as Vacation Judge, on Wednesday, September 3rd, for leave to serve notice of motion for the following week for an injunction. Counsel stated that Mr. Aron, a director, was under an order and undertaking to do all things necessary for the carrying on of certain proceedings before the Comptroller of Patents, but a meeting of the company had been called at which a resolution had been passed to abandon those proceedings, and notice of that resolution had been sent to the Comptroller. Such a resolution was in breach of the order and undertakings, and was prejudicial to the rights of the Receiver who had been appointed in the debenture-holders' action. Under these circumstances, he asked for leave to serve notice of motion for the following Wednesday to restrain the company from acting on the resolution and from sending notice of it to the Comptroller.—His Lordship gave the required leave.

Osram Lamp Patent Case.—On the same day, counsel applied on behalf of the plaintiffs in the action of the Osram Lamp Works, Ltd., *v.* William Glenn & Co., for an interim injunction to restrain until the trial or further order an alleged infringement of their patents. He stated that the injunction he asked for was in respect of two patents which had already been the subject matter of an action tried in 1912. Mr. Neville, for the defendants, submitted that the plaintiffs could not be entitled to any injunction; the patents sued upon were for a squirted filament as distinct from a drawn filament, and he admitted the sale of the lamps alleged to be an infringement, but he had evidence that the filament in them was not a squirted filament, but a drawn-wire filament. His Lordship said that on that evidence he could not grant an interim injunction. Counsel for the plaintiff said he desired to cross-examine the defendants' witness, who was not a manufacturer; he said he believed the lamps in question had a drawn filament, but the plaintiffs desired to have the grounds for that belief. His Lordship said that on the evidence as it stood he could not grant an interim injunction, and on the defendants' undertaking to keep an account of the lamps sold in the usual way, there would be no order on the motion.

Appointments Vacant.—Lecturer in electrical engineering for the University of Queensland, Australia. Salary £350 per annum, less 7½ per cent. deduction for the purchase of an endowment assurance policy in favour of the lecturer; junior switchboard attendant, Salford (26s.); electrical engineer for the Leek U.D.C., to take charge of electricity undertaking (£225-£275); shift engineer at the Stuart Street generating station, Manchester, (£175); switchboard attendant (25s. to 30s.), for the Portsmouth Corporation; testing assistant for Pendleton (26s.). See our advertisement pages to-day.

Inquiry.—Agents for the "Vita" heaters are asked for.

Disclaimer.—Messrs. Wm. Wadsworth & Sons, Ltd, lift and transporter makers, Bolton, wish to announce that they have absolutely no connection whatever with the Wm. Wadsworth, 16, John Dalton Street, Manchester, referred to in our issue of 22nd ult. in connection with "Bankruptcy Proceedings."

Exhibitions.—The Sheffield Fuel, Light and Power Exhibition, which opens on October 24th next, has received the approval of the B.E.A.M.A., and will afford a good opportunity for showing electric lighting, cooking and other apparatus.

Next year there will be a Universal Exhibition at Nottingham, and an Anglo-American Exposition at Shepherd's Bush, London, both from May to October. Interesting particulars regarding all these coming events have come to hand as we go to press, and will be dealt with in our next issue.

The Strike in London.—At the time of going to press, no change had taken place in connection with the strike of painters and electricians employed by the Office of Works. The strike committee of the electricians on Wednesday issued a sensational statement regarding the alleged dangerous condition of the wiring in the Premier's residence.

Iron and Steel Institute.—The autumn meeting of the Institute was held at Brussels on Monday and Tuesday this week. Amongst the papers read was one by Mr. Otto Frick on "The Electric Refining of Steel in an Induction Furnace," of which we shall publish an abstract in a later issue.

Railway Disaster.—A collision took place on Tuesday morning on the Midland Railway, near Aisgill, between two express trains. Fourteen lives were lost, and three wrecked coaches were burnt to ashes. We refer to the matter in our leading columns to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bridlington T.C., on August 28th, confirmed a resolution to increase the salary of the electrical engineer, Mr. A. J. Beckett, from £350 to £375 per annum, as from January 1st, 1914.

The York Electricity and Tramway Committee has appointed Mr. J. J. Smith as installation superintendent at the electricity works, at a salary of £120 a year, rising by £10 per annum to a maximum of £150.

Mr. W. Corin, chief electrical engineer, N.S.W. Public Works Department, is visiting this country, as well as the Continent and America, with a view to studying bulk supply and transmission questions on behalf of his Government.

The marriage took place at Milnsbridge, last week, of Mr. Sam Dawson, younger son of Mr. W. W. Dawson, of Milnsbridge, and who is on the electrical staff of the Leicester Corporation, and Miss Mary Hanson, of Golcar. They received many valuable presents.

General.—On completing half a century's service with Messrs. Siemens Bros. & Co., Ltd., of Woolwich, S.E., Mr. Abraham James Pembery, of the india-rubber department, has been presented by the firm with a bag of gold, and by the staff and employés with a gold watch and chain, and a gold mounted umbrella for Mrs. Pembery.

Mr. R. W. Willis has resigned his position as chief assistant electrical and mechanical engineer to the Swindon Corporation, and is joining Mr. R. A. Smith as principal assistant in his consulting practice at Westminster.

Mr. C. Lucken, who for the past five years has been engineer-in-charge to Messrs. Siemens Bros. & Co., Ltd. (Tantalum Lamp Works), Tyssen Street, Dalston, has resigned this position to take up a similar appointment with the Hong-Kong and Shanghai Banking Corporation, Gracechurch Street. The new bank buildings are being fitted with most up-to-date plant representing some of the latest developments in electrical and mechanical engineering. Mr. Lucken was presented with a solid marble clock by his colleagues as a token of their continued good wishes.

Obituary.—Mr. C. T. Hargreaves.—Intelligence has reached Blackpool of the death by electric shock at Santos, Brazil, on August 23rd, of Mr. Christopher Thomas Hargreaves, son of Mrs. Hargreaves, of Blackpool. Mr. Hargreaves, who was formerly an electrician in the tramway department at Blackpool, was engaged at Santos with the City Improvements Co., of London. He was only 29 years of age.

Mr. H. S. Jacques.—The death has occurred in the West Cumberland Infirmary, after an operation, of Mr. Henry S. Jacques, who was in business as an electrical engineer in Tangier Street, Whitehaven.

NEW COMPANIES REGISTERED.

John Fowler & Co. (Sydney), Ltd. (130,819).—This company was registered on August 28th, with a capital of £20,000 in £10 shares, to acquire the goodwill of the branch business carried on by John Fowler & Co. (Leeds), Ltd., at Sydney, N.S.W., and to carry on the business of mechanical, civil, hydraulic and telegraph engineers, millwrights, machinists, iron and brass founders, metal workers, makers of, and dealers in, steam engines and boilers, steam ploughs and cultivating machines and apparatus, manufacturers of, and dealers in, wire, cables and appliances used in connection with electric telegraphs and lighting, contractors for the execution of works in Australia, New Zealand, or elsewhere, &c. The subscribers (with one share each) are:—A. Fowler, 113, Cannon Street, E.C., engineer; W. McIntosh, 113, Cannon Street, E.C., engineer. Private company. The number of directors is not to be less than two or more than four; the first are R. H. Fowler, A. Fowler and W. McIntosh. Registered office, 113, Cannon Street, E.C.

Jones, Burton & Co., Ltd. (130,820).—This company was registered on August 28th, with a capital of £15,000 in £1 shares, to take over the business of mechanical and consulting engineers, carried on at Liverpool as "Jones, Burton & Co.," and to carry on the business of mechanical, electrical, consulting and inspecting engineers, contractors and manufacturers of, and dealers in, railway, tramway, magnetic, manufacturing and other plant, machinery and apparatus, &c. The subscribers (with one share each) are:—G. L. Burton, 19, Castle Street, Liverpool, engineer; R. Fynes-Clinton, 19, Castle Street, Liverpool, engineer. Private company. G. L. Burton is entitled to act as governing director, and shall have power to appoint other directors; qualification of first directors, 1 share; of subsequent directors, 100 shares; solicitors, Sampson, Williamson, Inglis & Edgecombe, 35, Dale Street, Liverpool. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

Auto-Flash Sign Co., Ltd. (130,829).—This company was registered on August 29th, with a capital of £1,000 in £1 shares, to carry on the sole or part agency in the United Kingdom, India, Canada, Cape Colony, Australia, New Zealand, and elsewhere, for the business of manufacturers of, and dealers in, electric signs, novelties and other articles now, or to be, manufactured wholly, or in part, or dealt in by Messieurs Riex & Co., of Paris. The subscribers (with one share each) are:—J. McGill, 95, Elliescombe Road, Charlton, S.E., engineer; M. Honnert, Alexander Villa, Etchingham Park Road, Finchley, N., merchant. Private company. Table "A" mainly applies. Registered office, 83-85, Farringdon Road, E.C.

Cayenne Motors, Ltd. (130,749).—This company was registered on August 22nd, with a capital of £5,000 in £1 shares, to take over the business of an electric and automobile engineer and maker and repairer of, agent for and dealer in auto cars and motor-cycles carried on by H. E. H. Hayes at 159, Bexhill Road, St. Leonards-on-Sea, as "Hayes & Co." The subscribers (with one share each) are:—H. E. H. Hayes, Drayton Lodge, Ninfield, Battle, gentleman; J. R. Hayes, Drayton Lodge, Ninfield, Battle, motor engineer; L. Hubbard, Sackville Chambers, Bexhill-on-Sea, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Hayes, J. R. Hayes and L. Hubbard; qualification, £1. Registered office, 159, Bexhill Road, St. Leonards-on-Sea.

Dromore Electric Light and Power Co., Ltd. (4,040).—This company was registered in Dublin on August 22nd, with a capital of £5,000 in £1 shares (1,000 preference), to carry on the business of an electric light and power company. The subscribers (with one share each) are:—G. Allen, 85, Queen Street, Belfast, electrical engineer; J. Graham, Dromore, Co. Down, contractor; H. P. Grosse, 35, Queen Street, Belfast, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are J. Graham, G. Allen and H. P. Grosse; qualification, 50 ordinary shares. Registered office, 35, Queen Street, Belfast.

Climax Rock Drill and Engineering Works, Ltd. (130,833).—Registered August 29th, by Downing, Handcock, Middleton & Lewis, Crosby Buildings, E.C. Capital, £60,000 in £1 shares. Objects: To acquire any interest in letters patent, brevets d'invention, licences, concessions, or the like, to carry on the business of gas, electrical and mechanical engineers, manufacturers of and dealers in gas-making, electrical and other machinery and appliances, rock drill manufacturers, sellers and contractors, tool makers, brassfounders, metal workers, boiler makers, millwrights, machinists, iron and steel converters, &c., and to adopt an agreement with W. C. Stephens, carrying on business as R. Stephens & Son, for the acquisition of certain patents, rights and property referred to therein. The signatories (with one share each) are:—A. E. Clutterbuck, 37, Lawrence Road, South Ealing, W., clerk; H. Evans, 16A, Ivydale Road, Nunhead Road, S.E., accountant. Private company. The first directors (to be not less than two or more than five) are A. E. Clutterbuck and H. Evans (provisional directors); qualification, 300 shares; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bristol Tramways and Carriage Co., Ltd.—Acknowledgment of indebtedness dated August 19th, 1913 (supplemented to trust deed dated January 24th, 1908), to secure £125,000 deb. stock in addition to and ranking *pari passu* with £250,000 like stock issued under principal deed, charged on certain freehold and leasehold property in Bristol, &c., and the company's undertaking and property, present and future, including uncalled and unpaid capital. Trustees: Sir George White, Bt., Cotham House, Bristol, and S. White, Dorset House, Clifton.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.—Supplemental trust deed dated July 31st, 1913, to secure £7,500 6 per cent. pre prior lien deb. stock, charged on certain premises and company's other assets, present and future, including uncalled capital. Trustees: Rt. Hon. Lord Waleran, P.C., 44, Hans Mansions, S.W., Bradfield, Cullompton, Devon; and Rt. Hon. Lord Rotherham, Broughton, Lancs., and 61, Queen's Gate, S.W.

Aero Fire Alarm, Ltd.—Assignment dated August 13th, 1913, to secure £1,000, charged on certain contracts, full benefit thereof and moneys payable thereunder. Holder, Sir Arthur Cory-Cory Wright, Bt., 52, Mark Lane, E.C.

Pernambuco Tramways and Power Co., Ltd.—Particulars of £1,250,000 debentures, created July 24th, and secured by trust deed, dated August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged (specifically): Tramway and gas undertaking and other real or immovable property in Brazil and its share interest in La Companhia Ferrocarril de Pernambuco (as a floating security) the company's undertaking and property, present and future, including uncalled capital. Trustees: A. P. Henderson, 28, Austin Friars, E.C., and Capt. C. S. Schreiber, Marlesford Hall, Wickham Market.

ELECTRICAL TRAIN DISPATCHING ON THE RHYMNEY RAILWAY.

The handling of railway train movements is a most important function in the proper control of traffic, especially in areas where minerals and goods traffic is large and complicated. In the coal-mining areas of South Wales, therefore, it is not to be wondered at that a very complete and efficient system of train dispatch by telephone has been installed by the Rhymney Railway Co. Both the telegraph and the telephone are already employed by many railways to deal with traffic control, but the Western Electric Co.'s system, introduced by Messrs. J. B. Saunders & Co., Ltd., of York Street, Westminster, upon the railway mentioned possesses features not found in other systems, and it may therefore be interesting to briefly describe the system. The control of the traffic, either on the whole of the railway line or on a certain section, is usually entrusted to one man, known as the controller, whose office is placed at some important point on the route. From this office a pair of wires run alongside the line to the signal cabins and other points where traffic is dealt with. At these points telephones are looped across the wires. These telephones are equipped with a selector, the use of which will be mentioned later. The controller wears a head receiver and a transmitter placed on the chest, and thus he is able to receive and transmit messages while at the same time having his hands free.

In front of the controller is a cabinet fitted with a number of keys or switches, each key being associated with one of the signal boxes or way stations with its telephone set and selector. The keys are so arranged that when they are actuated they send a series of impulses along the line, the current being supplied by a battery fitted at the controller's office. The number of impulses sent out differs with each key, the keys being adjustable so that the required number of impulses may be sent. The selector fitted at the signal box or way station consists essentially of an electro-magnet fitted with an armature actuating a small pawl, which in turn rotates a small ratchet wheel. The latter is fitted with an adjustable contact, so arranged that this contact is closed after a certain number of teeth have been rotated. The operation of one of the keys results in sending a series of impulses along the line, and each of these impulses causes the armature of the selector to be pulled up and then released, and each time that the armature is pulled up it actuates a stepping pawl, and sends the ratchet wheel forward one tooth. All the selector ratchet wheels along the line operate at the same time, but as each of them has its contact set at a different point, after a definite number of impulses have been sent out, and the ratchet wheels come to rest, only one of them has its contact closed, and thus the ring is given to the required station. The ratchet wheel is locked in one direction by a retaining pawl during the time that the current impulses are passing along the line, by an arrangement of the electrical circuit, and hence the wheel can be stepped forward tooth by tooth, but cannot fall back at the time the stepping pawl returns to engage with a fresh cog. When the ratchet wheel has been stepped round to the correct position, contact is made and the bell rings. All the ratchet wheels then fall back to their normal positions, ready for a fresh call, the whole of these movements being made very rapidly, and with great certainty.

The problem of efficient speech transmission over the lines has been solved by devising special telephone circuits, so that as many as 40 telephones can be looped across one pair of wires, and anyone speaking at one station can be perfectly heard at all the others. This special telephone circuit has made it possible to provide a general call scheme for giving simultaneous daily instructions to all the way stations. This general call scheme is arranged as follows:—In addition to the contacts on the selectors already described, a second contact is fitted on each set at the same position on all selectors, as, for example, on the 40th tooth. At the controller's office an extra key is fitted, this key sending out the required number of impulses, in this case 40. On operating this key, all the selectors pass through 40 teeth, and all the contacts for the general call are made so that the bell in each station rings.

For speaking to the controller it is only necessary for the man in one of the way stations to remove the receiver from the hook and to listen, to find whether the line is already used. If not, he can speak directly to the controller, as the caller always has his telephone connected across the line. If the controller is not always listening on the line, a magneto bell can be fitted in the controller's office, the way stations being supplied with hand magneto-generators.

Another interesting addition which is often made to this system is the fitting of a time-sending scheme, each selector being fitted with an additional contact, which is made when the ratchet wheel has rotated a complete revolution. The controller uses this for sending out signals for the regulation of clocks, &c., and by simple modifications of the circuit, this type of selector system can be made to serve other useful purposes in connection with railway working.

In conjunction with the apparatus described above, the Rhymney Railway Co. have installed immediately in front of the controller a table, on which is fixed a diagram board of the whole railway, showing the up and down lines respectively. On this board the movements of all engines and trains are recorded by the controller from time to time as advice reaches him, by the sliding of brass disks bearing the number of the particular train, from position to position. Provision is made in the diagram board at the more important junctions, stations and sidings for sliding the disks from the grooves representing the running roads into side tracks when the engines are detained, shunting, and so on. In order to carry this scheme out, the controller has to be supplied with information as each engine picks up or puts off traffic at the various junctions, and he can at any moment see the exact position of all the trains working throughout the railway. In this way he is able to direct engines to any particular point where traffic is awaiting clearance, or prevent them from making unnecessary journeys to points where traffic which was expected is not in readiness for being moved forward.

The advantages of this interesting method of train dispatching are so obvious, that it is surprising that American practice has not been more speedily followed, and there is no doubt that now that the lead has been given, the matter will receive very careful consideration by other traffic managers. We are indebted to the courtesy of the general manager of the Rhymney Railway and to Messrs. J. B. Saunders & Co., Ltd., for the information given in this article.

CITY NOTES.

Metalite, Ltd.

An adjourned ordinary general meeting of the shareholders of the above company was called for Friday last, at 22, Christopher Street, Finsbury, at 11 o'clock, but shareholders who presented themselves shortly before the appointed time were told that the meeting would be held at the registered offices of the company, 9 and 10, Pancras Lane, Queen Street, Cheapside, as permission to meet in Christopher Street had been denied the directors at the last moment. It was 11.30 before the proceedings actually commenced, when there were present, in addition to Mr. W. Stewart, who presided, the directors, Mr. Harrison and Mr. Moore, and the representative of the Electrical Review.

The Secretary explained that the reason the meeting was being held at Pancras Lane was that the company's premises at Christopher Street were held under a sub-tenancy, and the board had been unable to get possession to hold the meeting. It was, therefore, deemed advisable to hold the meeting at the registered offices, and to postpone it until half an hour after the proper time, in order to give shareholders an opportunity of getting from one place to the other.

Mr. Harrison asked whether the adjournment had been arranged without giving notice to the shareholders.

The Secretary replied in the affirmative, and said it was not until the previous day that he learned they would not be able to get possession of Christopher Street. Of course the inconvenience

which shareholders had been put to was much to be regretted, but he believed that every shareholder who had presented himself at Christopher Street was present.

Mr. Harrison said it was not so, as two shareholders who he saw go to Chistopher Street, were not then present. He and Mr. Moore had signed the attendance book under protest, as they did not consider the meeting legal. He also complained that the directors had not fulfilled the promise they made at the last meeting to send round to the shareholders, within 14 days, particulars of the scheme of reconstruction they were arranging.

The Chairman said he would deal with that matter in his speech. Continuing, he said the meeting was simply a third formal adjournment of the annual general meeting of the company, nominally to enable the directors to present the balance-sheets and accounts of the company, but the position, as they had already been informed at previous meetings, was that the Receiver was still in possession, for the first mortgagees and the directors had no funds wherewith to defray the cost of preparing such balance-sheets and accounts and having the same audited. At the last adjourned meeting the outlines of the scheme of reconstruction were given to those present, with the intimation that the directors hoped to be in a position to put it before the general body of creditors within a short time of that date, and it was also stated that they were in active negotiation with a group of financiers to provide a considerable sum of money, and thus obviate having to call on the shareholders for so large an amount as would be required. However, these negotiations had now fallen through, and the directors had instructed the solicitors acting for the various parties to complete a scheme so that the same could be put forward at the earliest possible date, therefore giving the shareholders an opportunity to save their property. The directors had been able to arrange that holders of the series of debentures, of which some £18,100 had been issued, should accept shares in the new company. This was a very considerable step towards preparing financial arrangements for the future. It was hoped to have sent prints of the scheme to all shareholders immediately after that meeting, but they had that morning received a letter dated the previous day from two firms of solicitors, one acting for the company and the other for the vendors, wherein they stated that it would be impossible to settle the matter, as counsel who was advising could not be back at his chambers until the middle of September. He must, therefore, ask them to have a little more patience under these difficult circumstances, and would move: "That this meeting do stand adjourned until Thursday, October 30th, 1913, at this office at 11 forenoon."

Mr. Lee formally seconded the resolution.

Mr. Harrison said he wished to propose as an amendment that the meeting be further adjourned, and to register his protest that anything done there would be *ultra vires*.

Mr. Moore, in seconding the amendment, said it was high time that the directors took the shareholders into their confidence. These continued adjournments were simply dallying with them, and he felt confident that when October 30th came, they would be in exactly the same position. It was absurd to call that sparsely-attended gathering a meeting of shareholders. He thought it was quite time that the shareholders were circularised and called together properly.

Mr. Bentley said that as soon as the scheme was settled a print of it would be sent to all the shareholders. The adjournment was only a formal thing, and the complete scheme would be in the shareholders' hands before the end of next month.

The Secretary said he saw that the representative of the Electrical Review was present taking notes. He had a private letter from the solictors acting in regard to the scheme, which he would read to the meeting if the representative would agree not to publish it. Our representative said he was unable to give this pledge, and accordingly the letter was not read.

Mr. Harrison said the trouble was that the shareholders were unable to give the directors any assistance, as they were absolutely in the dark. They knew nothing of what had been done. He was a shareholder for about 5,000 shares, which was a very considerable holding, and he thought they were fairly entitled to know what the directors were doing.

Mr. Moore said that directly and indirectly he represented about 150,000 shares, and he could assure the directors that the shareholders were getting heartily sick of the whole thing.

Mr. Lee asked whether it would not be possible to shorten the time of the adjournment. He had been the means of inducing many people to put a considerable amount of money into the company, and he felt very strongly about the matter. If he thought it was going to be any advantage, he would support the amendment, although he had seconded the resolution, but he could not really see that they would be doing any good by passing the amendment.

Mr. Harrison said he would withdraw his amendment, subject to having a promise from the directors that the terms of the proposed reconstruction should be sent round to the shareholders at least seven days before the adjourned meeting at which it was to be considered.

The Secretary said that under the articles the directors would be bound to give at least eight days' notice of the meeting, because it would be in the nature of a special resolution, and subsequently if the resolution was passed at the first meeting it would have to be confirmed at another extraordinary meeting which could not be held until a period of at least 14 days had elapsed from the first meeting, or later than 28 days.

Mr. Moore stated that as far as he was concerned he did not believe the company would get any "forrader" until a committee of shareholders had been appointed to investigate the whole position.

Mr. Bentley said he was sure that the directors would be only too delighted if the shareholders would co-operate with them in putting the company on its feet.

Mr. Harrison said that he would remind them they had not yet had a balance-sheet, which he thought they were justly entitled to ask for.

The Secretary said that that would cost about £400, and at present there was no money to pay for it.

Eventually it was agreed to adjourn the meeting until Monday, October 13th, due notice of the time and place to be given to all the shareholders.

Companies Struck Off the Register.—The following have been struck off the Register, and are accordingly dissolved :—

Dynelectron Syndicate.
Electrical and Mechanical Exhibition.
Electric Coin Freed Meter Dimming Syndicate.
Electric Tramways Trust.
Hirst Magneto Co.
Illuminating Engineering Co.
Morris-Hawkins.
Motor Hiring Syndicate.
Schreiber Electric Battery Co.
Vulcan Dynamo and Motor Co.

Buenos Ayres Tramways Co.—As a result of the decision of the Anglo-Argentine Tramways Co. to issue new ordinary shares to the amount £750,000 to £800,000, the proceeds of which are to be utilised for carrying out the new works already in hand, the Belgian Company of Tramways of Buenos Ayres, holding at present the whole of the ordinary share capital of the Anglo-Argentine, has resolved to issue 60,000 *bons de caisse* of 500 fr. each, bearing interest at the rate of 6 per cent., for redemption in 5 years, two-thirds of the amount to be issued immediately.

Ascot District Gas and Electricity Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (6s. per share), less income-tax on the ordinary shares for the half-year to June 30th.

Davis & Timmins, Ltd.—The directors recommend the payment of the interest on the 6 per cent. preference shares and an interim dividend on the ordinary shares at the rate of 6 per cent. per annumn for the half-year ended June 30th, 1913.

Bishop's Stortford, Harlow and Epping Gas and Electricity Co., Ltd.—The report states that, including £1,110 brought forward, the accounts for the half-year to June 30th, show an available sum of £3,704. The directors declare dividends at the full statutory rates of £5 14s. per cent. per annum and 5½ per cent. per annum on the "A" and "B" ordinary stocks respectively, carrying forward £615.

Halifax and Bermudas Cable Co., Ltd.—The directors have declared a dividend on the ordinary shares of 6s. a share, being 6 per cent. for the year.

Direct West India Cable Co., Ltd.—The directors have declared a dividend on the ordinary shares of 1s. 6d. a share, making 6 per cent. for the year.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year ended June 30th, 1913, at the rate of 6 per cent. per annum on the preference shares, and at the rate of 10 per cent. per annum on the preferred ordinary shares, to be paid on September 26th.

Brazilian Traction, Light and Power Co.—The directors have declared a dividend of 1½ per cent. for the three months ending September 30th, 1913, on the 6 per cent. cumulative preference shares, payable in Toronto on October 1st, 1913.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for interim dividends, due the 31st inst., on the company's 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1913, have been posted.

Aberdeen Suburban Tramways Co.—Mr. G. J. Walker, the chairman, at the half-yearly meeting moved the adoption of the report which recommended a dividend of 2½ per cent. He said the directors had had under their serious consideration the question of extending the company's operations by the working of railless cars or other mechanically-propelled vehicles, and they were satisfied that the working of such vehicles would not only be profitable in itself, but would be profitable as a means of attracting fresh traffic to the company's undertaking. Mr. F. T. Garden moved—"That the shareholders authorise and empower the directors to work trackless cars or other mechanically-propelled vehicles in connection with the company's undertaking." This was agreed to.

Stock Exchange Notice.—The Committee has appointed Thursday, September 18th, as a special settling day, and also ordered the following securities to be quoted in the Official List :—American Telephone and Telegraph Co.—$34,101,600 convertible 4½ per cent. Gold Bonds, Nos. M 1 to 15,140 and 26,501 to 43,080 of $1,000, D 1 to 1,555, 1,601 to 1,624 and 1,701 to 2,555 of $500, and 1 A to 698 C and 951 A to 1,418 C of $100 each.

German Electrical Companies.

The *Continentale Ges. für Angewandte Elektrizität* (*Applied Electricity Co.*) reports gross profits of £49,000 for 1912-13, as compared with £38,000 in 1911-12, when a dividend at the rate of 6 per cent. was declared on share capital of £120,000. In addition to factories at Landeck in the Tyrol and at Poissy, France, the company maintains works at Erith, Kent. The headquarters have been removed from Glarus to Basle.

The *Körting Elektrizitätswerke A.G., of Berlin*, whose activity is limited to the ownership and working of several supply works, which now represent a total connection of 12,189 KW., realised gross receipts of £65,000 in 1912-13, as compared with £69,000 in the previous year. After meeting general expenses and placing £18,000 to depreciation as against £20,000 in 1911-12, the accounts show a net surplus of £15,500, as in the preceding year. The dividend is at the rate of 8 per cent., being the same as in 1911-12.

The *Isaria Zählerwerke A.G., of Munich*, which company is closely associated with Brown, Boveri & Co., of Baden, earned gross profits of £101,000 in 1912-13, as contrasted with £88,000 in the preceding year. After meeting general expenses and other charges, and setting aside £6,800 for depreciation in 1912-13, as against a similar sum in 1911-12, the net profits are returned at £19,000, as compared with £15,000. The directors recommend a dividend of 10 per cent. on the share capital of £110,000, being the same rate as in the previous year. The report mentions the formation in London of the firm of Isaria, Ltd., in April, 1912, whose share capital is held entirely by the parent company, and it also states that the orders brought over into the new year show a considerable increase over the corresponding period in 1912.

The report of *Brown, Boveri & Co., of Mannheim*, for 1912-13 states that the turnover was 25 per cent. greater than in the previous year. The production, particularly in the steam turbine and electrical departments, was increased and the prime costs reduced, and it was possible to comply with the frequent requirements for early delivery. In steam turbines the company was well employed on large units, and the largest order received was for a machine of 40,000 H.P. for the Mark communal electricity works—a size which had hitherto not been used on the Continent. After referring to the work carried out by the ship turbine department, the report recalls the protracted action which was decided in favour of the Brown-Boveri group last October, and according to which electrical firms who construct turbo-generators have to obtain a licence from this group. The company received an order for the generators for the hydro-electric works building for the Prussian Government in connection with the Mohnetal dam and the Edertal dam; and the system of winding engine plant for mines found extended use. A considerable expansion took place in the railway department, and the orders included 15 main line locomotives for the Laubach-Konigszelt section of the Prussian State railways. A locomotive shop for the erection of locomotives will be brought into full operation in the autumn of 1913, and the transformer department is also being enlarged. The accounts show gross profits of £202,000 for 1912-13 as against £166,000 in the preceding year. After meeting general expenses and other charges and placing £38,000 to depreciation as compared with £27,000 in 1911-12, the net profits and balance forward are returned at £36,000 as contrasted with £21,000. It is proposed to pay a dividend of 8 per cent., this comparing with 5 per cent. and 4 per cent. in the two preceding years respectively.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Bath	Aug. 30	5,600	+1,141	35	33,962	+ 2,477	..	..
Blackpool-Fleetw'd	„ 30	10,246	+1,077	8	17,706	+ 2,650	8	..
Bristol	„ 29	38,291	+4,611	35	277,649	+38,837	30·5	..
†Brit. Elec. Trac. Co.	„ 22	119,360	+14,312	34	843,505	+62,687	..	..
Chatham and Dist.	„ 28	4,486	+ 442	34	31,527	+ 1,610	14·98	..
Cork	„ 28	2,428	+ 198	34	17,156	+ 210	9·89	..
Dublin	„ 29	25,857	+ 929	35	207,887	+ 5,427	54·25	..
Hastings	Sept. 1	7,732	+1,078	..	..	+ 2,667	19·3	..
Lancashire United	Aug. 27	6,845	+ 940	34	51,792	+ 5,428	39	..
Llandudno-Col. Bay	„ 29	3,743	+ 219	39	13,550	+ 1,195	6·5	..
London United ..	„ 29	30,681	+3,418	35	220,611	+ 1,456	..	..
Tyneside	„ 27	2,086	+ 391	9	4,823	+ 431	11	..
Anglo-Argentine ..	„ 26	213,749	+19,857	..	1,884,512	+165,451	..	..
Auckland	„ 1	18,960	+ 667	4	22,067	+ 209	25·5	1·3
Bombay (B.E.T.) ..	„ 1	12,036	+ 948	31	96,134	+ 4,218	..	..
Brisbane	July	26,205	+ 3,145	..	177,208	+46,494	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 30	17,274	+1,175	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	July 31	2,796	..	..	20,022	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
†Madras	Aug. 31	3,675	+ 173	35	28,080	+ 2,110	15·25	1
Montevideo ..	„ 31	28,829	+2,580	44	316,431	+26,924	..	..
Cen. London Rly.	„ 30	14,629	−2,583	35	170,123	+ 10,810	6·78	·4
City & S. Lon. Rly.	„ 30	9,044	−1,927	35	97,963	— 9,487	7·26	..
Dublin-Lucan Rly.	„ 29	809	+ 104	8	1,653	+ 205	7	..
L'pool Overh'd Rly.	„ 31	7,634	+ 677	35	60,134	+ 4,784	6·6	..
London Elec. Ry. Co.	„ 30	44,035	−1,715	35	477,875	+ 3,795	21·25	..
Mersey Railway ..	„ 30	8,492	+ 284	35	77,793	+ 4,984	4·5	..
Metropolitan Rly.	„ 31	62,489	− 876	35	583,841	+ 2,603	25·75	..
Met. District Rly.	„ 30	46,210	+1,419	35	453,397	+17,926	25	..

STOCKS AND SHARES.

Tuesday Evening.

Investment business is the only kind of trade which is doing in the Stock Exchange. Speculation breaks out sporadically. One day there is animation in Americans; on the next, it is rubber shares which are affected. But there is little continuity of movement; and although August produced more business than it does as a rule, nobody connected with stocks and shares is sorry to see the new month, with its promise of better trade which the autumn is supposed to usher in. Prices, on the whole, remain firm, the strength of Consols being a useful factor. On the other hand, the Dublin riots aroused a certain amount of anxiety lest the Irish fever might spread to English workmen, occasional flickers of unrest in English circles serving as reminders that this kind of agitation is likely to remain with us as long as the poor.

The list of English Electricity Supply shares is colourless, the only actual changes being ⅛ rise in County of London Preference shares to 12⅛, and of 1 in London Electricity 4 per cent. Debenture stock, which took the price to 90½. Two or three *ex* dividend markings have produced practically no net change.

The market in Foreign issues is almost equally tame, although here there is generally a little Mexican news—either adverse or favourable—to freshen things up. This week prices are better, Mexican Light and Power Common and Preference both rising 2 points. The feature amongst Latin-Canadians is the strength of Shawinigan Water Capital shares, which have risen 5½ to 142; there are further rumours in the air with regard to a possible agreement between this Company and some other. Toronto Debenture stock came into demand, the price advancing 2 points; and for some of the other companies' bonds there is a steady investment inquiry.

Mexico Trams Common shares gained 1½, which lifted the price to 100. Brazil Tractions hardened a little, and the Anglo-Argentine Tramways group is better in places. United Electric Tramways of Monte Video shares improved to 4⅞, the high yield attracting buyers. British Columbia Electric Railways stocks came to market, and the quotations show a few small falls.

In the Home Railway department, prices have been moving in zigzag fashion. Business is erratic, and a good deal of it emanates from the professional brigade. With labour troubles in the offing, prices cannot get under way to any satisfactory extent; and whenever the wind seems set in a favourable direction, some gust blows from an unexpected quarter and twists prices down again. Districts are ¾ lower at 34¾, Metropolitans ¼ down at 48, while the Surplus Lands stock at 60 is 1 easier. The Central London "assented" trio is *ex* dividend. Great Northern and City Preferred shares remain at 2¼, unaffected by the announcement that, although the company will not be taken over by the Metropolitan until later on, for all practical purposes the fusion has already taken effect, and improvements are to be made at once in the working of the line. The talk is revived of extending the system to Lothbury, but the scheme is evidently in the air at present.

The recent sellers of London and Suburban Debenture stock finished their orders, and upon the pressure being withdrawn, the price was put up 6½ to 76½, business being marked on Monday at 77. The substantial rises in British Electric Traction stocks have made further progress, the improvements ranging from ½ to 1, on top of the gains noticed last week. South Metropolitan Debenture at 70 is 4½ up. The Underground Railways group is firm; both the Income Debenture stock and the Income bonds are now quoted *ex* their interest.

At the Marconi meeting the chairman's speech was received with somewhat mixed feelings, in consequence of the absence of much detail which would enable people to form an idea of the dividend-earning capacity of the concern. The shares accordingly weakened a trifle, but firmed up later, and the net movement leaves rises of ⅛ in the Ordinary and Preference shares. American Marconis, after being 1 3/16, reacted to 1⅜; while Canadians eased off to 11s. 9d. after having been about 6d. higher. Speculative interest in the Marconi market will probably drop for a bit, there being nothing exciting to "go for," so far as can be seen, in the immediate future. But the shares have furnished sufficient surprises in the past to make the observer extremely reticent about venturing upon excursions into the land of Marconi prophecy.

The Telegraph market, as a whole, is quietly steady, and the announcement of further reductions in rates by some of the leading cable companies has had no appreciable effect upon quotations, although the step is hailed with satisfaction by those who have noticed how previous experience in the same direction has turned almost invariably to the advantage of the companies concerned. Mackay Common at 86½ is 3½ higher, in response to New York buying. Cuba Telegraph Preference have weakened.

The feature in the manufacturing group is the strength of British Aluminium shares and British Westinghouse Preference. In the last-named there is now a market almost active, as compared with the utter stagnation into which the shares had fallen for many months previously. British Aluminium Preference are 1/16 higher, and the company's two Debenture issues have both hardened. Brush 4½ per cent. Debenture stock, quoted *ex* dividend, stands now about 38. The Rubber Share market pursued an erratic path, early strength in the shares being sapped by rumours that a large quantity of raw rubber will be offered for sale at the Mincing Lane auctions next week. There is not much public business doing in the shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9¼ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¼ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	10	8½ — 8¾	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 8⅞	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14⅜ — 15⅝ xd	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	11¾ — 12½ xd	..	4 14 1
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	10	6	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	+ ⅛	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅜	..	8 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90	..	5 0 0
Hove	5	9	9†	7⅞ — 8½	..	5 9 1
Kensington & Knightsbridge, Ord	5	9	8†	7⅛ — 7⅜	..	5 18 0
Do. 4 % Deb.	Stock	4	4	91 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	3	2½	2½	1½ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	−1	4 7 9
Metropolitan	5	4	4†	3⅛ — 3⅜ xd	..	5 15 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 9 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	93 — 94	..	4 19 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	8†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2¾ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 7/16 — 1 9/16 xd	..	6 1 4
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅝ — 2¾	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 8¾	+ ½	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 17 1
Calcutta, Ord.	5	8½	8½	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 1
Canadian Gen. El. Com. ..	$100	7	7	113 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	3	5	5/8 — 13/16	..	6 3 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90 — 92 xd	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/8 — 5/8	..	Nil
Do. 6 % Pref.	1	6	6	9/16 — 13/16	..	10 13 4
Kaministiquia Power, 5% G. Bs.	$500	5	5	102 —104	+1	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4†	66 — 70	+2	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	97 —102	+2	6 17 3
Do. 5 % 1st Mort. Gold Bds.		5	5	90 — 92	..	5 8 8
Do. 5 % 2nd Mort. Bonds ..	100	5	5	79 — 81	..	6 3 5
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	74 — 77	..	6 9 10
Montreal, Lt., H. and Power ..	$100	8	9†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ - 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5	6½	140 —144	+5½	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	+ ⅛	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ —101½	+2	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90⅛ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11⅜d.	17⅜d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 96	..	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	132 —135	..	5 18 6
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph ..	Stock	8	8	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	107¼ —108½	− ¾	5 10 10
Do. Def.	Do.	30/-	30/-	23¼ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2
Chili Telephone	5	7	8	7 5/8 — 7 7/8	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	− ½	4 15 3
Cuba Telegraph	10	6	5	8¼ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	15¼ — 16¼	− ½	6 3 1
Direct Spanish Telegraph, Ord.	5	4	4†	8½ — 8⅞	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7¼	..	6 12 0
Direct United States Cable ..	10	5	4	6⅞ — 7⅛	− ⅛	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	+ ⅛	4 2 6
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅛ — 12⅝	..	4 15 1
Great Northern Telegraph ..	10	15	20	30 — 32	..	6 13 0
Indo-European Telegraph ..	25	13	13	55½ — 57½	..	5 13 1
Mackay Companies Common ..	$100	5	5	85 — 88	+3½	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	10	20	4 — 4⅛	+ ⅛	4 17 0
Do. 7½ Cum. Partic. Pref.	1	17	17	3 5/16 — 3 7/16 xd	+ ⅛	4 18 11
Monte Video Telephone, Ord. ..	1	6	6†	⅞ — 1 1/32	— 1/32	5 9 8
Do. 5 % Pref.	1	5	5	¼ — ⅜	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ⅛	4 9 1
Oriental Telep. and Elec. ..	1	5	10	1 3/32 — 1 5/32	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	— ½	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	9½ — 10½	..	9 5 6
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/8	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	93 — 95	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅜ — 2⅝	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10⅜	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 9⅝	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12⅜ — 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	93½ — 92⅝	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	93 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 23/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 10½	+ ½	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	+1	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	..	3	47 — 50	+1	6 0 0
Do. 5 % Perp. Deb.	100	5	5	91 — 94	+1	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78	+ ½	5 15 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	..	80 — 82 xd	+1	4 17 7
Do. Pref.	100	4	4	77 — 79	+1	5 1 3
Do. Gtd. Assented	100	..	..	81 — 83 xd	..	4 16 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	79 — 81 xd	+1	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	4	93 — 95	+1	4 4 3
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	25/32 — 27/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 3 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	9/16 — 11/16	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	74 — 79	+6½	5 13 11
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol.	100	1⅞	1⅝	47¾ — 48¼	— ¼	3 7 4
Do. Surplus Lands	100	2⅞	2¾	59 — 61	..	4 10 2
Do. 8½ % Deb.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	81 — 83	..	4 4 4
Do. 8½ % Con. Pref.	100	8½	8½	77 — 79	..	4 8 7
Metropolitan District Ord.	100	Nil	Nil	34½ — 35	— ¾	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 8½ % Gtd.	100	8½	8½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	4½	3½	9/32 — 13/32	..	..
Do. 5 % Pref.	1	6	6	9/16 — 11/16	+ 1/32	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	..	..	5/8 — ¾	..	8 0 0
Do. 4 % Deb.	100	..	4	68 — 72	+4½	5 11 1
Underground Elec. Railways	10	..	..	8⅞ — 4⅛	..	Nil
Do. "A"	1/-	4½	..	½ — 5/8	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	109 —111 xd	..	5 8 1
Do. 4½ % Bonds	100	Nil	4½	99 —101	..	4 9 1
Do. 6 % Income	100	8	6 †	91½ — 92½ xd	..	6 7 9
Yorkshire (West Riding), Ord.	5	..	..	⅛ — 3/8	..	Nil
Do. 6 % Pref.	5	..	3†	3⅜ — 3⅞	— ⅛	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/32 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	91½ — 93½	+ ½	4 5 7
Do. 4½ % Deb.	100	4½	4½	95½ — 97½	..	4 12 4
Do. 5 % Deb.	100	5	5	98 —100	+ ½	5 0 0
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	95½ — 96½	+ ¼	6 4 4
Brisbane Trams Invt., Ord.	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	98 —101	+1	4 9 —
B. Columbia Elec. Rly., Def.	100	8	8†	125 —130	—1	6 3 2
Do. Pref. Ord.	100	8	8	111 —116	..	5 3 5
Do. 5 % Pref.	100	5	5	102 —105	— ½	4 15 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	— ½	4 7 8
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	+ ½	4 11 0
Cape Electric Trams	1	2½	5	1/16 — 1/8	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 6/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	13/32 — 17/32	..	..
Do. Pref.	1	6	..	25/32 — 1 1/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	6	1 3/32 — 1 1/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1 1/32	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7†	98⅛ —100½	+1½	6 19 4
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 91 xd	—1	5 9 11
Do. 6 % Bonds	100	6	6	92 — 94	— ½	6 7 8
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 — 6⅛ xd	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛ xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100		4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..		5	101 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	95 — 97	..	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	£500	5	5	102 — 104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5⅛	+ ⅛	6 15 7
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

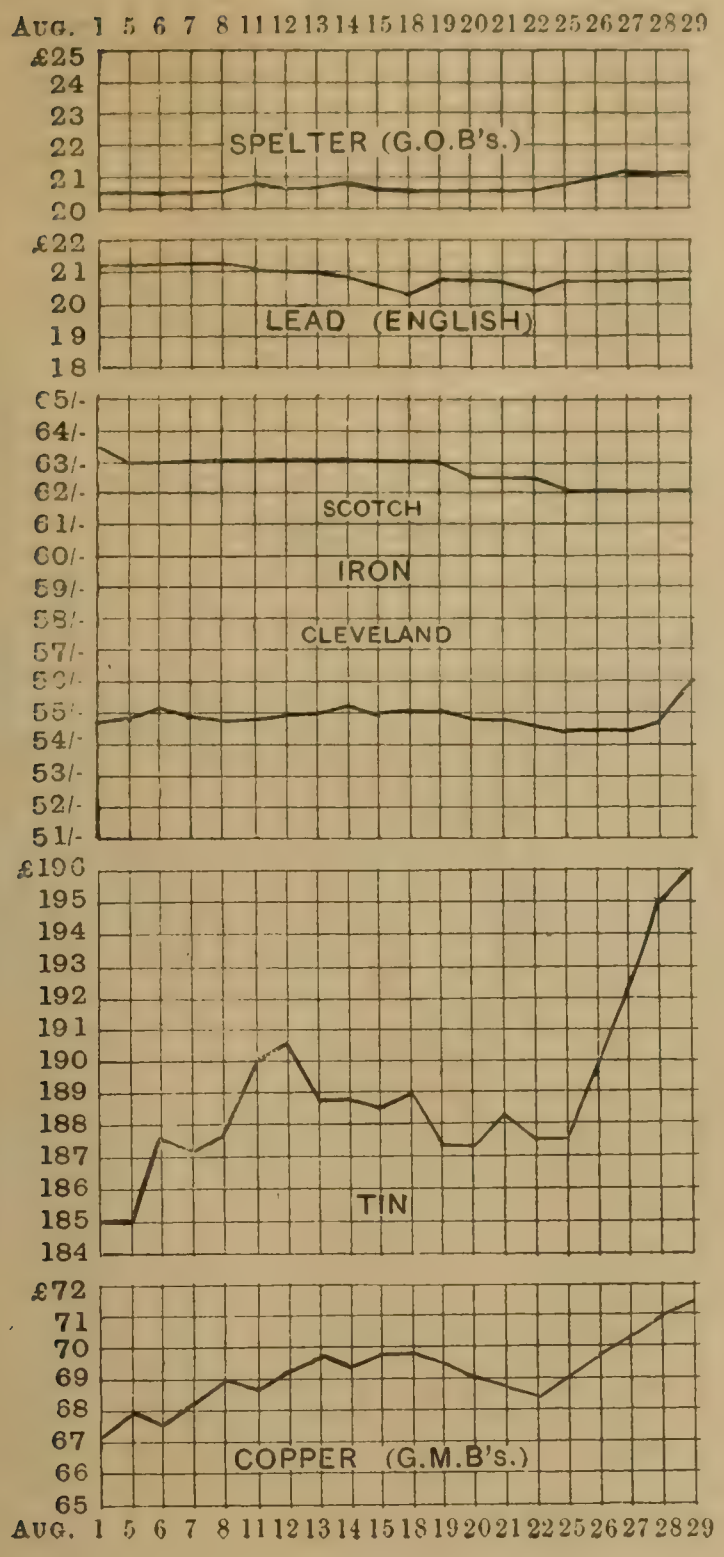
Aron, Ord.	1	6	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	23/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	28	16	3 1/16 — 3 3/16	..	5 0 5
Do. Pref.	1	6	6	1 5/16 — 1 7/16	+ 1/16	4 3 6
British Aluminium, Ord.	1	Nil	..	15/16 — 1 1/16	..	..
Do. 6 % Cum. Pref.	1	Nil	6	13/16 — 15/16	+ 1/16	6 8 0
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	+1	5 5 3
Do. Deb. Stk.	100	5	5	83 — 86	+1	5 16 8
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾ xd	..	4 14 0
British Westinghouse, Pref.	8	Nil	Nil	1/16 — 1⅛	..	Nil
Do. Deb.	100	4	4	66 — 69	+1	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	+1	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½ — 40½ xd	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	28 — 27	..	16 18 4
Callender's Cable	5	15	15	10⅜ — 11½	..	6 10 5
Do. Pref.	5	5	5	4 1/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	3 1/16 — 3 3/16	..	5 4 11
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	5/16 — 7/16	..	..
Do. Pref.	1	5	6	8½ — 8¾	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3¾	5	1 — 1¼	..	8 0 0
Do. Pref.	2	7	7	1 3/16 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	5	9¾ — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12¼ — 13 xd	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16 xd	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	12⅜ — 13⅜	..	5 9 1
Do. Pref.	10	5	5	9⅝ — 10⅛	..	4 18 9
Telegraph Construction	12	17½	20	37 — 39	..	6 3 1
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

METAL MARKET.

Fluctuations in August.



A New Rubber Plant.—The Mexican Department of Agriculture announces a fresh source of rubber supply, viz., the red *Plumeria* or *Cacalosochilt*, as the plant is called by natives. All the known Mexican members of this family have a milky sap, but the red plumeria is the only one yielding caoutchouc in sufficient quantities to make its collection worth while. The stem of the tree is 6 to 15 ft. in height, and 8 to 24 in. in circumference; the bark is thick and bright grey in colour. The tree is widely distributed over Mexico and Central America, and favours a sandy or rocky soil, altitudes between 1,000 and 5,000 ft., and dry localities where the annual rainfall averages from 27 to 45 in. Propagation is effected by cuttings, and tapping may be commenced when trees are three years old. Since the young wood contains most caoutchouc, the latter is collected, not by tapping the bark, but by pruning the young shoots and recovering the sap from the pieces cut away. The life of the tree is not curtailed by this treatment. On the other hand, if pruning be performed judiciously, the number of young shoots can be multiplied almost indefinitely. The twigs and shoots removed contain about 4 per cent. of a caoutchouc comparing very favourably with the grades now on the market, and having the following analysis: Resin, 21·9 per cent.; water, 15·07 per cent.; caoutchouc, 25·5 per cent.—*Elek. Anzeiger.*

Country House Lighting Plants.—In the new extension of the works at Northfield, near Birmingham, of the Austin Motor-Car Co., Ltd., now nearing completion, a separate department is being established for the manufacture of stationary petrol motors, principally intended for country house electric lighting installations. The Austin Co. proposes to devote its attention particularly to engines which work in conjunction with the Walker-Horrocks automatic system. Special attention is to be given to a small plant, entirely automatic in its working and suitable for installations up to 50 lights.

ELECTRICITY SUPPLY IN DOVER.

(*Concluded from page 330.*)

Distributing Systems: Cables, &c.—D.C. supply at 500 volts for traction and large motor demands is distributed from the switchboard alongside the battery room, while 2,000-volt single-phase distribution for lighting and small power consumers is effected from a 1903-type Ferranti board. The traction output is metered on the switchboard, and is delivered to the tramways department at the Town Hall, at which point the interest of the station in the matter ceases: current is thence distributed to various switching pillars in the tramway area under the control of the tramways department.

Twenty-two open-type Gilbert arcs are installed along the Folkestone Road in two series circuits (alternate lamps on each circuit); these lamps are supplied from the traction bus-bars, and are switched off from the station at midnight, reduced illumination being then provided till dawn by incandescent lamps on the tramway poles.

The only feature calling for special notice in the A.C. switchboard is the stepped coils through which the A.C. street lighting circuits are closed; flame arcs in the two main streets of the town and the metallic-filament lanterns on the sea front are thus controlled.

The original concentric rubber-insulated H.T. mains laid in iron pipes are still in use, but faults are now becoming fairly frequent; the electrostatic stresses caused by the central control of the street lighting circuits are severe, notwithstanding the use of switching chokers. Paper-insulated, lead-sheathed L.T. mains are laid in iron pipes and paper-insulated, lead-covered, armoured power mains are laid direct. The total lengths of various classes of cable now in use are:—H.T. rubber-insulated and paper, lead-covered, 17 miles; L.T. paper, lead-sheathed, and power lead-covered armoured feeders and distributors, including L.T. services, 32 miles.

There are 27 underground transformer stations now in use, in addition to local transformers on piers, the clock-tower and so on. The largest sub-stations had originally three 18-KW. Brush transformers, but, with the exception of one Burnand and two Westinghouse transformers, Berry apparatus is now used, and one 50-KW. and one 18-KW. unit form the equipment of the main sub-station.

The original Brush arcs along the front were adapted to the use of flame carbons in March, 1906, and were replaced by H.C.P. Harrison lanterns, in combination with the arc lamp hoods, containing four 100-C.P. tungsten lamps, in April 1912, when also the open-type A.C. arcs in the main streets were replaced by flame arcs. Each lamp standard was originally equipped with a 2,000/50 V., 750-W. transformer, and on installing metal lamps, it was found economical to fit 50/100-V. auto-transformers (costing 15s. each). The high iron losses involved by the double transformation are comparatively unimportant, as the street lighting circuit is open during the day. It is estimated that £300 per annum is saved by the metal filament installation as compared with the old Brush lamps, together with the substitution of "flame" for open arcs in the main streets. Extensive conversions from gas to electric street lighting have recently been effected, and, including those proposed for the current year, will result in a saving of nearly £1,500 per annum. A further annual saving of £200 will be effected by the installation of 325 time switches for street lamp control.

Loads Supplied.—The distribution of the total sales for this and last year is shown in Table III. The number of consumers is approximately 1,350. The introduction of the metallic-filament lamp led to a serious diminution in the lighting sales during 1907 and necessitated an increase of ½d. per unit in the lighting tariff in 1909. Fortunately the crisis has now passed and, as the mean revenue per unit sold is steadily increasing (from 3·62d. in 1907 to 4·51d. in 1911 and 4·02d. in 1912), while the costs per unit sold are diminishing (see Table II), it is probable that a reduction in the lighting tariff will soon be possible. Four cinematograph halls are supplied; three operate on A.C., through local transformers, while the fourth employs a motor converter set to allow of the exhibition of Kinemacolor films (which require a D.C. arc of

TABLE III.—Distribution of Output.

	1912-1913 (estimate).		1911-1912.	
Public lamps—Arc		100,000		109,410
,, ,, Incandescent		25,000		25,493
Tramways*		437,000		436,916
Admiralty lighting	55,000		32,700	
,, power	40,000		23,000	
Duke of York's School	39,000		39,000	
Messrs. Pearson's lighting	21,000		31,000	
,, ,, power	20,000		52,000	
Harbour Board†	15,000		15,000	
Private consumers (by meter)		738,000		712,421
		1,300,000		1,284,240

* Seven miles track, 4·75 miles route (1·25 miles sleeper construction), 21 double-deck cars each with two 25-H.P. motors and seating 44 passengers; 303,406 car-miles; 2,767,889 passengers in 1911-1912. † Including cranes on Admiralty Pier, four capstans on Prince of Wales Pier and swing bridge over Wellington Dock.

very high candle-power to suit the very short exposure of each picture and to allow for absorption in the colour screens).

For many years past it has been the practice to illuminate the promenade with festoons of coloured lamps. From 1,000 to 1,500 5-C.P. and 8-C.P. carbon lamps have been employed, and a very light and cheap overhead construction has been possible, since any moisture collecting in the lamp sockets, &c., was rapidly boiled out without any electrolytic damage such as would occur on D.C. supply. Unfortunately, this scheme was abandoned last year, much to the disappointment of visitors. The cheapness and beauty of the illuminations certainly made them a good investment as regards the popularity and welfare of the town.

The chief lighting and power consumers are shown in Table III. During the building of the Harbour works, Messrs. Pearson's took very large quantities of energy for lighting and power; but this demand has recently decreased, and will soon cease entirely; it has, indeed, been extended longer than was anticipated by the contract for the widening of the Admiralty Pier, which work is now nearing completion. The increasing Admiralty demand compensates to a large extent for the loss of the contractor's load, and at present consists in a lighting demand on the E. and W. Arms and S. Breakwater (which are served by a ring main, enabling supply to be given from either end), and a power demand for various crane and other D.C. 500-volt motors.

Messrs. Pearson's have been supplied for lighting at flat rate, and for power at 4d. after dark and 1½d. per unit during the day—to correspond with the 24-hour flat rate of 2½d. per unit charged to the tramways. The Admiralty have already been supplied for over three years, and it is expected that a 10-year contract for bulk supply (probably about 400,000 units per annum) will be made in the near future. Dover is to be made an important submarine station, and it is expected that the demand for charging the submarine batteries will reach about 250 KW., and that the annual consumption will be in the neighbourhood of 240,000 units.

A useful miscellaneous power load of press motors, gutta-percha strippers, &c., is supplied, but the single-phase supply which is used for small motors does not favour a rapid increase in their use. Typical winter and summer load curves are shown in fig. 1, from which it will be seen that the turbine or Ferranti set alone can supply the usual evening peak. During 1911-12 the maximum demand was exceptional, owing to the Coronation festivities, and was 521 KW. A.C. (normal 424 KW.), and 495 KW. D.C. (normal 363 KW.). The load factor is good for this class of station, and is likely to be increased considerably by future Admiralty day loads. The actual load factors in 1911-12 were 15·93 per cent. A.C., 12·86 per cent. D.C., 14·43 per cent. combined, but the maximum demand during this period was exceptional on the A.C. mains, owing to the Coronation illuminations, and on the D.C. mains owing to the official trials of reducer sets installed by the Admiralty for charging submarine batteries. Excluding these exceptional demands, the load factors in 1911-12 were 19·57 per cent. A.C., 17·53 per cent. D.C., 18·63 per cent. combined. The power factor of the A.C. supply is 90 per cent., and no measures are required for its improvement.

The financial success of the undertaking is handicapped by the heavy capital burden (over £102 per KW.) which results in high annual capital charges (1·48d. for interest, 0·80d. for sinking fund; total, 2·28d. per unit in 1912-13), and prevents such additional outlay as would undoubtedly increase the economy and scope of operation of the undertaking. Thanks to a most careful administration, the financial position of the station has steadily improved during recent years, and as compared with a gross profit of 5·43 per cent., and a net deficit of £3,171 in 1908-9, there was realised 7·93 per cent. gross profit, and £3,254 net surplus in 1911-12, leaving an outstanding deficit on net revenue account of £1,370. In 1912-13 the gross profit realised was 6·78 per cent. and the surplus £1,092.

In conclusion, our best thanks are due to Mr. L. W. Woodman, M.I.E.E., borough electrical engineer, for his courteous assistance in the compilation of the above notes.

ADVERTISEMENTS AND THE LAW OF DEFAMATION.

[BY A LEGAL CONTRIBUTOR.]

The advertiser who is at a loss for words in which to extol his own wares is sometimes tempted to depreciate those of a rival trader. It need not be done directly. Many subtle devices may be adopted in order to show that the wares of Brown, Jones or Robinson will not bear comparison with those of Smith. For instance, a table might be published showing that, under similar conditions, "Smith's 20th-century Excelsior lamp outshone those of all other competitors." It might then be stated that taking the efficiency of Smith's lamp as 100, that of Brown's lamp was 75, that of Jones's 50, while poor Robinson's lamp only reached 25!

Persons who were sufficiently simple to accept Smith's own untested figures might be led to avoid the lamps sold by the other three gentlemen, who would suffer damage in consequence.

This method of attaining publicity and others still more subtle may sometimes be adopted by persons who are not in the habit of playing cricket in the commercial sense. But do they do more than offend against certain unwritten laws which are generally observed by good men of business? Are they, in other words, within reach of the law of libel?

It is an elementary principle of the law of libel that a "thing" cannot be libelled. To write (*e.g.*) that a motor-generator is badly designed or constructed is not actionable *per se*; whereas to write of an electrical engineer that he is a bad designer of generators could clearly be made the subject of a claim for libel, although the plaintiff was unable to show that any actual damage had been occasioned to him.

The law cannot be better summarised than in the words of Mr. Spencer Bower, K.C., who has recently published "A Code of the Law of Defamation." He writes:—

Disparagement of property is actionable at the suit of any person entitled to the property so disparaged, though such disparagement is not such as to amount to or involve defamation if, but not unless, such person alleges and proves the several facts in clause (2) hereof mentioned, provided that: (1) For the purposes of this article, "property" means and includes every species of property known to the law, whether real or personal, corporeal or incorporeal, and in the case of goods, it includes not only specific goods but any type or class or kind of article manufactured, sold, or otherwise dealt with in the course of any person's trade or business; (2) Disparagement means and includes any publication of matter, the meaning or effect of which is to deny or cast doubts upon the existence or validity of any person's right, claim, title or interest to or in any property, or to depreciate or disparage the merits, utility, qualities, or value of any person's property; but the mere assertion by any person that any manufacture or invention of his own or any class of goods in which he deals, or other like property, is superior to that of all other persons, or of any particular person, does not of itself constitute the disparagement.

(3) In order to maintain an action for disparagement of property, it is necessary and sufficient to allege and prove

each and every of the following facts, that is to say (1) that the defendant has published matter in disparagement of the plaintiff's property ; (2) The such matter is false ; (3) The such publication was actuated by malice as in the next clause defined ; and (4) that the plaintiff has sustained actual damage, which was either the natural and probable result of publication, or the result which the defendant had, in fact, intended. "Malice" means any motive other than that of asserting, protecting, promoting, or defending, any claim, interest, or duty, either of the person who has published the disparaging matter, or of some person whom in virtue of privity of estate or agency he is entitled to represent, or to, or in, or with, reference to the property disparaged in the existence and validity of which claim he believed when publishing the matter.

It will be seen that the plaintiff who founds an action on disparagement of goods has a somewhat onerous duty to discharge. He must prove that the words were false and malicious, and that he has suffered actual damage. For instance, to revert to the case of the lamps quoted at the commencement of this article, Robinson could not hope to succeed in an action against Smith for saying his lamps had but 25 per cent. of the efficiency of Smith's lamps, unless he could prove that he was actually damaged by the statement, and that it was false and malicious.

He would have to bring one witness to Court to say : "I have made tests, and Smith's tests are untrue and misleading." He would also require another witness to say : "I was on the point of trying Robinson's lamp, when I suddenly saw this advertisement, and bought Smith's (or Brown's) instead." The question of malice would, of course, be for the jury to determine, but if the statement was *true*, it would not matter that it was malicious. For Smith to say *truly*, in his advertisement : "My boosters are infinitely more efficient than Brown's" cannot be libellous, although the jury find that Smith is actuated by malice, and not by a fair and proper motive.

From what has been said it will be seen that the type of advertisement which depends upon "odious comparison" cannot often be questioned on the ground of illegality. At the same time, we should be very sorry to see this objectionable method of self-laudation, even in relation to goods, come into greater vogue than it is in at present.

THE PEKING LEGATION MACHINERY.

We have received from the British Engineers' Association the following correspondence, to which we refer in our leading columns :—

Sir,—In order to remove a serious misapprehension which is damaging British engineering interests in China, the British Engineers' Association has obtained the authorisation of H.M. Office of Works to publish a letter addressed by that Department to this Association, dated March 7th, 1913, and a schedule containing the names of certain contractors which accompanied it. Copies of these are attached to this letter.

These documents have to do with a contract for an electrical and refrigerating installation recently erected at the British Legation in Peking. The conditions surrounding the invitations to tender, and the placing of this contract, have led to a very general belief that the machinery was manufactured in Germany. The false impression to the effect that the official centre of British interests in China had been equipped with German machinery has proved a severe blow to British engineering prestige. The Chinese are continually told, by the representatives of certain Continental firms, that the British Government were obliged to go to Germany because there were no makers in England capable of doing the work satisfactorily.

The enclosed documents show that there is no foundation whatever for this statement. This Association would, therefore, deem it a favour if you would give publicity to the letter from the Office of Works above referred to, and to the following facts :—

1. The contract was not given to the Siemens China Electrical Engineering Co., a purely German concern representing the Siemens German interests, but was placed with the Siemens Bros. Dynamo Works, Ltd., in London. Whether this firm is considered British or not, it possesses works in Great Britain.

2. Messrs. Siemens only manufactured a portion of the plant in question, and this, according to the enclosed letter, was manufactured not in Germany but in England.

3. The rest of the plant was also manufactured in Great Britain by the British firms whose names are given in the schedule attached, some of whom are members of this Association.

The following causes gave colour to the misconception that the machines were German :—

(*a*) Until now no official denial has been published.

(*b*) The erection of the plant at the Peking Legation was entrusted to a German firm in China, the Siemens China Co., and this company were assumed by many to be the contractors owing to a similarity between their name and that of the contractors.

(*c*) The public generally have either been unaware that there was a stipulation that the whole of the plant must be made in Great Britain, or have believed that such a stipulation was not enforced.

This Association is aware that the manner in which this contract was negotiated and placed has caused grave dissatisfaction among the purely British firms who originally tendered. On this question, however, I am not directed to enter. The point which this Association is anxious to make clear is that, on the authority of H.M. Office of Works, the whole of the plant installed at the British Legation in Peking was manufactured in Great Britain.

I am, Sir, your obedient servant,

Stafford Ransome,
Secretary of the British Engineers' Association.

Caxton House, S.W., *August 28th*, 1913.

Letter from His Majesty's Office of Works, dated March 7th, 1913, to the Secretary of the British Engineers' Association.

Sir,—With reference to your letters of the *12th inst.* and *22nd ult.*, I am directed to furnish the following information respecting the contract for engineering works at the British Legation at Peking.

1. Tenders were originally invited in August, 1911, from British firms only, and before an invitation was issued to the firm whose tender was ultimately accepted, they were required to satisfy both the board's officer in Peking and the British Consul that they might be so regarded.

2. Owing to the conditions prevailing in China in December, 1911, the board decided not to proceed with the work, and the firms who tendered were informed accordingly. No undertaking was given, however, that fresh tenders would be called for at a subsequent date.

3. When it was found possible to proceed with the work, time did not permit of the invitation of fresh tenders, but the two firms who had submitted the lowest tenders in the first instance were asked to submit fresh prices. The more favourable tender, that of Messrs. Siemens Brothers Dynamo Works, Ltd., was then accepted.

4. The whole of the plant has been manufactured in England. A schedule is attached showing the names of the sub-contractors by whom the various parts of the work have been undertaken.

5. The erection of the plant is being carried out by the contractor's representatives, the Siemens China Electrical Engineering Co., under the supervision of a British engineer, by whom Chinese labour is being employed direct.

I am, Sir, your obedient servant,
(Signed) Lionel Earle.

The Secretary,
British Engineers' Association,
Caxton House, Westminster, S.W.

British Legation, Peking.

Main contractors for the above contract—Siemens Bros. Dynamo Works, Ltd.

The following is a list of the contractors and the material they are supplying :—

Specification A.—This covers :—(1) Steam heating installation ; (2) Hot and cold water supply installation.

1.—Steam Heating.

Contractor.	*Material.*
Babcock & Wilcox.	Main boilers and fittings, Weir's feed pump, pipework in boiler house and engine rooms.
Atmospheric Steam Heating Co.	Complete steam heating installation in the various buildings, including pipework, feed-water heater, vacuum pumps, radiators, valves, fittings and accessories.

2.—Hot and Cold Water Installation.

Rees Roturbo Mfg. Co.	1,000-gallon pumps.
Siemens Bros. Dynamo Works, Ltd.	Motors for above pumps.
Whipp & Bourne.	Starting gear for above motors.
Fredk. Braby & Co.	Tanks, cisterns and cylinders.
Hartley Sugden, Ltd.	Dome top boilers.
Stewarts & Lloyds.	Valves and lap-welded tubes and accessories.
T. & W Farmiloe, Ltd.	Lead piping, paint, &c.
Merryweather & Sons, Ltd.	Fire hydrants.
Thos. Piggott & Co., Ltd.	12 × 12 × 8-ft. pressed-steel tank.

Specification B.—This covers :—(1) The electrical generating plant ; (2) ice-making plant.

1.—Electrical Generating Plant.

Contractor.	*Material.*
Siemens Bros. Dynamo Works, Ltd.	Main generators, main switchboard, main cables, motor-booster set, wiring material for engine and boiler rooms, electrical fittings and accessories.
Bellis & Morcom, Ltd.	Main engines.
Pritchetts & Gold.	Battery.

2.—Ice-Making Plant.

Siemens Bros. Dynamo Works, Ltd.	Motor for driving ice-making plant.
Mr. Sam. Puplett.	Ice-making plant.

REVIEWS.

Practical Alternating Currents and Alternating-Current Testing. By C. F. Smith. Manchester: Scientific Publishing Co. Price 6s. net.

This is undoubtedly one of the best books on alternating currents that we have seen. Very little fault can be found either with the method of treatment or the subject matter of the book, for the treatment is clear and thorough, and the subject matter has been carefully chosen and prepared.

The book is written upon experimental lines, but the principles are not neglected, and in no case does the author depend upon any "rule-of-thumb" methods where first principles can be used to provide an explanation.

Mr. Smith has made full use of graphical methods and vector diagrams for circuits with both capacity and self-induction, and the early chapters on Impedance, Power Factor and Capacity would be hard to beat for clearness.

Actual results of experiments are given in many cases, and curves plotted from the results given. This is a far better way of dealing with alternating currents than the usual method of drawing diagrams for a general case and leaving the reader to guess at the magnitudes of the actual currents, speeds, and resistances from which the curve would have to be drawn in practice.

The section on transformers is very complete, and the line diagrams are well drawn. The method of obtaining the equivalent resistance and the discussion of the general effect of the secondary on the primary are also well stated.

The chapters on Alternators and Synchronous and Induction Motors are essentially experimental. The explanation of the rotating magnetic field is not up to the author's usual standard of lucidity, and we may also reasonably complain of finding no comparison made between the capabilities and performances of the two kinds of A.C. motors. It is also doubtful whether the last chapter, on Wave Composition and Analysis by means of Oscillographs and Fourier Series, will appeal to the type of reader that Mr. Smith is obviously catering for in his earlier pages; but apart from this, the last chapter must be regarded as one of the best in the book.

Mr. Smith's book will undoubtedly prove of use to students in technical colleges in connection with their laboratory work, and will also appeal to a wider range of readers on account of the exceptionally logical and lucid method of treatment.

Reports of the Committee on Electrical Standards Appointed by the British Association for the Advancement of Science. 1913. Cambridge: University Press. Price 12s. 6d. net.

The original British Association Committee on Standards of Electrical Resistance was appointed in 1861 at the suggestion of Prof. William Thomson (later Lord Kelvin), and, to quote Lord Rayleigh's prefatory remarks, the early reports of this Committee were for many years the highest authority on their subject. The 39 reports up to 1912 have now been republished under the editorship of Mr. F. E. Smith, whose intimate acquaintance with recent developments of the subject, in which he has taken a leading part, eminently qualifies him for the task. This publication has been made possible by a generous donation of £100 from Mr. R. K. Gray, and by a similar grant from the General Committee of the Association.

At the time of the appointment of the Committee, "no coherent system of units for the measurement of electric resistance, current, electromotive force, quantity or capacity had met with general approval," and the principal object of the Committee was, first, to determine what would be the most convenient *unit* of resistance, and second, what would be the best form and material for the *Standard* representing that unit.

It is difficult to appreciate fully the gigantic task before this Committee, and it is certainly impossible to overestimate the value of its work in bringing order out of chaos, and in fixing the standards by which all our electrical measurements are now made. Some idea of the chaos upon which this Committee was called to brood may be gained from the fact that the word Ohm was then uncoined, and the units of resistance were based on the more or less arbitrary size and weight of some conductor in the form of a wire. The units in England, for example, were (1) the resistance of a foot of copper wire weighing 100 grains, and (2) the resistance of 1 mile of copper wire $\frac{1}{10}$ in. in diameter.

On the other hand, the activities of the Committee between 1862 and 1870 may be gauged from the following list of reports:—

1. The measurement of a resistance in terms of the centimetre and second, by Prof. J. Clerk Maxwell and Messrs. Balfour Stewart and Fleeming Jenkin.
2. A determination of the dynamical equivalent of heat from the thermal effects of electric currents, by Dr. Joule.
3. An investigation of resistance alloys, by Dr. Matthiessen.
4. The determination of a unit of capacity, by Dr. Matthiessen, Prof. Carey Foster and Mr. F. Jenkin.
5. The determination of "v," the ratio between the electrostatic and electromagnetic units, by Sir Wm. Thomson, and also by Prof. J. Clerk Maxwell.

When it is pointed out that all these reports in their entirety, illustrated with drawings of the original apparatus, and often couched in the very words of these master scientists, are printed in the first 290 pages of this book, it is obviously unnecessary to comment further on the unique value which this republication must have, both from a purely scientific and from a practical standpoint.

During this early period Sir William Thomson had been making his memorable investigations into electrostatic measurements, and had designed the various electrometers that now bear his name. The fifth appendix to the Dundee report (1867) is a "Report on Electrometers and Electrostatic Measurements," by Sir William Thomson, F.R.S., and contains 35 pages, a complete illustrated account of repulsion electrometers, symmetrical electrometers and attracted-disk electrometers, together with a general statement of the theory and practice of the replenisher.

There are no doubt many people who would be roused to enthusiasm by the announcement of a text-book of electricity by J. Clerk Maxwell—and there is truly much excuse for enthusiasm over Appendix B to the 1863 Report, for here we have reprinted a 60-page treatise "On the Elementary Relations Between Electrical Measurements," by Prof. J. Clerk Maxwell. This appendix in itself is of immense value, and will, no doubt, be read with eagerness by those to whom these reports have hitherto been inaccessible.

In 1870 the Committee was "unable to report any material progress," and suggestions were made for the appointment of several small committees. These committees devoted themselves to consideration of (1) the standard of resistance; (2) the standard of capacity; (3) the standard of electromotive force; and the reports immediately following are chiefly concerned with the testing of various coils and the establishment of national standard laboratories.

Although the work of the Committee since that time has not been of such an epoch-making kind, it has, nevertheless, been of great scientific importance. In 1891 it prepared evidence for the Board of Trade inquiry into the "Standards for the measurement of electricity for use in trade," and it has taken an active part in the preparation of the specifications for the Clark cell, and other more recent forms of standard cells.

Considerable space in the later reports is devoted to the consideration of resistance thermometry, and the Committee authorised various comparisons and researches to be made on electrical and gas thermometry, the results of which are embodied in appendixes to the reports in 1893, 1899 and 1903.

In 1895 the Committee turned its attention to magnetic units, and discussed a paper on this subject by Dr. Oliver Lodge. This paper is printed in full in an appendix to the report, and is a valuable, though little known, contribution to the literature of magnetism. The 1896 meeting devoted its time to discussing a standard heat unit; suggestive letters from the highest authorities on heat measurement were received, and these are duly published with the report in this volume.

The Electrical Standards Committee is to be congratulated

on this publication of the labours of its members and their illustrious predecessors, not only on account of its historical interest, but as providing an excellent statement of principles by such masters as Kelvin and Maxwell, and also as pointing out the lines of recent research and progress in electrical measurement.—P. H. S. K.

Resuscitation. By C. A. Lauffer, M.D. London: Chapman & Hall. Price 2s. net.

This is a small book by the medical director of the Westinghouse Electric and Manufacturing Co., of Pittsburg. It describes simply and concisely Schäfer's prone pressure method of artificial respiration, which should be tried in all cases of electric or traumatic shock, drowning or asphyxiation from any cause; the directions for self-instruction are supplemented by anatomical details, so that an intelligent grasp of the rationale of the treatment may be obtained by those who read the book.

Dr. Lauffer was struck by the number of cases that came under his observation where the respiratory apparatus had become temporarily inhibited and death had supervened before medical aid could be procured. Had those present at the accident possessed the simple knowledge of producing artificial respiration, many of these lives could have been saved.

Accordingly he set to work to train as many men as possible within his sphere of influence, and one man alone of those was instrumental in saving six victims of electric shock—all of which would have been fatal cases but for his timely and efficient efforts.

As was pointed out in these pages a few months ago (April 4th), death may be instantaneous as the result of a shock, the heart being thrown into a state of fibrillary contractions. It would be impossible for a layman to differentiate between such a case and one where respiratory inhibition only had occurred, so that all victims of shock should be at least given a chance of being brought round even though the labour entailed should be wasted.

The same method is applicable to cases of apparent drowning, inhalation of noxious gases, various poisons, shock produced by heavy blows, &c.

Wechselstromarbeitsdiagramme: Das Rechnen mit umlaufende Vectoren nach der Symbolischen Methode. By Emil Waltz. Berlin: Hermann Meusser. Price M. 22.5.

Herr Waltz, in his preface, states that he originally merely intended to produce a German translation of Messrs. Cramp and Smith's book on "Vectors and Vector Diagrams," but decided later that a complete survey of the subject would involve the writing of practically a new and much enlarged book, and this plan he finally adopted. The result is a volume about three times as large as the English book, although covering, if anything, rather less ground.

The extra space is devoted, in typically German fashion, to a more thorough and detailed study of the points touched upon.

Whether this will help the ordinary student, is an open question, as the extreme detail evidently aimed at is often the cause of much waste of time to the reader. It also makes it difficult for him to get a clear view of the relative importance of the various quantities, since many of the points raised are minor ones, of purely theoretical interest.

Numerical examples are fairly frequent, but even these often have an air of unreality for want of diagrams of connections and arrangement, and a clearer explanation of the relations of the given resistances, reactances, &c., to the dimensions of the apparatus dealt with.

As a comprehensive reference book on the subject of vector and circle diagrams as applied to simple alternating circuits, to transformers and to induction motors (other apparatus have had to be excluded for amount of space), the volume will, however, prove of considerable value to those already having a good working knowledge of alternating currents.

The explanation of the actions going on in the polyphase induction motor, given in Chap. 12, is especially clear and to the point.

WORKSHOP FLOORING.

By W. H. Booth.

The flooring of a workshop is a detail deserving of considerably greater attention than it often receives. A floor should be something more than a mere division between two rooms, though this view of a floor has been in the past carried to such an extreme that it has often not been thought necessary to make a floor sufficiently sound to prevent dust from falling through the cracks and upon the tools beneath. With this view of the duties of a floor, it is not surprising that the ground floor, below which there is no room, should be left of plain unvarnished dirt. We say unvarnished advisedly, because a dirt floor that is varnished is better than one that is unvarnished. The usual dirt floor appears to be cinders trampled hard, and, in process of time, more or less covered with iron dust. When dry such floors are very dusty and cause a deposit of dust upon the machine tools, greatly to the detriment of these costly appliances. To prevent dust, especially when sweeping up, it is the practice to water such floors, a proceeding which promotes the rusting of the iron filings, and probably, when the water has evaporated, leaves the floor dustier than ever. But, except with an undesirable amount of swilling, a dirt floor will always cast up much dust when swept.

If anyone is so unfortunate as to possess a dirt floor, he may mitigate its faults by means of oil. An oiled floor will be dustless. The oil should be a heavy non-volatile quality of petroleum residuum, so as to be free from inflammable vapour, and it should be sprinkled hot through as fine a rose as it will freely pass. The application should be scanty, and repeated if necessary after the effect has been observed. No more than necessary must be employed. After the first application, all collection of dirt about machine feet should be removed with a sharp flat spade, and the whole floor should be kept level, and no low places allowed to wear in it. Such a floor ought to be swept with a softish brush, and damp sawdust may be sprinkled all over before sweeping. Men working at machines should stand on boards to keep them off the floor. The worst dirt producer in a shop is the badly cleaned casting, which brings in sand and black dirt. Castings properly cleaned by acid water, and washed off, bring in no dirt.

One of the worst floors is that of soft pine, which splinters badly and cannot be kept nicely clean. For heavy shop floors the street paving block of hard wood is a good covering. To make a good floor with blocks which shall be even, the foundation of concrete must first be laid and floated level to a fine surface, which should first be allowed to set to dryness, and then hot tarred. The floor blocks may then be laid on it, each block being dipped in hot tar mixture as laid, and tapped up to the adjacent blocks and down on its bed.

Such a floor is expensive. It is probable, however, that the blocks need not exceed 3 in. in height, for the wear of a shop floor is small compared with that of street paving.

Such a block floor would be put into good condition by dressing with linseed oil. All floors in the best American shops are made of $\frac{7}{8}$-in. maple boards about 4 in. wide, nailed across pine boards about $1\frac{1}{2}$ to 2 in. thick, these being in turn nailed to battens that are sunk level in concrete. The pine boards thus rest on the concrete.

In an English modification of this floor the concrete is of breeze floated over with tar mixture, upon which are nailed pine boards, and on these again the hard maple. There is no doubt that no floor exceeds the maple floor in excellence for light tool shops. It is lightly oiled with linseed to keep it in order and kept swept, and where dirt tends to trample hard on it, scraped. Such floors, properly attended to, remain clean, smooth, and free from dust.

The pine floor is of too open a grain to remain dust free. If the colour is not objected to, the Australian woods of the eucalyptus order would probably serve well as floorboards if well seasoned and dried, for they are hard and close grained. Except the Jarrah, of West Australia, and its congener the Karri, the Australian timbers are not much seen here. The blue gum, tallow wood, and blackbutt are familiar timbers in Australian wagon works, are dense and heavy, and should make good flooring wood, if laid dry enough not to curl edgeways in the process of further drying.

Where machines are run flooded in lard oil, there are rarely provided floor trays of an area sufficient to catch all the oil drops or greasy shavings of metal. Such trays ought to be much larger than usually provided. Automatics are so usually placed together that it would seem good policy to stand them on an entirely metal-sheeted floor in a section by themselves.

Where a machine requires a special foundation and holding-down bolts, there is no objection to this being at the general level of the concrete, the pine and facing timber coming between this and the machine, and any holding-down bolts standing through the timber. But where a special foundation comes up through the floor, the boards should come close up to the foundation, and the joint should be concealed by laying round the foundation block and upon the floor a fillet of wood $2\frac{1}{2}$ in. × $1\frac{1}{4}$ in. or thereabouts as a finish.

Except in these special cases floors should always extend completely beneath machines, which can then be removed and their positions varied without inconvenience. Most machine tools can be placed direct upon a good floor, and to this end machines ought to be planed on the underside of their bed-plates parallel with the top side. A level floor will then give level machines with least cost in erection. A floor should, in fact, be such that a properly-made machine need only be simply set down upon it to be ready to run, coach screws being a sufficient holding-down. When a machine is

removed the screw holes in the floor ought to be plugged with plugs of the same material cut with the grain horizontal and planed off after driving nearly flush.

The objects to be kept in view in planning a floor are level surface upon which and about which machines may be placed and moved at will ; a surface to which dirt will not adhere and in which chips will not become imbedded ; a surface easily to be cleaned and which will not break up into splinters. It should be free from knots, and this alone will bar all the cheap pines of the northern hemisphere, It should be easy to sweep, close jointed, so that, if necessary, it can be washed without letting water percolate, and it should be capable of a sufficiently oily surface to adhere to dust until the sweeper comes round.

Though pine wood can be had free from knots, such timber is too soft and absorbent of oil, water and chips ; the pitch pine may be excepted. The pines of Australia and New Zealand are hard, closely grained and dense timbers of less splintering nature and remarkably free from knots.

Where, as at the entrance of a room, a floor wears into a hole, this should be prevented by closely studding it with small hard nails over the part where wear takes place, or a grid of plain bars may be let into the floor like a mat, removable, so that the accumulation of dirt can be cleared away.

Generally, the floor of a shop ought not to be looked upon as the dumping ground for rubbish and tea leaves, and there should be nothing upon the floor, except what is necessary for the work in hand, such as castings or forgings too heavy or bulky to be placed on shelves or benches. No benches other than solid-fronted benches with drawers, should be placed against the walls of a shop, otherwise rubbish will surely accumulate in the covered space. Shelving for tools, small parts, &c., should be open to light on both sides, and most shelving would be better made of wire netting or of expanded metal than of wood or of sheet metal. For tools such as have cutting edges the shelving and shop stands should, of course, be of hard wood ; but even then a shelf of narrow-spaced bars will prevent accumulation of dirt from taking place. Asphalt or any semi-plastic material is of doubtful value, as heavy articles gradually sink into it, especially in warm weather, and the hollows thus formed become receptacles for dirt.

THE KEOKUK POWER DEVELOPMENT.

One has become so accustomed to regard the United States as the home of big things, that the Keokuk hydro-electric development on the Mississipi River, despite its projected capacity of 300,000 h.p., is apt to be overlooked.

Actually it is the largest water-power plant in the world, and that, moreover, with a comparatively low head of water.

Our American contemporary, *Power*, recently described at considerable length many interesting features of this scheme, and the following particulars are gathered from this source.

Naturally the constructional work concerned the civil engineer rather than the electrical man, as it was necessary to hold up the Mississipi River, which at Keokuk is nearly a mile in width, and divert a large proportion of its flow, ranging from 20,000 cb. ft. per sec. minimum to 372,000 cb. ft. per sec. maximum through thirty 18 ft. diameter concrete tubes to the turbines in the power house, which stands in the river.

For about 12 miles above this point the river level falls some 23 ft. over the Des Moines Rapids, and the erection of the dam has had the effect of forming a lake from one to three miles wide, for 65 miles above the dam, with a depth at its lower end of 40 ft. and at its upper end of 8 ft. One of the conditions imposed by the United States Government was that navigation should not be interrupted, and thus it comes about that a lock and a large dry dock were incorporated with the dam, which take the place of a now disused 9-mile canal, which formerly passed round part of the rapids.

The dam itself has a total length of 4,649 ft., and consists of 118 concrete piers 6 ft. wide, 53 ft. high, and with a thickness of 29 ft. at the top and 42 ft. at the bottom, the taper being on the down stream face.

The intervening 30 ft. spaces between the piers were subsequently filled by means of a concrete web rising 32 ft. above the river bottom, with vertical up-stream and curved down-stream faces.

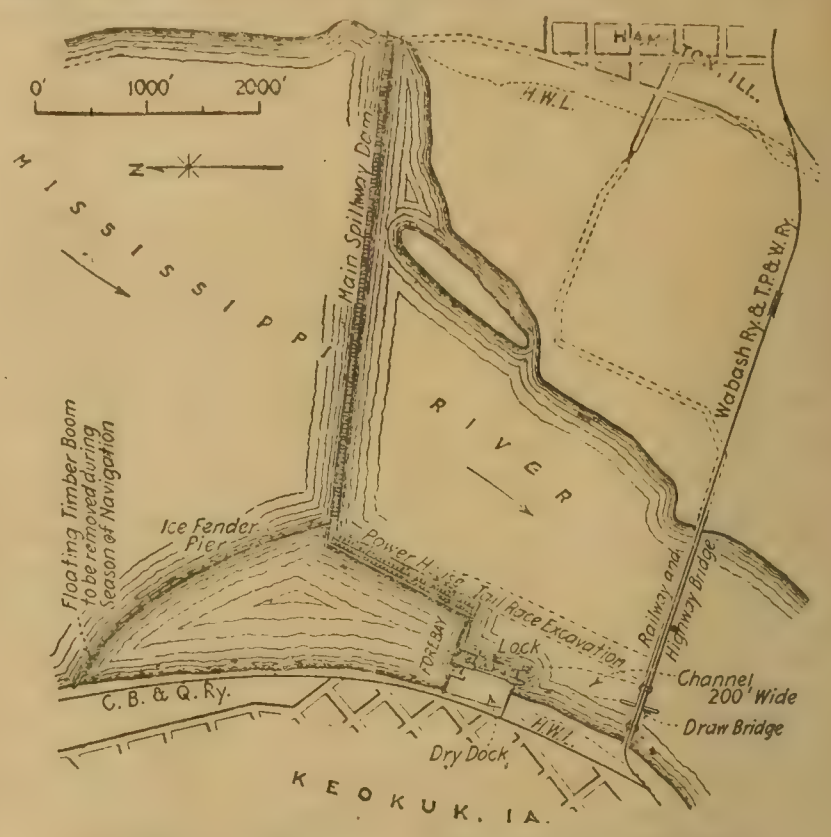
The webs are surmounted by adjustable steel gates which hold back the water and create a difference in level of between 29 ft. and 41 ft. depending on their position.

The dam is of the gravity type and coffer-dams were used in its construction, the river being only some 7 ft. deep.

The first 36 spans of the east end of the dam were built on a meadow intervening between the normal shore of the river and the bluffs, and for these no coffer-dam was needed. Coming to the river, a sectional coffer-dam 78 ft. wide was constructed, as required, the first section to be put down being about 1,000 ft. long. Subsequent sections ranged in length from 400 ft. up. A complete pumping plant containing two 6-in. centrifugal pumps of about 1,000 gallons per min. capacity, was used for pumping out the various sections of coffer-dam enclosed area.

The first operation in constructing the dam was to blast out a slot in the rock bottom of the river several feet deep and as wide as the base of the dam itself in which the solid concrete work of the huge monolithic structure was commenced. Thus, the dam was firmly keyed in position. Next, the solid concrete piers and overhead connecting arches were poured into steel moulds. As a section of the concrete hardened, the forms were removed and used again. A partition wall was thrown across the coffer-dam between the finished and unfinished work and the section of coffer-dam thus rendered unnecessary would be destroyed. Coffer-dam material was economised and the least possible obstruction was made to the flow of the river, the spaces between the piers being left clear for the water to flow through.

On the site of the power-house, dry dock and lock a large coffer-dam was put down and pumped out, unwatering an area of

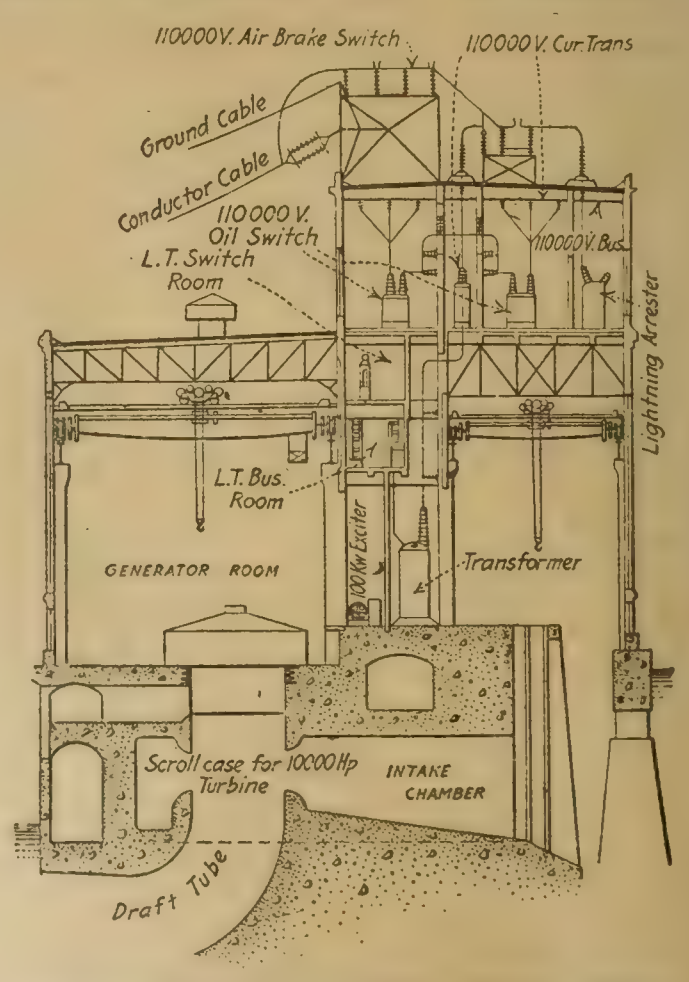


Plan of the Keokuk Dam and Power House.

35 acres. After the completion of these structures the work of building up the dam between the piers was commenced.

The power house will ultimately be one-third of a mile long ; the first section built is 859 ft. long, and as in the case of the dam, &c., is of concrete, but partly reinforced on the walls, with a width of 133 ft., and depth, including the part under water, of 177 ft.

The substructure portion containing the intake tubes, turbines, and draft tubes, is 70 ft. high from the bottom of the foundations, which are 25 ft. below the river bed, and rest on solid limestone. The sectional view gives some idea of the arrangement of the



Sectional View of the Keokuk Power House.

generator and switch rooms, while a further sectional view shows the arrangement of one of the generating units.

The present equipment consists of 15 Francis type turbines, normally rated at 10,000 h.p., but capable of giving 13,000 h.p. each, which are claimed to have an efficiency of 86 per cent. on a 32-ft. head, and speed of 58 r.p.m.

The turbine runner, 16 ft. in diameter, carries 20 blades, and is hung on a 25-in. shaft, which carries the alternator rotor at its upper end, and is supported half way in a single huge thrust bearing, the weight of the revolving parts being some 550,000 lb.

Two steady bearings are also provided to hold the parts in position.

The thrust bearing is of the roller type, and is provided with means for forcing a film of oil between the two faces at 250 lb. per sq. in. pressure, to float the load and obviate the need of rollers. An attempt is to be made to operate with the rollers only, and use oil in emergencies. The turbines are fitted with Lombard governors, and four water-inlet passages are provided to each runner, each fitted with a headgate and screen.

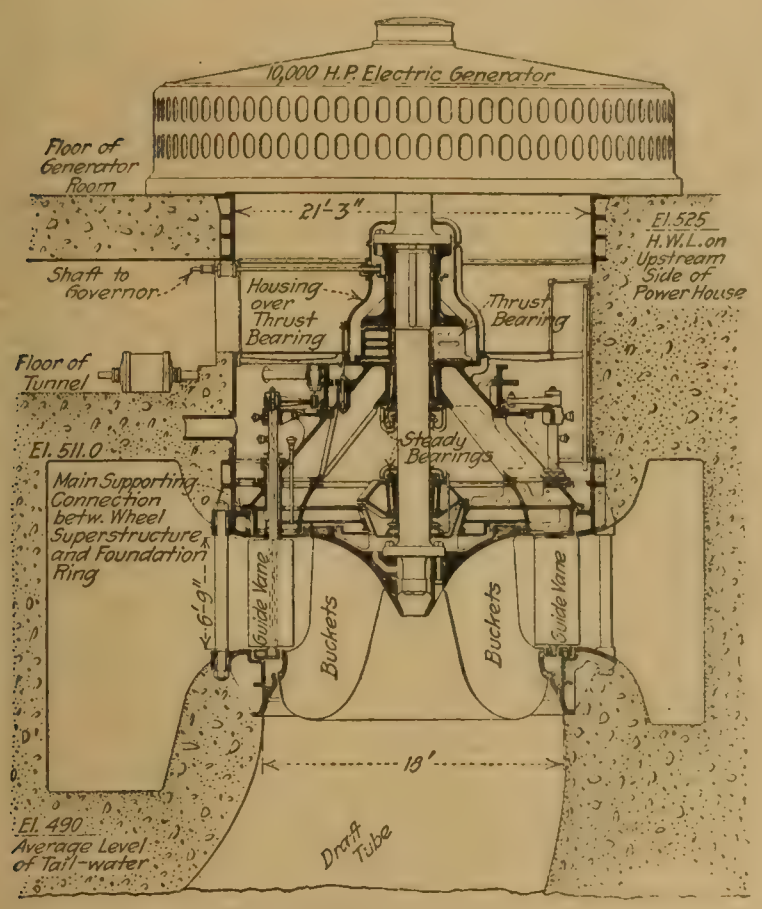
The alternators are each of 7,500 KW. normal output, of the revolving field type, generating 25-cycle three-phase current at 11,000 volts pressure.

Owing to their low speed these machines are 31 ft. in diameter and over 7 ft. high.

The efficiency of these generators is 96·3 per cent. at full load and their regulation is 13 per cent. at 100 per cent. power factor. Each machine is fitted with a brake to facilitate bringing the revolving parts to rest when shutting down.

The method of excitation is somewhat unusual. Two 2,000-K.V.A. alternators driven by water turbines of the same general design as the main turbines will furnish excitation current for the 30 main generators in the completed station. These feed 25-cycle current at 440 volts to three-phase bus-bars running the length of the station. From these bus-bars a 100-KW. motor-generator set is operated for each main generator, supplying it with current at 250 volts.

For emergency, another 440-volt bus has been installed for each group of 15 units, supplied from the main power bus-bars through



Arrangement of Keokuk Hydro-Electric Unit.

two 600-K.V.A. transformers and all of the motor-generators are arranged for connection with this bus. The voltage of each main generator is controlled by a Tirrill regulator connected with the field of the exciter.

Energy is distributed in the locality at 11,000 volts pressure, but for long-distance transmission it is stepped up to 110,000 volts.

High and low-tension bus-bars in duplicate are provided, coupled through selector switches to the various apparatus. One L.T. emergency bus runs the length of the station; the other, for normal use, is in sections coupled through switches and current-limiting reactances, so that each outgoing line will be fed from its own machine and transformer group. Local 11,000-volt bus-bars are also provided.

Except those for the low-tension bus sections, all switches are non-automatic, and arranged so that trouble in one section causes the opening of the two nearest section switches, and through a relay on the voltage regulators, a reduction of the generator voltage.

The emergency and transfer high-tension bus is divided into sections, one for each line. The other is similarly arranged, but equipped with section switches, so that, if desired, the sections may be paralleled.

The low-tension switches are directly above the bus-bars, and are enclosed in concrete cells.

The low-tension circuits are guarded from internal voltage surges by electrolytic static dischargers connected to the various sections. Protection from excessive current is secured by the sectionalisation previously mentioned, which divides the equipment into 10 groups. Connection between these groups is made through current reactances rated at 240 K.V.A. These reactances consist of copper cable wound on three large concrete cores, making a total weight of about 27,000 lb.

The transformers are for three-phase, 25-cycle, 11,000-110,000-volt service and rated at 9,000 K.V.A. On the low-tension side they are connected delta and on the high-tension, star, with the neutral dead grounded. Each transformer is set in a concrete compartment and weighs 231,000 lb., and 10,000 gallons of oil is required.

The connections from the transformers to the high-tension bus-bars and switches, which consist of 1¼-in. standard iron pipes, extend vertically to the top floor where the bus-bars and switches are located. These connection pipes are painted copper colour for psychological reasons.

The high-tension switches are triple-pole solenoid operated and of 400 amp. capacity. They are provided with disconnecting switches on one side only, being attached directly to the high-tension bus-bars on the other.

The high-tension bus-bars are installed individually in separate rooms and run the full length of the building. These bus-bars are of 2-in. standard iron pipe hung from the ceiling by seven-unit suspension insulators. The connections from the bus-bars to the current transformers are of 1½-in. copper pipe. From the transformers the connections pass directly up through the roof bushings, through choke coils to an air-disconnecting switch of the rotary double-break type, mounted 24 ft. between phases and with arms 12 ft. long. Taps to the lightning-arrester horns are made between the choke coils and the disconnecting switches. The horns are connected through roof bushings with electrolytic arrester tanks enclosed in concrete compartments on the top floor of the building.

The oil switches are all operated from a remote control bench board, which will extend round three sides of a room on the top floor; the board will be in charge of a load dispatcher who will be in telephonic communication with the entire system.

Two long-distance lines carried on a single set of towers have been run to St. Louis, 144 miles distant, where 60,000 H.P. has been contracted for. These lines are of 36,000-KW. capacity each. Two 27,000-KW. lines have also been built to Burlington.

The larger lines, those to St. Louis, are of ⅝-in. copper cable; these cables are carried on towers averaging 80 ft. high, spaced on 800-ft. centres, by means of suspension-type insulators, each consisting of seven 10-in. disks.

The Lightning Conductors of St. Paul's Cathedral.

—St. Paul's Cathedral was completed long before the introduction of lightning conductors, and it was not until 1769 that the Dean and Chapter, alarmed by serious damage to other buildings by lightning, applied to the Royal Society for advice as to the best means of safeguarding the Cathedral. Benjamin Franklin, the inventor of the lightning conductor, was, at the time, in London, and the Society invited him to act, in conjunction with Dr. Watson and Messrs. Delaval, Canton & Wilson, in advising as to the best means to adopt. This Committee disagreed as to whether points or balls should be used as terminals, and a controversy was started that lasted some years, but Franklin's recommendation of points was adopted by the Dean and Chapter, and the system for which he was largely responsible was installed.

In this scheme the metals used in the construction of the building were used as part of the system, the breaks in continuity being made up with iron bars. It is probable that, under the conditions then existing, this was sufficiently effective, but in 1872 it was found to be in bad order, owing to rust and derangement, and a system of copper ropes was installed, the mains to earth being carried through the air ducts or shafts arranged by Sir Christopher Wren in the walls for the rain-water pipes, and ending in a large sewer that almost surrounds the Cathedral.

In 1900 the conductors were overhauled, and more copper ropes were carried over the roofs and down the ducts. Recently Mr. Alfred Hands, M.I.E.E., was instructed to examine the system and advise as to the better protection of the building. He found that 21-rope conductors were carried down in the ducts, some terminating in the ground with comparatively small copper plates, others connected to iron tubes driven into the ground, and some "earthed" on to water mains; but three had been cut away and were coiled up inside the Cathedral, and others were found in the dirt in the sewer, now disused and comparatively dry.

The carrying of the conductors through the ducts may originally have been justifiable, but as from time to time gas and water service pipes, hot-water pipes, electric light leads, and other ramifications of metal were also carried into these ducts, close to the conductors and leading to various parts of the Cathedral, the arrangement was regarded as a very undesirable one, and they have all been removed by Messrs. J. W. Gray & Son, of 91, Leadenhall Street, E.C. (in which firm Mr. Hands is a partner), who have now installed 14 new main conductors of copper tape 1 in. × ¼ in., which are carried down to earth on the outer walls, and end underground with copper plates 4 ft. × 3 ft. 6 in., sunk over 12 ft. in wet clay, with connections to hydrant mains. Connections have also been made to various roof metals not previously connected, but the copper rope conductors on the upper part of the building have not as yet been renewed. These are so interconnected that satisfactory tests are impossible, but Messrs. Gray & Son are now regilding the cross and other parts of the Cathedral, and Mr. Hands is taking advantage of the opportunity to inspect the upper part of the conductor system.

In one of the western towers a part of one of the original iron-bar conductors, erected under Franklin's supervision about 140 years ago, was found still in place. It had probably been left because of the difficulty of removing all but the lower portion, and being inside the tower, and not exposed to the weather, was still in a good state of preservation.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,692. "Electromagnet stage drop-curtain." T. B. Boatwright. August 18th.

18,727. "Spark-plugs." M. G. Kopf. (Convention date, November 8th, 1912, United States.) August 18th. (Complete.)

18,728. "Spark-plug socket for oil and gas engines." E. C. Male. August 18th. (Complete.)

18,733. "Electric pocket lamps." B. Lax. August 18th. (Complete.)

18,751. "Setting any apparatus from a distance." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) (Addition to 30,292/10.) August 18th. (Complete.)

18,753. "Sparking-plugs." Soc. Generale des Huiles et Fournitures Industrielles L. Oleo. (Convention date, June 6th, 1913, France.) August 18th. (Complete.)

18,755. "Insulators." A. Orinschnig. (Convention date, May 5th, 1913, Austria.) August 18th. (Complete.)

48,765. "Oscillatory electrodynamic apparatus for submarine signalling and other purposes." R. A. Fessenden. (Convention date, January 29th, 1913, United States.) August 18th. (Complete.)

18,779. "Terminals and high-tension wires of magnetos for internal-combustion engines." W. Douglas (trading as Douglas Bros.). August 19th.

18,818. "Apparatus for industrially producing hydrogen and oxygen from water by electrolysis." Soc. Anon. l'Oxhydrique Francaise. (Convention date, September 21st, 1912, France.) August 19th. (Complete.)

18,819. "Electrically-propelled road vehicles." E. Cross. August 19th. (Complete.)

18,827. "Apparatus for measuring ionisation of gases." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) August 19th. (Complete.)

18,833. "Method of and means for effecting the efficient transmission of electric signalling impulses through insulated cables and wires." A. Williams. August 19th.

18,869. "Electrolytic devices suitable for use as, or in the construction of, meters, switches, and other apparatus." W. B. Thorpe and Thorpe Meter Syndicate, Ltd. August 19th.

18,883. "Field magnets." A. Rolfe. August 20th.

18,900. "Detachable desk for use with a table telephone or other suitable support." J. D. Joyce and H. C. Lumb. August 20th. (Complete.)

18,902. "Antiseptic paper cover for the mouthpiece of telephone-transmitting instruments." H. Smith. August 20th.

18,907. "Dynamo-electric machinery and conductors therefor." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. August 20th.

18,924. "Sparking-plugs with an insulator composed of two parts." Siemens & Halske Akt. Ges. August 20th. (Convention date, October 25th, 1912, Germany.) (Complete.)

18,926. "Incandescent body for electric lamps, stoves, and the like." E. Podszus. (Convention date, August 21st, 1912, Germany.) August 20th. (Complete.)

18,961. "Electro-magnetic relays for use in connection with wireless telegraphy installations and for other purposes." A. B. Williams and W. A. Solomon. August 21st.

18,962. "Spark-gaps for use in connection with wireless telegraphy installations." A. B. Williams and W. A. Solomon. August 21st.

18,975. "Electrical high-tension indicator." J. Stephenson. August 21st. (Complete.)

18,983. "Safety burglar alarm." I. Shenker. August 21st.

18,997. "Portable searchlights." E. C. R. Marks. (Siemens-Schuckert Werke G.m.b.H., Germany.) August 21st. (Complete.)

19,011. "Electric batteries." A. H. Byng. August 21st.

19,017. "Trans-oceanic and long-distance telephone systems." A. J. Gaskell. (E. Gaskell, Canada.) August 21st.

19,022. "Distribution systems for vapour-electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 21st.

19,029. "Preventing excess voltages." F. A. Becker. (Divided application on 12,908, June 1st, 1912.) August 21st. (Complete.)

19,041. "Electric ceiling roses and the like." J. Davies. August 22nd.

19,085. "Boxes for electrical contacts." J. Bonham. August 22nd.

19,104. "Fusible cut-outs." O. L. Peard. August 22nd.

19,109. "Plates for electrical or secondary batteries or accumulators." E. Hancock and D. David. August 22nd.

19,110. "Apparatus for the display of announcements, advertisements, and the like." A. E. Turnham. August 22nd.

19,121. "Telegraphic receivers and relays therefor, and for analogous purposes." Eastern Telegraph Co., Ltd., and A. Fraser. August 22nd.

19,124. "Relinking mechanism for use in printing telegraphs or the like." Western Electric Co., Ltd. (Western Electric Co., United States.) (Divided application on 25,382/12. November 5th.) August 22nd. (Complete.)

19,125. "Telegraphy." F. G. Creed and Creed, Bille & Co., Ltd. August 22nd.

19,141. "Switch-actuating apparatus of electrically-driven machines." A. Prior and Butterworth & Dickinson, Ltd. August 23rd.

19,162. "Compasses for ships or the like." Anschutz & Co. (Addition to 19,224/10.) (Convention date, September 17th, 1912.) August 23rd. (Complete.)

19,182. "Phase-transformation of electric currents." British Electric Transformer Co., Ltd., and R. Crosbie-Hill. August 23rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Gear for Automatically Reversing Electric Motors Employed for Driving Machines and the Like. J. P. Hall. 10,599. May 4th.

Brush Holders of Dynamo-electric Machines and other Electric Machinery. W. White, P. Dawson and R. H. Houghton. 18,145. August 7th.

Electric Switching Devices for High-tension Alternating-current Conductors or Systems. F. Coates and A. Reyrolle & Co. 18,210. August 7th.

Fire-alarm Signal Boxes for Automatic Telephone Systems. A. J. Boult. (Denio General Electric Co.) 18,262. August 8th.

Means for Driving Dynamos Attached to Vehicles. C. E. Pehrsson. 18,482. August 12th.

Apparatus for the Measurement of Electrical Energy. H. Gottschalk and H. Aron Elektricitätszahlerfabrik Ges. 18,809. August 16th.

Production of Magnetic or Electric Fields Applicable for Changing the Frequency of Alternating Currents and for other Purposes. M. Plohl. 18,893. August 17th. (August 18th, 1911. Addition to No. 15,774 of 1912.)

Apparatus for Winding Conducting Wires for Electric Blasting Fuses into Skeins. W. E. Lake. (Fabrik Elektrischer Zunder Ges.) 20,560. September 9th.

Appliance for Holding and Supporting Telephone Receivers and Combined Receivers and Transmitters. A. H. Tullett. 20,671. September 10th. (Convention date not granted.)

Trolley Pulleys of Electric Tramcars and the Like. E. Warren and J. E. Mort. 22,696. October 5th.

Trolley Arms Used in Electric Tramcars, Telphers and the Like. Robert Dempster & Sons, Ltd., and J. W. Broadhead. 24,263. October 24th.

Incandescent Electric Lamps. F. Harrison and F. L. Harrison. 24,571. October 26th.

Engine Starting and Lighting System for Motor Vehicles. J. B. Entz. 25,386. November 5th. (March 11th, 1912.)

Method of, and Apparatus for, Annealing Magnetic Material. British Thomson-Houston Co. (General Electric Co.) 25,902. November 11th.

Electrical Switches. W. A. Knapton. 27,854. December 3rd.

Speed-governors for Internal-combustion and other Engines Driving Motor Vehicles. P. M. Justice. (North-East Electric Co.) 28,479. December 10th.

1913.

Method of Rotating a Magnetic Armature Step by Step. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 1,277. January 16th.

Electric Resonance-operated Apparatus. H. W. Hancock, A. H. Dykes and W. Duddell. 1,395. January 17th.

Supports for Electric Hand-irons during Heating. H. Sameli. 1,562. January 20th.

Electrolytic Iron.—In a recent issue of the *E.T.Z.*, M. Breslauer reports the result of his investigations concerning the advantages of electrolytic iron in the manufacture of induction and D.C. motors and transformers. The Leipzig firm of Langbein and Pfannhauser now market blocks and thin sheets of iron prepared electrolytically by Fisher's process, and this material has excellent magnetic properties—particularly in respect of permeability. Hysteresis losses are extremely low and may be taken as $0{\cdot}98 \times 10^{-8} \cdot B^2$ watts per kg. at 50 cycles per sec. Owing to its high electrical conductivity, eddy-current losses are high in electrolytic iron, but, on the other hand, the latter can be obtained in very thin and flat plates giving a smooth and not oxidised surface. The coefficient of solidity of a core made up of 0·25 mm. plates of electrolytic iron is 85 per cent. If plates of this thickness are used at 70° C. in a dynamo (50 cycles and 10,000 gauss), the total iron losses are 1·66 watts per kg. as compared with 2·8 watts per kg., using ordinary 0·5 mm. plates under the same conditions. Using 0·25-mm. electrolytic plates in transformers, the iron losses may be reduced to 1·23 watts per kg. as compared with 1·45 watts using 0·4-mm. alloy plates.

The following table, showing the ampere-turns per cm. required to produce various inductions in the irons stated, demonstrates the great advantage of electrolytic iron in respect of permeability :—

Gauss.	Electrolytic iron.	Ordinary iron.	Special iron.
7,000	0·4	2-4	2
10.000	0·7	5-6	5·5
15,000	4·0	24-32	52·5
18,000	72	146-180	260

As regards price, electrolytic iron costs 5·4d. per lb. and special transformer iron 3·5d. per lb.

In the case of an induction motor (230 mm. overall diameter × 100 mm.) and a 30-kw., 50-cycle transformer (copper losses = 87 per cent. iron losses; cooling, 7 w. per dm.^{2}), electrolytic iron offers the advantages indicated by the following data :—

	Induction motor.		Transformer.	
	Electrolytic iron.	Ordinary plates.	Electrolytic iron.	Special plates.
Induction (gauss) ...	—	—	13,000	9,000
Power (kw.)	3·5	2·5	—	—
Weight of iron (kg.) ...	20	21	154	243
Weight of copper (kg.)	8	7·2	51·5	82
Efficiency (per cent.) ...	83	78·5	—	—
Ratio of no-load to full-load current	0·45	0·48	—	—
Cost (shillings)... ...	—	—	408	518

In transformers with artificial cooling, full advantage can be taken of the high permeability of electrolytic iron, and the losses on overload of a transformer in which these plates are used decrease owing to the high temperature coefficient of the electrolytic iron.

Not much advantage can be gained in D.C. armatures by the use of electrolytic iron, since the teeth ordinarily work at 22,000 gauss, and this limit must not be exceeded in pure electrolytic iron, but considerable saving may be effected in the field system. The poles are in any case well saturated, but, using electrolytic iron, the yokes may be worked at 17,000 instead of 13,000 gauss, using the same number of ampere-turns. In the case of a 300-kw. 375-r.p.m. machine, the weight of the field system is reduced 22·5 per cent. by using electrolytic iron in place of cast-steel. The new material will certainly play an important part in the design of commutating poles, the poor conductance of which is at present responsible for the magnetic dispersion which occurs on overload.

THE

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CONTINUITY.

RARELY have we been privileged to read so remarkable and interesting an address as that which was delivered before the British Association by the President, Sir Oliver Lodge, on Wednesday. Traversing the whole field of physical science, and analysing with masterly skill the tendencies ruling in each department, the author presents to the reader a picture, or rather a panorama, of the scene as it appears to himself. We advance so rapidly nowadays, in so many different directions, that it is difficult for the ordinary man even to keep in touch with all the developments which are taking place, and impossible for him to be familiar with them all; we are, therefore, grateful to Sir Oliver for the glimpse which he gives us of the fundamental characteristics of modern scientific thought and labour, for indicating the directions in which they are moving and working, and defining in the clearest language, comprehensible to the plain man, the great questions which are now absorbing the attention of the leaders of the world of science.

So wide a range is covered by the address, and so broad is the author's view, that we cannot attempt to provide our readers with a report of its contents which would do anything like justice to its merits in the space at our command. We shall merely indicate, therefore, the main lines of the address.

The characteristic of the period, says Sir Oliver, is "Rapid progress, combined with fundamental scepticism." Looking back to the latter part of last century, he reminds us that it was then believed that there was little scope for any further great discoveries in physics, and that all that remained to be done was to polish away the imperfections of the science. But there came a succession of startling developments—"the realisation of predicted ether waves in 1888, the discovery of X-rays in 1895, spontaneous radio-activity in 1896, and the isolation of the electron in 1898"—all, be it noted, in the electrical field—and the pace has never slackened since then.

So much for the question of progress. The scepticism to which the author refers is not the old-fashioned theological type, but a philosophic scepticism, the presence of which is manifest at the root of controversies dominating all departments of scientific thought, and which results in a mistrust of purely intellectual processes and a recognition of the limited scope of science.

"Philosophers have begun to question some of the larger generalisations of science, and to ask whether in the effort to be universal and comprehensive we have not extended our laboratory inductions too far." Ancient postulates are being pulled up by the roots; the universal truth of even the sacred Law of Conservation of Energy is called in question, the permanent validity of the Newtonian laws of motion is audaciously doubted!

Sir Oliver, however, stands fast by Newton: his laws need not be discarded—but they must be supplemented in the light of further knowledge. The scientific scepticism is the fruit of the more exact knowledge which is now available—the simple laws of mechanics and physics "are still true as far as they go, their inaccuracy being only detected by further real discovery . . . the law is not really disobeyed, but is modified through the action of a known additional cause."

This brings the author to the subject of his address; for he regards the present phase of physical controversy as a fight between Continuity and Discontinuity, the outcome of which is in doubt. "On the surface of nature at first we see discontinuity; objects detached and countable. Then we realise the air and other media, and so emphasise

continuity and flowing quantities. Then we detect atoms and numerical properties, and discontinuity once more makes its appearance. Then we invent the ether and are impressed with continuity again. But this is not likely to be the end; and what the ultimate end will be, or whether there is an ultimate end, is a question difficult to answer."

"Electricity itself—*i.e.*, electric charge—strangely enough has proved itself to be atomic. There is a natural unit of electric charge, as suspected by Faraday and Maxwell. . . . . Even magnetism has been suspected of being atomic."

The author declares himself an upholder of *ultimate* Continuity, and a fervent believer in the ether of space, the universal connecting medium which binds the universe together, the vehicle of transmission of all manner of force, from gravitation down to cohesion and chemical affinity. Its density "must be far greater than that of any form of matter, millions of times denser than lead or platinum. Yet matter moves through it with perfect freedom, without any friction or viscosity. There is nothing paradoxical in this: viscosity is not a function of density; the two are not necessarily connected. . . . Certain it is that the ether exhibits no trace of viscosity." Even energy has been supposed atomic; Prof. Planck's theory of the *quantum*, or indivisible atom of energy, has excited great interest, and in many respects shows remarkable agreement with the observed facts. If the Principle of Relativity is established, it seems that even *time* will become discontinuous, and the ether must go! But the author advocates a conservative attitude in these matters, and urges moderation in the uprooting of ancient landmarks, especially that of Continuity.

It is exceedingly difficult to make experiments on the ether; motion of matter with respect to the ether has never been observed, the great obstacle being that in every case the ether itself is the vehicle of comparison, so that the effects cancel out. The modern electrical theory of matter —the great new theory of the 20th century—indicates that every material interaction is electrical, *i.e.*, etherial, whence arises the difficulty. There is, however, one hope; the velocity of light in space is independent of that of the source, and by this means it may yet be possible to observe relative motion between matter and ether.

Science, says the author, is incompetent to make comprehensive denials, even about the ether, and goes wrong when it makes the attempt. Each class of scientific worker deals only with a compartment of science—chemists ignore the ether, physicists take no notice of live things, biologists exclude mind and design from their studies. "Hence it is that Science has no authority in denials. To deny effectively needs much more comprehensive knowledge than to assert." A living thing obeys the laws of physics, like everything else—but life introduces something incalculable and purposeful amid the laws of physics, and thus supplements those laws. But although Life and Mind may be excluded from Physiology, they are not excluded from Science, any more than is the ether, though the latter also makes no appeal to the senses. The extreme school of biologists hold that there is nothing but Chemistry and Physics at work anywhere; but they could not account for the existence of such a thing as Beauty by these means—there must be something more. Our studies do not exhaust the universe. To deny the existence of any other region than that of the material world because we are incapable of appreciating it, is to stray from our legitimate province. Evolution is not an illusion; neither is the course of events preordained and inexorable. "Science may not be able to reveal human destiny, but it certainly should not obscure it." With these words Sir Oliver claims for the scientific study of Psychology a fair field; he believes that the Psychic region is amenable to law like other things, and he boldly states that the facts already examined have convinced him "that memory and affection are not limited to that association with matter by which alone they can manifest themselves here and now, and that personality persists beyond bodily death." Moreover, the methods of science are not the only means of arriving at truth. "Genuine religion has its roots deep down in the heart of humanity, and in the reality of things"; as in the case of the ether, "the actions of the Deity make no appeal to any special sense . . . we are deaf and blind, therefore, to the immanent Grandeur around us, unless we have insight enough to appreciate the Whole, and to recognise in the woven fabric of existence, flowing steadily from the loom in an infinite progress towards perfection, the ever-growing garment of a transcendent God."

Rubber.

While there has at times been a somewhat better tendency in the market for rubber, it would probably be premature to assume that prices have yet reached the very bottom of the slope down which they have been slipping for so long. The production from the plantations in the Middle East proceeds apace, and the prospects point to a continued and rather important increase of output from there during the next few years, when what at present are immature trees get into the productive stage. Meantime, however, undue pessimism should not be entertained on the score of the Mid-Eastern potentialities, because rubber has sunk to a price at which the pursuit of the wild industry has, in very many cases, become unprofitable, added to which there is already a serious reduction in the supplies of certain of the wild rubbers, such, for instance, as guayule. Not only has the destruction of the plant by collectors in this case been a factor making for decreased production, but there has been the revolution in Mexico to reckon with, and this has been no slight hindrance to industrial operations generally in that much-disturbed land.

With occasional fluctuations, the broad course of prices of rubber has been downwards. At the auctions occasional spasms of firmness have been seen, but over a period prices are lower. The hard Para market continues to be more or less controlled, and this is, of course, an unhealthy feature, for an artificial element has been introduced, which at any time may result in undue depreciation following unwarranted inflation. There is certainly no sane reason, on the merits of the two grades, why plantation rubber should stand at a big discount compared with hard Para. The former is admittedly the better value, but there are still manufacturers who prefer, probably from old association's sake, to use the latter, even at a small premium. It is generally admitted, however, that the relative prices of the two are out of harmony. There is another point too. Fine hard Para is put on the market and reaches consumers in a very rough condition, while the plantation manager of the Middle East turns out his material in a variety of prepared forms, the processes involved in which necessitate the expenditure of much time (which means money), and it is quite a question whether this elaborate process of working up the raw rubber, which is adopted on the plantations, is worth while, from the point of view either of the plantation owner or of the consumer. On the face of it there appears to be no valid reason why, in the one case, the roughest methods of preparation should suffice, while, in the other, the most elaborate treatment should be given.

It is not as if there were any difference between the latex from plantation Para trees and that from wild trees of the same species, for there is not. It has been suggested that the plantation manager would be doing better for his employers if he abandoned all the present elaborate preparation of rubber into sheets, biscuits, and so on, and instead graded only into rubber from trees of less than eight years' growth and rubber from trees of eight years and over. The young trees yield poor latex, and the admixture of the latex from all the trees on an estate regardless of age, which is the custom, produces certain irregularities of quality. When all the supplies coming from various plantations are considered, this leads necessarily to uncertainty as to the actual quality of parcels offered. A change in this respect, tending to greater uniformity, would do a good deal to improve the reputation of plantation rubber in the eyes of consumers at large.

The offerings at this week's auctions were on a more limited scale, considerable sales having been recently effected privately, which thus reduced the total available. Prices showed an initial reduction of from ½d. to 1d. a lb. where crêpes were concerned, whereas the demand for smoked sheets was sufficiently good to cause values to be maintained at the level last established.

LEST WE FORGET!

The Aisgill Disaster, and Others.

Lest we forget! Oh! that we could forget Aisgill! Oh! that we might for once shirk our duty and refrain from again perusing the ghastly details of one of the most heart-rending and pitiful of the avoidable catastrophes which have blackened the pages of British railway history. That we might wake up to find it to have been a distressing nightmare! That we might close the book and say: "What a very sensational piece of holiday fiction"! But it cannot be. We have only to turn to our daily papers of a few days ago to find such passages as these:—

Helen Slanders Patterson said her husband was a passenger on the train. She identified a gold watch and other articles produced, but could not identify the remains.

Mary Buchanan Fargie identified certain articles as belonging to her sister, but could not identify the remains.

Alexander Trail identified a brooch with a photo inside as that of his daughter Rebecca. He identified the remains in pile "No. 4" by a piece of chain belonging to a pendant worn by his daughter, clinging to the back of the neck.

As Mrs. Patterson and the witnesses who followed gave evidence, an official produced a little brown paper and laid the contents on the Coroner's table—little scraps of metal that had been through the fire, all that remained recognisable of those who had met their death in the blazing wreck. More than anything else these pathetic relics brought home to one the horrors of that funeral pyre that shamed the tardy dawn on the lonely moor, and one could picture the scene as never before.

The horror of it! Suppose it had been our daughter, son, wife, or parent that was represented by that charred heap "No. 4"!

Our deepest sympathy goes out towards those bereaved relatives who have lost kith and kin in such harrowing circumstances. To lose a friend or a relative is ever a sad experience, but to gaze upon a mangled and charred pile and say: "Alas! that must have been my daughter, I recognise her locket"; or, "Poor boy, that watch, which is all I can recognise, was my last birthday present to you," is an experience the haunting memory of which time can never blot out. So far as is known the death roll of the disaster is 16, two persons having since the accident succumbed to injuries received. The following is the list of the first 14 victims handed in by the doctors at the inquest, and represents the "piles" of which "No. 4" has been already referred to:—

1. Adult female.
2. Uncertain as to sex; probably female.
3. Adult female.
4. Adult female.
5. Probably male child.
6. Child; sex uncertain.
7. Adult male; pieces of gold found in back.
8. Adult female.
9. Portion of child; probably female.
10. Adult female; large woman.
11. Female child; probably portion of No. 9.
12. Adult male.
13. Remains of young person; sex uncertain.
14. Young female.

Each of those unrecognisable piles represented what a few hours before was a human being. Sombebody's son—somebody's daughter! Would that we *could* forget.

But what of the cause, and was it preventible? These are serious questions to which the British public demand, and will continue to demand, an answer. It is not for us to anticipate the findings either of the Board of Trade Inspector or of the Coroner's jury, but distasteful and unthankful as the task may be, we feel it to be our duty to fix the attention of our readers, and through them of the general public, upon the state of things immediately following the collision, and to remind them once again of similar circumstances in connection with previous railway accidents. Let us turn, then, to the records of the daily Press, which, in commenting on this appalling tragedy, have exhibited an extraordinary unanimity.

Giving his experiences, one passenger said:—

Six men were pulling at a man who was fixed by his middle in the wreckage which was blazing around him.

After five or ten minutes' struggle he was released, his legs being badly burned, his hair burned, and his arms and hands crushed.

I was one of those who were pulling him out, and I heard him say, "Pull, my God! pull." He kept on saying that all the time, and as the wood burned away around him we got him free.

No sooner had this man—who, I believe, has since died—been dragged out than a pair of hands shot out of the side of the carriage amid the flames.

A man standing by rushed to get hold of them, but found that, owing to the heat and the man being pinned down so heavily, it was impossible to get him out.

We could see nothing of his head or body, but only those two hands waving frantically in the flames, and when his rescue was found to be impossible every man turned away in silence. We were all crying.

The flames were lighting up the whole of the landscape round, and there was a crackling and roaring which was awful to hear when we knew that there were people inside the blazing wreck.

From another paper we cull the following, being part of an interview with a passenger who assisted in the work of rescue: "The burning coaches made the work of rescue exceedingly difficult, for they sent out tremendous heat, and rendered it impossible at times for anyone to approach near enough to reach the passengers who were buried." The same passenger said: "The glare of the blazing woodwork of the wrecked carriages lit up the hillside on each hand"; and, referring to a poor woman with swollen eyes who was nursing a baby whose face was badly scarred, he added: "From what I learned it would appear that the other three children whom the woman had in her charge must have been burned to death before the rescuers could get to them." We do not wish unnecessarily to harrow our readers' feelings, but we do want to impress upon them the terrible nature of the scene which followed the collision, for, as a writer in the *Pall Mall Gazette* has truly pointed out, "there is only too much reason to fear that when a week or two have passed, the subject will have passed likewise, and the problem of railway safety will have been abandoned to those whom it professionally concerns."

There is, of course, the possibility that a passenger suffering from the severe shock which such an experience must naturally produce may unintentionally exaggerate the awfulness of the scene; but, against this view, we have the descriptions of eye-witnesses who were not passengers. Thus, a man who lives within 100 yards of the spot where the collision took place was aroused by the noise of the impact, and, on going out, "could discern the flames shooting high above the cutting. Flames were coming from the last three coaches, and it was evident that if anybody was to be saved a miracle would have to happen. There could be no help, for the flames were everywhere roaring like a furnace. The flames scorched all who were near the lines. I saw a couple of bodies removed from somewhere . . . the victims were charred beyond recognition, and the smell of burnt flesh was horrible. . . . It was a terrible sight, and if I live to be 100 I shall never forget it." Although numerous other extracts to a like effect might be given from the descriptions in the daily Press, sufficient has, perhaps, been said to convey an idea of the appalling character of the scene, and again we must put the question: "Is it an essential sequel to a collision between two trains that the coaches should take fire and add to the effects of the collision the unspeakable horrors of burning alive?"

Our readers know what is in our mind. They know that our opinion, which we have not hesitated to express on many an occasion in the past, is that the lighting of trains by compressed oil gas is not only unnecessary, but, in the light of past experience, should not be permitted.

There are some, a small minority, including the officials of the Midland Railway Co., who contend that it was not gas which set fire to the coaches. An official message issued by the general manager of the Midland Railway contained the following passages:—

The fire was confined to the three last coaches of the first train, and was started by the fire scattered from the engine of the second train in collision.

The doctors who made a post-mortem examination have given us authority to say that in their opinion there is no doubt that those passengers who lost their lives were instantly killed by the collision.

We fail entirely to reconcile the latter portion of this statement with the list of 14 victims handed in by the doctors at the inquest. As already indicated above, the remains of these 14 victims consisted of almost unrecognisable heaps of charred material, so charred that in five cases out of 14 the sex was uncertain, and in practically all cases the identity

was only established by means of metal trinkets which had belonged to the victims. In the face of such gruesome facts, how can we be expected to believe that death was in every case instantaneous and due to the collision only? We have only to refer to the remarks of the Coroner at the inquest on Sir Arthur Douglas: "He was only rescued in the teeth of the flames after the protracted efforts of a band of rescuers." . . . . "The very serious injuries he received, probably from the fire mainly, had resulted in his death." And what of the accounts of eye-witnesses quoted above? The first statement, viz., that the fire was started by the fire scattered from the second engine, is equally incredible, and the evidence given by the driver of that engine (see our "Notes" pages) negatives the suggestion.

Even supposing that ashes or cinders were scattered, a possibility which we do not admit, any one who has ever tried to light a *properly-laid* fire by means of cinders knows that it is by no means an easy task. But what is the evidence on this point?

An eye-witness, who displayed great heroism in the rescue work, told a *Daily Chronicle* representative at Leeds that the fire came from the gas tube underneath the telescoped carriages.

> "When I jumped from the carriage just as the shock occurred," he said, "it was blowing like a blast furnace. It was this that undoubtedly caused the fire. It was partially stopped by the firemen, who tapped the pipe with the hammer; but the flame rushed under the carriage, which was thus set on fire, and that impeded the work."

At the inquiry, the following, among other evidence, was given - evidence which directly contradicts the official statement. After stating that fire had started within five minutes of the collision, Driver Nicholson was asked by the Inspector the following direct question: "Was any portion of the fire under the foot-plate of the engine?"

The reply was emphatic. "No, Sir, I am quite certain it was in front of the buffers of the engine." He added that "at the time there was a fire *in the roof* of the carriage."

The fireman (James Metcalfe), who was actually alongside the train near the point of collision when the accident occurred, described the occurrence as follows:—

In reply to a question: "What happened? Did you see a tremendous flash?" he replied:—

> No, I did not. The engine appeared to hit the brake van, and this seemed to rise about 3 or 4 ft. There was a flickering of light, as if it was caused by the engine bogie coming off the rails and running along the stones of the ballast.
>
> There was no big flash?—No, sir.
>
> Did you see fire thrown out from the engine firebox?—No, the sparks or light I saw were not caused by ashes.

Then we have the evidence of Arthur Fisher, the sleeping-car attendant:—

> The fire he noticed was a few yards in front of the buffer beam of the engine, and seemed to be on a higher level than the floor. He believed the seat of this fire was in the midst of a large quantity of broken baggage and boxes.

The evidence of Donnelly, the guard of the ill-fated train, was corroborative:—

> As soon as the collision occurred witness saw one monster flash as if all the gas in the cylinders under the train had become ignited. The flash was succeeded by darkness. The flash lasted only an instant. He added that the flames were high up.

The rear guard's evidence was also to the effect that the fire was burning up *in the roof* of the train.

No doubt the evidence of those passengers who have given their accounts to the Press will be taken later, but sufficient has already been published to establish beyond cavil the origin of the fire.

But, *lest we forget*, let us turn to the records of previous disasters. One need not search outside the files of the Electrical Review for evidence enough to convict any railway company of utter disregard to the safety of their passengers in persisting in the use of compressed gas lighting. From our issue of March 9th, 1906, we extract the following: "The report of Lieut.-Col. von Donop on the accident in Catesby Tunnel, on the Great Central Railway, makes interesting reading for electrical men. Three of the coaches were lighted with gas; when the train was derailed, the gas went out in every instance, and began to escape freely. Had any one struck a match and caused an explosion, what a horrible disaster would have ensued! Of the two electrically lighted coaches, one was put in darkness, but the other remained lighted, and its light was invaluable in facilitating the work of rescue. But alight or not, there was no danger from electricity. Needless to say, the Inspector strongly urges the use of electricity in preference to gas for lighting trains."

Here, then, we have a recommendation by a Board of Trade Inspector over seven years ago. Has it been acted upon? Nor was this the first occasion on which this Inspector had called attention to the dangers of gas lighting. In December, 1905, reporting on the accident at Witham, G.E.R., in which 10 persons were killed and 40 injured, Lieut.-Col. von Donop said:—"The gas in the cylinder of a first-class carriage . . . . appears to have been ignited. The occurrence points to the desirability of adopting some other form of illumination, probably electricity." Again, in reporting on the Grantham disaster on the G.N.R. in September, 1906, this Inspector reiterated his remarks as to "the unsuitability of gas as an illuminant for railway vehicles."

In our issue of December 30th, 1910, we referred to the collision which occurred on Christmas Eve at Hawes Junction, not far from the scene of the Aisgill disaster. On this occasion Major Pringle wrote in his report:—

> It cannot be denied that compressed oil gas, stored in the cylinders under the two first coaches, was the origin of the fire. Nor can it be denied that there is greater liability to fire in a railway accident of this description when gas is used as the illuminant than with electric light. With every possible precaution it will remain true that electric lighting will still be the safer method. On grounds of safety, therefore, I still hold electricity is the more desirable means of illumination for passenger trains, and, as such, should be adopted wherever possible. In the case of long-distance and express trains it is more particularly to be recommended.

We and the general public want to know what steps have since been taken by the railway company to comply with this very definite recommendation, and what steps, if any, have been taken by the B. of T. to enforce it?

In practically all the recent inquiries into railway accidents the same recommendations have been made. On March 15th, 1912, we gave an extract from Major Pringle's report on the collision which occurred on January 29th, near Saltley, on the Midland Railway. In his report the inspector said: "the escaping gas ignited in some way, difficult to ascertain, and set fire to the floor of the vehicle. . . . . The circumstances clearly point to the desirability of either abandoning the use of gas for lighting purposes, or of making such structural alterations and additions which will lessen the liability of fire arising therefrom."

Our own comment at the time was as follows:—"In our opinion, to strengthen the gas cylinders is mere temporising, the only sure remedy is to root them out, and adopt electric lighting," an opinion which we hold more strongly than ever.

In our issue of September 6th, 1912, we reported two accidents arising from gas-lighted carriages. One was at the Manchester Exchange station, where the gas reservoirs of a train were being charged. The escaping gas became ignited by a lamp carried by an employé, and the explosion which followed injured seven men. The second accident referred to in the same issue occurred in Toronto, and was caused in almost precisely the same way, namely, by the torch of a gas tester setting fire to the gas tank under the car. In our comments on the Manchester accident we said: "So many accidents of one kind or another have been reported in connection with gas-lighted trains, and the safe alternative of electric lighting is so readily to hand, that one begins to suspect Government and railway departments of being alike indifferent as regards the safety of both passengers and employés." So far as the Government is concerned, nothing has since been done to cause us in any way to modify our opinion, but we know that several railway companies are gradually extending the electric system of lighting their carriages without Government compulsion.

Coming to still more recent examples of the gas danger, the accident which occurred at Ditton Junction on the L. and N.W. Railway in September of last year was the subject of our leading article on September 27th, before the official report had taken place. On this occasion we wrote: "The shocking accident which took place at Ditton Junction last week, when a number of unfortunate passengers . . were not merely killed but tortured to death by fire, once more draws attention to the frightful dangers entailed by

the use of gas for lighting and cooking on railway trains. It is not as if there were no alternative; the remedy lies to hand. Electricity is perfectly capable of performing all the functions now fulfilled by gas, with the exception that it cannot be accused of roasting the passengers, and the preference still exhibited by some of the railway companies for the older system is attributable only to a tender regard for the pockets of the shareholders, arising from the belief that a slight economy can be effected by its use." We further commented on the attitude of our contemporary, the *Gas World*, which abused the daily papers because they then, as now, pointed out the wickedness of persisting in using so dangerous a system of lighting; our comment, "to argue that the gas was not to blame, is to fly in the face of reason," was amply vindicated in Sir H. A. Yorke's report, which contains the following significant passage :—

So far as safety is concerned, there can hardly exist in anyone's mind a doubt that electricity is the better, and I think the railway companies would be wise to recognise this fact and adopt electricity as the standard illuminant on all their main-line trains before they are compelled to do so by the pressure of public opinion.

We have referred in detail to the foregoing events, *lest we forget* the repeated warnings which have been given, and we would once again quote from our own pages. In referring on September 27th, 1912, to the Ditton Junction accident, we said :—

"For many years the inspectors of the Board of Trade have consistently urged the desirability of substituting electricity for gas, and have on various occasions definitely attributed fires to the use of gas. But nothing further is done, and the railway companies ignore the recommendations which are not backed up with compulsion. The public sleepily looks on, and the lay Press roundly abuses the companies for three days—then all is quiet until the next horrible disaster."

There are several other points arising out of the disaster under consideration, and we shall refer to these on a future occasion; for the present we want to rivet attention on the question of lighting, and to ask once again—what are the railway companies going to do about it? What is to be the Board of Trade's attitude? Hitherto, as the *Daily Sketch* aptly points out, it has pursued a policy of masterly inactivity, it has pigeon-holed its inspectors' reports, sat tight and done nothing.

If the Home Office has power under an order of the Home Secretary to make and enforce regulations for the safety of workmen in factories, surely the Board of Trade possesses similar powers of making and enforcing regulations for the safety of the travelling public. If not, then the public must not rest until such powers are obtained.

TRAMWAY CURVES.—II.

By A. J. BOUSFIELD, A.M.I.Mech.E.

If a tramway curve has been laid out as a simple arc of a circle, then its life is usually determined by the wear on a certain short part and not by general wear throughout its length. This localised wear will usually occur near the entrance to the curve, its exact position depending on the correctness or otherwise of the superelevation and the gauge.

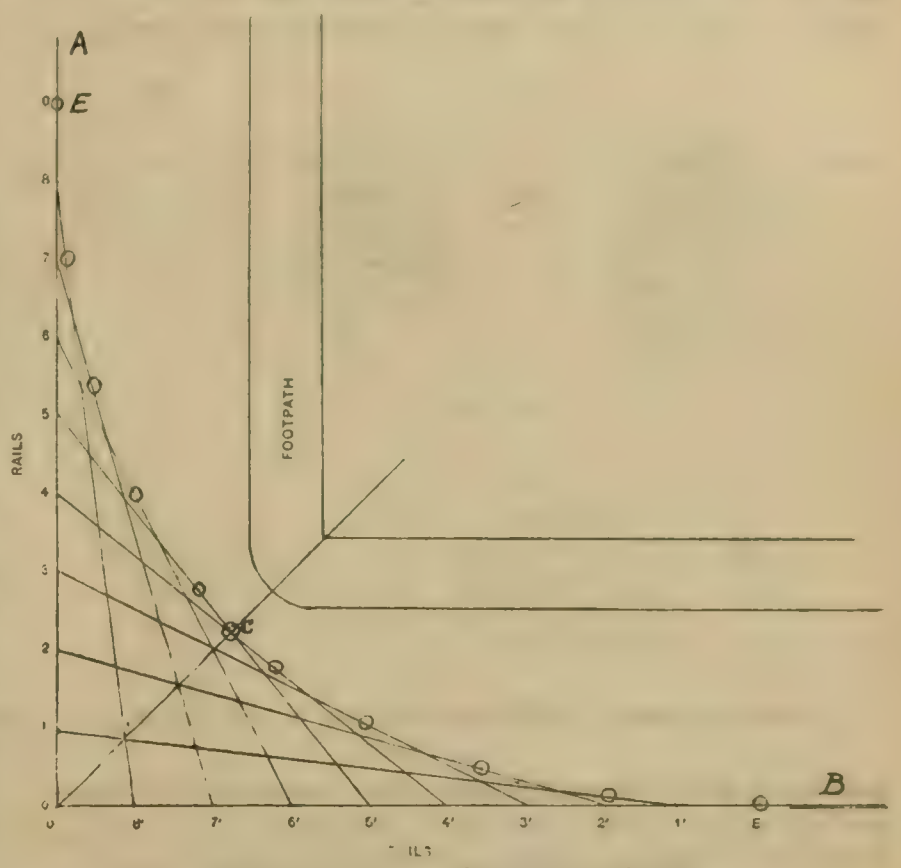
The remedy for this, alluded to in a previous article (Elec. Rev., May 2nd, 1913), is to lay the track as a parabolic curve, the curvature gradually increasing to a maximum about the centre of the curve and then gradually decreasing.

The parabolic curve has this advantage, that the radius of curvature increases as the speed of the car (as controlled by the average motorman) decreases, and decreases as the speed increases. A second great advantage is that the overhang clearances may be made less than is the case with circular curves, where the clearance all round the curve is controlled by that necessary at the ends of the curve where the cars swing most.

Where a true parabolic curve would not be admissible owing to local conditions, a curve may be improved by making it a compound circular curve having two or more radii, the rail being shaped up by the crow to the eye to make a smooth run.

To make a true parabolic curve, the method of procedure is as follows :—

1. By means of tape measurements or scaling off an ordinance map, transfer in chalk the contour of the street corner on to the rail crowing floor (which should be of ample size and finished up level and smooth with cement and painted with tar). This plan may be to scale, but should preferably be full size. Taking first the inner rail, mark in chalk



Setting out a Parabolic Curve.

the line of the straight rail at entry and exit of curve and extend these lines A O and B O until they meet at the point O.

2. Mark with a circle this point of intersection, and drive in a pointed iron pin.

3. Draw a line bisecting the angle A O B, and mark a point C on this line as near the curb as the rails will be allowed.

4. Divide up the line O A into (say) eight parts, marking them 1, 2, 3, 4, 5, 6, 7, 8.

5. Connect two pointed iron pins with a length of good light cord, so that, when stretched, they are a distance apart about equal to O A or O B.

6. Place one of the pins on O A, pass the line round O, and place the other on O B, stretching the line tight, and so that the pins are equi-distant from O; stretch a line tightly between the two pins and note if this second line passes through the point C; if not, adjust the length of the first line so that it does, taking care that the pins are equi-distant from O.

7. Place the pins on point marked 1, pass the line round O, and place the other pin on O B, stretching the line tight; stretch a chalk line between the two pins and mark by plucking.

8. Repeat, using point 2, and so on up to 8.

9. The centre of each of the sides of the portion of irregular polygon formed by the exterior of this construction is a point on the curve required. Place one pin at O and stretch the other to its full length along O A and O B; the two points so marked are the points of exit and entry of the curve. Draw out the curve through these points and paint in with white paint.

10. Mark off on this curve lengths equal to the length of rail to be used. Draw chords and a master chord from A to B for checking purposes.

11. Set up off-sets from these chords, increasing the number of off-sets where the curvature increases.

12. The platelayers can now crow up the rails to these off-sets and make a complete single rail which, when fishplated and bolted up, will be the inside rail of the curve.

13. The one (or three) remaining rails can now be crowed to gauge with this rail as a template, an equal overhang clearance being allowed all round if the track is double.

VICKERS PATENT S.B. SYSTEM OF TRAIN LIGHTING.

One of the most interesting features of the exhibit of Messrs. Vickers, Ltd., at the Ghent Exhibition is their improved system of train lighting by electricity. The firm for many years have made equipments for this purpose on the double-battery system, one battery being charged while the other is being discharged, but the "S.B." system employs only a single battery, and enables considerable economies to be effected in first cost, consumption of energy, and maintenance of the plant. Simplicity is a leading feature of the system, which is also completely automatic.

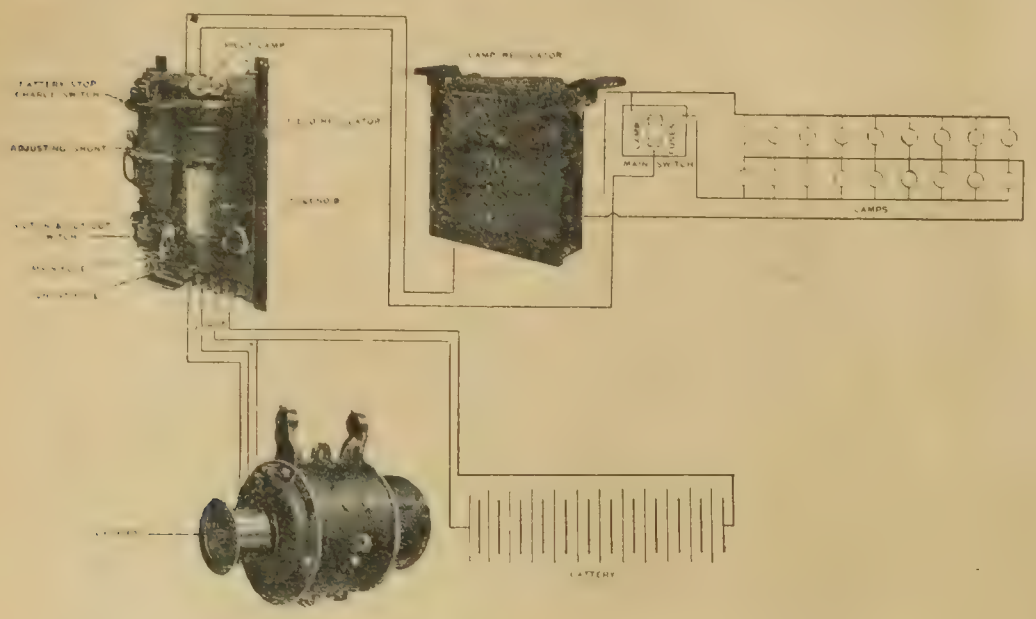


Fig. 1.—Arrangement of Vickers S.B. Train-Lighting System.

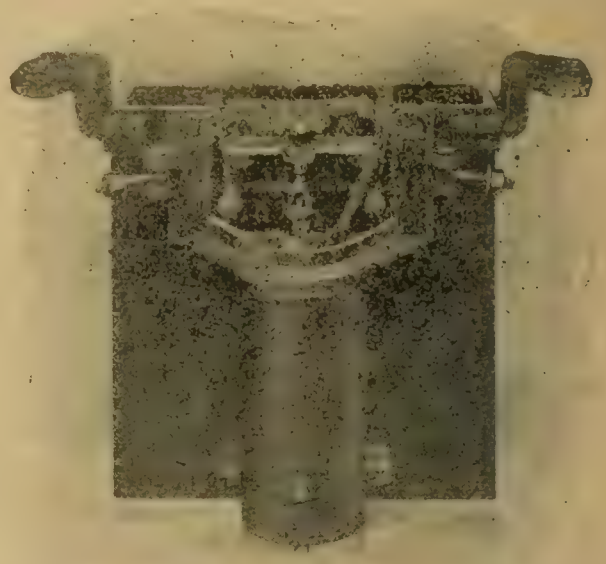


Fig. 3.—Lamp Voltage Regulator.

The general arrangement of the system is shown in the diagram of connections, fig. 1. The principal apparatus are the dynamo, the battery, and two regulators—one controlling the output of the dynamo and the other the voltage applied to the lamps, &c.

The dynamo, shown in fig. 2, is of the simplest form possible, being a plain enclosed shunt-wound machine, without any automatic devices except a movable brush carrier, which is mounted on ball bearings so that the friction of the brushes on the commutator suffices to rock the brushes over against stops in the direction in which the armature is running, thus maintaining the terminal polarity constant, no matter which way the train is running. The dynamo is slung under the carriage underframe or the bogie truck in the usual way, and is driven from one of the axles by a belt, the tension of the latter being maintained partly by the weight of the dynamo and partly by springs. The armature shaft runs in ball bearings, and the whole machine being dust-tight and waterproof, needs practically no attention.

The automatic regulator-controller, which is illustrated in fig. 4, is, so to speak, the brains of the system. Its several parts are indicated on the figure, and the diagram, fig. 5, shows the connections of the whole system. Starting from the dynamo + terminal, the current flows through the main fuse, and the series winding of the automatic switch to the lamps and battery respectively. In the battery circuit is interposed a solenoid, shunted by a diverter resistance (B E), which can be adjusted by varying the position of the contact B. A small branch from the dynamo + terminal, protected by a fuse, supplies three fine-wire windings: one on the automatic switch, which connects the dynamo to the battery when the voltage of the former is sufficiently high; one on a small automatic switch, the "battery stop-charge switch"; and the third on the main regulating solenoid, controlled by the stop-charge switch. The action of the main automatic switch, it will be noted, depends entirely upon the voltage of the dynamo, so that the latter cannot be connected to the battery unless it is excited and ready to charge the battery; hunting is prevented by the use of the series winding, which ensures that the switch will not open until the voltage has fallen to a value considerably below that at which the switch cuts in, and also produces a strong pressure between the switch contacts, increasing with the current.

The regulator solenoid, which is normally excited only by the current passing from the dynamo to the battery, acts upon a core connected to the field regulator, which varies the resistance in circuit with the dynamo field magnets. The construction of this regulator is exceptionally interesting. The steps of the resistance are connected to thin metallic plates sandwiched between layers of insulating material, their upper edges forming a track upon which the regulator contact *rolls*, as shown in fig. 5. The contact maker consists of a bundle of copper laminations, V-shaped in cross-section, with their edges applied to the track; it is mounted in such a way as to have perfect freedom of movement, and is tilted to and fro by the core of the solenoid so as to vary the amount of resistance in circuit by a large

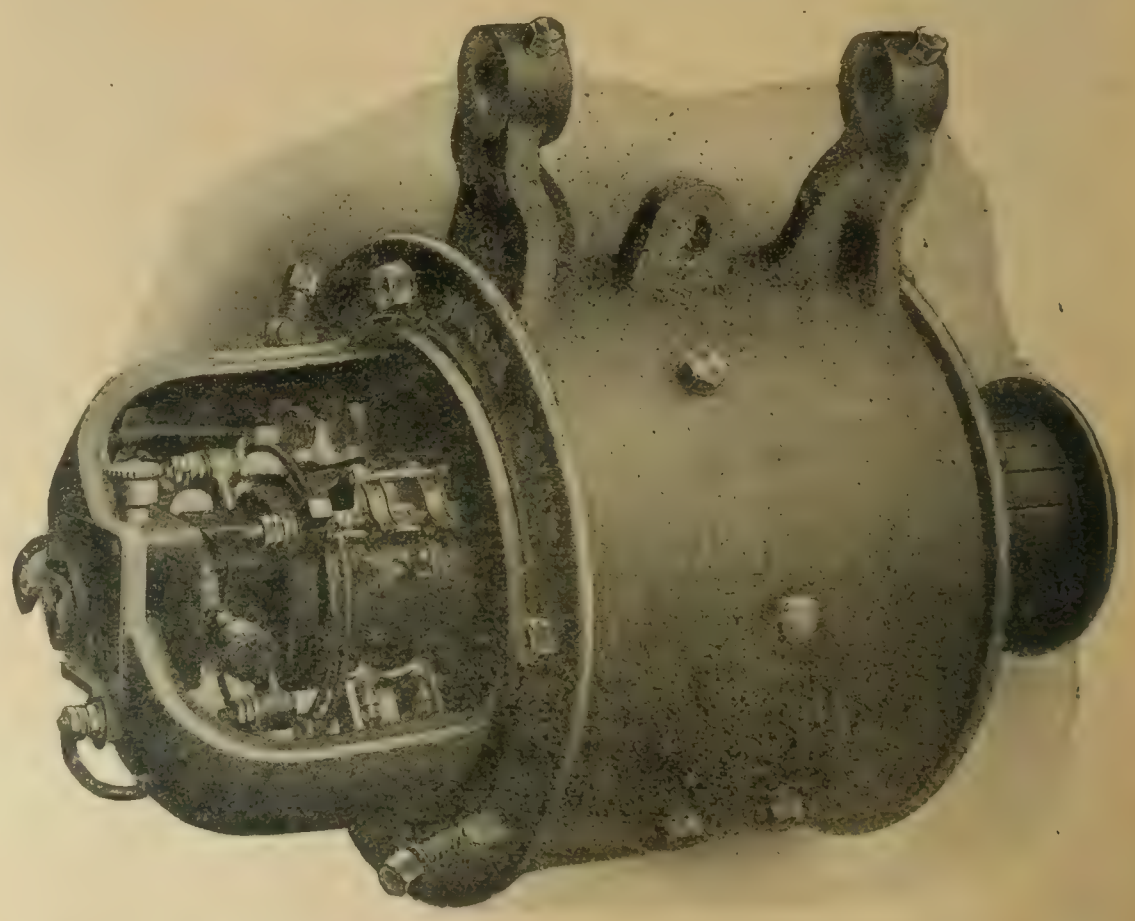


Fig. 2.—Vickers Train-Lighting Dynamo, with Dust Cover Removed.

number of small steps, the roller being connected to the small positive branch from the + terminal mentioned above. The device is the best mechanically operated variable resistance that we have yet met with. To prevent sudden movements, the plunger of the solenoid is provided with an air dash-pot.

The operation of the regulator is controlled by the position of the adjustable contact B, which is clamped upon the spiral wire diverter F E; when B is near E, most of the dynamo current goes through the diverter, while when B is near F a larger proportion passes through the solenoid. As the regulator always acts so as to maintain a constant current in the main winding of the solenoid, the total output of the dynamo to the battery thus depends upon the position of B, which is determined when the apparatus is installed.

Should the battery be charged for so long a period that its voltage rises beyond a predetermined and adjustable limit, the small automatic switch is actuated and closes the circuit through the fine-wire winding on the solenoid, which assists the main winding, and therefore inserts a larger resistance in the dynamo field circuit; this has the effect of reducing the charging current to a few amperes only, and prevents the battery from becoming overcharged.

We now turn to the lighting circuit, which it will be seen is connected to a second travelling contact on the resistance F E, and to the negative terminal common to the dynamo

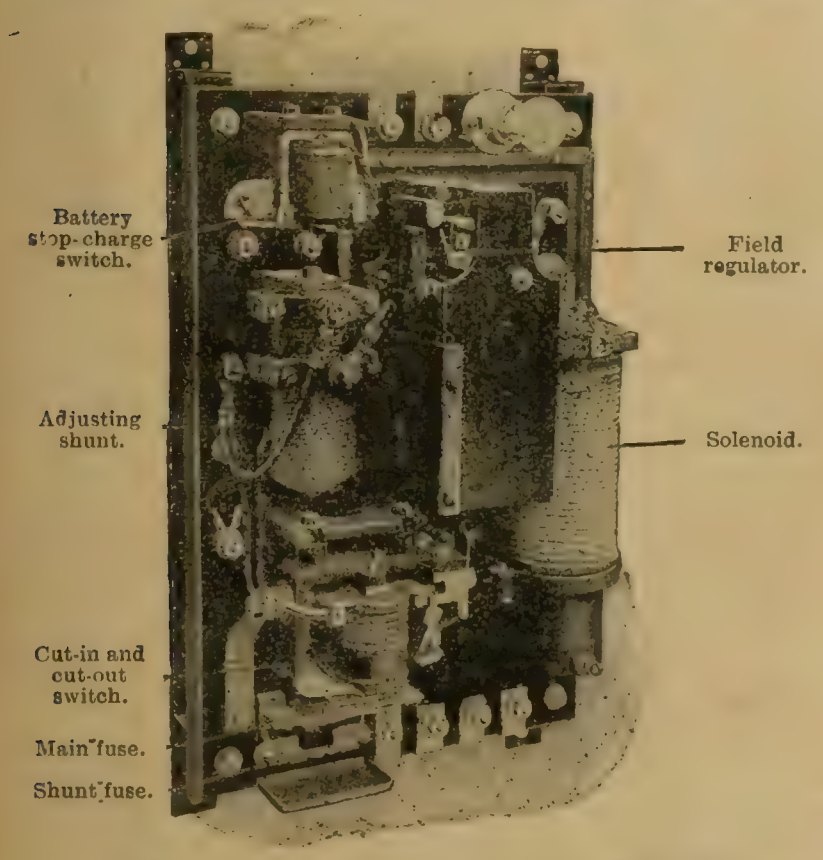


Fig. 4.—Automatic Regulator Controller.

and battery. As the lighting current passes through the same resistance that is used as a diverter for the regulator solenoid, it is evident that a wide range of adjustment is available; with D at E, the whole of the lighting current is derived from the dynamo in addition to the normal charging current; with D against B, the lighting circuit is connected across the battery terminals, and the dynamo output is limited to the ordinary charging current; with D in any position between B and E, intermediate divisions of the load can be obtained, and, as previously explained, the contact B can be moved to regulate the charging current. The minimum dynamo output is obtained by disconnecting A from B.

A separate regulator, fig. 3, is provided for controlling the voltage of the lighting circuits, based on the same principles as the regulator-controller, but with the difference that in this case the actuating solenoid is wound with fine wire and acts so as to maintain the voltage constant by short-circuiting more or less of the resistance, which carries the current going to the lamps. It is stated by the makers that with this device the variation in pressure at the lamp terminals, under ordinary working conditions, is only 1·1 per cent. from the normal.

Both the regulators are enclosed in dust and waterproof cases, suitable for fixing to the underframe of the coach; they can be installed inside the coach if preferred, but in any event they are entirely automatic and need no attention on the part of the train staff. The lamps are divided into two circuits, either or both of which can be switched on with a single switch, but they can, of course, be arranged in any way that may be specified.

The battery is of any suitable type that may be preferred by the user, and consists of 12 cells, the normal voltage of the system being 24 volts. It is carried under the coach in a box.

From the foregoing brief description it will be seen that the system is very simple, and involves the minimum of

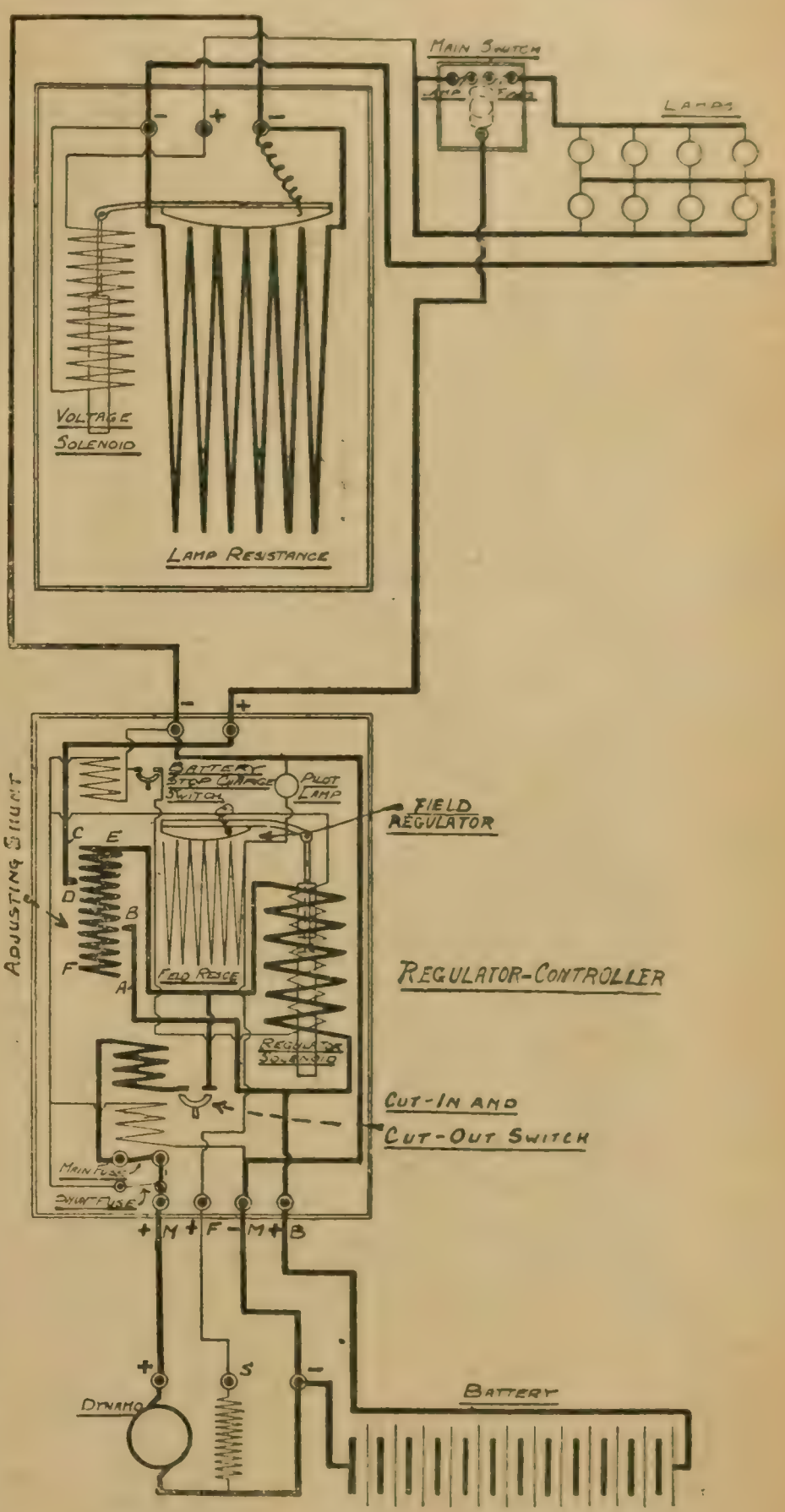


Fig. 5.—Diagram of Connections, Vickers S.B. Train-Lighting System.

apparatus and plant; it is also effective and reliable. The equipment is made in three standard sizes, the output of the dynamo being 25, 50 or 75 amperes, and the battery being of corresponding capacity, but only one size of regulating apparatus is required for all three types.

In view of the close attention which has recently been directed to the subject of train lighting by the tragedy of Aisgill Moor, we think that this, the latest system that has been developed for that purpose, should be of especial interest to our readers. The system is in use on a large number of passenger coaches in this country and abroad; we inspected one of the equipments installed on the Continental trains of the South-Eastern Railway Co., and were very favourably impressed with the design and construction of the apparatus, which appears to possess all the qualities required to ensure satisfactory operation.

ELECTROMETALLURGY OF ZINC.

Among common metals, zinc is that of which the world's consumption has risen most rapidly and uniformly. From 1900 to 1912, this consumption rose from 470,000 to 920,000 tons, and 37 companies in Europe are now engaged in the production of 570,000 tons of zinc per annum, the market value of which exceeds £14,000,000.

Hitherto zinc has been volatilised from its ores by heating charges of from 110 to 220 lb. in banks of small refractory retorts, the whole arrangement representing a multiplication of laboratory apparatus. The retorts absorb a great deal of heat, and each produces—in a discontinuous manner—from 44 to 66 lb. of metal per 24 hours. The furnaces are costly to build and maintain, consume five tons of coal per ton of zinc produced, and permit at least 10 per cent. loss of metal from the ore treated. A large and skilled staff is required, and the foundry must be located near deposits of refractory earth. The continual rise in coal and wages costs absorbs the small economies realised by gradual perfecting of the furnaces and retorts, and shaft furnaces taking several tons of ore and fuel at each charge, are not applicable, since the air necessary for the combustion of the fuel oxidises the zinc.

The electric furnace described below avoids this difficulty while realising the chief advantages of the shaft furnace. It is simple in construction, easy and cheap to maintain and operate, compact yet of high output, expeditious and efficient in action. The loss of metal from the ore is about two-thirds that occurring under the most favourable conditions in Belgian and Silesian retorts.

The capital cost of the equipment per ton of metal produced per 24 hours, is £2,800 for retorts, and £800 for electric furnaces, and the cost of treatment per ton of 50 per cent. ore is :—

	Silesian retorts.	*Electric furnaces.*
Desulphation by roasting ...	£0·40[1]	—
Lime and coal for desulphation	—	£0·48
Heating	0·88[2]	0·68[3]
Labour	0·72[4]	0·32[5]
Maintenance	0·48[6]	0·64[7]
Total	£2·48	£2·12

[1] Paid to H_2SO_4 works for roasting ore. [2] 2 tons coal at 8s. 9d. [3] 120 H.P. for 24 hours at £1 16s. per H.P.-year. [4] Three days at 4s. 9d. [5] Two days at 3s. 2d. [6] Retorts, pipes, furnace repairs. [7] Electrodes, refractory and electrical material.

The corresponding total costs of manufacture per ton of metal are :—£6·72 by the retort, and £6·28 by the electric furnace method ; in the case of 30-35 per cent. ores, the advantage in favour of the electric furnace is still more marked.

The metallurgy of zinc is dominated by the fact that, since about 2 tons of coal is used per ton of 50 per cent. ore reduced in Silesian retorts, the foundry is located as near as possible to collieries. Consequently, the ore has frequently to be transported over long distances ; for instance, there are mines in the Pyrenees from which ore has to be transported by mules and, later, wagons to the nearest port or foundry. With few exceptions, these deposits (at 5,000-6,600 ft. elevation) are very difficult of access and yield only 20 per cent. ore, which must be washed up to 50 per cent. metal content before being placed on the market. To effect this enrichment without leaving more than 15-20 per cent. of the zinc in the tailings, a modern washery plant must be erected capable of handling 100 tons of ore per diem and costing, say, £40,000. If the mine is not sufficiently productive to employ fully such a washery, it may be unprofitable to work it at all unless zinc stands at over £20-£22 per ton. For this reason, France imports over 20,000 tons of zinc per annum instead of exporting this metal.

Where sufficient water power is available to operate hydro-electric stations producing from 3,000 to 4,000 H.P. at £2 or less per H.P.-year, the use of electric furnaces revolutionises the economical situation in poor ore zinc mines.

Referring to fig. 1, the curve A B shows that the cost of electric furnace treatment is higher the poorer the ore, but the cost of washing the ore increases with the concentration required. The intersection O of A B, C D corresponds to the lowest point M on the curve E F representing the cost of both treatments ; this minimum corresponds to a zinc content between 30 per cent. and 35 per cent. The latter figure varies according to the cost of electrical energy but, in any case, a mechanical preparing plant costing about £2,400 would bring the ore up to a zinc content suitable for treatment in electric furnaces.

It is characteristic of the electric furnace that it retains its economic advantages even in small units, so that it would be

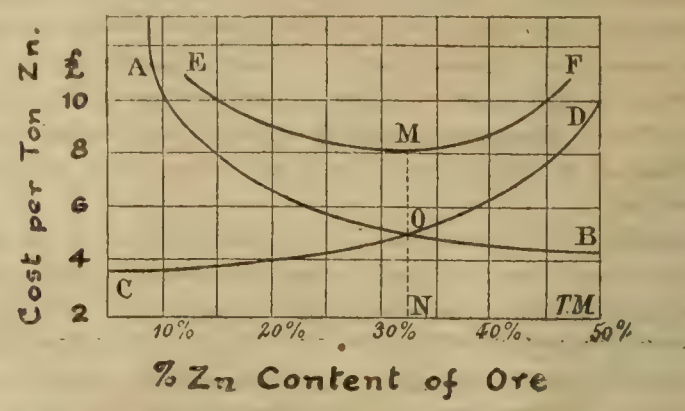


Fig. 1.

preferable to erect a number of small electric zinc foundries rather than transport ore by road or mountain railway to a large foundry.

As an example of the economic advantages of electric furnaces, let us assume that a blende mine, 5,600 ft. above sea level, produces 10,000 tons per annum of 16 per cent.-ore and that :—

Case I.—The ore is taken by cableway to a washery, where it is made to yield 2,600 tons of 43 per cent.-ore ; the latter is sold at Antwerp and taken to Bayonne by sea.

Case II.—The raw ore is washed till it yields 3,700 tons of 35 per cent.-ore, which is reduced in an electric foundry costing (complete with three 400-H.P. furnaces, buildings, land, &c.), £12,000.*

Case I.

Extraction, descent, enrichment	£5,600
Transport to Antwerp	3,450
Cost	£9,050
By sale of 2,600 tons ore	10,730
Profit	1,680

If the market value of zinc fell below £20 per ton, this profit would vanish and the mine could not be worked commercially.

Case II.

3,700 tons of 35 per cent.-ore delivered at furnaces ...	£5,410
Energy—1,200 H.P.-years at £1 16s.	2,160
Lime and coal	1,440
Electrodes, furnace maintenance, works' materials, &c. ...	2,080
Labour (at 3s. 7d. per man per day)...	1,080
Management, taxes, insurance, &c.	1,000
	£13,170
Delivery to Havre	1,280
Total	£14,450
Sale of 110 tons zinc at £21	23,100
Profit	8,650

By reducing its ore electrically, the mine would thus secure £8,650 profit, as against £1,680 realised by selling 43 per cent.-ore.

The Côte and Pierron Electric Furnace.—Considering the old method of separating lead by fusion of galena with iron in a shaft furnace, one would expect that the analogous displacement of zinc by fusion of blende with iron in an electric furnace would be industrially successful. However, although the zinc leaves the bed of the furnace as vapour, the water, carbon-dioxide and air inevitably introduced by the ore oxidise the metal, so that "blue" powder is obtained instead of coherent blocks of zinc. The redistillation of this powder is costly, and involves a serious loss of metal. Further, the high temperature required in the zinc furnace severely attacks the refractory lining of the bed.

In 1904, Côte and Pierron first endeavoured to overcome these difficulties by the use of the electric flux,† and the first industrial electric zinc furnaces were installed in a 250-600-H.P.

* For details of this and other composite sums in the estimate, see an article by C. Lordier, "La Technique Moderne," No. 5, 1913, whence these notes are extracted.

† See also Annales de la Soc. d'Agric., Sciences et Ind. de Lyons, Decr., 1908

plant at Arudy. Despite the irregularity of the water power available, excellent results were obtained, and a larger and improved plant operating on the same system is now in use in Ugine (Savoy).

Fig. 2 represents diagrammatically the arrangement of a 400-KW. furnace as used at Ugine. The chamber A is 3 ft. 6 in. deep × 4 ft. internal diameter, and is of *pisé* construction, electrode paste being used in building it. The dome of the chamber is electrically insulated from it, even at red heat. Arc and resistance heating are employed, *a* A forming one, and a carbon cylinder B (7 ft. 6 in. × 1 ft. 6 in.), the other electrode. A 500-K.V.A. transformer, installed 4 ft. 6 in. away from the furnace and fed at 20,000 volts, supplies 52-56-volt, 50-cycle current. The design of the furnace is such that the metallic frame of A is in one piece magnetically and the power factor very near unity.

Ore is stacked on top of the furnace and 660 lb. of the partially dried material (mixed with a suitable proportion of granulated cast-iron), is introduced at intervals of two

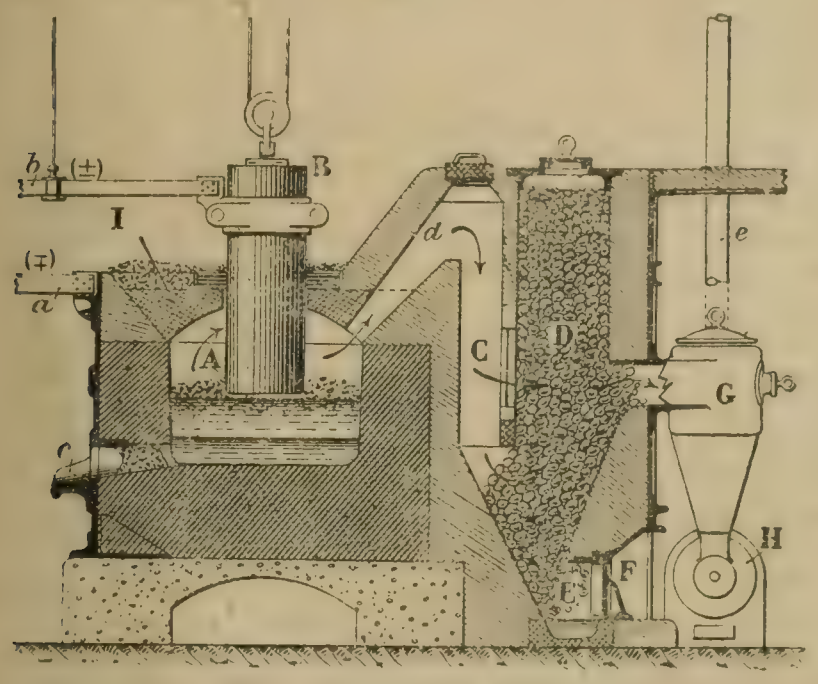


Fig. 2.—Section of Electric Zinc Furnace: Côte and Pierron Type.

hours through two symmetrically placed orifices in the direction I. Slag is removed at C, and zinc vapour escapes *viâ d*. For some moments after each charge is introduced, air, moisture and CO_2 are expelled. Fusion then commences and some zinc vapour is condensed in C (the temperature of which is regulable). Foreign materials volatilised in A and carried over by the zinc vapour pass, as shown, through a column of large pieces of carbon—introduced cold into *d*, and gradually brought to red heat as they descend. Vapour escaping the condensation and filtration in C D passes into a large vessel G, where there collects zinc powder, very pure and oxidised to a minimum extent. This powder falls to an electrically-heated melting chamber H, and vapours incapable of condensation escape by E; zinc condensed in C D collects in E. The red hot carbon in D prevents access of air to A when F is open.

When zinc-white is to be made, the temperature of C D is raised so that practically all the zinc is carried into a combustion chamber mounted in place of G. When using the furnace to produce metallic zinc, it is easy to secure from 67-75 per cent. of the output at E, and it is expected that, in future, it will be possible to eliminate the chamber G H.

Work is being carried on at Ugine with a view to acquiring experience and training a staff to be employed in a projected plant of much greater capacity. In the equipment described above, 21,000 lb. of blende* was reduced in 72 hours; 6,540 lb. of iron turnings, and 990 lb. of flux were used, and 6,200 lb. of 99·06 per cent. zinc,† and 1,180 lb. of 34·72 per cent. slag‡ were recovered. The slag collected at *c* weighed 21,500 lb., and contained only 1·85 per cent. zinc. The total loss of zinc was about 11 per cent. in this case, but experience justifies the belief that this figure will be reduced in future. The total electrical energy consumed was 16,285 KW.-hours (2·6 KW.-hours per lb. of zinc at E, H), and the cost of the treatment was as follows:—

Treating 7,000 lb. 34·38 per cent. Ore per 24 Hours (cost per ton of ore).

Electrical energy 2,300 H.P.-hours at £2 per H.P.-year	[illegible]
Depreciation and maintenance of buildings and equipment	9s. 6d.
Electrodes—26·4 lb at £19 5s. per ton (erected) ...	4s. 7d.
Iron recovered from FeS (allowing for sale of S) ...	3s. 4d.
Labour (17 hours at 1½d.)	6s. 5d.
Proportion of general charges (£4,000 per annum in a works treating 20,000 tons ore per annum) ...	4s. 0d.
Total	[illegible] 4d.
Corresponding cost per ton of zinc (6,400 lb. of ore)	[illegible] 11s.

In view of the fact that the type of zinc furnace, hitherto in general use, consumes from 1·7 to 2·0 tons of coal per ton of ore, whereas the electric furnace requires only 2,300 H.P.-hours (corresponding to a fuel consumption of 3,800 lb. in modern steam-electric generating plant), it seems likely that the electric zinc furnace will come into use in colliery districts as well as in localities where water power is available.

In conclusion, the advantages of treating zinc ores in the electric furnace may be summarised as follows:—

1. Possibility of establishing foundries in regions, barren of coal but rich in zinc ore, at a capital expenditure far less than is required by Silesian retort foundries.
2. Reduction of loss of metal to half that sustained when using retort furnaces and highly concentrated ore.
3. Simplified operation; staff required is smaller and can be recruited from mountain peasantry.
4. Reduction in charges for ore transport and possibility of profitably working many large deposits, the low zinc content of which makes them commercially worthless in the present state of the zinc industry.

* Having the percentage composition:—H_2O, 1·04; Zn, 34·8; Pb, 2·63; Fe_2O_3, 10·86; SiO_2, 12·48; S, 21·12; $CaCO_3$, 7·34; Al_2O_3, 5·67; MgO, 2·34; various, 1·72 per cent.

† Containing 0·07 per cent. Fe, 0·81 per cent. Pb, and 0·86 per cent. other impurities.

‡ Returned to the furnace with poorer ore.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The City Guilds Examinations.

It has often been a puzzle to me how the lists of works of reference in the programme of the City and Guilds technological examinations are decided upon, and by whom.

They have not generally erred on the side of paucity and the rather amazing number for the subject electrical engineering in the current programme should be noted.

I believe I am right in saying that the books enumerated for certain past sessions (if not in the present list) have included some that are hopelessly out of date, and even some that were out of print.

The electrical engineering list would be more helpful to professors, teachers, and students if the prices of the books were included, and if some closer indication than the titles were given of their scopes.

These lists, presumably the work of one or two individuals, would be still more useful if they were carefully revised each year, and if the said professors and teachers had a voice in the revision. It should not be too much trouble at the end of each session to ask, say, 150 of the more prominent lecturers to revise the old list, and to take the sense of the majority in drawing up the new one. The constant crop of new books and revised editions fully warrants this procedure; and it would be nothing less than just to those who have undergone the throes of authorship.

It is something of an anti-climax to turn to the works of reference for electric wiremen's work, but there is a new point to be raised. Why was it that in the programme for 1911-12, and possibly some other issues, no works of reference were mentioned; and why are only four books given in the current programme, one of them being somewhat out of place? It is significant that two of the four

were published subsequent to the above date, when no list was given; and if one did not know, one might assume that there was only one book on wiring in existence then. So far from this being the case, one might cite Clinton's "Electric Wiring," Ibbetson's "Theory and Practice of Electric Wiring," and "Electric Wiring, Fitting, Switches and Lamps," by an author who shall be nameless.

The first of the above-mentioned books saw the light in 1902, and besides two reprints, has just reached its third edition. The last-mentioned work was first published in 1899, and (not to mention various reprints) it reached its fourth edition in January, 1911. The question is, why were neither of these (or Ibbetson's) considered worthy of inclusion in the current programme? Perhaps Mr. Frank Broadbent may be able to explain.

Apart from this, I think the views of professors and teachers on the matter of revision would be of interest.

W. Perren Maycock.

West Norwood, S.E., *September 4th*, 1913.

The Electric Lighting of Trains.

I have read with interest your article in your current issue on the question of electric lighting of trains, but I think that you have overlooked some of the most important points.

It is not yet at all conclusive that the fire at Aisgill was due to gas, in fact it is more likely due to ashes from the wrecked engine setting on fire the splintered woodwork of the carriages, but supposing it is proved that the gas aided, or even caused the fire, surely it is just as unreasonable to make this outcry against carrying gas, as it would be to argue that motor-cars should not carry petrol, which is more dangerous than gas, and in either case a light must be applied to start the fire; besides, in all methods of locomotion it is impossible not to take some risks. Furthermore, are the public and the Press quite convinced that electric light is so much safer than gas, as whenever a large house is burnt down, it is nearly always attributed in the daily Press to the "fusing of an electric wire"?

I cannot agree with you that there is "no reason why electricity should not be used for lighting, heating, and cooking on the main line trains," as I think there are many good reasons, of which I might give a few. First, there has to be found a system of lighting which makes a coach independent of its service, as in most cases the equipment on any coach has to be adjusted to suit the service. Secondly, the locomotive engineers already complain of the additional load on the engine due to electric dynamo-driving, and if the whole of the lighting were electric this load would be largely increased. If the heating and cooking were also added, I am afraid it would be the rule rather than the exception to see two engines on a main-line train. Further, with regard to heating and cooking, there is already frequently a difficulty to find sufficient room under a coach for dynamo and batteries for lighting purposes, so that I venture to suggest that it would not be possible to accommodate sufficient apparatus for the enormous cooking and heating currents which would be required.

I cannot follow the argument as to the lighting and heating on the tube railways being electric, as when there is such an abundant supply of cheap electricity available, I cannot conceive anyone even thinking of introducing gas or steam for lighting or heating.

Although I am in the electrical engineering profession, and I should like to see more electric lighting of trains, I do not agree with a blind outcry against gas without considering the feasibility or even the possibility of entirely replacing it by electricity. I have not discussed the question of cost, as this, I think, does not materially affect the question of safety or possibility of electricity.

Fair Play.

[Proofs are accumulating that the fire was undoubtedly due to gas—*vide* the evidence given before the Board of Trade Inspector. One can get out of a motor-car easily enough in case of fire. No train has ever been set on fire by the electric lighting installation—nor ever will be, the voltage being only 24 volts; the battery connections, too, are sure to be broken when a coach is wrecked, and fuses are provided. There is no inherent or insuperable difficulty in making every coach for all practical purposes independent of the service as regards its electric lighting equipment. The extra load on the locomotive is about 2 per cent. of its normal output—an insignificant fraction—and this on a long-distance train lighted throughout with electricity. The mid-day meal is served in daylight, when the lighting load is off; the dynamo can supply the current direct—besides, how much of the cooking is actually done *on the train*? We have studied the subject for years past, and we know, as everyone knows who has done so, that it is quite feasible to fulfil all requirements with electricity. Our correspondent would do well to study the paper read before the Institution of Civil Engineers by Mr. Roger T. Smith, electrical engineer to the Great Western Railway (see abstract, Elec. Rev., December 15th, 1911), and other articles on the subject (*e.g.*, p. 406 of this issue), as he is clearly not familiar with modern practice.—Eds. Elec. Rev.]

Pressure Regulation.

In his article in your issue of September 5th, Mr. Turnbull states that in the event of the supply of steam being shut off from a self-excited compound-wound D.C. turbo-generator, the shunt field would disappear and the generator would run as a series motor and attain excessive speed. But how could the shunt field disappear? So long as it was connected across the brushes it would still be excited. It is true that, when running as a motor, the series field would oppose the shunt field, and might possibly weaken it sufficiently to allow the machine to run up to a dangerous speed; is this the explanation? And could not the danger be guarded against by a reverse-current breaker?

With regard to the difficulty that Mr. Turnbull speaks of, in working mid-wire boosters at very low voltages, it would be interesting to know whether he has experienced any similar difficulty in connection with reversible battery boosters, which often have to work at practically zero voltage with heavy armature currents. The writer cannot say that he has noticed any such difficulty, although he has had to do with a good many reversible battery boosters, automatic and otherwise.

G. C. Allingham.

Hendon, N.W., *September 8th*, 1913.

The Status of the Shift Engineer.

Once again that hackneyed phrase "the status of the shift engineer" occurs in your "Correspondence" columns. This time two correspondents are indignant that the shift engineer is about to lose his beloved status; perhaps it is because this is all he has left, his salary seemingly being of very little account nowadays.

The poor shift engineer is being classed with skilled workmen! There are hundreds who would only be too glad to be classed as such, and *paid* accordingly. I could name a number of stations where the stokers are paid more than the charge engineers.

It is a generally acknowledged fact that status to-day is £ s. d., the status varying directly as the amount of £ s. d. at one's command. The electrical engineer with his low salary consequently has a very queer status.

The root of all the troubles of electrical engineers is this "social status," "social respect," as your correspondents call it.

If electrical engineers would forget all about status for a time, and *demand* fair and equitable payment for their services, the status would look after itself. It matters little how you are classed by your employer, provided he pays a fair salary—public opinion will put you in your proper place.

Perhaps most shift engineers think they are embryo chief engineers (but it is surprising, when investigated, how few chief engineers of to-day have ever been in charge of a shift); this makes the average shift engineer compare himself with doctors, lawyers, &c., and at the same time

accept less payment for his services than builders' labourers demand and get.

In the preceding paragraph I have used the words: "demand fair and equitable payment"; the electrical engineer has never demanded anything; he has a great power, and has been afraid to use it.

In your columns and elsewhere, very good arguments have been put forward why electrical engineers should be paid fair salaries. From experiences all over the country, it has been found that chief engineers, Electricity Committees, &c., are very little affected by good arguments; they ignore them. A power behind these arguments would alter the aspect of affairs considerably.

From observation it seems that the power to demand is the foundation of the status of any profession.

W. J. Ebben, *Hon. Secretary,*
Association of Electrical (Station) Engineers.

London, E., *September 9th*, 1913.

I was very much interested in reading the two letters on the above subject in this week's paper.

It might be interesting to the writers to know that out of the four shift engineers originally appointed for the central station of the General Post Office, three resigned within two years of the commencement of supply, and also that no fewer than six vacancies, including the three shift engineers above, occurred in the staff for the scheme within two years. This will, I think, prove that the engineers could see that the future prospects of service under Government were about as bad as they possibly could be, and it has now been brought to the public notice in the Parliamentary Committee's Report, where they class the shift engineers on a level with drivers and stokers as "skilled workmen."

Of the engineers who left, some are now in responsible positions, and thankful to be out of Government service. It may also be a warning to others very carefully to consider the future prospects when appointments are offered them from this quarter.

When the scheme was first started, most of those appointed were experienced men, and had been through colleges, workshops and central stations.

It is quite time that the engineering department of the General Post Office had a thorough "spring cleaning," and that proper treatment should be given to those who are in such a responsible position as that of keeping the central station running at Blackfriars, upon which the General Post Office depends for its lighting and power, and also the Central Telephone Exchange.

I am glad to say that I am not in Government service.

E. Nest.

New Japanese Lamp Works.—New works for the manufacture of incandescent lamps have just been completed at Nishi-Hiranuma, by the Yokohama Denki Kogyo Kaisha. The company, which has a capital of £50,000, hopes to turn out about 10,000 lamps per day.

PROCEEDINGS OF INSTITUTIONS.

The Electric Refining of Steel in an Induction Furnace.

By Otto Frick (London).

(Abstract of paper read before the Iron and Steel Institute at Ghent, September, 1913.)

The results given in the paper are based on data obtained in the Frick furnaces at Krupp's works in Essen. Two furnaces of this type are at work. The first came into regular operation in August, 1908. The second furnace, originally of the Kjellin type, was rebuilt on the same principle as the first Frick furnace, after this had been proved superior both in design and with regard to power consumption and efficiency.

The data relating to these 10-ton furnaces are:—

Raw materials	cold scrap of good analysis.
Actual working capacity ...	8·5 tons.
Weight of casts	6·5 „
Average power used	650 KW.
Frequency	5 cycles per second.
Voltage	5,000
Power factor, cosine ϕ at 8·5 tons	0·53
Average duration of one heat ...	6 hours 45 minutes.

Theoretical energy consumption per ton, 432 KW.-hours calculated. Average electrical loss, 4·5 per cent.; average radiation loss, 160 KW.; average total efficiency, 70 per cent.

Figs. 1, 2 and 3 give a clear idea of the design of the furnace, and figs. 5, 6 and 7 show sections of the single ring and double ring furnaces. Fig. 3 represents the 10-ton furnace in plan.

As the furnace was to be used for melting cold scrap only without any refining, the original type with a rotating cover was chosen, being specially designed for the treatment of cold scrap and offering the advantage of easy charging and distribution over the whole crucible without any delay or trouble. The rotating cover further facilitates the supervision of the metal and of the furnace walls. Additions of slag or alloys are quickly and evenly distributed over the bath. The design of the cover has proved most satisfactory for its purpose.

The electric losses, that is, the losses in the primary coils and in the magnetic iron core, are reduced by giving these parts ample dimensions. Notwithstanding the great weight of the core, nearly 45 tons, the total electric loss in the furnace in Essen only amounts to 4 or 5 per cent. of the total energy supplied to the furnace.

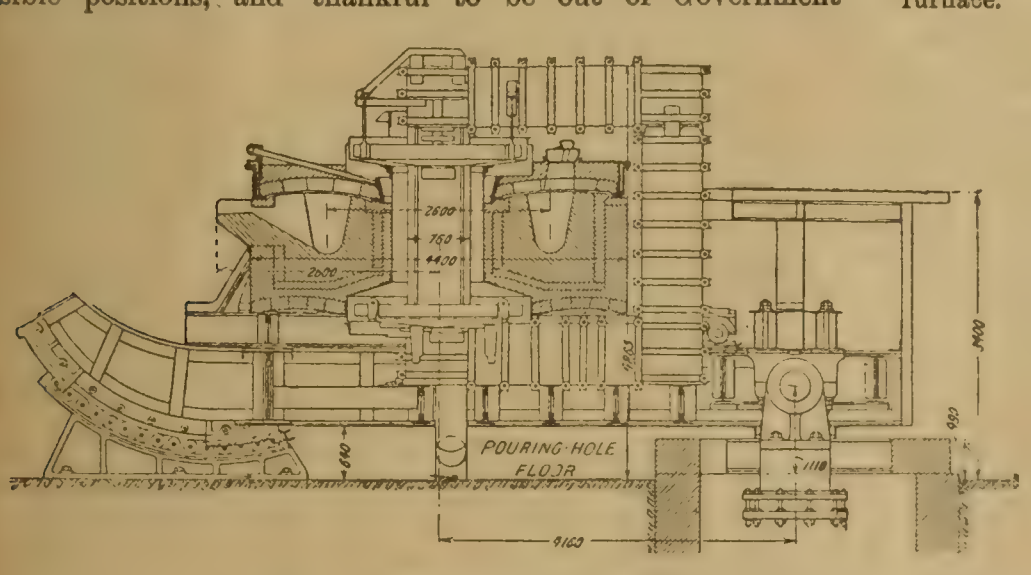


Fig. 1.—Longitudinal Section.

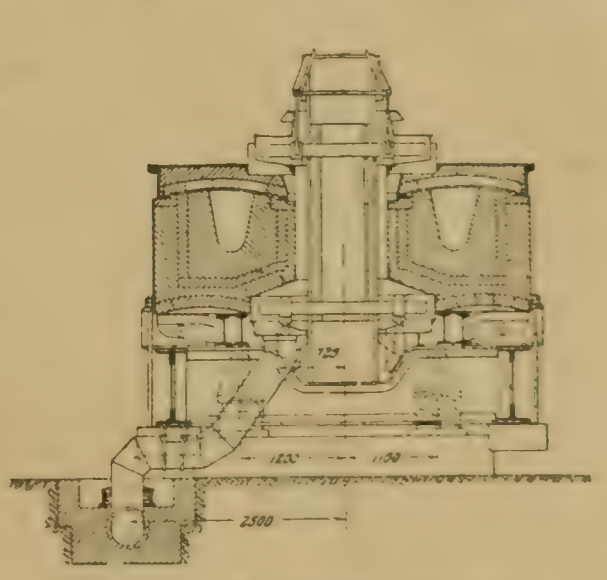


Fig. 2.—Transverse Section.

10-Ton 1,000-h.p. Frick Furnace at Krupp's Works, Essen.

Of greater influence on the efficiency are the losses due to radiation. The author has made a careful study of the heat conductivity of refractory materials at highest temperatures, and has provided his furnaces with insulated walls in accordance with the results. Further, great care was taken to make the doors in the cover tight and as easy as possible to keep closed. By these means the radiation losses were reduced to a minimum. Comparative calculations have shown that the radiation loss of the Kjellin furnace exceeds that of the Frick furnace by 75 KW. or 48 per cent., which also involves an increased cost for current, labour, and lining in the case of the former.

As an example, a run of six weeks' duration may serve.

	Kjellin.	*Frick.*
Output in six weeks, good ingots, tons ...	696	850
	Shillings.	
563,500 KW.-hours at 0·43 penny	20,250	
Labour estimated at...	5,900	
Lining...	2,000	
Light, cooling fan, &c.	450	
Total costs in six weeks	28,600	
Costs per ton of ingot	41·10	33·70
Saving by Frick furnace, per ton	7·40	
„ „ „ per campaign ...	6,300	
„ „ „ in one year of seven campaigns with one furnace	44,000	

£

Were 12 per cent. interest and depreciation on an estimated outlay of £12,500 also taken into account, the annual saving would be increased to £2,500. These figures demonstrate the importance of low radiation losses, and prove the effectiveness of the design of the Frick furnace in this respect.

Nearly six years of actual working have shown that no drawbacks have been caused by the insulation of the furnace.

At the Krupp works a Girod furnace of 1,200 KW. and 12 tons capacity has been installed next to the Frick furnace, thus giving an opportunity to compare the Frick furnace with a furnace of the arc type. The following figures represent average results, and will give a fair idea of the relative efficiency of the two types :—

KW.-hours per ton of steel in the Girod furnace ... 1,000 KW.-hours.
" " " Frick " ... 600 "

It may be assumed that the theoretical energy consumption of the Frick furnace is 425 KW.-hours per ton. For the Girod furnace it has been assumed to be somewhat higher, or 460 KW.-hours per ton, as it is possible that this furnace is working on a raw material with more scale or rust, and therefore under less favourable conditions.

It has been assumed that the Frick furnace has an interval of only 7½ minutes between heats. For the Girod furnace two cases have been calculated, viz., for an interval of 55 minutes and for one of 1 hour 25 minutes per heat, the longer intervals being necessary for charging, which has to be completed before the current can be turned on, whereas in the Frick furnace the current may be put on immediately after tapping. It may then be calculated that—

The average loss of the Frick furnace = 186 KW.
" " Girod furnace = 580 "

or over three times more than the Frick furnace, although the capacity of the latter is only 20 per cent. less.

In the Frick furnace the heat is generated directly in the steel bath, and, consequently, there is practically no heat transfer necessary, but the highest temperature prevails in the metal itself. Further, the slag acts as a very effective heat insulator, which prevents the furnace walls above the bath and the roof from becoming as hot as the bath itself.

In an arc furnace the essential part of the heat is generated in the arc or arcs playing between the ends of the electrodes and the metal, and, consequently, the heat has to be transferred from these centres to the other parts of the bath by heat transmission, which requires a very high temperature in the arcs and at the lower end of the electrodes, a temperature which certainly exceeds 2,500° C., whereas the highest temperature in a Frick furnace never exceeds 1,680° C. at any part.

It must also not be forgotten that the electrodes themselves are fairly good heat conductors, and through them no small amount of heat is conveyed away out of the furnace. In melting cold scrap the conditions are somewhat more favourable, as the electrodes are surrounded by the charge, which absorbs some of the heat otherwise dissipated towards the roof.

It may therefore be concluded that the efficiency of an arc furnace for treating liquid metal will always be less than 50 per cent., and in melting cold scrap will only slightly exceed 50 per cent. The Frick furnace, on the other hand, shows an efficiency of over 70 per cent., which may be further improved with larger furnaces.

With regard to the lining, the induction furnace offers certain intrinsic difficulties through the ring-shaped form of the crucible. On the one hand, greater difficulties arise in making the lining stand high temperatures without cracking, on the other the ring-shaped form makes it impossible to give the furnace walls sufficient slope to enable the repair to be made in the same manner as in an open-hearth furnace, or simply by throwing dolomite or magnesite on the places which have been cut by the slag. The upper part of the inner wall, which is the one most exposed to the cutting by the slag, may be sufficiently sloped to allow a repair in this manner, but it would mean considerably increased dimensions of the furnace and increased losses and energy consumption. To make the dimensions as small as possible, it is thus necessary to make the walls almost vertical.

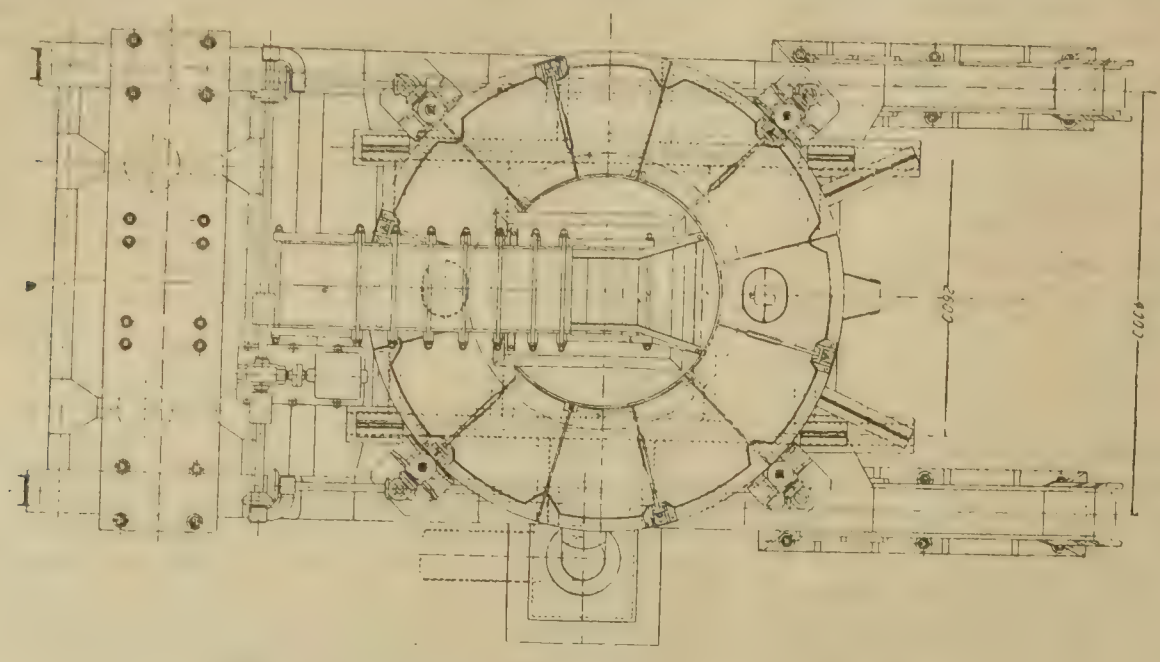


FIG. 3.—PLAN OF 10-TON FRICK FURNACE, 1,000 H.P.

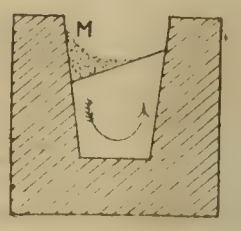


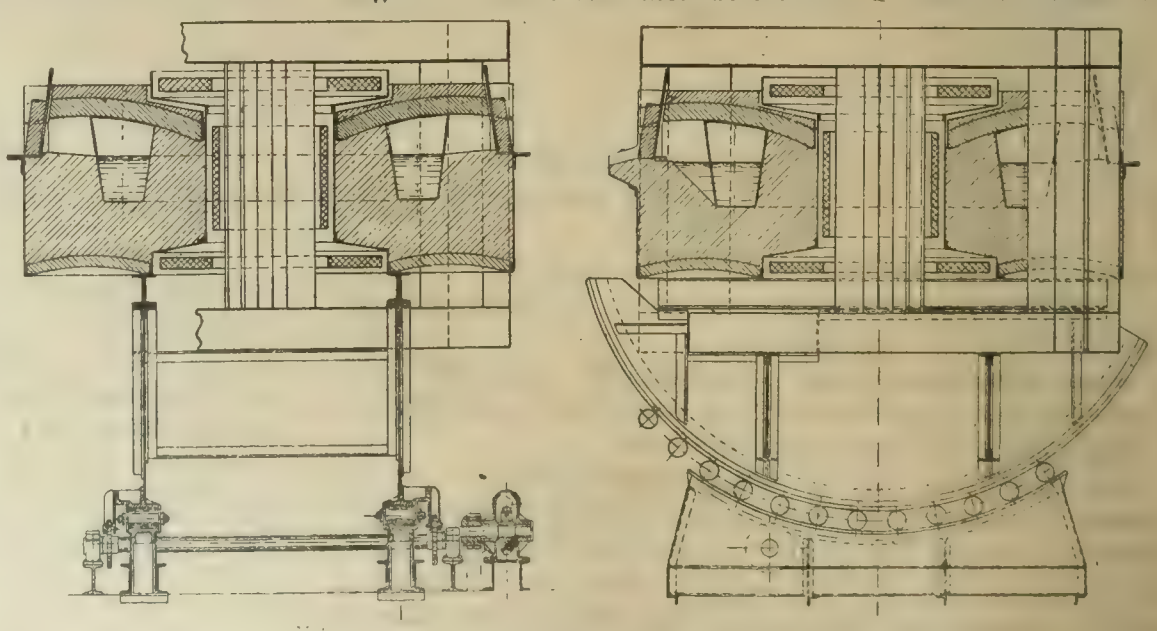
FIG. 4.

The difficulties with regard to cracking are due to the fact that the outer wall is ring-shaped, and has its highest temperature on the inside, whereas the equally ring-shaped inner wall is hottest outside. The only possible way of overcoming these difficulties consists in using a material which has practically no contraction or expansion at very high temperatures.

The lining at Essen was the outcome of most extensive researches and much experimental work; it is made of magnesite of the highest purity, preferably up to 93 per cent. MgO, without any binding agent, and treated in such a way that it neither contracts nor expands up to the highest temperatures. It possesses a remarkable compactness, mechanical strength, and resistance to the action of slags.

But even the best of linings will not stand more than a few weeks if it is not further protected against the cutting action of ordinary slags. As all attempts to repair a cut place in the lining have proved to be of little or no value, the author was led to a very simple solution, especially adaptable to his furnace, by the following consideration.

As all basic slags contain a certain percentage of MgO, which seldom exceeds 10 per cent., and usually runs at about 6 to 7 per cent., the conclusion is justified, that basic slags must saturate themselves to this extent. If now such slags are given an opportunity to take up MgO from another source, they will not attack the lining. By adding crushed magnesite in such a way that the slag can become saturated before it has been able to attack the lining, this ought to be protected against cutting, and should last for a considerable time.



FIGS. 5 AND 6.—SECTIONS OF FRICK SINGLE RING SINGLE-PHASE FURNACE.

Such an automatic preservation of the lining is much facilitated by the inclination and rotation of the bath, which will be more fully described later on. Old magnesite, without any value for other purposes, may be used. It is introduced into the furnace in such a manner as to form a heap in front of the inner wall, against which it is pressed by the inclination and rotation of the bath. The sketch, fig. 4, shows a section through the lining and the bath, with its surface inclined towards the inner wall. The slag additions, mixed with magnesite, are shown as a heap M, and the rotation of the bath is indicated by an arrow.

The silicon and phosphorus in the steel are brought to the

surface near the outer wall by the rotation of the bath, and are in this way brought into contact with the air or with the oxides of the slag, which they rob of the necessary amount of oxygen for the formation of Si_2O and P_2O_5. These oxides float on the inclined surface of the bath and meet the heap M, from which they absorb the necessary amount of MgO and CaO before they reach the wall. This method has proved to be most satisfactory, and it has even been found possible to make the inner wall grow by adding too much magnesite, and to cut away the excess by diminishing the percentage of magnesite in the slag.

The lining of the Frick furnace at Essen now attains a life of two to three months regularly. The rotating cover of the furnace facilitates the distribution of the magnesite or the magnesite lime mixture along the inner wall. The roof of a Frick furnace, if not revolving, can be made to last at least as long as the lining.

The reciprocal electromagnetic action of the current in the primary coils and in the bath produces the double effect of making the surface of the bath take an inclined position towards the inner wall, and of causing the whole of the molten metal to revolve in the direction shown by the arrow in fig. 4.

The inclination of the bath surface causes the slag to be carried towards the inner wall. If the angle of inclination is too sharp, or the quantity of slag too small, the surface of the metal will be uncovered and exposed to the oxidising action of the air if the furnace is not well closed. A very small inclination is sufficient. With an angle of 4° and with a thickness of the slag of 1 centimetre at level bath the width of the uncovered part will be 51 per cent. if the total width of the bath is 12 in.

The disadvantage of the inclination, if it is excessive, consists in the greater quantity of slag necessary to cover the metal. The experience with the furnaces at Essen shows that the Frick furnace in this respect also is superior to induction furnaces of the Kjellin type. The following inclination of the bath surface has been measured:—In the Kjellin furnace, 24°. In the Frick furnace, 4° 34′ to 5° 5′. The amount of slag required in the Kjellin furnace is 4·5 to 5 times that required in the Frick furnace.

TABLE I.—Single-ring Furnaces for Steel.

Capacity in tons	0·3	1·0	3·0	10·0	20·0
Normal power-consumption, KW.	80	180	375	950	1,750
Normal frequency, cycles per second	50	15	8	5	5
Power factor at normal frequency	0·53	0·70	0·68	0·56	0·39
Radiation loss at 1,500° C., KW.	35	68	104	160	230
Electrical losses, per cent.	9·0	6·2	4·7	3·2	3·1
Maximum efficiency at 1,500° C., per cent.	42	56	64	77	81
Efficiency, if stops 25 per cent. of total time, per cent.	24	37	53	70	75
Maximum weight of cast, cold charging, tons	0·10	0·50	1·95	7·7	16·5

TABLE II.—Single-phase Double-ring Furnaces for Steel.

Capacity in tons	0·6	2·0	6·0	20·0	40·0
Normal power-consumption, KW.	145	320	690	1,800	3,400
Normal frequency, cycles per sec.	50	15	8	5	5
Power factor at normal frequency	0·53	0·70	0·68	0·56	0·39
Radiation loss at 1,500° C., KW.	61	115	168	267	374
Electrical losses, per cent.	7·5	6	4·5	3	2·5
Maximum efficiency at 1,500° C., per cent.	45	54	68	79	83
Efficiency— If stops 25 per cent. of total time, per cent.	28	40	58	73	78·5

The rotation of the bath is favourable in so far as it secures a great uniformity of the metal and assists in the protection of the lining, as mentioned above, as well as in hastening the reaction between the slag and the metal. For all these purposes an exceedingly slow rotation of about 1 R.P.M. would be sufficient, whereas it is generally many times more, and under unfavourable conditions may exceed 100 R.P.M. Every means should be used to keep the speed of rotation down. This is done in the Frick furnace by the arrangement of the coils, and by using a current of low frequency for the operation of the furnace. While the steel in the Frick furnace was practically calm, that in the Kjellin furnace seemed to rotate at a great speed, producing the effect of fierce boiling near the inner wall.

In comparing arc furnaces with the Frick furnace it should be mentioned that the amount of slag necessary to cover the bath of an arc furnace is less than in the latter type. As, however, the Frick furnaces at an angle of inclination of 5° only require about 22 kg. of slag per ton of steel in single ring, and about 28 kg. in double-ring furnaces to cover the bath, the saving cannot be considerable.

It may be assumed that the arc furnace only requires 18 kg. of slag to cover the bath and to complete the metallurgical reactions. The saving would be 4 kg. over the single-ring and 10 kg. over the double-ring Frick furnace, the melting of which represents a theoretical energy consumption of about 2·5 or 6·5 KW.-hours per ton of steel respectively. This higher theoretical energy consumption of the Frick furnaces is compensated by its higher efficiency. For comparison it may be assumed that Frick furnaces have an efficiency of 70 per cent., as at Essen, and that the arc furnace has an efficiency of 40 to 50 per cent., the higher value probably being the very highest efficiency which can be obtained in an arc furnace working on hot metal, while the latter figure generally is not exceeded.

Even in this exceptional case, and with current at the price of only ½d. per KW.-hour, the single-ring Frick furnace comes out better than the arc furnace under all conditions, and the arc furnace has the advantage over the double-ring furnace only if its efficiency is above 30 per cent.

It may be said that the future of the electric furnace for steel production will be in the final refining of steel, pre-melted and pre-refined either in a converter or open-hearth furnace, and that its use for melting cold stock, except in places with very cheap water power and high priced fuel, will be restricted to comparatively small quantities of high-class alloy steel, and to the melting of valuable alloys for the addition to ordinary steel, if a saving of alloy can be effected by melting under exclusion of air, as, for instance, for the melting of ferro-manganese.

The success of the large furnaces at Essen has warranted the building of still larger types, up to 20 tons capacity as single-ring furnaces; and to meet demands for still larger capacity, double-ring furnaces up to 40 tons have been designed.

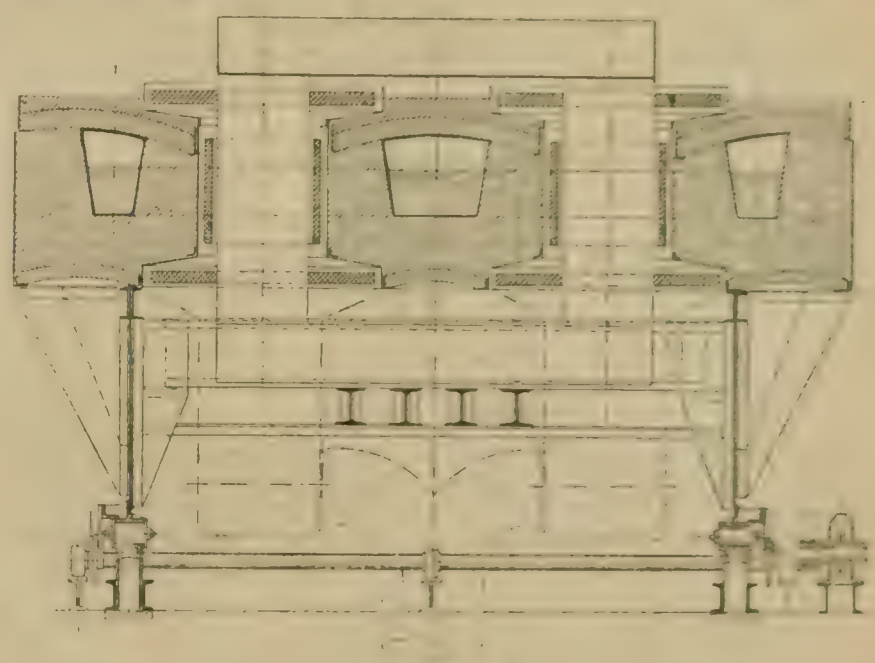


Fig. 7.—Section of Double-Ring Single-phase Furnace.

All the furnaces will preferably work with single-phase current, although the double-ring type may also be made to take a two or three-phase current.

Figs. 5 and 6 show the design of single-ring furnaces of 0·3 to 20 tons capacity.

Fig. 7 shows the design of double-ring furnaces of 0·6 to 40 tons capacity for single-phase current. The only difference in double-ring furnaces for two or three-phase current consists in the use of two independent iron cores instead of the one common to the two rings formed by the bath as shown for the single-phase double-ring furnace.

Tables I and II contain general information on single-ring and double-ring furnaces for steel.

As induction furnaces have a very low power-factor at the normal frequencies of 25 to 50 cycles, it is only in exceptional cases advisable to connect them directly to existing plants. It will in no case be economically justifiable to connect furnaces for steel of over 3 tons, and for ferro-manganese of over 6 tons capacity, to a supply system of 25 cycles.

The single-ring single-phase furnace, as a rule, is cheaper in first cost, and much more economical in use on account of the lower radiation loss.

Even with an extra dynamo the first cost of the Frick furnace plant will be lower than that of an arc furnace of any of the existing types, considering the much smaller plant needed by the Frick furnace on account of its higher efficiency.

Furnaces for melting ferro-manganese are generally smaller, and may with advantage be connected to a system of 25 or 50 cycles.

A low frequency offers appreciable advantages with regard to the electric losses in the coils and in the iron core.

The Frick furnace can be constructed for any voltage up to 5,000 volts, and higher for larger furnaces. The furnace at Essen has been in operation for nearly five years with current at 5,000 volts, the high-tension parts being all insulated in such a way that it is impossible to come in contact with them. One advantage of a high voltage is that the cables are smaller, less costly, and easier to fix.

A great advantage of the induction furnace is the high load-factor and the absolute uniformity of the load without shocks or variations. In this respect the induction furnace differs favourably from arc furnaces, which even when treating liquid metal give rise to serious short circuits, especially when the metal is boiling as during the oxidation period. The only way to reduce these short circuits is by lengthening the arc and reducing the load. The load-factor is of no little influence on the production, and thereby on the cost per ton of steel.

In comparing a 15-ton 1,750-KW. arc furnace with a Frick furnace of the same capacity and power, it is certainly not unfavourable to the arc furnaces to assume a load-factor during

the heat of 90 per cent., as against a load-factor of 100 per cent. attainable by the induction furnace. But this means 10 per cent. higher production and 10 per cent. lower cost per ton of steel.

Amongst metallurgists the conviction is general that the induction furnaces are not, and cannot be, suitable for refining.

This opinion about the importance of a thin slag has its origin from the experience with open-hearth furnaces. The induction furnace, far from being a poor refining apparatus, in reality offers decided advantages over all other furnaces.

Altogether excellent results with regard to desulphurisation have been obtained in induction furnaces, amongst which those in Dommeldingen might be mentioned, where, according to analyses published in *Stahl und Eisen* of 1911, steel of 0·012 per cent. sulphur to traces, with an average of 0·008 per cent. sulphur, has been produced out of a raw material containing about 0·04 per cent. sulphur.

In the electric furnace the following reactions may be carried out: (1) Decarburisation; (2) desiliconising; (3) dephosphorisation; (4) deoxidation; (5) rephosphorisation; (6) desulphurisation; (7) recarburising; (8) alloying with silicon, manganese, nickel, chromium, tungsten, &c.

On account of the possibility of completely deoxidising both metal and slag, the electric furnace is eminently suitable for the manufacture of all kinds of alloyed steels, as it will not only save the losses of metal, occurring in other furnaces, but will also greatly facilitate the obtaining of correct analyses. Through the gentle rotation of the bath in the Frick furnace, a perfect distribution of the alloys and an absolute uniformity of the product can be secured.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Royal Heater.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, are introducing a new heater, fig. 1, under the Bastian patent. This heater, in an elegant brass case, is of best London make, and suitable for use in drawing rooms, boudoirs, first-class state-rooms aboard ship or any superior apartment. It

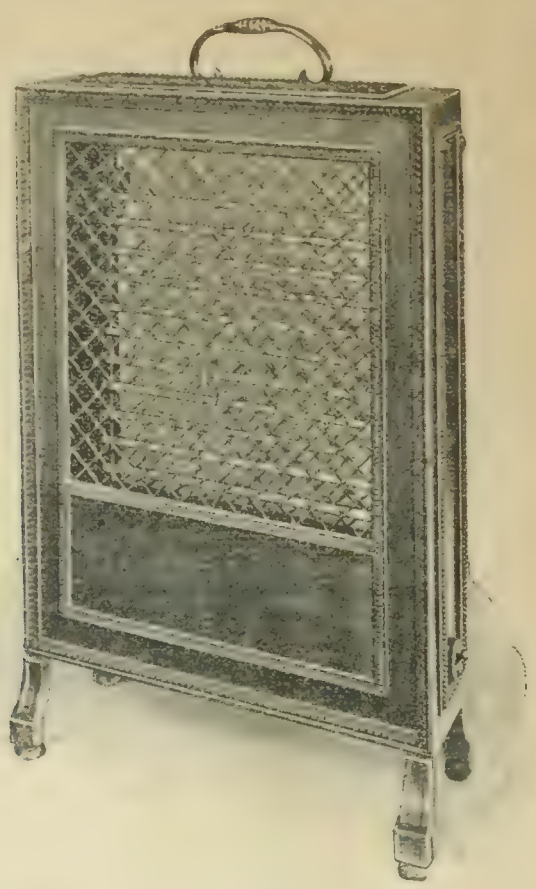


Fig. 1.—The "Royal" Heater.

is usually fitted with two switches and 12 Bastian glowers of 1,500 watts capacity, but the same pattern can be supplied fitted with eight glowers only of 1,000 watts capacity. It stands 19 in. high, has a depth of 5 in., and breadth of 12 in.; the weight is 10 lb., and energy consumption ¾ to 1½ units per hour (12 glower) or ½ to 1 (eight glower).

New Ozonair Apparatus.

Messrs. Ozonair, Ltd., of 96, Victoria Street, S.W., have recently brought out two entirely new designs of ozone generators, which are illustrated herewith. Fig. 2 shows a portable pattern, type No. 28, for alternating current only, which is not provided with a fan, nor has it any moving parts; a three-point regulator enables the strength of the ozone to be varied. The apparatus weighs only 20 lb., and is exceptionally neat and simple. The other illustration shows types Nos. 26 and 27, for A.C. and D.C. respectively, which have been designed mainly for use in tropical and humid climates; the ozone generator is enclosed in a special compartment, with shutters which close the air inlet and outlet when ozone is not being generated.



Fig. 2.—Portable Ozone Generator, Type No. 28.

The fan motor is entirely accessible for lubrication and renewal of brushes, and a regulator is provided to control its speed, with a

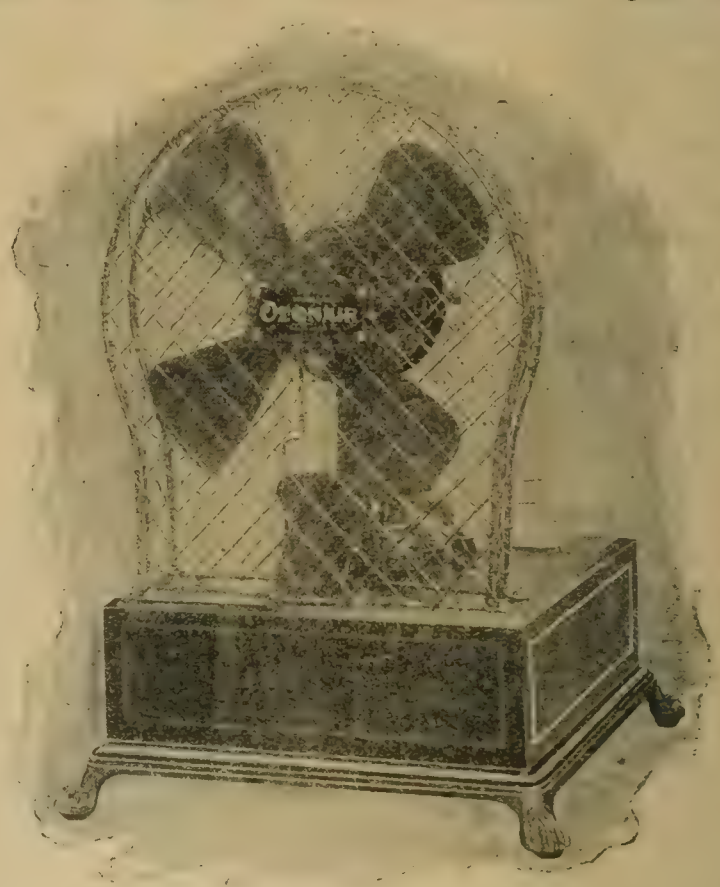


Fig. 3.—Portable Ozonair Apparatus, Types 26 and 27.

four-way switch which also controls the ozone generator and operates the shutters.

BUSINESS NOTES.

The German Glow-Lamp Market.—The situation of the market for incandescent lamps is referred to in the report for 1912-13 of the Wolfram Lampen Gesellschaft, of Augsburg, which underwent financial reconstruction in the past year. The market is characterised as having been unfavourable owing to the too rapid promotion of new factories for the manufacture of wire lamps and the extension of the productive capacity of others. Nevertheless, the company's new type of lamp has been successful in competition with lamps having drawn-wire filaments. A severe trade contest, however, may be expected in the future, and a change in this respect could only be effected by the combination of existing makers. The report also states that the patent action in regard to the manufacture of drawn wire, which has already proceeded for a year and a half, has not yet been decided, and the efforts of a group of manufacturers to monopolise drawn Wolfram wire, appear from the beginning to have no prospect of being successful, inasmuch as the process of manufacture became common property long ago through prior publication.

Book Notices.—*The Commonwealth Engineer.* Melbourne: The Tait Publishing Co. Pty., Ltd. Monthly, price 6d. —Mr. Peter Tait, well known as the publisher of the *Mining and Engineering Review*, has recently added to his publications a new monthly journal—the *Commonwealth Engineer*—the first number of which is to hand. Uniform in style with the *Review*, it is the intention to include in its pages matters relating to civil, mechanical, electrical and railway engineering, for which it has been impossible in the past to find sufficient space in that paper, which is, of course, mainly devoted to mining and metallurgy. The first issue, which makes very interesting reading, contains a series of articles, many of them illustrated, dealing with electrical matters, dock work, water supply, concrete bridge work, Australian timber, &c. We gather that considerable support has been promised to the new venture, which has our best wishes.

"Researches in Magneto-Optics." By P. Zeeman. 1913. London: Macmillan & Co. Price 6s. net.

"Factory Lighting." By C. E. Clewell. 1913. London: Hill Publishing Co., Ltd. Price 8s. 4d. net.

"Dynamo Lighting for Motor-Cars." By M. A. Codd. Price 2s. 6d. net. "Molesworth's Pocket-Book of Useful Formulæ and Memoranda." 1913. Price 5s. net. "Science Abstracts." Sections A and B. Vol. 16, part 8. August 30th, 1913. Price 1s. 6d. net each. London: E. & F. N. Spon, Ltd.

"*Journal* of the South African Institute of Engineers." Vol. XI, No. 12, and Vol. XII, No. 1. July and August, 1913. Johannesburg: The Institute. Price 2s. each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 6. August, 1913. New York: The Society.

"United States Government Specification for Portland Cement." "Analysed Iron and Steels—Methods of Analysis." "Analysed Iron and Manganese Ores—Methods of Analysis." 1913. Washington: Government Printing Office.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII. No. 15. August 15th, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

Ironising Boiler Tubes.—Mr. Sherard Cowper-Coles has granted a licence to the British Mannesmann Tube Co. for ferro-zincing and ironising boiler tubes to prevent corrosion or pitting; they are erecting a plant at their Landore works for this purpose. The process consists of coating the tubes with a thin layer of pure iron, which may or may not be afterwards coated with zinc. The coating of pure iron is found to be very inert to chemical action and thus forms a good protective covering.

The "Weak-Current" Industries in Germany.—It is stated that efforts have been made in Germany for some time past with the object of bringing about a combination in the weak-current (telephones, telegraphs, &c.) industries for the purpose of counteracting depression in prices. An agreement has already been reached in certain classes of manufactures. But owing to the multiplicity of the products dealt with, great difficulty will be experienced in securing a close association of all the works concerned.

Extensions at the Cyclone Works.—Correcting an item which recently appeared in our "Contractors' Column," Messrs. Matthews & Yates, Ltd., inform us that their extensions were completed by the beginning of this year. They consist of, first, a building which doubles their capacity for making light sheet-iron work, used principally for ventilating ducts in connection with their fans, and gives them probably one of the largest sheet-metal works in the country for this class of work. The second extension is practically a new works, designed and specially equipped for heavier sheet-metal work and light constructional work, used partly in connection with the firm's ventilating, dust-collecting, drying and other schemes, in which fans are largely used, but also giving them facilities for constructional work for outside firms which is not particularly connected with fan work, such as steel hoppers, chutes and bins, oil separators, settling tanks, roof principals and light constructional work, &c.

Disclaimer.—Mr. W. W. Martin, electrical engineer, of 320, Witton Road, and 84, Trinity Road, Birmingham, and 70, Coventry Street, Kidderminster, asks us to state that he has no connection with the Mr. A. E. Martin, recently mentioned under "Bankruptcy Proceedings."

Spanish Commercial Museum.—A Royal decree has been issued ordering the creation of a Museum of Commerce under the direction of the Ministry of Commerce, Industry and Labour. The object of the museum is the increase of commerce, and especially foreign commerce, by supplying information to Spanish producers and merchants as to the state of industries in Spain and abroad. It is intended to institute a permanent exhibition of samples, Spanish and foreign, methods of packing, &c.; an office for information on transit rates; an office for foreign trade; an office to supply information on Spanish and foreign tenders and contracts and other openings for business, and a section for experts' reports, publications, and a library. The museum will publish a catalogue of samples and a *Boletin Comercial* which will furnish a list of foreign firms wishing to enter into business relations with Spanish houses or others interested, as well as particulars of Spanish and foreign adjudications on tenders. There will also be established at the Ministry of Foreign affairs a "Centro de Informacion Comercial del Ministerio del Estado," which will likewise furnish information calculated to extend the commercial relations between Spanish and foreign firms and others concerned.

Catalogues and Lists.—General Electric Co., Ltd. —"G.E.C. Monthly List"—a new feature, consisting of a leaflet so perforated that the respective sections of it can readily be separated, for the purpose of gumming them into the corresponding sectional catalogues. It is intended to distribute these monthly sheets to everyone on the firm's mailing lists, to keep their customers posted with the latest information regarding new types of apparatus, &c. The present sheet relates to new patterns of the "Geeko" double-line auto-reset intercommunication telephones, electric bells, and lead-headed wall nails for supporting cables.

Brimsdown Lamp Works, Ltd., Kingsway House, W.C.—Price list of "Wirum" lamps, all sizes from 5 to 1,000 c.p. and voltages from 25 to 260 volts.

The Ostro Light Co., 11, Queen Victoria Street, E.C.—Leaflet giving particulars and prices of the "Ostro" lamps, with metal filaments.

Hans Fickenscher, Ritterstr., 31, Berlin S. 42.—Prospectus 53 of electric light lustres, pendants, lanterns, bead-shades, &c.

International Electric Co., Ltd., 111-115, Salusbury Road, Kilburn, N.W.—Price List D, covering domestic, direct-working, central-battery and magneto telephones of a variety of types.

Messrs. D. N. Dobson & Co., 93, Aldersgate Street, E.C.—Price list of Dutch hand-made art-metal ware, including electric light fittings, from the "Cuprera" Art Metal Works, for which the firm are sole agents for Great Britain and the Colonies.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—Pamphlet No. 51, describing the "Cyclone" electric fans and exhausters for ventilation and kindred purposes, as well as the "Cylone" electric d.c. motor and the "Sirius" oxy-acetylene welding and cutting plant.

Messrs. Siemens Brothers Dynamo Works, Ltd., Tyseen Street, Dalston, London, N.E.—Leaflet dealing with a new style of opal reflector under the name of "Marbella." These reflectors have a pleasing appearance, and eliminate glare, giving a pure, soft, white light; they are exceedingly easy to clean, and do not collect dust. They are made in concentrating and distributing types. Galleries are unnecessary, as these reflectors have a 1½-in. hole.

Simplex Conduits, Ltd., 116, Charing Cross Road, W.C.—Leaflet describing two larger sizes of their cast-iron ovens which are now being supplied, and a rapid water heater.

International Railophones, Ltd., Prudential Buildings, Corporation Street, Birmingham.—Price list of railophone equipments, which are ready for prompt delivery. One of these equipments has been tested on a section of the German Imperial State Railways, near Berlin, with the result that an extension 10 times as long as the original plant has been ordered. The apparatus has been patented in 33 countries. Had it been installed at Aisgill, there would have been no collision.

Coal Mines Act, 1911.—Notice is given that the books containing the parts of the Abstract and General Regulations prescribed by the Secretary of State under Sec. 88 (1) (*b*) of the Act, in respect of the different classes of persons employed in mines, are now in the press, and will, it is expected, be on sale not later than September 13th at the Government sale agents—Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C., and 54, St. Mary Street, Cardiff; H.M. Stationery Office (Scottish Branch), 23, Forth Street, Edinburgh; and Messrs. E. Ponsonby, Ltd, 116, Grafton Street, Dublin.

Sec. 88 (1) (*b*) requires the owner, agent, or manager of every mine to supply gratis to each person employed in or about the mine a book containing the parts of the Abstract and General Regulations prescribed as affecting him, and also to supply a copy, at a price not exceeding 1d., to any such person applying for it at the pay office of the mine.

A list of some of the classes of persons for whom separate books are required is given below, and the official reference number, which should be quoted in ordering books, is given in each case. The books will be published at the uniform price of ½d. each or 3s. a hundred.

	Mines and Quarries Form No.
Officials superior to the firemen, examiners and deputies	55
Mechanical engineers	56
Electricians and assistant electricians	58
Winding enginemen	59
Boiler minders	63
Persons in charge of ventilating machines	64
Shot firers	65
Hauling enginemen and persons engaged in mechanical or gravity haulage operations	70

Underfeed Stokers.—Amongst recent sales of stokers by the Underfeed Stoker Co., Ltd., are the following:—

Bradford Corporation, 2 E; Brompton and Kensington Electricity Supply Co., 2 E; Edinburgh Corporation Electricity Works, 2 B; Holloway Electricity Works, 2 B; Yorkshire Electric Power Co., 2 E; Luton Corporation, 4 E; Warrington Corporation, 1 E; Bury St. Edmund's Corporation, 2 B; Loughborough Corporation, 1 E; Lisbon Electric Tramways, 4 E; Philadelphia Power Station, 2 A.

A large number have also been supplied to manufacturing companies at home and abroad.

Dissolutions and Liquidations.—Hobart Electric Tramway Co., Ltd.—On August 15th and September 1st the company resolved that it be wound up voluntarily, and Mr. F. J. Warner, 11, Queen Victoria Street, E.C., was appointed liquidator, with a committee consisting of Messrs. A. Mattei and J. G. Bellamy.

A meeting of creditors will be held at 126, Mansion House Chambers, 11, Queen Victoria Street, E.C., on September 16th, at noon. Particulars of claims to be sent to the liquidator by October 15th.

Gilbert Arc Lamp Co., Ltd.—A meeting will be held at 3, Fenchurch Street, E.C., on October 7th, at 3 p.m., to receive an account of the winding up from the liquidator.

Doncaster Electrical Co., Ltd.—A meeting will be held at 37, Manor Row, Bradford, on October 8th, at 11 a.m., to receive an account of the winding up from the liquidator.

Trade Announcements.—Messrs. The Ostara Metal-Filament Lamp Works, of Plauen, have now made arrangements to be represented in Great Britain at 105, Market Street, Manchester, and in future all trade inquiries will be dealt with from this address.

Larger and more convenient premises at 18 and 20, Parliament Street, Nottingham, have been taken by Messrs. J. Farr & Co., electrical engineers and contractors, of South Sherwood Street.

Bankruptcy Proceedings.—Wesley Sutton, traveller for electrical manufacturers' agents, 62, Dale Street, Liverpool.—Notice is given in the *London Gazette* of the release of trustee as from June 19th last.

Austrian Cable Manufacture.—The employment of the Austrian cable works, which was active down to the spring of the present year on the basis of old contracts, has since been very unsatisfactory. A considerable decline has taken place in the exports and in the receipt of private orders for the home market, whilst Government orders are entirely absent. The work in connection with the development of the Vienna telephone exchanges has also been postponed.

LIGHTING and POWER NOTES.

Abercarn.—It has been reported to the U.D.C., that the Risca District Council declines to co-operate in promoting a Bill, giving the local authorities power to provide electricity and electric traction in the district, and has intimated that it reserves the right to oppose any such scheme.

Argentina.—According to the *Review of the River Plate*, it was reported that the Farquhar Syndicate had obtained control of the Hydro-Electric Co., of Tucuman. It has also been reported that it is its intention to electrify a portion of the Argentine North-Western Railway; the company is supplying in Tucuman in competition with two existing companies and, according to our contemporary, the rates have been cut so low that even small mud houses of one room have the electric light.

Australia.—The South Perth (W.A.) Municipal Council intends to borrow £7,000 for the purpose of purchasing the electric light works, and making extensions to the plant.—*British Australasian.*

Balderton.—Public Lighting.—The electric street lighting carried out by the Parish Council has been inaugurated by Lieut.-Col. C. J. Huskinson, who switched on the current. The installation, which is on the overhead system, has been carried out by Messrs. Loxley & Co., and current is taken from the engineering works of Messrs. Simpson & Co., which are in the parish.

Battle.—Workhouse Lighting.—The B. of G. on September 5th decided to engage Mr. A. C. Ticehurst to draw up a complete specification for the electric light installation at the Workhouse, to supervise the work and to thoroughly inspect it on completion, at a fee of £12 12s.

Bognor.—Such rapid progress has been made by the local gas company with the construction of the electricity works, that it is hoped to have a supply of current available by the end of September.

Bradford.—A Satisfied Consumer.—A correspondent writing to a Bradford newspaper urges his fellow citizens to meet the advance of house coal prices by using electricity for heating, and gives a concrete example to prove that, by combining lighting and heating, the householder can easily save money on the use of electricity as against gas and coal. The illustration given from actual experience is as follows:—House of rateable value £19. Total cost of installation and equipment, from the entrance of the wire into the house to and including the provision of 16 lamps for lighting, and two four-light radiators with five connecting plugs, £20; cost of electricity supply for one year, £2 17s. at 3s. in the £ on the rateable value, and £1 15s. 5d. for 850 units used at a half-penny per unit; total electricity cost, £4 12s. 5d. The result of the use of electricity for heating was a reduction of the coal bill from £8 8s. to £4 6s. That saving of £4 2s. deducted from the total electricity cost of £4 12s. 5d. leaves 10s. 5d. only to set against the former gas bill. The amount of the former gas bill is not given, but, of course, could not be anything like so small a figure as the 10s. 5d. The correspondent does not work out the amount which should be added to the electricity cost to represent the annual proportion of the capital outlay, but, on the other hand, he also omits to mention the saving in cost of house decorations by reason of the greater cleanliness of electricity.

Braintree.—Proposed Electric Supply.—The Direct Electrical Supply Co. has informed the U.D.C. that the formation of a company was contemplated with the object of providing a supply of electricity for Braintree and Bocking, and asking the Council if it was prepared to assist and facilitate the scheme. When the matter came before the Council on September 2nd, the chairman said that the Council had decided to keep the matter of electric light in its own hands. He added that a Committee had the question under consideration, and an expert had been appointed to make a report respecting the provision of electricity works. This report, he hoped, would be available within the next month.

Brazil.—The Santos Power Plant.—The Compania Docas de Santos, which in addition to controlling the Docks at the Port of Santos, Brazil, carries on a good deal of building and other work in that city, has recently completed a large electricity station at a place about 37 miles from Santos, where the power of the River Statinga is utilised. The river is located in a very mountainous district, and is stated to have a fall of over 2,000 ft. in a few miles. A canal had first to be constructed to conduct the water to the pipe line; the latter is about 1¼ miles long; it is built up of steel pipes, each section being nearly 20 ft. long. The power station is located on the banks of the river, and owing to the marshy nature of the land, cement foundations to a depth of nearly 60 ft. had to be constructed. The plant at present installed comprises five sets of turbines and 3,000-kw. three-phase generators, working at 2,300 volts, 60 periods, the normal speed being 514 r.p.m.; three sets of turbines and 130-kw. (220-volt) exciters; also transformers, each of 1,000 kw. capacity, arranged in groups of three. The current is transmitted at a pressure of 44,000 volts to Santos, where at the sub-station five 3,000-kw. transformers step-down the current to 6,600 volts. From the sub-station 21 distributing circuits run to different parts of the city—to the docks for power purposes—for the operation of the numerous cranes and conveyors—to the lighting system, and to a quarry owned by the company, the latter absorbing about 650 h.p.

Bridge (Kent).—Electricity Scheme.—The R.D.C. on September 4th received from Mr. G. Stainton, of Whitstable, particulars of the E.L. scheme for Sturry, Fordwick, Westbere and Broad Oak, briefly referred to in a recent issue of the Elec. Rev. Mr. Stainton stated that current would be generated at the Black Mill at Sturry. Water-power would be utilised, and, if necessary, this would be supplemented by a suction gas plant. It was proposed to distribute the current by overhead wires, at about 240 volts, and this would enable the company to provide electricity at a rate sufficiently cheap to compete with both oil and gas. The Council deferred further consideration of the scheme.

Canada.—The *Canadian Electrical News* states that there are no signs of abatement in the demands being made on the Hydro-Electric Commission for extensions of its service. To cope with these the plant of the Niagara Falls transforming station is being increased from 50,000 to 75,000 h.p. A second circuit of aluminium steel-cored cable is being added between Dundas and St. Thomas, and a new double copper circuit line between St. Thomas and Windsor is being built. The Commission's engineers have devised an apparatus for testing insulators in service, which will be continuously used with a view to avoiding breakdowns.

Two 5,000-kw. hydro-electric units are being added to the Winnipeg City plant, also a 9,000-kw. transformer. The present transformer plant is built for 6,000 volts, but future equipment will be for 110,000 volts, and a second transmission line to be erected will consist of steel towers with suspension insulators, and be available for the higher pressure.

The Kaministiquia Power Co. (Fort William) which has a 35,000-h.p. hydro-electric plant, is proposing to bring this up to 50,000 h.p. by the addition of either one or two units.

Carlisle.—E.L. Surplus and Rate Aid.—At a meeting of the T.C. on the 9th inst., there was a discussion with regard to the allocation of the profits of the electrical undertaking. The Electricity Committee recommended that £500 be added to the reserve fund, and that the balance of £1,000 be paid to the City Fund in relief of the rates. Mr. Creighton moved an amendment that the whole of the profits be handed over to the the City Fund, the net profits of the gas works, £6,000, being, in his opinion, sufficient reserve, especially as they could fall back on the City Fund in the event of a deficit. After discussion, the amendment was carried by 19 votes to 11. It was resolved on the recommendation of the Electricity Committee to install a high-tension supply in order to meet the present and future wants of the area, at a cost of £4,300; also to seek the permission of the B. of T. for the scheme.

Ceylon.—The Municipality of Galle has passed a resolution in favour of electric lighting for the town.—*Indian and Eastern Engineer.*

Chile.—A Large Electrolytic Plant.—The Chile Exploration Co., which owns mines at Chuquicamata, has placed an order for a large electric power plant with Messrs. Siemens-Schuckert, for the purpose of delivering current at the mines in order to deal with the extraction of copper by electrolytic methods. The power station is to be placed at Cobija, on the Chilian coast, and the first installation will consist of four turbo-generators of 10,000 kw. each, and a pressure of 5,000 volts. The current will be stepped up to 110,000 volts, and transmitted to the mines at a distance of about 180 km., where it will be stepped down and converted by means of motor-generators, each of 2,500 kw. capacity, to continuous-current at a pressure of from 250 to 190 volts, at which pressure the power will be passed into the baths. The steam

turbines in the power station will be fed from 16 marine-type boilers, the fuel being oil, which will be delivered in bulk direct from the ship into tanks placed above the power station. It is interesting to note that this will be one of the largest installations of its kind in the world.—*Review of the River Plate.*

Continental Notes.—France.—The Municipal Council of Roubaix has voted a credit of £44,000 for the extension of the municipal electrical installation.

The Ateliers de Construction Electrique du Nord et de l'Est is about to erect a generating station of 15 000 H.P. capacity at Fourthambault in the Department of the Nièvre, with a view to supplying electricity to the factories on the Nièvre and the cement works located in the basin of the Beffes.

Russia.—The municipal and provincial fund recently created by the Russian Government, and actually operative only since the beginning of the present year, has already received from municipalities and provincial councils 128 applications for loans to a total of 23,435,500 roubles. Among towns actually accorded loans are :—Raizan, 1,000,000 roubles for the construction of an electric station and the establishment of a water supply service ; Krasnviarsk, 150,000 roubles for the same objects ; Vero, in Livonia, 30,000 roubles for a generating station.

Spain.—A company has just been formed in Madrid with a capital of £45,000 and the title La Sociedad Nuestros Senores del Rosario, to construct a railway and an electricity generating plant in connection with the marble quarries near Macael, in the province of Almería. Some available water power is to be utilised.

Crewe.—A clause is to be inserted in the draft Omnibus Bill, which is being promoted by the Corporation, to enable the Corporation to sell, let for hire, &c., electrical fittings.

Dewsbury.—The Electricity Committee has decided to adopt for operation, from January 1st next, an alternative tariff for consumers for all purposes of 15 per cent. on the rateable value of the consumer's premises, and ¾d. per unit for current consumed, and to reduce the charges for meter hire from 7s. to 5s. per annum.

Doncaster.—The T.C. has decided to apply to the L.G.B. for powers to purchase land adjoining the electricity works in Grey Friars Road for the erection of extensions to the present works.

Ealing.—The B.C. has received the sanction of the L.G.B. to the scheme for extending the Town Hall, which is to provide better accommodation in particular for the electricity department.

Eastbourne.—Workhouse Lighting.—The B. of G. has decided to have the electric light installed at the workhouse infirmary, to the specifications of Mr. Brydges, borough electrical engineer. The estimated cost is £84.

Ecuador.—Messrs. J. G. White & Co., of London, are negotiating with the Guayaquil Electric Light and Power Co. regarding an extension of the company's plant.

Gellygaer.—Public Lighting.—The U.D.C. has decided to ask the Merthyr Traction Co. to quote terms for public lighting by electricity at Bedlinog.

Great Harwood.—Upon the question of an electricity supply at Great Harwood, it is reported that Mr. S. J. Watson, borough electrical engineer, Bury, has attended a meeting of the Council and given his views. It is understood that he favoured negotiations with Accrington, with a view to ascertaining the terms on which it would supply current, rather than the erection of a local generating station, providing, of course, that the terms were satisfactory.

Hebburn-on-Tyne.—The Mains Question.—At a meeting of the Urban Council, on the 8th inst., a member drew attention to a case of the fusing of electric cables in the vicinity of his residence, which resulted in his room being filled with the smell of bitumen ; his neighbour was awakened, and found that the whole house was filled with the odour. In the shop adjoining the position was worse, and the smell was similar to that referred to at the inquest on the victims of the Lyons Street explosion. These happenings were becoming so frequent that it was high time that the Council took drastic action. The clerk said the B. of T. had decided to hold an inquiry into the Lyons Street affair, and also the system under which the cables were laid in the town, but he understood that inquiry would take place in London. If he were instructed he would ask the B. of T. to state the date of the proposed inquiry, and he suggested that members should supply him with particulars, or be prepared to place particulars before the inquiry. It was decided to write to the Electric Supply Co. and ask for an explanation.

Hetton-le-Hole.—Public Lighting.—The U.D.C. has accepted the tender of the local E.L. company to light public lamps in Houghton Road, from August 10th to May 14th, at £1 8s. 9d. each.

Horsham.—Year's Working.—The electricity accounts for the year ended March 31st last, show that after paying interest and principal, there was a profit of £264, as against £434 in the previous year. But for heavy expenses incurred in relaying mains, the profit would have exceeded that of 1912. The undertaking continues to grow, and has well maintained the progress of past years. The number of lamps connected has increased by 2,268 ; this is the biggest increase shown since 1905.

Hyde.—Street Lighting.—An experiment is about to be made by the Lighting Committee with a view to comparing the merits of electricity and gas for street lighting purposes. The Joint Tramways and Electricity Board is being asked to fix three electric lamps in Bennett Street, and the Gas Co. is to supply mantles and fittings for three lamps in the same street, the power to be similar.

Knaresborough.—Proposed Electric Supply.—The U.D.C., last week, adopted a recommendation by the Gas Committee that a hydro-electric plant should be placed on the river Nidd for the purpose of making a commencement of the town's electricity supply. The chairman said the scheme was only a beginning, but if the Council did not make a move, there was little doubt that some private company would do so and leave the authority in the lurch.

Leeds.—Sewage Pumping.—At a meeting of the City Council last week, Mr. T. Oldroyd, moving the minutes of the Sewerage Committee, referred to the pumping plant of the new sewage disposal scheme. He said that three years ago the Committee decided to use electric power for the pumps, but when the tenders were being received, its attention was directed to the Humphrey pump, and the Committee asked for a tender for this pump and thought of recommending the Council to accept it. Upon urgent representations of the Electricity Committee, however, the matter was reconsidered, and the contract had since been placed in accordance with the original intention, and he believed that the terms upon which it was receiving a supply of electrical energy for pumping purposes justified the Committee in its eventual action.

London.—Lewisham Infirmary Lighting.—The Guardians on Monday considered two accounts received from the South Metropolitan Electric Light and Power Co., Ltd., the first amounting to £108 for installing the electric light in the Connaught and Albert wards at the Infirmary. The company had installed the light in order that the Guardians might for themselves decide on the relative merits of electricity and gas for lighting the institution, and after a prolonged trial the Board decided to install the electric light in the infirmary and workhouse. The installation in the other parts of the buildings was given to Mr. J. Hewens, of Lewisham, the lowest tenderer who accepted the work. The account of the company had been considered by the Finance Committee, who recommended that the company be offered £50 in full settlement of the claim in respect of the two wards. This offer had been communicated to the company, who, in a letter to the Board, asked for a reconsideration of the matter, as at the present contract price, the installation in the two wards would amount to £73 10s. ; after discussion, this price was agreed to.

The second account was for £54 for the installation in the medical superintendent's house. Objection was raised to a sum of £9 for nine brass standards, it being maintained by Mr. A. O. Weeks that the standards were included in the contract. It was decided to refer the account back to the Committee for reconsideration.

Maidstone.—The E.L. Committee has introduced a new scale of charges for electric lighting for shops and business premises, as follows : A fixed charge of 8d. per lamp per annum for each 32-watt lamp (25 C.P.) or equivalent, plus 1d. per unit for all energy supplied. An alternative is the M.D. system, with 7d. and 2d. per unit.

Malvern.—There was a profit on the electricity undertaking last year of £47. In the two previous years there was a loss.

Middleton (Lancs.)—The E.L. Committee has given consent to the Lancashire Electric Power Co. supplying Messrs. S. Schwabe & Co., Ltd., with electricity on certain conditions. Councillor Wiggins said the contract between Messrs. Schwabe and the Power Co. was for 10 years, and he took it that the Corporation would not be able to meet the demand before that time.

The report of the auditors to the T.C. shows that during the past financial year capital expenditure amounted to £2,432. There was a loss on the past year's trading amounting (after provision of £500 for depreciation) to £1,800, as compared with £991 for the year ended March 31st, 1912.

New Zealand.—The Dominion Portland Cement Co. has received a licence to generate hydro-electric power at Wairoa Falls, subject to the Whangarei and Dorgaville boroughs being supplied with certain power.

The company has 2,000 acres of limestone country, and is on the eve of calling for tenders for the hydro-electric plant and cement-making machinery required. The falls are expected to give 1,500 H.P. with the natural flow, and this can be increased by damming the river above.

North Wales.—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for consent to use overhead lines for the transmission of current from Fachell to the Dolgarrog works, and thence to the quarries of Penmaenmawr and the Welsh Granite Co., Ltd., at Penmaenmawr.

Redcar.—At a meeting of the U.D.C. on September 4th, a letter was read from the B. of T. intimating that it was considering the question of revoking the Electric Lighting Order of 1900, held by the Cleveland and Durham County Electric Power

Co., Ltd., owing to the failure of the company to provide a supply. The Council has decided that the general manager of the Electric Power Co. should be interviewed respecting the question.

Redditch.—Suggested Sale of E.L. Undertaking.—Following on a report by the manager, that even with the new turbine plant at the electricity works, a breakdown of the latter would involve failure of supply, a member of the Council, rather than face additional expenditure on plant, gave notice that he would move that the clerk be instructed to call a town's meeting to consider the advisability of selling the undertaking.

St. Anne's.—Loan Sanction, &c.—Sanction has been received for the borrowing of £3,000 for electric mains and services.

Messrs. Taylor & Leigh, the electrical engineer and clerk, have been authorised by the Council to enter into negotiations with Lytham Council with reference to a supply of electricity in bulk to Lytham.

Salford.—Loans, Street Lighting, &c.—An application is to be made for sanction to borrow £2,000 to cover the cost of converting a portion of the bulk supply of three-phase current at 6,600 volts to 3,000 volts two-phase current. The detailed estimate of the cost of the scheme is as follows:—One twin 3,000-volt two-phase switchboard with three transformer panels (one blank) and four-feeder panels on each phase, £1,081; two automatic regulators, £283; replacing old transformers, £300; contingencies, £335. In addition to this, the cost of a two-phase feeder cable from the power station to Cavendish Road transformer pit, Kersal, is given at £2,587, but this latter will be defrayed out of the loan of £21,000 for mains recently sanctioned by the L.G.B.

At the T.C. meeting last week a question was asked as to when the Council might expect the report of the special committee appointed to go into the question of street lighting. Alderman Hulton, who did not give a definite reply, said that when they presented a report they wanted to present one that would be complete, and that would show the alterations and improvements they proposed to make.

Sheffield.—The T.C. announces that current for lighting the outside of business premises is now supplied at 2d. per unit when taken through a separate meter.

Skelton and Brotton.—At a meeting of the U.D.C. on Friday last, it was announced that plans and specifications were being prepared for an electricity scheme to be carried out under the recently obtained prov. order.

South Africa.—The Uitenhage (Cape Province) ratepayers have confirmed the purchase by the Corporation, from the Uitenhage Electric Light and Power Co., of London, of the electric lighting installation for £30,000. Authority was also given to raise the necessary loan to defray the purchase price and incidental expenses.

A further increased demand for electrical cooking appliances is anticipated in Durban, as the municipality is considering a scheme for advancing the money to householders who find the outlay an obstacle. During the past financial year the number of consumers of current for private purposes has advanced from 5,529 to 6,100.—*African World.*

Stockport.—Dealing with the abstract of accounts at the T.C. meeting on September 3rd, the chairman of Finance Committee said the sales of electricity were up by £3,956, which was equal to an increase of 18 per cent. The working expenses were up by £1,896—an increase of only 12¾ per cent.—and the result was highly gratifying.

Stretford.—The question of the supply for tramway purposes in Trafford Park has been adjourned for a couple of months. In the meantime the resident engineer is to draw up a report upon the cost of connecting up the Trafford Park system, and the effect thereof upon the station. Pending the result of the foregoing, the question of extending the plant at the generating station has also been adjourned.

Swansea.—Loan Sanction.—It was reported at last week's meeting of the Electric Lighting and Tramways Committee, that the L.G.B. had sanctioned the borrowing of £40,000 for electrical extensions in the borough. The electrical engineer (Mr. Prusmann) was instructed to prepare specifications and invite tenders for electric motors and switches for periods of one or two years, the existing contracts having almost run out. It was further agreed to purchase from Messrs. Ferranti, Ltd., a switchboard required for temporary use at the electricity station, and eventually for permanent use.

Teignmouth.—Mr. E. M. Lacey has been asked to report on a proposed electricity scheme for the Corporation.

Torpoint.—Public Lighting.—The U.D.C. has decided to adopt electricity for public lighting, and has accepted the terms of the electricity company for 50-c.p. lamps at £2 5s. each per annum.

Winchester.—Loan Sanction.—The T.C. on September 4th received from the L.G.B. sanction to a loan of £1,800 for the purchase of the freehold of the site of the electricity works. It was decided to install a new reversible booster at an estimated cost of £350.

Wolverhampton.—The Water Committee has decided to dismantle the existing plant at Goldthorn Hill station, and to install electrically-driven high-lift centrifugal pumps (in duplicate) at an estimated cost of £630, to be paid for out of reserve fund.

Yorkshire Municipal Extensions.—Large schemes of extensions of area are being entered upon by Leeds, Bradford, Huddersfield and Halifax, which, if carried to success, will involve a very great increase in the possibilities of electrical supply, bringing into the jurisdiction of the authorities named a wide stretch of terrain which has now no such facilities. Leeds proposes an increase of area by 41,441 acres, and Bradford aims at an accretion of 57,482 acres.

TRAMWAY and RAILWAY NOTES.

Ashton.—No Strike.—The difficulty which threatened to bring about a general strike of tramwaymen has now been overcome. There was an insufficient majority of the tramwaymen in favour of a strike, and as a result of a conference, a scale of pay has been drawn up which has now been accepted by both sides.

Argentina.—For year ended June 20th the Compania de Tramways Eléctricos del Sud made a profit of $231,843·90 m/n. The paid-up capital is $3,098,500.—*Review of the River Plate.*

Australia.—The plans for the Sydney tube railway have been approved by the New South Wales Cabinet. The Minister of Works stated that the matter will be submitted to Parliament as early as possible this session, with a view to the work being started without avoidable delay.—*Tenders.*

Bristol.—The Tramways Purchase Report.—At a recent meeting of the Council, a report of the Committee, appointed in February last, to consider as to the desirability or otherwise of exercising the option to purchase the tramway undertaking within the city, was considered. In the Bristol Tramways (Extensions) Act, 1898, provision is made that the Corporation may first give notice to exercise its power to purchase the whole of the undertaking then within the city on May 1st, 1915, or within six months of that date. This power to purchase, if not exercised at the above-mentioned date, or within six months afterwards, will recur at the expiration of every subsequent period of seven years. In its report the Committee states that the option at present extends to about 25 route miles out of a total of 31 route miles of the Bristol Tramways undertaking. Of the remainder, about 1½ miles is purchasable in 1928, and five other short lengths in 1946. After having obtained all the information possible with reference to other tramway undertakings, and with the view of arriving at an approximate valuation of the Bristol Tramway undertaking, the report continues, the Committee obtained the assistance of Mr. J. B. Hamilton, Leeds, and of Mr. J. F. C. Snell. These gentlemen have gone very exhaustively into all the questions referred to them, and have advised as to the probable cost of acquiring the undertaking, and the probable return which would accrue to the Corporation on the capital amount spent in its purchase, and after taking into consideration the past history of the undertaking, and the probabilities for the future both as regards the number of passengers to be carried on the present or an extended system, and the chance of any alteration or improvement in electric or other form of traction which would replace the present system, they have advised that on their estimate the Corporation possesses a very valuable option which it would be advantageous for it to exercise on May 1st, 1915, in the absence of any important or radical changes. Continuing, the Committee states that under the Tramways Act, 1870, the Corporation can acquire the greater portion of the tramways in 1915, but if it so acquires them, power to work them must be obtained by a special Act, and without such power the Corporation is not in an equitable position to enter upon any negotiations with regard to the undertaking. Under the circumstances, therefore, the Committee confidently recommended the Council to promote a Bill in the next Session of Parliament for the necessary powers to work the undertaking if acquired, and also to raise the purchase money to be paid by the Corporation. This recommendation, the Committee stated, did not bind the Council to any definite policy, but left it free to determine, when the proper time arrived, whether it would exercise the option to purchase or not; whilst even if the Council decided not to give notice to purchase the tramway undertaking, the expense of obtaining the powers above mentioned would not be thrown away, inasmuch as the powers when once obtained would remain for all time, and could be put into force should the Council at any further date determine to exercise the option of purchase.

Ald. Pearson moved that a clause be inserted in the proposed Bill enabling the Corporation to take a poll of the city on the question. The Tramway Co. had been approached for information to enable the Committee to value the undertaking upon absolutely reliable information, but the company did not think the time had arrived when it could give the information. The Committee, however, was in possession of certain information which enabled it to provide an estimate. Mr. Witty doubted if the Bill itself was necessary. He declared that the Council had authority to purchase and to work the trams, and that the Bill was not therefore needed. Mr. Moore asked if the Corporation was the authority to grant licences for motor-'buses, and an affirmative reply was given. Ald. Pearson's resolution was in the end carried, with a slight amendment.

(*Continued on page 428.*)

ELECTRICAL INSTALLATION AT A FRENCH IRON WORKS.

By Dr. ALFRED GRADENWITZ.

Among the various groups of metallurgical and other works characteristic of the industrial region of Northern France, those in the district of the River Sambre are amongst the oldest and perhaps the most important—Haumont, Louvroil, Maubeuge, Recquigies, and Jeumont, being names well known in the annals of industry. The position of this area on the boundary of the Charleroi colliery district and only a short distance from the Mons and Valenciennes collieries, as well as the importance of the railways passing through it, are among the principal factors to which its present prosperity is due.

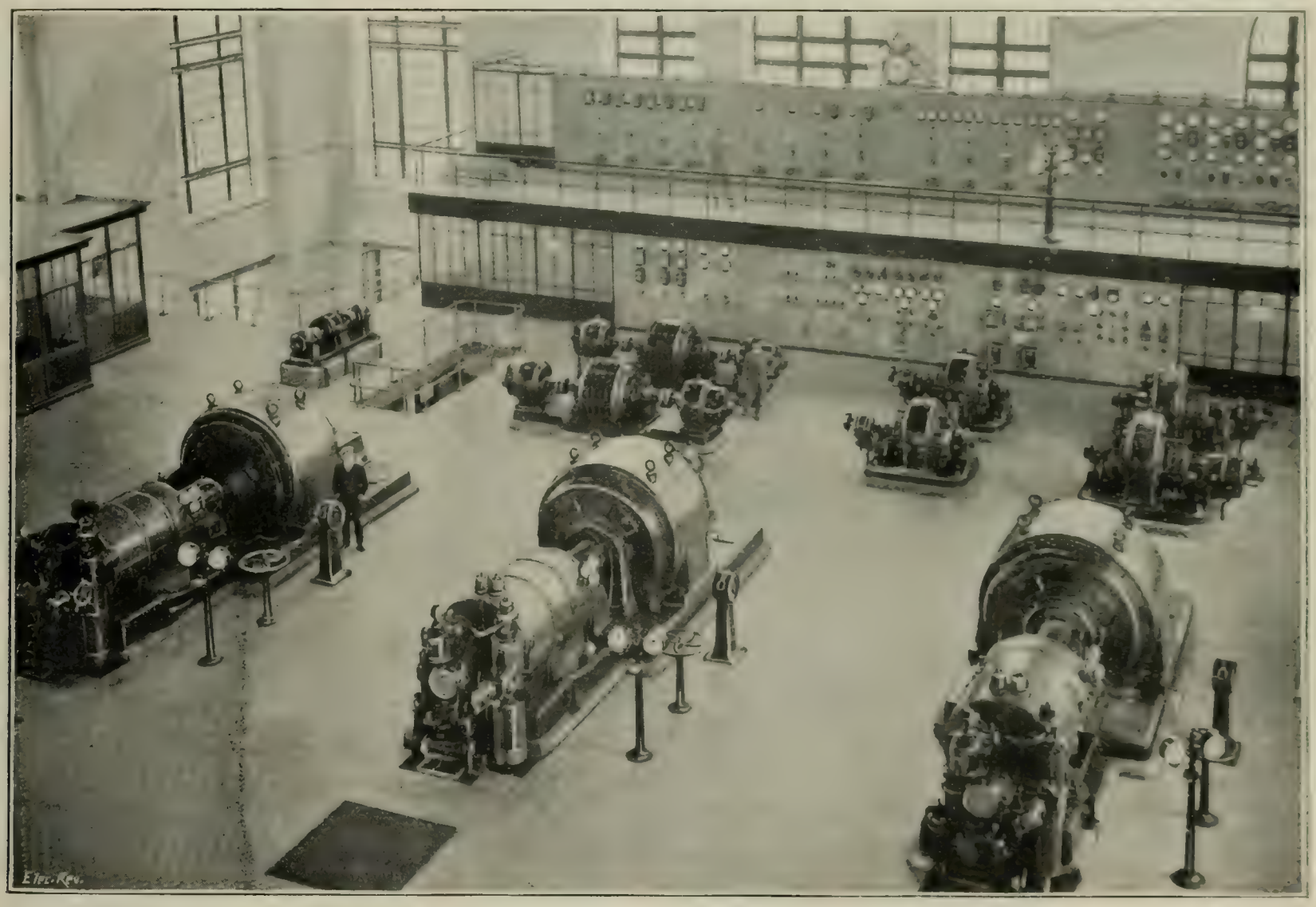
The industry of this district has of late years developed largely, through the creation of a number of new works and extension of many existing ones, practically all of which make great use of electricity for the operation of their various departments.

In the present article it is proposed to describe the electrical installation of the Societé Anonyme des Usines de l'Espérance, of Louvroil, which was supplied and erected by Messrs. Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont, France.

It may be said that these works are among the oldest of the district. Being situated on the left bank of the Sambre, between the river and the international railway connecting three of the European capitals, they have, by the quality of their products, won a considerable reputation. In addition to two blast furnaces at Aulnoye, the company possess 21 puddling furnaces, six other furnaces, five rolling mills, and an extensive horseshoe factory ; the total output of these works during recent years amounted to about 50,000 tons of castings and 60,000 tons of manufactured iron.

The electrical installation comprises a three-phase alternating current power transmission plant (at 3,150 volts, 50 cycles) for feeding sub-stations situated at a considerable distance, the blast furnaces, pumps, &c., and a 550-volt direct-current system for supplying the motors of the cranes and transporters (these being mostly situated only a short distance from the central station, transmission was not expensive) ; there is also a direct-current three-wire distribution system (2 × 120 volts) for the lighting of the works.

The central power station is situated in the same building as the blowing engines, and comprises :—Three turbo-alternators for 3,150 volts ; two static transformers for 3,150/525 volts ; four rotary converters for 3,150 volts alternating/550 volts direct-current ; two converters for 3,150 volts alternating/2 × 125 volts direct-current ; also high-tension main and low-tension auxiliary switchboards.



View in the Power Station of the Soc. Anon. des Usines de l'Espérance.

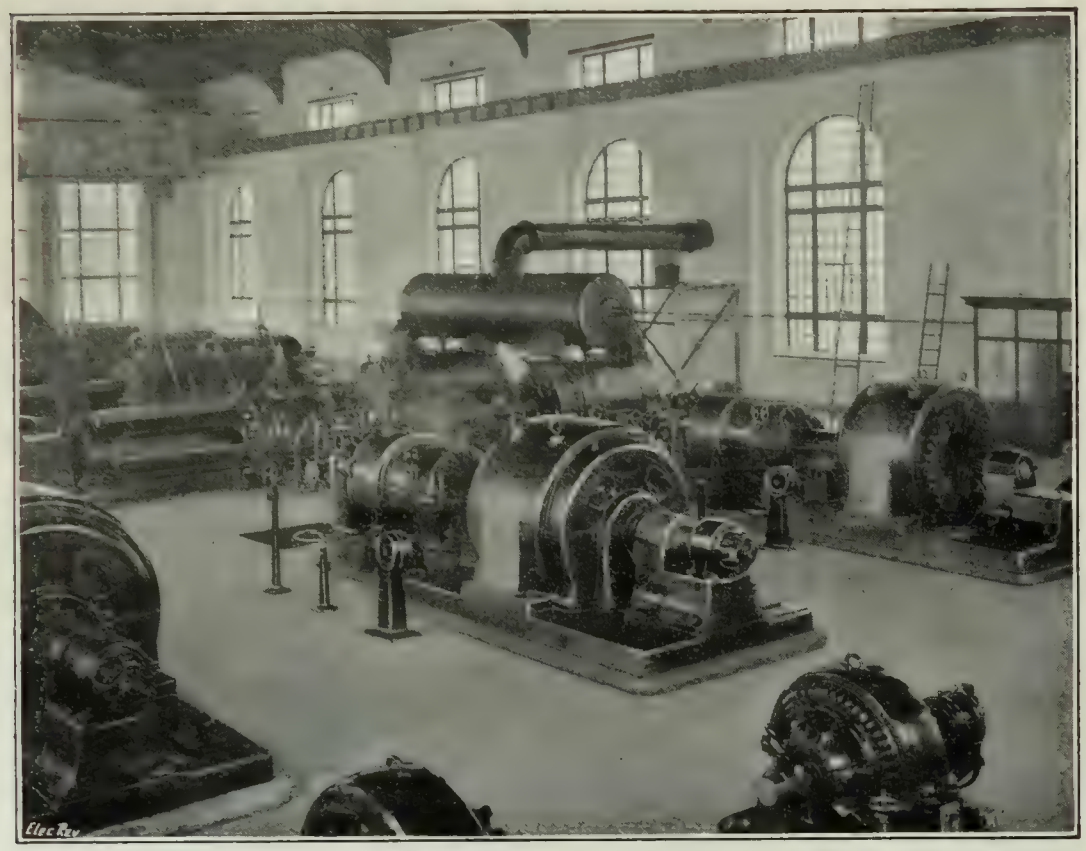
The central station was arranged so as to separate the steam plant well from the electrical machinery.

The whole output of the central station is generated by three turbo-generators, comprising Brown-Boveri-Parsons steam turbines, of 1,200 kw. normal rating, fed with steam superheated to 300° C. at a pressure of 180 lb. ; each turbine drives an enclosed alternator provided with forced ventilation, and capable of supplying 1,600 k.v.a. in the form of three-phase current at 3,150 volts and 50 cycles. Each set runs at a speed of 3,000 r.p.m., and carries its own direct-connected exciter, but the machines can be excited from one of the converter sets for the lighting service.

The air for the ventilation of the alternators is drawn from the outside atmosphere through a masonry conduit, and before reaching each alternator passes through a suitable filter ; self-acting slides are fitted in the conduits to prevent the hot air and dust from returning into the machines and suction chambers.

Current from each generator is led to the high-tension main switchboard by two three-core armoured cables, generally worked in parallel, each of which is able to ensure the service in case of breakdown of the other.

The high-tension switchgear is subdivided; the service and control switchboard is situated on a platform in the engine room, and armoured concrete compartments contain all the apparatus directly submitted to high-tension. The cubicles are on two floors, the ground floor being set apart for the duplicate bus-bar system and for the coupling and earthing section switches. Each of the bus-bars is carried on porcelain insulators in a special compartment running the whole width of the panels. The bus-bars are connected to the section switches of each panel by cables carried on insulators; each panel comprises a set of three-section switches, which allow the panel to be connected up to one only of the two bus-bar sets.



Interior of Power Station, showing Turbine Plant and Blowing Engines.

On the first floor are arranged mechanically-operated oil switches and the instrument transformers, &c. Each panel is separated from those adjoining it by armoured concrete partitions, and can be readily cut off from the bus-bars, earthed and worked on in safety whenever required. The conductors to each panel are covered with asbestos braiding, and carried on porcelain insulators, any bare portions of the conductors and apparatus being separated from one another by a movable and incombustible insulating partition. Each concrete cubicle corresponds with a switchboard panel carrying measuring and control instruments.

The opening and closing positions of the switches are indicated on the switchboard by the position of the control lever, and checked by signal lamps (green and red) visible from the end of the hall.

All the feeder panels are protected by adjustable time-lag maximum-current relays; the alternators are also protected by time-lag power relays.

The synchronising of the alternators and the rotary converters is centralised on a double-faced column placed on the platform. Instructions to the turbine operator can be given by the switchman through the apparatus on the column which is visible at a distance, or else through apparatus and signal lamps placed beside each set, the signal lamps being controlled from the switchboard.

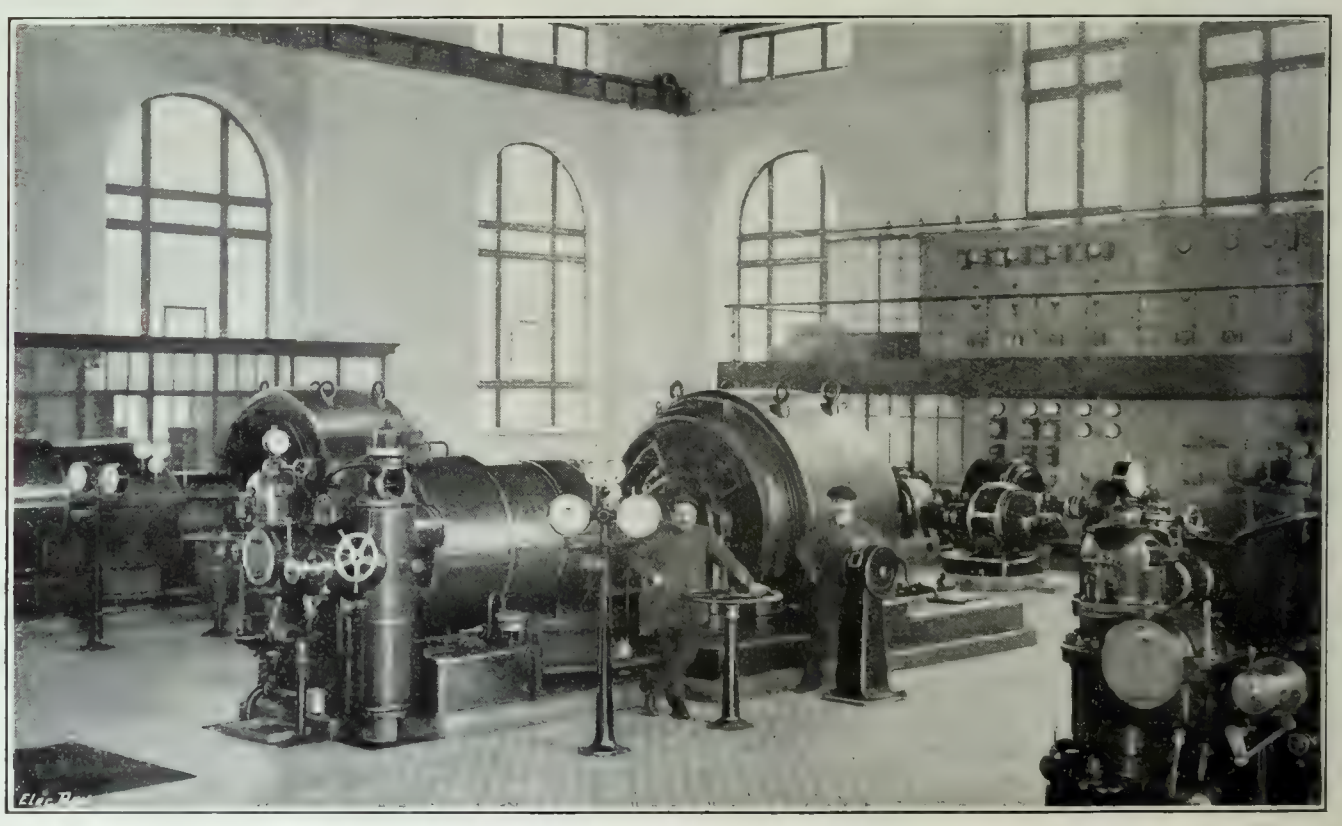
The high-tension A.C. supply is distributed to the converters, transformers, and sub-stations through this switchboard, which comprises a total of 20 panels.

Alternating current is supplied to four, three or six-phase compound rotary converter sets, two of which are of 350 KW. and two of 175 KW. capacity each. Each unit comprises a transformer, a reactance coil, a rotary converter, and a starting motor. The rotary converters are operated at a speed of 750 R.P.M, and supply 550-volt direct-current for the elevators and tractors of the blast furnaces, as well as for all the lifting machinery and transporters at the steel works and rolling mills, where momentary overloads of up to 100 per cent. have to be met without inconvenience.

Two static three-phase transformers of the oil-insulated type, with natural cooling, each of 350 K.V.A. capacity, supply the motors for the condensers and the feed pumps for the boilers.

The two rotary converter sets for the lighting service (arc and incandescent lamps) each consist of a three-phase asynchronous motor (3,150 volts, 50 cycles, 250 H.P.), comprising an arrangement for short-circuiting the slip-rings and lifting the brushes, which operates through half-elastic coupling sleeves two compound-wound dynamos, each of 75-KW. capacity 125 volts pressure, speed about 725 R.P.M.

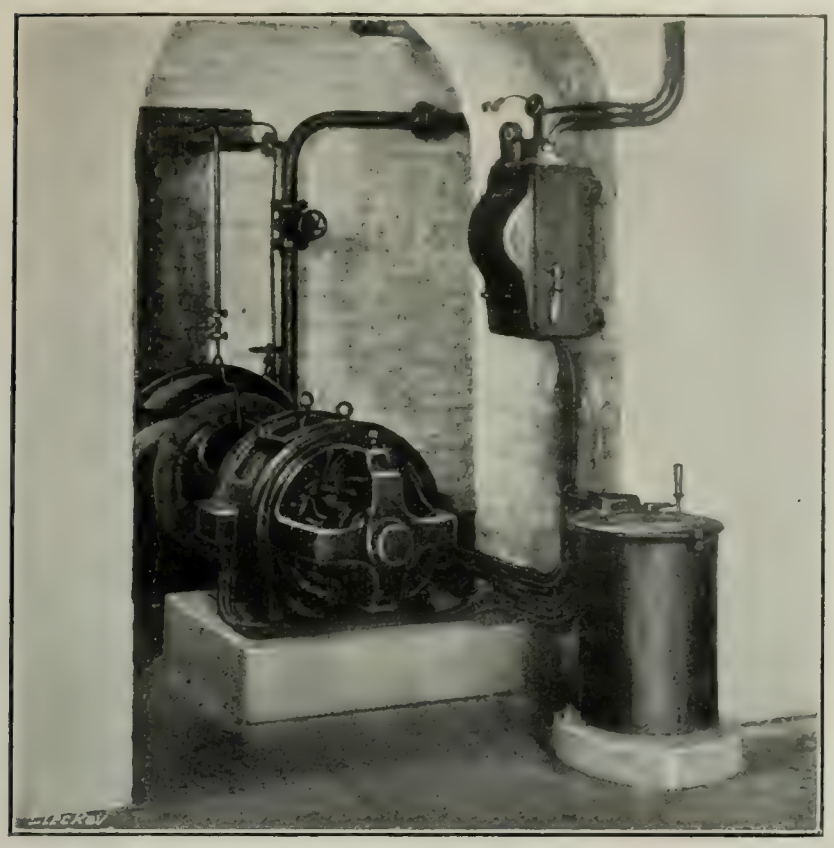
All the apparatus for controlling the low-tension supply is grouped on a series of marble panels placed below the platform in the neighbourhood of the machines to be controlled.



1,200-KW. Turbine Set; Steam End.

The armoured cables for the alternating-current supply had to comply with exacting requirements, particularly as regards their excess pressure capacity was concerned. The 3,000-volt cables were designed for a working pressure of 5,000 volts, and tested for half an hour at 15,000 volts, while those for the 550-volt service were designed for

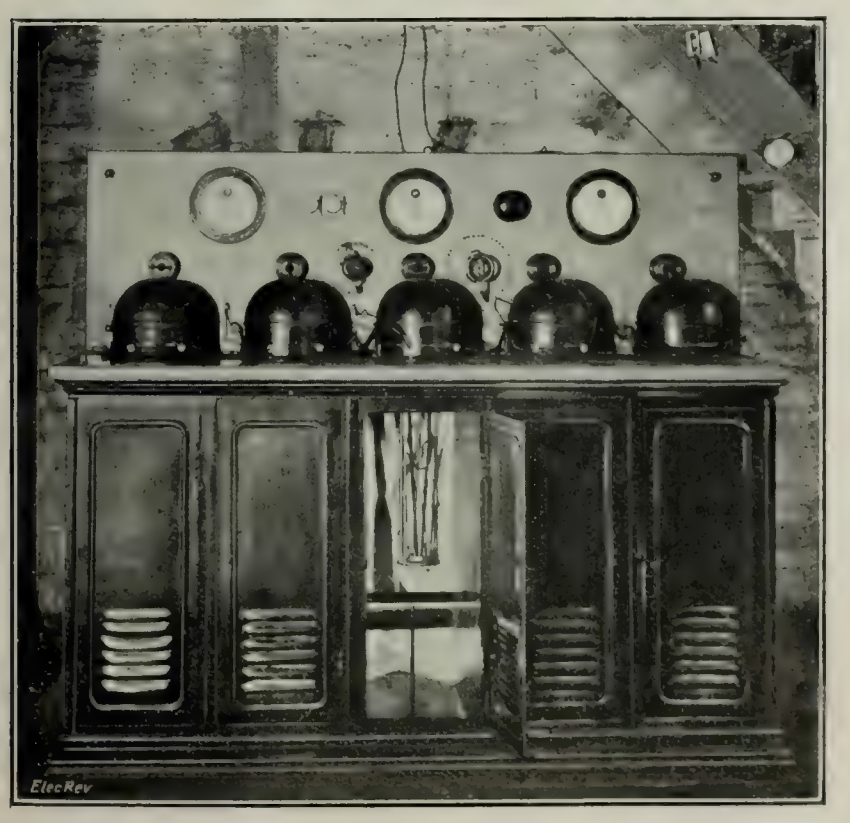
1,000 volts and tested for half an hour at 3,000 volts. Rupture tests made on cable samples showed the pressure limits as a minimum to be 30,000 volts for the 5,000-volt cables, and 9,000 volts for the 1,000-volt cables. Bending and excess voltage tests made after laying the cables gave very satisfactory results. The armoured cables have an aggregate length of about 5 km.



Motor-Driven Pump, &c., for Condensing Plant.

The direct-current conductors are aerial lines connecting the low-tension switchboards, with the roof of the central station.

The most important of the distributing sub-stations is that feeding the steel works and rolling mills, which contains high-tension switchgear feeding a static transformer of the same type as those in the central station, with a ratio of 3,150/525 volts and an output of 350 K.V.A. ; also 525-volt



Testing Board for Arc Lamps.

A.C. switchgear for distributing the supply to two repair shops and some accessory services of the rolling mills. This switchboard has been designed for receiving, in case of emergency, 500-volt three-phase current from the central station, each of its out-going lines being protected by an adjustable overload relay.

A direct-current switchboard distributes energy received direct from the central station through two lines connected in parallel, each of which can maintain the service in the event of accidents. This switchboard has connections for two incoming lines equipped with circuit breakers for isolating automatically any damaged line ; it also controls six out-going lines for the transporting machinery at the steel works and rolling mills, each of which has an adjustable maximum overload circuit-breaker, a single-pole switch and ammeter. A switchboard is also provided for the distribution of 2 × 120-volt current for the arc and incandescent lighting.

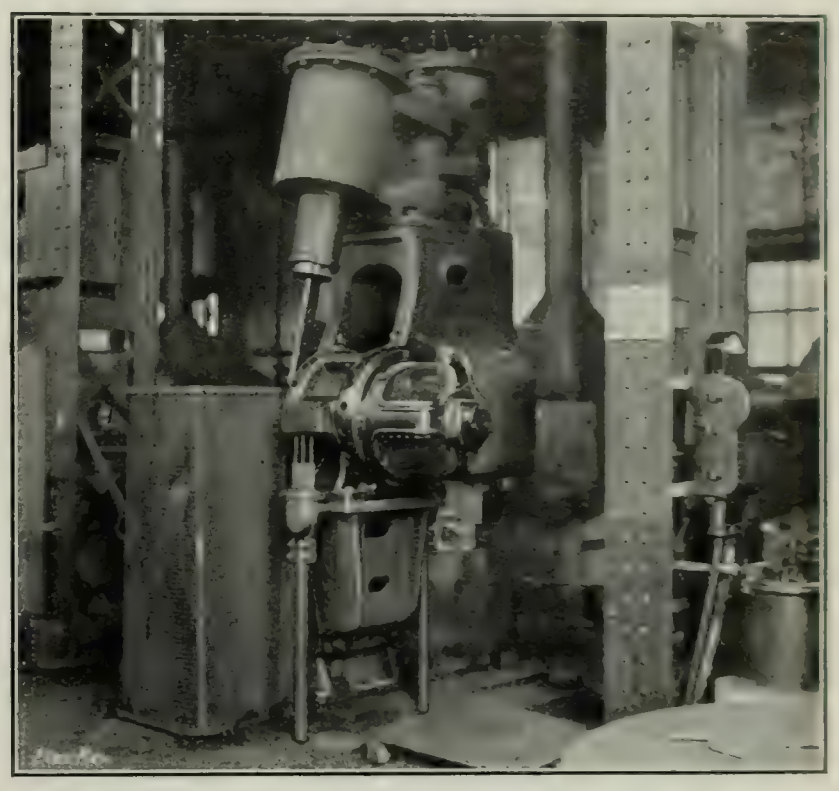
The Société Anonyme des Usines de l'Espérance has an installation of 13 travelling cranes, five of which were constructed by Messrs. Ateliers de Constructions Electriques du Nord et de l'Est, viz. :—

1. A 25-ton travelling crane in the engine room with a span of 29 m., the three electric motors on which are controlled from a cabin on the crane. The lifting motor is of 35 H.P. and the traversing motors, each 9·5 H.P.

2. A travelling crane for dismounting the blooming rolling mills with a 25-ton lift, and three electric motions.

3. A 15-ton travelling crane for the repairing of casting ladles, having four electric motions controlled from the floor of the factory.

4. A travelling crane in the general repair shop, with a capacity of 15 tons, and three electrical motions.



Electrically-Driven Pneumatic Hammer.

5. A 10-ton travelling crane for the service of the repair shop for the upkeep of the machinery and the handling of converter bottoms in course of repair. The three electric motions are controlled from the floor.

All these cranes have been specially designed for the steel works service, and are equipped with enclosed motors of a type similar to the traction motors of the same company ; all the gearings are enclosed in oil-tight casings.

The installation also includes a number of motors fed by 525 volts, 50 cycles, three-phase current, and an electric testing shop equipped with a testing switchboard having three compartments for 3,150 volts and 525 volts A.C., and 550 volts D.C. respectively.

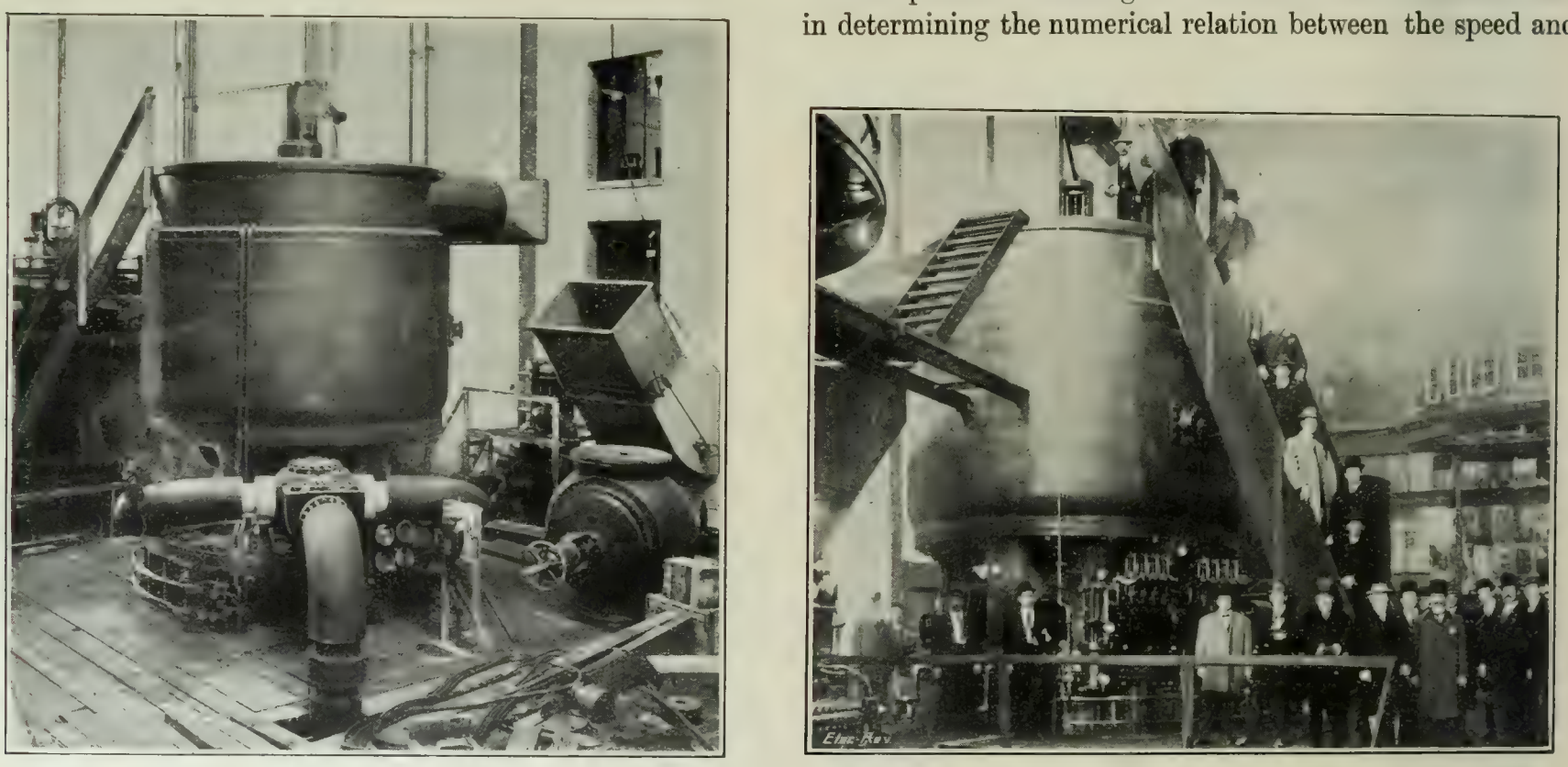
From the foregoing description it will be seen that the electrical installation forms a very important department in a modern iron-works, being indispensable for the supply of light and power ; the day may not be far distant when it will be equally necessary for the refining of the metal. Already the electric steel furnace has made great progress in development, and the facilities which it offers for the production of accurately compounded alloys such as are becoming more and more important to the engineering industry, render it of the greatest assistance to the metallurgist. There is much work to be done in perfecting the construction of the furnace, but many experimenters are engaged upon the problem, and there is little doubt that this application of electric power will, in the future, become at least as important as the functions which it already performs in iron and steel works.

THE NEW YORK EDISON CO.

Probably the largest turbo-generator in the world is that installed at the Waterside station, New York, by the New York Edison Co. Rated at 30,000 h.p., it could supply all the power needed for an average American city of a quarter of a million population.

When this generator was installed at the Waterside plant, it stood alongside seven vertical engines, until then regarded as efficient examples of electrical power plant. These were operating at full capacity, supplying the city needs for light and power; at a signal, one of the seven vertical engines stopped and the new turbine took up the load, and in succession the remaining six engines of the older type were brought to rest, and the new giant assumed the entire load of the seven. Yet the modern turbine plant occupies only a little more space than any one of them.

This latest addition to the Waterside station makes it the world's largest, with a capacity of 500,000 h.p. With an underground system of cables, feeders and mains totalling 1,114 miles, the supply for practically the entire city of New York proper, or Manhattan is furnished, together with the borough of Bronx, comprising a total area of more than 25,000 square miles, densely populated and



The 30,000-h.p. Curtis Turbine Unit at the Waterside Station of the New York Edison Co.

alive with industry and commerce. This represents more than 100,000 consumers, whose needs are supplied by nearly $4\frac{1}{2}$ million incandescent lamps (4,431,000), more than 40 thousand arc lamps (40,200), and horse-power in motors aggregating 263,500 h.p. To register the energy supplied no fewer than 122,000 meters are required. The plant occupies two full city blocks.

The history of this company is remarkable in showing continuous service from September 4th, 1882, until the present day, with only 12 hours' total interruption in all that period. The fires of 1883 and of 1890 caused interruptions of three and six hours respectively, and were the only occasions on which complete interruption of service occurred. The growth of the system in that time from an underground main and feeder system of 15 miles, serving a square mile of territory in the heart of New York City to the present immense area covering more than a score of thousand square miles, is a most significant object lesson on the advance of the electrical science in a comparatively brief period.

The electricity supply of New York City and the adjoining area requires in all generating plant of over 700,000 kw. The load factor is 36·9 per cent. and the diversity factor about 7·5 per cent. Tramway supply accounts for half the maximum demand.

METER CONSTANTS.

By "X. Y. Z."

The differences of meaning attaching to the term "testing constant" as applied to electricity meters are a source of considerable inconvenience to those who have to calibrate and test meters of varied types. These differences in meaning are about as great as they could be, and in the case of some types of meters, the testing constants appear to have been invented with a view to making them as unsuitable as possible.

The essential property of an electricity meter is that the speed of the rotor is proportional to the load, and the magnitude known as the testing constant is connected in some way or other with this proportionality. As the load on the meter is represented by the angular speed of the $\frac{1}{10}$-unit pointer spindle, it follows that the testing constant expresses in some way the gearing of the counter. From this point of view the constant "revolutions per unit" is the simplest, expressing as it does the ratio of the speeds of the rotor and the $\frac{1}{10}$-unit spindle.

The operation of taking a revolution test of a meter consists in determining the numerical relation between the speed and the load, and comparing the observed figure with the figure according to which the meter is geared. Generally speaking, some calculation is necessary after each test. The amount of calculation is important in the case of a meter assembled after repair, where the original calibration has been destroyed, and much time can be wasted in this way. Unfortunately, the constant referred to above—revolutions per unit—is about the worst in this respect. In one case, at any rate, calculation can be eliminated, or can be performed mentally, and this is with an ampere-hour meter in which the constant means ampere-seconds per revolution. In this case, if the number of revolutions counted is some simple multiple of the current, the observed constant can be deduced immediately from the reading of the stop-watch. Those who have tested Chamberlain & Hookham or Ferranti direct-current meters know how convenient this method is, and are also probably aware of the annoyance occasioned by having to use a more unsuitable testing constant.

In view of this the writer has found it advisable to convert all testing constants to ampere-seconds per revolution for the testing of quantity meters. When the voltage is under control in the test room, this advantage can be extended to the testing of direct-current energy meters. The formulæ for these conversions are given below for the testing constants usually met with.

Let v be the supply voltage, and K the ampere-seconds per revolution constant required—

(*a*) Watt-hours per revolution. Calling this K_1 ... ... $K = 3{,}600\ K_1/V$.

(*b*) Watt-seconds per revolution. Calling this K_2 ... ... $K = K_2/V$.

(*c*) Revolutions per unit. Calling this K_3 ... ... $K = 3{,}600{,}000/K_3V$.

(*d*) R.P.M. at full load. Calling this K_4, and full load current C, ... $K = 60\ C/K_4$

(*e*) Revolutions per ampere-minute. Calling this K_5 ... ... $K = 60/K_5$.

In the case of alternating-current meters, when the power is directly observed in watts, a similar method is applicable by the use of the constant—watt-seconds per revolution, the number of revolutions counted in this instance being a simple fraction of the number of watts passing.

The writer has lately adopted this method in his test-room, and he has found it to be much easier and quicker than the usual system of calculating the different constants from the observed data.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 418.)

Birmingham.—The Hagley Road tramway was opened for service on September 5th, and the 'bus service withdrawn.

In response to requests it is proposed to introduce some so-called "first-class" cars on this route.

Blackpool.—Year's Working.—The annual report of the Corporation Tramways undertaking states that during the year ending March last the total receipts were £74,166, and the working expenses £39,681, leaving a gross profit of £34,484. Of this £16,152 was required for interest and sinking fund charges, £8,000 for the permanent-way renewal fund, £2,000 for reserve fund, £667 for the rates suspense account, leaving a surplus for the rates of £7,664. During the year £9,987 was spent on the track out of the permanent-way renewal fund, and Mr. Furness, the general manager, states that it is very desirable that a sum of not less than £10,000 be allocated annually to this fund for at least the next five years. The department possesses 78 cars, of which, 20 are of the double staircase type, 15 are vestibule cars, 7 cars-de-luxe (open) and 18 "toast racks." There are 20 passenger shelters. The average number of cars in daily use all the year round was 32, but on August Bank Holiday 72 cars were in service. The circular tour with the additional open type cars, has maintained its popularity, the average receipts per car-mile reaching the high figure of 32·90d.

Bury.—A Corporation tramcar, proceeding to the Rochdale town centre, was badly damaged last week. The controller at the front of the car caught fire, and the flames spread to the other end of the car and also to the upper deck. Fifty or sixty passengers got off the car, and nobody was injured. The flames was put out with sand, and the car was towed back to the depôt.

Canada.—It is understood that the first section of the Edmonton Interurban Electric Railway, which will operate between Edmonton and St. Albert, will be in service within the next few weeks, and cars of the gasoline-electric type will be used.

Continental Notes.—Hungary.—The Hungarian Government has decided that the State Railway authorities shall take a lease for a period of 50 years of the Waitzen-Buda Pesth-Godolloer local electric railway on the payment of an annual rental of £14,583. The Phœbus Electricity Co., which is the other party to the ageeement, will continue to supply power for the operation of the line.

Germany.—According to the *Financier*, the Berlin authorities have sanctioned proposals for a suburban electric railway, 6 miles long, with 14 stations, between Gesundbrunnen and Neukolla, to cost 4½ million pounds.

Dewsbury.—New Tramways.—The Corporation has adopted an agreement with the National Electrical Construction Co. to construct tramways to Dewsbury Moor and Shaw Cross, and work them on a lease until 1950, the company to receive a subsidy of £500 per annum for the first five years and not exceeding £250 per annum for the second five years, subject to deductions of any profits made during those periods, and all financial obligations of the Corporation to cease at the end of the 10 years. The Corporation estimates that the sale of electricity to the tramway company will yield an annual profit of £220, the rates payable by the company will be £170, and there will be a saving of £500 per annum in respect to the maintenance of the roads.

Doncaster.—The Tramways Committee has introduced a new car with a Peckham radial truck. The car is fitted with a new form of saloon seat, the invention and patent of the tramways manager, Mr. E. S. Rayner. The seat rests upon legs and can be tipped back to facilitate the thorough cleaning of the car. It allows more room for passengers' legs and leaves a vacant space for the storage of parcels, &c. The new car accommodates 74 passengers.

Dublin.—According to an Irish correspondent, the tramway strike has "fizzled" out and the men are returning to their employment. The cars only ran during the day. A collection has been voluntarily subscribed for the employés who remained loyal.

The tramway company's receipts have naturally suffered during the week, the falling off being some £1,000—although the aggregate receipts to date are considerably above those of last year.

Fife.—The Wemyss District Tramways Co. is to double the line from Leven to Gallatown, and arrangements have been made for the work to be pushed forward with little delay. Formed about 10 years ago, originally as a private concern, the company has had a flourishing career.

Japan.—The Joto Railway Co. is the name of a new concern which has just been formed in Tokio, with a capital of £100,000 to construct and work an electric railway about 18 miles long, between Yanagishima, Hoiyo and Uraysau, in the province of Chiba.

Leith.—Proposed Tramway Extension.—The Tramways Committee of the T.C. has been instructed to report upon a further extension of the tramway system. The proposed extension is from the present terminus at Seafield to the boundary at Portobello Road. The estimated cost of the proposed works is given as £5,000 for single track, and £8,000 for a double track.

Manchester.—All-Night Cars.—The all-night service of cars was inaugurated on September 3rd. On the first night there was an abnormal rush for the cars, thousands of people having been attracted to the city at a late hour to witness a huge warehouse fire.

The Tramways Committee has decided to accede to the request of the Tramway Workers' Union for an increase of wages for tramway employés. The question of holidays was also considered, the men asking for seven days' vacation instead of six; the Committee referred the matter to the Workmen's Special Committee, with the recommendation that the request be acceded to. The cost of the extra payments to be made, if the consent of the Council is secured, will be about £6,000 a year.

Newcastle-on-Tyne.—In the B. of T. report on the tramway collision which occurred on June 21st last (and was described in detail in our issue of July 11th), Lieut.-Colonel von Donop attributes the accident to the fact that the runaway car had not been taken out of service at once when it was found to be defective; to the omission to apply the hand brake from the rear end of the car when it came to a stand at the top of the incline; and to the want of skill and resource on the part of the fitter, Urwin, who was acting as driver of the runaway car, in the use of his brakes when the car first started away from rest. Colonel von Donop recommends that in view of this accident the Corporation should consider the advisability of fitting the Westinghouse magnetic brakes with the mechanical attachment which allows of the slipper being applied by hand as well as electrically.

Oldham.—Year's Working.—Mr. J. W. Dugdale (general manager) in his just-published annual report on the tramway undertaking, states that the total receipts for the year ending March 25th last were £110,577, and are the largest in the history of the undertaking. The working expenses, including cost of energy, were also larger than ever before, £73,437. The gross profit was £37,140. The number of passengers carried was 21,435,727; the number of miles run 2,045,343, and the average receipts per car-mile 12·57d. The net working expenses per car-mile were 6·084d. on 2,049,916 miles. The total energy used for propelling and lighting the cars and lighting the depôts was 3,435,211 units. The gross capital expenditure on the system up to March 25th last was £442,174, and the Corporation has £76,719 unexhausted borrowing powers. Interest on loans amounted to £11,829, and contributions to sinking fund £3,966, income-tax £1,099, and the rent on leased lines to £5,347. Mr. Dugdale states that the track generally is in a very poor state of repair, and a great amount of work on the track will require to be carried out in the near future.

Salford.—Workmen's Fares.—At a meeting of the T.C. on September 3rd, a long discussion took place on a proposal that workmen's tickets should be issued up to 8 a.m. Ald. Linsley (chairman of the Tramways Committee) opposed the resolution, and said the Committee now had under consideration concessions which would cost £4,000 or £5,000 a year. He did not think they would get extra passengers to balance that. When the 8 o'clock proposal was tried in 1908-9 the receipts dropped £14,000. It was his intention, in considering the proposed concessions, to advise the Committee to do away with workmen's fares altogether. He thought it was time these fares were abolished. It was decided to refer the matter to the Tramways Committee to consider and report to the next meeting of the Council.

Proposed All-Night Cars.—A petition has been prepared for submission to the Tramways Committee urging an all-night service of tramcars in Salford. So far 800 signatures have been obtained, and 1,300 persons have signed a petition for Saturday all-night cars.

Sheffield.—A deputation representing the Sheffield University recently waited upon the Tramway Committee to urge the claims of the University Council for a grant in aid of the

scheme for the extension of the University buildings in Western Bank to meet the increased requirements of the Science and Art Departments. The Tramway Committee has decided that it is for the public benefit of the inhabitants of the city that the application should be complied with, and that it recommends the City Council to make a grant of £1,000 per annum for a period of ten years from the funds of the tramway undertaking.

Stirling.—Proposed Tramways Purchase.—At a special meeting of the T.C. a report with reference to the offer of Mr. George Balfour, London, to purchase the electric light undertaking as a preliminary to the electrification of the tramways, was submitted. The price which Mr. Balfour proposed to pay for the undertaking was the sum which would relieve the Corporation from all outstanding indebtedness. The unredeemed debt at May 15th, 1913, was £28,642. The capital sums spent by the Council on the undertaking up to May 15th, 1913, amounted to £43,284. During the earlier years of the undertaking there were debit balances which were paid out of the rates between 1900 and 1908, the amount being £4,382. Since 1909 credit balances of £2,129 have been carried to the reserve fund. After discussion, it was agreed to forward a copy of the report to Mr. Balfour, and to request him to submit to the Council details of his offer.

U.S.A.—New Single-Phase Railway.—The Norfolk and Western Railway, which serves the coalfields of West Virginia, has contracted with the Westinghouse Co. to equip its Bluefield-Vivian section—some 85 miles in length—on the single-phase system. The contract calls for 26 130-ton single-phase-two-phase locomotives, together with power station and transmission apparatus. Single-phase A.C., at 11,000 volts and 25 cycles, will be supplied to the locomotives by an overhead trolley line, identical with that used on the New Haven electrified sections. The coal trains to be hauled weigh up to 3 250 tons each, and at present require three powerful Mallet steam locomotives to haul and push them over the gradients. Two electric locomotives are to do the same service at double the present speeds. These will be built for running speeds of 7, 14 and 26 miles an hour, and will be supplied with energy from a 27,000-KW. turbine station. Work is to be begun at once, and completed in the summer of 1914.

Warrington.—The tramways manager has been authorised to advertise for the supply of two additional motor-'buses similar in construction to those already in use.

Wigan.—Alderman Ashton, speaking at the Council meeting on September 3rd, remarked that the Sub-Committee appointed to deal with the purchase of new cars hoped to be in a position before the next meeting to recommend the class of car which would be most suitable for the Wigan tramways. The members had visited Bolton, and there seen a car which they regarded as suitable for their purpose, and with some slight alterations and modification he thought it might be adopted for Wigan.

York.—Tramway Extensions.—The proposals of the Tramways Committee for an extension of the present system, and the provision of railless cars to Heworth and along the Huntingdon Road, have been referred back by the Council for further consideration.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Deputies have approved a Bill regulating the wireless telegraph service within the country. It provides that the wireless service within the territory of the nation and for international communications up to a distance of 1,000 kilometres shall be carried out exclusively by the State, Government to provide for the erection of the necessary wireless stations, which are to be constructed in such a manner that a vessel navigating the coast and rivers can always be in communication with a station. The sum of $400,000 is provided for this work. The use of this service is declared obligatory on all vessels entering or leaving Argentine ports with 50 or more persons on board, including crew and passengers. The wireless stations are to be capable of transmitting messages a distance of 200 kilometres along the rivers and 5,000 kilometres at sea.—*Review of the River Plate.*

Australia. — The Commonwealth wireless station at Esperance (W.A.), the 12th of the coastal series of Australia, was opened for business in July. Applications are invited for the positions of officers in charge at 12 stations. The salary in each instance ranges between £216 and £240 per annum.—*A.M.S.*

Barbados.—The Secretary of State for the Colonies has sanctioned the acceptance by the local government of the tender of the Anglo-French Wireless Co., for the erection of a station at Bridgetown.

Belgian-Swiss Telephone Service. — A Convention between Belgium, France and Switzerland is about to be signed for the establishment of telephonic communication between Belgium and Switzerland.

Birmingham.—An all-electric power signalling apparatus has been installed at the south box at Snow Hill Station, Birmingham. The instruments are similar to those fitted recently in the north box. The signal motor circuits are not controlled by being led through the facing-point detectors on the ground, as was done at the north box, but by means of route switch contacts in the signal box itself. The route switches are actuated by control magnets, which are energised by the return indications from the points. In order to show the signalman visually the position of each of the points under his control, a small indicator is provided on the locking frame behind each point lever. Track circuits will be provided on all the four main lines through the station and control the stop signals in each direction, so that it will be impossible for a signalman to lower a signal for a train to proceed over a certain road if another train is in possession.—*Birmingham Daily Post.*

Discontent in the Telegraph Service.—It is alleged by the *Matin* that the reason for serious telegraphic delays which have occurred during the past few weeks between England and France is that the British telegraphists are systematically indulging in a novel form of partial strike. In the middle of the transmission of telegrams to Paris the line suddenly appears to become interrupted, and no sooner have the operators at the Paris end got their instruments ready to correct the apparent fault, than the line resumes work as if nothing had happened. This intermittent stoppage of the London telegraphs has resulted in delays of many hours frequently occurring in the transmission of messages between the two countries. The reason for the adoption of this policy is said to be discontent in the British Post Office owing to the recent refusal of the Postmaster-General to increase wages, and also the new modification of the telegraphists' hours of service.

The report has been flatly denied by the Deputy Comptroller of the Telegraph Department, who states that there is no discontent in connection with the Anglo-French service.

Meetings of telegraphists have been held at various provincial centres recently to consider the report of the Holt Committee on postal servants' wages, which has been severely criticised. A special conference on the subject is to be held at Liverpool.

Germany.—The Supplementary Budget for 1913 contains an appropriation of £7,500 for the improvement of wireless communication between Dune and Nola, in the German Colony of New Kamerun.

A flash light for the convenience of flying machines has been installed by the Telefunken Gesellschaft at the Nauen wireless station, at the instance of the German military authorities. The light is of 2,000 C.P., and burns from dusk to dawn. The light-flashes are emitted continuously in the rhythm of the Morse code letter "N," to indicate to aviators the place of origin. Tests made by means of a balloon showed that the light was visible to a distance of 24 miles.

Italy.—Messrs. Franco Tosi & Co., of Legnano, have taken up the construction of Diesel engines. Among the contracts at present in hand are four 225-H.P. four-cycle engines, which are being constructed to the order of Messrs. Fraser & Chalmers for radio-telegraph stations in Canada and Ireland, for the Universal Radio Syndicate, Ltd., London.

Marconi Strike.—The Italian operators of the Marconi wireless installations on board steamers at Genoa, not having obtained from the company the concessions for which they asked, have struck. They have sent messages to Paris, Liverpool, New York, and other centres, asking for the support of their colleagues.

New French Cable Steamers.—The Minister of Post and Telegraphs has just submitted a scheme to the French Senate for the acquisition of two new cable-laying steamers for use in connection with the maintenance of submarine cables. One of the new vessels will be of large size and will be stationed at La Seyne; the other will be a smaller vessel and will be attached to the port of Havre. The French Government has at present only one cable-laying steamer, which is to be sent to Dakar.

Sheffield.—The Watch Committee has decided to install the Stuart & Moore system of telephonic street alarms (consisting of alarms for fire, police and ambulance) at fifty points in the city.

Telegraph Rates.—The rates for ordinary and deferred telegrams to most places in the Belgian Congo are now 4s. 9d. and 2s. 4½d. respectively. Ordinary rates for telegrams to French Equatorial Africa now vary between 4s. 3d. and 4s. 8d. and the deferred rates between 2s. 1½d. and 2s. 4d. The rate for telegrams to Colombia has been increased from 3s. to 3s. 5d. per word.

Telephone Corruption.—Five telephone girls in Paris have been accused of being in the pay for some time past of a corn broker, giving him communication to the detriment of other subscribers, and cutting off certain rivals from all communication with the Corn Exchange when operations were in full swing. The operators also allowed their client to tap the conversations of his rivals with the chief corn dealers. A special call warned him when the line was switched on, and all he had to do was to listen. In return for these services the broker made the girls presents of money.

Later reports indicate that the scandal is more serious and of wider extent than had been supposed; the communications of M. Bloch-David, the principal French operator on the Corn Exchange, had been hampered by preventing him from getting through, and other speculators had been enabled to listen on his line, so as to obtain information as to his proceedings. Apparently these practices have been going on for several years, and numerous complaints have been lodged, but have been disregarded by the authorities.

Telephony in Mines.—An installation of "wireless" telephony has been put down at Dinnington Main Colliery, apparently on the system described in our issue of April 4th, 1913.

Telewriter Exchanges.—The National Telewriter Co., Ltd., has opened a telewriter exchange in Liverpool, and nearly 100 subscribers have been enrolled. Hitherto the company's operations have been confined to London.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—September 30th. Insulators at Sydney, Melbourne, Brisbane, Adelaide, Perth and Hobart.

PERTH.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

NEW SOUTH WALES.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

SYDNEY.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

VICTORIA.—November 12th. For the Victorian Railways; flame arc lamps.

MELBOURNE.—September 16th. For the P.M.G.; a common-battery or an automatic switchboard.

September 16th.—Corporation. 176 yd. 0·25 sq. in. three-core lead-covered cable; 5,471 yd. 0·15 ditto, and 3,500 yd. ·05 ditto. Also three 250-K.V.A. three-phase transformers. See "Official Notices" August 29th.

September 23rd.—Sulphate of copper, for the P.M.G. Specifications from the Commonwealth Office, 72, Victoria Street, S.W.

October 14th.—For the P.M.G. A common-battery multiple switchboard.

October 14th.—For the P.M.G. Cable boxes (Sch. 877). See *Commonwealth Gazette*, August 2nd.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

September 23rd.—P.M.G.'s Department. General stores for a period of two years, as per Schedule 913.—*Tenders.*

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" to-day.

October 1st.—Victorian Railways Department. State coal mines, Wonthaggi. Supply of rope road haulage engine and electrical equipment for M'Bride Tunnel, P.D., £15. Particulars at the Melbourne office, Robb's Buildings, Collins Street.

SOUTH AUSTRALIA.—November 12th. For the P.M.G. One lamp signalling switchboard of five sections, one cable turning section and one cable storing section, one two-position recording desk, and one chief operator's desk (Spec. 432, Sch. 296).

September 15th.—Home Affairs Department. Canberra power plant. (Sec. 1) Main power house switchgear; (Sec. 2) switchgear for Diesel engine plant. (Time extended from September 1st.)

ADELAIDE.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" to-day.

Austria.—September 29th. The Königliche Lagernhausern authorities in Trieste are inviting tenders for the supply of a large floating electrically-operated crane, complete with Diesel engine generating plant.

September 26th.—The Austrian State Railway authorities in Stanislau are inviting tenders for an installation of electric lighting at the railway works in that town.

SERAJEVO.—October 1st. Tenders are required by the Direction of the Bosnia and Herzegovina Railway for the supply of a year's requirements of lighting material, &c. Particulars will be forwarded on receipt of 20 pfennigs postage.

Belgium.—September 17th. Supply and erection of a 25-ton crane, with electric motor and accessories, at the Malines central machine shops. Deposit 1,700 fr. (Cahier des Charges Special No. 1,410 gratis); plan, 0·90 fr. It is advisable to send in tenders by September 13th. Salle de la Madeleine, Brussels.

Bingley.—September 15th. Corporation. Sec. A.—Rotary converters and transformers. Sec. B.—A.C., E.H.T. and L.T. and D.C. switchgear. Sec. C.—Low-tension cables. See "Official Notices" September 5th.

Burnley.—September 22nd. The Guardians of the Burnley Union invite half-yearly tenders for the supply of electrical requirements.

Canada.—October 1st. Regina City Commissioners require tenders for coal bunkers, ash hoppers, coal and ash conveyors and crushers. Deposit with tender. Specifications, Mr. E. W. Bull, Superintendent of Light and Power, Regina.

Dartford.—September 16th. U.D.C. (*a*) Water-tube boiler, economiser, fan, steel chimney and accessories; (*b*) inverted rotaries, transformers, switchboard and cabling. See "Official Notices" August 29th.

Douglas (I.O.M.).—September 15th. Good steam coa (about 521 tons) for the Tramway Department of the T.C. Mr. A. Robertson, Town Clerk.

Eastbourne.—Electric light installation at the Workhouse Infirmary, for the B. of G. Mr A. Hurst, Clerk.

Egypt.—October 31st. Ministry of the Interior. Tenders for the installation of the electric light at Damanhur.—*African Engineering.*

Germany.—September 20th. The Prussian State Railway authorities at Konigsberg are inviting tenders for the supply and erection of several electrically-operated high-pressure pumps.

September 22nd.—The Baden State Railway authorities in Carlsruhe are inviting tenders for the supply of from 80,000 to 100,000 metres of electric cable.

Greece.—September 30th. The Harbour Authorities at the Piræus are inviting tenders for the supply and erection of two electrically-operated cranes, one of 10 tons and one of 6 tons capacity.

Hoylake and West Kirby.—Corporation. Steam and exhaust piping. See "Official Notices" to-day.

Ilkley.—October 6th. (Sec. 1) Prime movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" to-day.

Leicester.—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" September 5th.

Liverpool.—September 16th. Electric supplies for a year to the Mill Road Infirmary, for the West Derby B. of G. Mr. H. P. Cleaver, Clerk, Brougham Terrace.

London.—HAMMERSMITH.—September 24th. Borough Council. Underground cables, and sub-station switchgear. See "Official Notices" August 29th.

HAMMERSMITH.—September 24th. Corporation. One 125-H.P. alternating-current motor. See "Official Notices" to-day.

BERMONDSEY.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

Madeira.—With a view to rendering more accessible the interior of the island, the authorities propose to construct a network of railways, which will be worked mainly by electricity. The construction of a generating station is also contemplated. Public tenders for the works will shortly be invited. Those intending to compete would do well to send a technical expert for a preliminary inspection of the circumstances of the several localities.

New Zealand.—November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire for two years. Specifications from Electrical Engineer, Dunedin.

Tenders are also asked for the supply of two A.C. pressure regulators for 3,000 and 400 volts. British manufacturers can obtain particulars at the B. of T. Commercial Intelligence Department.

Oldham.—September 17th. Steam coal for the Electricity Committee for three, six or 12 months, commencing October 1st. Specifications and forms of tender obtainable from Mr. S. W. Newington, Electricity Offices.

Orsett (Essex).—September 18th. Provision of communication bells and telephones and repairs to existing bells and telephones at the Workhouse, for B. of G. Mr. E. W. Wilson, the Workhouse, Orsett.

Roumania.—September 17th. Lighting of the city of Tetuci with electricity, and construction of a generating station. Provisional deposit 25,000 fr. Offers to the municipality.

The municipal authorities of Constantza have just invited tenders for the concession for the electric lighting of the town and suburbs.

Spain.—September 21st. The municipal authorities of Saldana (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

September 28th.—The municipal authorities of Riaja are inviting tenders for the concession for the electric lighting of the town during a period of six years.

Tunbridge Wells.—September 13th. Corporation. Supply and delivery during the ensuing 12 months of high and low-tension cables. Specifications and forms of tender from the Borough Electrical Engineer, Stanley Road, Tunbridge Wells.

Turkey.—Supply of 21,500 insulators with curved iron fitments, 1,350 ordinary iron telegraph posts, 150 iron telegraph posts 6 m. long, 150,000 kg. galvanised iron wire, diameter 2 mm. Imperial Ottoman Post and Telegraph Administration, Constantinople.

Uganda.—December 31st. Electric light and power supply for 10 years at Kampala and district, including 300 32-C.P. street lamps and 200 16-C.P. lamps in Government quarters. Uganda Public Works Department, Entebbe.—*Brit. S.A. Export Gazette.*

Wigan.—September 20th. Corporation. 1,500-KW. turbo-alternator, ejector condenser, pipework, and all accessories. See "Official Notices" September 5th.

Worthing.—September 29th. Corporation. Supply, delivery and erection of Diesel engine and D.C. generator. See "Official Notices" to-day.

CLOSED.

Australia.—VICTORIA.—Wycheproof Shire Council. Tenders for electric supply plant have been accepted as follows:—

Dynamo and direct-coupled booster-generator and spares, complete switchboard equipment, and erection of electrical equipment.—Australian Metal Co., Ltd.
Hart accumulator.—Edison & Swan United Electric Light Co.
Meters.—Warburton Franki, Ltd.
Aluminium wire.—British Insulated and Helsby Cables, Ltd.
Tenders.

TASMANIA.—The P.M.G. has accepted the tenders of Messrs. T. Zwicker & Co. and Messrs. Bullers, Ltd., for insulators, and that of Messrs. R. Johnson, Clapham & Morris for 20 tons of copper wire.

NEW SOUTH WALES.—The P.M.G. has accepted tenders for copper binders, copper and zinc battery plates, &c., from the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; copper tapes and wire, British Insulated and Helsby Cables, Ltd.; copper wire, R. Johnson, Clapham & Morris, Ltd., Noyes Bros. (Sydney), Ltd., and W. T. Henley's Telegraph Works Co., Ltd.; glass cells, R. J. Connolly; brass connectors, British General Electric Co., Ltd; battery parts, &c., Lawrence & Hanson Electrical Co., Ltd.; battery materials, &c., Theodore Zwicker & Co.; Morse inkers, Siemens Bros. Dynamo Works, Ltd.

Bispham.—The U.D.C. has accepted the tender of the Premier Accumulator Co., Ltd., for the new battery.

Bournemouth.—The T.C. has accepted the tender of Messrs. W. Griffiths & Co. for the reconstruction of the permanent way of the tramways in Wimborne Road and Charminster Road and at Poole, at £14,621. The Council has also accepted an amended tender from Messrs. Walter Scott, Ltd., for tramway rails and fastenings, at £6,067, this being due to extra rails being needed.

Bradford.—The Electricity Committee has accepted the tender of Messrs. Holden & Brooke, Ltd., for the supply of a vertical-spindle centrifugal pump, with motor and switchgear, for the Valley Road works, for £119.

Bristol.—The City Council has entered into a contract with the Bedminster, Easton and Parkfield Collieries, Ltd., for an annual supply of coal to the Avonbank electricity works. The value of the contract is estimated at £16,675.

Burnley.—The Electricity Committee has accepted the tenders of the British Insulated and Helsby Cables, Ltd., to supply 1,000 yds. of 1-in. and 500 yds. of ·05-in. lead-covered cable. The British Thomson-Houston Co. has been awarded the contract for the supply of further standard sizes of electric motors required during the period ending March, 1914.

Doncaster.—The tender of Messrs. Crompton & Co. for the supply of feeder panels has been accepted by the Electricity Committee.

Glasgow.—The T.C.'s Committee on Tramways recommend acceptance of the following tenders:—

Sheet mica.—Micanite and Insulators Co., Ltd.
Armature binding wire.—W. N. Brunton & Sons.
Scrap.—Zinc, lead-covered cable, brass turnings and borings, brass dust, copper and mica turnings, dry cells.—John Jackson & Co.
Scrap.—Lead, brass, copper, motor field coils, armature coils.—P. & W. MacLellan, Ltd.
Scrap vulcanised rubber cable.—Ballardie, Holden & Co.
Scrap rubber and motor tires.—City Waste India-Rubber Co.
Scrap old bagging.—George Cunningham.
Altering superheaters, Pinkston power station.—Babcock & Wilcox, Ltd.

The Telephone, Lighting and Power Co., Glasgow, has secured the renewal for a year of the contract for the upkeep of the private telephones in Shieldhall Hospital.

The electrical engineer to the T.C. is to put up signalling apparatus in the new pavilions at Ruchill Hospital, at an estimated cost of £32.

Dundee.—A contract for converting machinery has been placed with Messrs. Bruce Peebles & Co., Ltd., Edinburgh, at £1,500, and the British Insulated and Helsby Cables, Ltd., has secured the cable contract.

Heywood.—The Education Committee has accepted the tender of Mr. Charles Booth for the electric lighting of the Central Council School.

Liverpool.—The tender of the Northern Electrical and Ventilating Co., Ltd., has been accepted by the City Council, at £31, for automatic indicators for the fire-alarm systems at the City Hospital North.

Manchester.—The Corporation Electricity Committee has accepted the following tenders:—

Water-softening plant at Stuart Street station.—Kennicott Water Softener Co., Ltd.
Construction of new meter repair workshop at the Polygon Stores.—Messrs. J. Gerrard & Sons, Ltd.
Supply, delivery and erection of hoist gear, motor and cage, for the new meter repair workshop.—Messrs. Etchells, Congdon & Muir, Ltd.
Supplies of cable.—Messrs. W. T. Henley's Telegraph Works Co., Ltd. Messrs. Callender's Cable and Construction Co., Ltd.; and Messrs. Johnson & Phillips.

New Zealand.—The Waverley Town Board has accepted tenders, approximating to £8,500, for water and lighting works. Amongst the successful tenderers were Messrs. Turnbull & Jones, Wellington, for the hydro-electric pumping and lighting plant, £3,514.

Sheffield.—The following tenders have been accepted by the City Council:—

Stuart & Moore.—Installation of 50 patent telephonic street alarms, £4,097.
Blasberg Engineering Co., Ltd.—Two natural-draught cooling towers, complete with pumps, pipes, &c., £8,779.
Royce, Ltd.—Three electric capstans, fairleads, ropes, motors, &c., £1,128.
C. Bushby & Sons.—Excavations and concrete work for cooling towers, £3,515.

The Council's contract with the Automatic Ticket Printing Co., Ltd., for the supply of tram tickets, is to be continued for a term of five years from April 1st, 1911.

South Africa.—The A.E.G. Electrical Co. of South Africa, Ltd., is the successful tenderer for the entire installation of power house equipment required by the Stellenbosch municipality for the new lighting scheme.

Messrs. Hubert Davies & Co., Johannesburg, have received a contract from the Durban Town Council for 1,000 electricity meters.

Stretford.—The tender of Messrs. Bertram Thomas has been accepted, at £127, for altering the switchboard.

Winchester.—The T.C., on September 4th, accepted the tender of the Tudor Accumulator Co. for the maintenance of a 206-cell battery for 10 years, at £86 per annum.

FORTHCOMING EVENTS.

British Association.—September 10th to 17th. Meeting at Birmingham.

Junior Institution of Engineers.—Saturday, Sept. 13th. At 10.30 a.m Visit to the works of Messrs. R. Waygood & Co., Ltd., Falmouth Road London, S.E.

Salford Technical and Engineering Association.—Saturday, September 20th. At 7 p.m. Lecture on "Grinding Wheels, Grinding Machines, Grinding," by K. D. Morgan.

Municipal Tramways Conference.—September 23rd to 26th. Meeting at Sheffield (particulars on page 427).

NOTES.

The Aisgill Accident.—Mr. Paget, the general superintendent of the Midland line, is not, we think, doing his company any good by airing his opinions, as may be gathered from a statement reported to have been made by him to the *Daily Mail*.

"In my opinion," he said, "the coaches would have been gutted in any case. The pressure of gas would certainly cause the fire to burn more furiously, but I am sure that the fire was not due to the spontaneous combustion of the gas . . . . . The intense heat of a piece of coal from the engine fire would be sufficient to set a light to the woodwork, which would blaze up like a bonfire."

Now, Mr. Paget was present at the inquiry held by Major Pringle at Leeds, and below we give the *Times* report as to the origin of the fire. Driver Caudell, in the course of his examination, said:—

"One of the carriages was partly under the engine and partly under the tender. He left the foot-plate a minute or two after the collision, and fire seemed then to be coming from the carriages. The engine was surrounded on all sides by splinters of wood. He noticed that there were some of these burning between the level of the foot-plate and the ground. He could not say what started it. Something might have been thrown out of the ash-pan. Nothing was thrown out of the smoke-box. He shut the regulator altogether. Nothing would come out if the blast was off.

"The Inspector: Do you agree, Mr. Paget?

"Mr. Paget: It depends. Something might come out. (To the witness.) Supposing there was a tremendous blow, that would shake up the ashes in the smoke-box. In your opinion would the blow be strong enough to blow these ashes upward?—The witness: I do not think so. The blast was closed by the force of the regu-

lator, and I do not think the blow would send the ash out of the smoke-box. I do not think much came out of the ash-pan.

"Was not fire thrown out anywhere?—No. The fire was all in the box. It shook forward a bit. There was no fire thrown out on the foot-plate.

"So that, if the fire started from the engine, it must have been either stuff thrown out from the ash-pan, or possibly some fine ash blown out of the smoke-box?—There is nothing else for it that I know of.

The witness proceeded to explain that there was timber lying all round the engine. It was piled up as high as the top of the chimney. There was also a very slight fire, possibly a gas fire, amongst some *débris* on the line a few yards in front of the right-hand corner of the engine-cab.

A Small Fire Left Burning.

"Do you think it was a gas-jet?—I thought it looked like a gas fire, but I cannot say. I did not take particular notice of it.

"Did not you think it was important to put this out immediately?—I thought the passengers were more important than quelling the small flames that I saw.

"Did you use any water subsequently to try to put this fire out?—Yes; water from the tender with my own bucket, and then I fetched buckets out of the van.

"Was it when the fire began to increase in size that they began to work at it?—When I first saw the fire I thought we could put it out after we had seen to the passengers. The fire increased so rapidly that I found that that was a mistake. It grew to such a size, and so rapidly, that they were not able to cope with it."

There is nothing in Caudell's evidence to support Mr. Paget's opinion. The fire was all in the box, just as anybody conversant with the construction of a locomotive firebox would expect it to be. No fire was thrown out anywhere, and so far as we are aware it has not been suggested that the gas became alight spontaneously. But, if a piece of coal from the engine fire, assuming it to have been thrown out, is sufficient to set light to a Midland carriage, which would blaze up like a bonfire, a new and hitherto undreamt-of danger threatens travellers on that picturesque route. The company must not only substitute electricity for lighting, *and cooking*, but steel carriages must take the place of the present wooden rolling stock. A telegram from New York, on the 9th inst., describing the smash-up of an express on the Pennsylvania Railway, affords a vivid contrast with the previous terrible disaster on the Newhaven Railway at Wallingford, and attributes the comparative immunity from serious injury of the 70 odd passengers in the express to the fact that all the cars involved were made of steel, while those demolished in the Wallingford accident were constructed of wood.

Even though the cause of the fire which followed the above accident has not been *officially* determined, we are somewhat astonished to read in our contemporary, *The Railway Gazette*, that "A point worthy to be remembered is that it is definitely stated by eye witnesses that the fire broke out as a result of live coals from the firebox, and that, therefore, the question of gas lighting or electric lighting does not arise"; and, again, in *The Engineer*, "we know that the wreckage caught fire . . . . but we do not know that gas was responsible; *indeed what evidence there is points the other way.*" We should have thought that the evidence given at this and previous accidents where gas-lighted coaches have been wrecked and subsequently burnt would have carried a certain amount of conviction even to our contemporaries.

Street Lighting.—The two following resolutions, passed at the Third International Road Congress, held in London a short while ago, are to be submitted to the next meeting of the Metropolitan Paving Committee:—(1) For the purposes of a general determination of methods of lighting, highways may conveniently be divided into three classes, as follows:—(*a*) Important streets in cities, towns or other urban areas in which the traffic after dark is considerable in volume, (*b*) important suburban roads in the vicinity of large towns, (*c*) rural roads in open country, and having regard to modern conditions of traffic, it is essential that adequate lighting by means of fixed lights should be provided in classes (*a*) and (*b*). (2) As a general principle in the lighting of all highways which require to be lighted by means of fixed lights, the method of lighting to be adopted should be such as will provide an illumination as uniform from glare as possible. The amount of illumination and the position of lamps must be determined with reference to local circumstances

The Staff Engineers' Association.—The formation of this Association, it will be remembered, was proposed as a result of recent correspondence in our columns. It will have as its main object the maintenance and furtherance of the economic and social interests of mechanical, civil and electrical engineers. We learn that the intervention of the holidays has retarded the work of organisation considerably, though soon the promoters will doubt-be able to continue their endeavours in this direction. We also understand that sufficient names have been received to prove that the Association is needed. At present, however, it is considered advisable to secure the co-operation of not less than 50 well-known engineers in first-class positions, and each with a different firm. So far, about 30 companies are represented, and efforts are being made to increase this figure to the total mentioned. The greater the number of such influential supporters the better, of course, since the standing of the Association will be enhanced accordingly. Needless to say, we hope the Association will meet with success, and can assure our readers of the good faith of its promoters. The address of the Hon. Secretary is 31, Queen Victoria Street, E.C.

Twenty-Fifth Anniversary.—The twenty-fifth anniversary of the incorporation of the Gothic Works, on August 10th, 1888, by the directors of Laurence, Scott & Co., Ltd., was recently celebrated. A party of 45 of the staff and workmen, whose employment with the company averaged 23 years, was conveyed to the residence of the chairman of the company, Mr. Reginald Laurence. After inspection of the grounds, games, and an excellent tea, presentations of gold watches, travelling and other clocks were made to each of those present.

Mr. Laurence, in referring to the occasion, pointed out that there were very few electrical companies in the kingdom which held such a long record as that of Laurence, Scott & Co., Ltd., and that the position of the company was largely attributable to the excellent feeling that it had been the constant desire of the directors to promote between the staff, the workmen and themselves. From small beginnings the company had steadily progressed till, at the present time, it was employing upwards of eight hundred hands. He cordially thanked all those present for their loyal co-operation in the past, and stated that he was proud of the fine position and reputation that the company held at the present time.

Mr. J. W. Bransby, the works manager, responded gratefully on behalf of the recipients of these testimonials, and, after presentations had been made to Mr. R. Laurence, Mr. W. H. Scott and Mr. C. Wilson, the company separated with hearty cheers for Mr. and Mrs. Laurence.

Copper.—A considerable drop in English stocks took place last month, the quantity at the end of July being 18,037 tons, while that for the end of August was 16.829, 1,208 tons less. French stocks are 45 tons higher than for the end of July. Total European stocks (including Rotterdam, Hamburg, Bremen, and quantity estimated for other ports) are 1,882 less than for the end of July. Deliveries have again been heavy, amounting to 50,884 tons for the month (August). (Figures from Messrs. Merton's circular.) European arrivals from North America are well above average, Spain and Portugal to England and France low, Chile shipments again high, Australian low below the average.

For the end of July American stocks stood at 23,926 tons, a small reduction on the month. The world's supplies, excluding Holland and Germany, were 52,270 tons on July 31st, an increase of 550 tons over the figure for the end of June. Total supplies, including Holland and Germany, were 59,553, which figure is lower than that for the end of June by 2,261 tons.

The Municipal Tramways Conference.—The twelfth annual conference of the Municipal Tramways Association will be held at Sheffield on September 23rd to 26th inclusive, and judging by the contents of the official programme, the coming meeting will be no less popular than its predecessors. An informal reception will be held during the evening of the 23rd, and the real business commences the following morning at the Town Hall, where the visitors will be welcomed by the Lord Mayor.

The agenda for September 24th is as follows:—

Reception by the Lord Mayor; presidential address by Mr. A. R. Fearnley, general manager, Sheffield Corporation Tramways; paper on "Advantages and Disadvantages of Platform Fare Collection," by Ald. Flint, Leicester, followed by a discussion and midday luncheon at the invitation of the Tramways Committee.

In the afternoon a paper by Councillor Fenton, Sheffield, on "The Maintenance of Paving on Tramway Track, as affected by Section 28 of the Tramways Act, 1870," and discussion.

In the evening a visit to the Lyceum theatre and a supper at the Town Hall (both by invitation) will claim the attention of the visitors.

On Thursday morning, September 25th, a paper by Mr. J. B. Hamilton, Leeds, on "Urban Passenger Transport," will be discussed, and after luncheon, the choice of inspecting Messrs. Allen's, Hadfield's, and Osborn's Works, the Electricity Works, Car Works and Depôt, or the Sheffield University is offered to the visitors. In the evening, the annual dinner takes place at the Royal Victoria Station Hotel.

Friday, September 26th, is given up to the annual business meeting in the morning and an excursion to the Dukeries in the afternoon. Special arrangements have been made for the ladies, which include a visit to Messrs. Mappin & Webb's works and show-rooms, and a 'bus excursion to Haddon Hall and Grindleford, as extra items.

Mr. Fearnley (Tramway Offices, Sheffield) is in charge of the arrangements for hotel accommodation; the Victoria Station Hotel will be the Association's head-quarters.

Electrical Research in the United States.—The success of the vehicle research work of the Massachusetts Institute of Technology, as carried out during the past two years for the Edison Electric Illuminating Co., of Boston, has been so pronounced that an extension is to be made of this department of the Institute's activities, it having been decided to establish an electrical research laboratory and bureau. The official title of the department, for which an endowment of over £22,000 has been obtained, is the Division of Electrical Engineering Research; the work of the Section will include the use of electricity in transportation, the handling of goods and telegraphic and telephonic communication.

Time Signals.—The Synchronome Co. inform us that a new edition of "Réception des Signaux Radiotélégraphiques Transmis par la Tour Eiffel" has just been published by Messrs. Gauthier-Villars, Paris (price 2.75 fr.), which they recommend to all who desire to take the wireless time signals.

Late Legal.—The X.L. Electric Co.'s Affairs.—Mr. Justice Bailhache, sitting as Vacation Judge, had before him on Wednesday, September 10th, a motion in the debenture-holders' action of *in re* the X.L. Electric Co., Ltd.—Wiener *v.* the Company—for an injunction. Mr. Strode, in support of the motion, said that it was made on behalf of the plaintiff, Capt. Wiener, and it asked for an injunction to restrain the company and certain of its directors from doing any acts which would constitute an interference with the Receiver, who had already been appointed by the Court, and, further, that the company be ordered to sign any documents and do all acts necessary for a final grant of letters patent, application for which was before the Comptroller. The plaintiff regarded this as a most important application, as it was for the completion of letters patent, under which the Receiver had actually manufactured articles. Mr. Justice Astbury had, said counsel, already granted a stringent order against Mr. Aron, one of the directors, but the company had purported to hold a directors' meeting, and had written a letter dated August 25th to the Comptroller, to the effect that the company intended to abandon this final application. This was a mortgager company that had nothing further to do with the matter.

Counsel representing the company, and two of the directors, asked that the motion might stand over to answer the plaintiff's evidence, and said he was willing to undertake not to take any further steps in the meantime.

Mr. Strode said that Capt. Wiener was a director, holding half the shares in the company and all the debentures, and this application No. 19,257, of 1912, was one of the principal assets of the company. Provisional protection had been granted, but it was most essential that the protection should be completed as soon as possible. While Capt. Wiener was away, a meeting was held at which it was purported to appoint two new directors—gentlemen who had no interest in the company, and were given one share each—and then a board meeting was held, at which it was decided to abandon this application. There was evidence that Mr. Aron was present, though he took no part in the proceedings.

Counsel for the defendants said this was a directors' squabble. Mr. Aron had signed everything he was required to sign, but the company had properly passed this resolution to abandon this application for final protection, as there was no profit to be obtained from it. Mr. Aron, he understood, was appearing in person, but was not then present, and he pressed for an adjournment.

His Lordship said that he would make the order as asked, with costs.

British Vacuum Cleaner Co., Ltd., *v.* James Robertshaw and Son, Ltd.—In this patent action, in which an injunction was granted by Mr. Justice Sargant restraining an alleged infringement of the plaintiffs' patent, application was made to the Vacation Court for a stay of execution as to costs, pending an appeal. Counsel for the defendants stated that the real object of the application was to obtain from the plaintiffs an undertaking that the costs would be repaid if the appeal was successful. They had applied to the plaintiffs' solicitors for such an undertaking, but it had been refused. His Lordship asked whether there was any doubt as to the solvency of the plaintiffs. Counsel said he had no evidence on the matter. His Lordship: Then you must pay the money.

Educational Notes.—We have received from University College (University of London) the Handbook of the Faculty of Engineering, and special programme of courses arranged for engineers in practice for the forthcoming session. Particulars of the ordinary and special courses in the Faculty of Engineering are given in our advertisement pages to-day.

A course of Postgraduate Lectures on "Conductors for the Electrical Transmission of Energy" will be delivered by Prof. J. A. Fleming, F.R.S., at University College, on Wednesdays at 5 p.m., Part I ("Telegraph and Telephone Conductors") beginning on October 29th, 1913, and Part II ("Electric Light and Power Conductors") beginning on January 28th, 1914. Application for tickets of admission to be made to the Secretary, University College, London.

The Municipal School of Technology, Manchester, has sent us a copy of the Prospectus of Part-time Classes in Mechanical and Electrical Engineering for the winter session. Copies can be had on application.

Borough Polytechnic Institute.—The next session of the Department of Electrotechnics opens on September 22nd; particulars are given in our advertisement pages to-day.

Fatalities.—Mr. Frank Darling, an electrician at Sacriston Colliery, County Durham, was crushed to death at that colliery on the 3rd inst. He was going about the pit-heap, when he was crushed between two wagons and severely injured. Medical assistance was soon obtained, but he died a few hours afterwards. Mr. Darling was the son of a well-known farmer in the district, and was a popular member of the Durham City Cricket Club.

James Myles, employed in the Post Office Telephone Department, was engaged in remedying defects on the wires near Thornton, when his head came in contact with an electric cable (carried on the poles), belonging to the Fife Electric Power Co., and he was instantly killed.

London Strike.—On Saturday last the electricians employed by the Office of Works, who had been on strike, decided to return to work, after being out about a fortnight. The men returned under the conditions that obtained before they went out. They were handicapped in their dispute by want of funds, and only a few of them received strike pay.

The British Association.—The meeting opened on Wednesday evening at Birmingham with the Presidential Address delivered to a crowded and distinguished audience in the Central Hall. The building is large, but its acoustic properties are so good, and the President's voice is so clear, that he could be heard well by everyone in the audience. The ventilation was about the standard for public halls, in other words, abominable—the heat being so great that one woman was carried out in a dead faint early in the proceedings, and a few of the audience left before the address was over.

Lord Rayleigh introduced the President, and the vote of thanks was moved by the Lord Mayor of Birmingham, and seconded by Sir Joseph Larmor.

At the close of the meeting, Prof. Perry, the general treasurer, announced that Sir James Caird, of Dundee, whose magnificent gift of £10,000 to the Association last year is still fresh in the memory, had sent a further sum of £1,000 to assist the advancement of science. He also announced that the attendance up to the end of the first day was 2,506, which is, of course, a long way above the average.

Sir Oliver Lodge's address was brilliant, original, and expressed with all the wit and humour and epigram which one expects from so accomplished a speaker. The audience was held spell-bound throughout. He referred to the losses sustained by the Association by the deaths of Sir Wm. White, who was to have been President at Birmingham, Sir John Lubbock, Sir George Darwin, Prof. John Milne, and Henri Poincaré. Other features of the address are referred to in our leading columns.

Forthcoming Exhibitions.—Sheffield Fuel, Light and Power Exhibition.—The above Exhibition, which opens on October 24th, and closes on Saturday, November 15th, 1913, should prove of great interest to the Sheffield trades and to the general public. Many interesting exhibits will be on view of the newest inventions in gas, electrical and mechanical appliances for domestic and commercial use. Among the exhibitors are the following:—Corporation of Sheffield, electrical department; T. W. Ward Ltd., Babcock & Wilcox, Ltd., W. E. Burnand and Co., R. H. Hornsby & Sons, Ltd., Heenan & Froude, Ltd., Alex. Wright & Co., Ltd., Triumph Stoker Co., Marsh Bros., J. Coates and Co., G. St. John Day (Patents), Ltd., G. A. Steinthal and Boydell, Ltd., &c. One of the objects of the Exhibition will be to show visitors the latest improvements in machinery and appliances for obviating the smoke nuisance, which is of supreme importance in a great industrial centre like Sheffield. Demonstrations of cooking by electricity will be given daily. The Exhibition is being organised under expert management, and the public will be well catered for with regard to music, as the famous bands of the Royal Marines and Royal Scots Greys have been engaged. The B.E.A.M.A. has granted permission to its members to exhibit on this occasion.

Nottingham Universal Exhibition, 1914.—This Exhibition will be open from May 28th to October 3rd, and is planned on a large scale; the city is within easy range of a population of 12 millions, and no exhibition of the kind has been held there for many years. The Palace of Light will be devoted entirely to the display of methods of artificial lighting, daylight being excluded, and the "Servantless House" will be a feature of the section allotted to domestic economy and the decoration of the home. Particulars as to space, &c., can be obtained from the Executive Commissioner, Universal (1914) Exhibition, Nottingham; London offices, 6, Lloyd's Avenue, E.C.

Inquiries.—A correspondent asks for the makers of "Silesit," an insulating material. Another wants data on the subject of telephone cables, and would be pleased if any of our readers could enlighten him on the following:—Having been giving the capacity, gauge of wire, and diameter over single insulated conductor, to find the diameter over a given number of wires or pairs, allowing for compression during stranding operations.

Makers of machines for grinding, sanding, scrubbing and polishing floors, are asked for; also of the "Nodon" valve or aluminium rectifier, and of fancy electric lamps in imitation of fruit and flowers.

International Electrotechnical Commission.—We have received the fourth annual Report of the Commission, which has for frontispiece an excellent reproduction of the portrait of Faraday, painted by Miss Beatrice Bright, and presented to Dr. Budde. The second plenary meeting of the Commission was held in Berlin last week, and the third will take place in San Francisco in 1915. Electrotechnical Committees are now established in 21 countries, and others are likely to be formed in some eight others. The appointment of Special Committees to deal with various specified subjects, and to report thereon to the National Committees, has proved very successful, saving much time and expense; their work was submitted to the Commission at Berlin. The Report gives particulars of the progress made by the respective National Committees, which are now thoroughly well organised and are working on well defined and normal lines. A report of the Berlin meeting will appear next week.

Appointments Vacant.—Two telegraph inspectors for the Post and Telegraph Department of East Africa Protectorate (£160-£200); borough electrical engineer for Whitehaven (£250); instructor in electric wiring, for Huddersfield Technical College. See our advertisement pages to-day.

The Batti-Wallahs.—The Committee has arranged to visit the *Olympic* on Saturday, September 20th, at Southampton Docks.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The salary of MR. W. J. CARTER, the assistant electrical engineer to the Batley Corporation, has been increased to £145 per annum.

MR. A. HAYHURST, switchboard attendant at Dewsbury Corporation electricity works, has been presented with a handsome case of toilet requisites by the staff and employés, upon the occasion of his leaving to take up the position of shift engineer at Stockton-on-Tees electricity works.

MR. B. SANKEY has resigned the post of borough electrical engineer to the Whitehaven Corporation, which post he has held for seven years, upon receiving the appointment of assistant electrical engineer to the municipality of Port Elizabeth, South Africa, at a commencing salary of £500 per annum. He sails from Southampton, by the *Kinfauns Castle*, on October 4th next.

MR. R. J. DAVIES, of the Aberdare electricity department, has been presented with an oak overmantle by the staff on the occasion of his marriage.

The West Hartlepool T.C. has increased the salary of MR. H. F. FRIEDERICHS, borough electrical engineer, by £50 to £450 per annum.

The Leek U.D.C. on September 2nd received with regret the resignation of MR. R. M. CARR, electrical engineer, who has received another appointment. Mr. Carr has been at Leek for ten years. The Council decided to appoint a successor at £225 a year, rising by £10 per annum to £275.

MR. J. A. SMITH, engineer-in-charge at the Burton-on-Trent Corporation Electricity Works, has resigned.

The Aldershot U.D.C. has increased the salary of the electrical Engineer, MR. GARSIDE, to a maximum of £350 a year.

MR. H. WILLOUGHBY LANCE, late electrical contractor of Llandudno, and previously mains engineer of the Islington Borough Council, who left Llandudno last September for Australia, has been appointed chief engineer for the township of Geraldton, West Australia.

Tramway Officials.—MR. STANLEY DUDMAN, late manager of the tramways at Dartford for Messrs. Balfour, Beatty and Co., Ltd., has been placed in charge of the firm's new tramway system between Ripley and Nottingham. MR. D. N. R. BRUCE, late of Stroud (Glos.), has become manager at Dartford.

The traffic superintendent of the Salford Corporation tramways is to proceed to New Zealand shortly to take up an appointment there.

The salary of MR. H. PARKES, depôt superintendent, Burton-on-Trent tramways, is proposed to be increased from £140 to £145 per annum.

General.—The wedding took place last week, at Goole, of Miss Harriett Hickman and MR. JOSEPH HARROP, of Wakefield, who is head of the electrical department at Wakefield Asylum.

MR. S. BOYS, who for the past 2½ years has held the position of supplies manager to the Sheffield branch of Messrs. Siemens Bros. Dynamo Works, Ltd., is resigning this position to take up an appointment with the Edison & Swan United Electric Light Co., Ltd., where he will take charge of their London business. Mr. Boys has been associated with Messrs. Siemens in various departments for over 10 years.

MR. WILLIAM H. HAIGH has been appointed general manager at Johannesburg, of the engineering and mining supply firm of Fraser & Chalmers, Ltd.

The marriage took place on September 4th of MR. J. A. R. PITTS, head of the order department, Messrs. Crompton & Co., Chelmsford, and Miss H. M. Boswell, of Ashbourne.

On the 4th inst., at St. Mary's Church, Clitheroe, HUMPHREY FREDERICK, eldest son of Humphrey Foster, of West Bromwich, and director of Foster Bros., Ltd., Wednesbury, was married to Emma Garnett, younger daughter of Alfred Horsfall, of Clitheroe.

On September 4th MR. R. W. BLADES, of the electrical fittings department of the British Insulated and Helsby Cables, Ltd., was married to Kathleen Irene, only daughter of Mr. H. C. Tenmer, of Ipswich. —The engineering staff of the works presented Mr. Blades with a handsome timepiece.

PROF. JOHN MILNE, the seismologist, who died July 31st last, left £11,927. Subject to other bequests, he gave £1,000 to the chairman of the Seismology Committee of the British Association for the study of earth physics and its attendant subjects.

Obituary.—MR. W. H. DOUGLAS.—The death has taken place at Etruria House, Pedmore, of Mr. Wm. Henry Douglas, for many years a tradesman at Stourbridge, and the inventor of one of the first meters for alternating current.

MR. CHARLES SHAW, of Blackpool, who was for several years the cashier to the Blackpool, St. Anne's and Lytham Tramways Co., died last week.

Manila Electric Railroad and Lighting Corporation.—The Municipal and General Securities Co., Ltd. (European fiscal agents), announce that a dividend of 1¾ per cent. ($1.75 per share) for the quarter ending September 30th has been declared on the common capital stock of the above Corporation, payable in New York on October 1st to stockholders of record, September 18th, 1913.

CITY NOTES.

United Electric Car Co., Ltd.

THE report of the directors for the year ending June 30th, to be submitted to the shareholders at Preston on September 17th, states that the works have been efficiently maintained as regards buildings and machinery, the cost of which has been charged against revenue. After paying debenture interest amounting to £1,783, and charging £5,951 for depreciation, the profit for the year is £10,809, to which is added £4,249 brought from last year, making a total of £15,058. The preference dividend for the six months ending December 31st, 1912, absorbs £3,000, leaving an available balance of £12,058. The directors recommend the payment of preference dividend, less income-tax, for the half-year ending June 30th, 1913, £3,000; a dividend of 5 per cent., less income-tax, on the ordinary shares for the year ending June 30th, 1913, £7,500; and to carry forward to next year £1,558. Two directors, viz., Mr. Prestwich and Mr. Kerr, retire and offer themselves for re-election.

Dumbarton Burgh and County Tramways Co., Ltd.

IN moving the adoption of the annual report, MR. GEORGE BALFOUR, chairman of directors, commented on the satisfactory nature of the year's working. The total receipts for the year amounted to £22,952, being an increase of £420 in traffic receipts and advertising, to which had to be added increased receipts from interest on deposits, temporary loans and transfer fees, making a total increase of £578, against which increased expenses had been incurred amounting to £1,015. There was every reason to believe, he said, that the current year would continue to show that the system was becoming increasingly popular. The bridge over the canal at Dalmuir, on the Glasgow Corporation lines, was now in course of construction, and would soon be completed, thus allowing the Glasgow Corporation cars to connect directly with the Dumbarton system. The company's cars ran 542 770 miles during the year and carried 3,405,391 passengers. The directors recommended a dividend on the ordinary shares, for the first time, at the rate of 1½ per cent. per annum. The dividend on the preference shares was at the rate of 6 per cent. per annum for the half-year to July 31st.

The report was unanimously approved, and the dividends recommended agreed to.

British Electric Transformer Co.—The directors have declared a dividend at the rate of 6 per cent. per annum on the ordinary shares for the past half-year.

Canadian General Electric Co.—The directors have declared a quarterly dividend at the rate of 1¾ per cent. for the three months to September 30th (at the rate of 7 per cent. per annum) on the common stock.

Direct West India Cable.—The report of the directors states that the net result of the year's working to June 30th is an available balance of £8,267, as compared with £7,764 for the previous year. The directors have dealt with the profits in the following manner:—Brought forward from 1911-12, £42,200; add profit for 1912-13, £8,267, giving an available profit of £50,480; expenses attending repairs and renewals of cable, £657; interim dividend at 3 per cent., £900; proposed final dividend at 3 per cent., £900, leaving to be carried forward, £48,022. The company's cables have worked efficiently. During the year debentures have been paid off to the amount of £7,000, leaving £15,000 outstanding.—*Financier.*

Continental.—The report of the Société Continentale d'Applications Electriques, of Basle, for the last financial year, shows a gross profit of £49,074, as compared with only £38,049 in the preceding 12 months. The dividend is being increased from 6 to 8 per cent.

The Gesellschaft fur Elektrische Kraftübertragung is the name of a new company which is being formed in St. Petersburg, with a capital of 4 million roubles, by the Société Allemande pour l'Eclairage Electrique de St. Petersburg, to take over the concessions and plant of the last-named concern.

Halifax and Bermudas Cable.—The report of the directors states that the net result of the year's working to June 30th is an available balance of £8,803, as compared with £8,533 for the previous year. The directors have dealt with the profits in the following manner:—Brought forward from 1911-12 £32,128; add profit for 1912-13, £8,803, giving an available profit of £40,931. Transferred to renewal and general reserve fund, £30,000; expenses attending repairs and renewals of cables, £3,392; proposed dividend, 6 per cent. for the year, £3,000, leaving to be carried forward, £4,539. The company's cable was interrupted near Bermuda during December last, and the necessary repairs and renewals involved an outlay of £3,392. The cable is now working efficiently.—*Financier.*

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from September 17th to 30th, 1913 (both days inclusive), for the preparation of warrants for interest for the half-year to October 1st, 1913.

STOCKS AND SHARES.

Tuesday Evening.

Markets in the Stock Exchange have scarcely recovered from their summer idleness, although people are by no means unwilling to invest money where they see what appear to be good opportunities. The lowest levels which prices have touched of late are already being left behind in quiet rises amongst many of the industrial departments. It is noticeable this week that various electric lighting shares show improvements. Business is almost confined to investment; there is little speculation going on in any of the markets. Dulness in Consols is an unfavourable factor; it is ascribed to the fear of heavy new issues being made in the near future.

So far as Home Rails are concerned, prices lean to the lower side. The Board of Trade returns published on Monday are satisfactory, their falling-off being easily explained by reference to special circumstances. There is no doubt, however, that the public are scared from the Home Railway market, at least for the time being, by the evidence which has been forthcoming at the Board of Trade inquiry into the accident on the Midland, with its lamentable loss of life. People are afraid of the railway industry for the time being; and although confidence will of course return, as it always does, prices for the moment have given way in leading cases.

We may perhaps be permitted to add another to the many expressions of regret that have followed upon the death of Mr. G. M. Lindsay, the Stock Exchange jobber, who died in the Leeds Infirmary, as the result of injuries sustained in the Midland collision. For Mr. Lindsay was ever ready to afford information, and to give the benefit of his experience in Home Railway matters, which have from time to time been discussed in this column of the Electrical Review.

Metropolitans are down ¾ on the week, but Districts show no further decline after their previous drop. Metropolitan 3½ per cent. Preference stock fell 2 points to 80. Underground Electric issues are dull; the £10 shares shed ⅛ to 3⅞, the "A" shares lost ⅛, and the 6 per cent. Income bonds at 91 are a point lower. South Metropolitan Tramways 4 per cent. Debenture stocks holds its big rise of last week, and so also does the 4½ per cent. Debenture stock of the London and Suburban Company. Great Northern and City Preferred have disappeared from the Stock Exchange Official List, and, therefore, from our catalogue of prices. London United Tramways Debenture rose 1. British Electric Traction 6 per cent. Preferred gained an equal amount, the price now being 11¾ middle.

Shares in the English Supply market are mostly better, and are not easy to obtain. The rises include 5s. each in Brompton Ordinary, Metropolitans, City Preference, St. James' Ordinary, and Notting Hill Preference; Westminsters are 7s. 6d. higher, and several others are 2s. 6d. up. It is some time since we had to record improvements of this kind, and they are the more noticeable in coming at the slackest period of the year. Speculation is rife as to the meaning of the movement, and the only explanation at which the financial layman can arrive is that the market, being short of shares, is easily moved by a comparatively small amount of demand. Besides this, there is the swing of financial fashion which brings illumination shares into notice regularly every autumn.

In the Foreign group the alterations are comparatively slight. Mexican Light and Power Preference fell 2, reverting to the same level as they occupied a fortnight ago; but the First Mortgage bonds are ½ higher, while the Seconds have fallen 1 to 79. Toronto Power Debenture, which was in request a few days ago, came to market on the price being put up, and the improvement has been lost, the quotation easing off to 99. Shawinigan bonds and Royal Electric of Montreal Debenture stock are both rather higher. Mexico Trams are steady, and the company's 6 per cent. bonds at 94½ are 1½ up. Several quotations in this market have been narrowed as regards the lower and higher prices, leaving the middle prices unchanged.

The Latin-Canadian group as a whole is suffering from the scandal that has arisen in connection with the Cuban Ports Company. Although this has nothing to do with electric light or power, its shares and bonds are dealt in in the same market as those of many of the Canadian and American utility undertakings. There is no connection between the Cuban Ports and these utility concerns except the merely sentimental, but this latter is a consideration which cannot be ignored in Stock Exchange matters, and the incident has created an uneasy impression, for which really there is no justification. Cuba Telegraph shares, after their fall of 10s. last week, are another 15s. down, although the Ordinary remain steady at 8¾.

Telegraph issues as a whole are firm, and except for a decline of ¼ in Anglo-American Telegraph 6 per cent. Preferred stock there are no quotable changes. Marconis continue to cling closely to the neighbourhood of £4, speculation in them ebbing away as it was expected to do after the declaration of the dividend, the issue of the report and the holding of the meeting. The market looks dull for the time being. Of the subsidiaries, American Marconis remain about 22s. 6d., and Canadians at 12s.

The Manufacturing group retains most of the rises which it secured a week ago, but British Westinghouse Preference, after their sudden jump, reacted to the extent of ⅛, shares being on offer now at 1. British Insulateds are stronger. Henley's Debenture stock hardened to 102. Rubber shares are fairly steady, business in them falling away to retail proportions. The feature in the Stock Exchange during the past few days has been further rises in the prices of the leading copper shares upon the fresh advance in the metal itself, which seems to have a capacity for soaring far from appropriate to the quality of the article itself. On Tuesday afternoon there occurred a slight reaction, reflected at once in the prices of the principal copper shares.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, September 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	¼d. inc.
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	£1 inc.
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£23 15	£2 5s. inc.
a Lead, Nitrate	„	£30	£2 10s. inc.
a „ White Sugar	„	£26	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	105/-	5/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	8§d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£96	£1 inc.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	⅛d. inc.
c „ Tube (brazed)	„	10§d.	⅛d. inc.
c „ „ (solid drawn)	„	9½d.	⅛d. inc.
c „ Wire, basis	„	8½d.	§d. inc.
c Copper Tubes (brazed)	„	1/-	⅛d. inc.
c „ „ (solid drawn)	„	11§d.	⅛d. inc.
g „ Bars (best selected)	per ton	£86	..
g „ Sheet	„	£86	..
g „ Rod	„	£85	..
d „ (Electrolytic) Bars	„	£76 15	£3 15s. inc.
d „ „ Sheets	„	£94 15	£3 15s. inc.
d „ „ Rods	„	£82 5	£3 15s. inc.
d „ „ H.C. Wire	per lb.	9§d.	§d. inc.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	..
h India-rubber, Para fine	„	3/8	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	54/9	..
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 17 6	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£196 to £198	£1 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 10	£1 5s. inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Electric Supply Co., of Victoria.—The directors have declared a dividend of 6 per cent. on the preference shares on account of arrears, allocating £2,216 for depreciation of stores, £1,000 off discount and commission on debenture stock, and carrying £7,570 forward.—*Financier.*

Hurst, Nelson & Co.—The accounts for the year ended July, 1913, will permit of the arrears of preference dividend being paid up on November 11th, 1913, together with dividend for the half-year ending on that date.—*Financial News.*

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8⅛ — 9⅛	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	+ ½	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4	..	5 12 6
Do. Do. 4 % Deb. ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	..	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	14⅜ — 15¾	..	5 14 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	+ ¼	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord. ..	10	6	8†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£8	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	89 — 91	+1	4 19 0
Hove	5	9	..	7¾ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 7⅞	+ ⅛	5 [illegible]
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	‖	2½		1⅜ — 1⅝	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅛ — 4⅜	..	5 14 5
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅛ — 3⅜	+ ⅛	5 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4†	4⅛ — 4⅜	..	5 9 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 19 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	78 — 81	+1	4 [illegible]
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10⅜	+ ½	5 11 7
Oxford	5	7	.	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	9½ — 9¾	+ ½	5 [illegible] 1
Do. 7 % Pref.	5	7	7	6⅞ — 7	..	5 9 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	.	2⅜ — 3⅛	+ ⅛	5 [illegible]
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅝ — 1⅞	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	.	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10†	8⅝ — 9⅛	+ ⅜	5 9 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Ade aide, 6 % Pref.	5	5	6†	4⅞ — 5⅛	..	5 17 1
Ca utta, Ord.	5	8½	..	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 1
Canadian Gen. El. Com. ..	$100	7	7†	113 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	8	6	92 — 94	+2	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	—	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90½ - 92½	+ ½	5 8 2
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	..	3/32 — 9/32	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	£500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4	66 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	95 —100	−2	7 0 0
Do. 5 % 1st Mort. Gold Bds.		5	5	90½ - 92½	+ ½	5 8 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	78 — 80	−1	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	74 — 77	..	6 9 10
Montreal, Lt., H. and Power ..	$100	9	10†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	£a	£a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ - 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	+1	4 7 5
Shawinigan Water, Capital ..	$100	5½	6†	140 —144	..	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	+ ½	4 13 9
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	98 —100	— ⅛	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	.	1/16 — 3/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅛	..	6 2 0
Do. 6 % Deb. Red.	Stock	5	5	94 — 96	..	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	132 —135	..	5 18 6
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	107 —108	— ¼	5 11 2
Do. Def.	Do.	30/-	..	23¼ — 23⅜	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	8¼ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	14⅓ — 15½	— ⅜	6 9 0
Direct Spanish Telegraph, Ord.	5	4	..	8¼ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6⅞ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127 —130	..	5 7 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 6
Eastern Extension	10	7	7	12⅛ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅝	..	4 15 1
Great Northern Telegraph ..	10	20	5†	80 — 83	..	6 13 0
Indo-European Telegraph ..	25	12	..	55½ — 57½	..	5 13 1
Mackay Companies Common ..	$100	5	5	85 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅞ — 4	— ⅛	5 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	3 5/16 — 8 7/16 xd	..	4 18 11
Monte Video Telephone, Ord. ..	1	5	6	3½ — 1 3/16	— ⅛	5 9 8
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ¼	4 9 1
Oriental Telep. and Elec. ..	1	10	..	1 13/16 — 1 15/16	..	5 8 8
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 16 9
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	— ½	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10†	9⅜ — 10½	..	9 17 6
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 3/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅝	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10½	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 9⅝	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92⅝	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 96	..	4 14 9

Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 11/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13½	+1	..
Do. Do. Deferred ..	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	47 — 50	..	6 0 0
Do. 5 % Perp. Deb. ..	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	75 — 78	..	5 15 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	4	80 — 82 xd	..	4 17 7
Do. Pref.	100	4	4	77 — 79	..	5 1 3
Do. Gtd. Assented	100	..	4	81 — 83 xd	..	4 16 3
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81 xd	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 25/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/8 — 2 5/8	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	1/2 — 3/4	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	15/16 — 1 1/16	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	74 — 79	..	5 13 11

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	61 — 65	+1	6 3 1
Metropolitan Railway Consol. ..	100	1 5/8	1½†	47 — 47½	— 3/4	3 8 5
Do. Surplus Lands	100	2 3/4	2 3/4†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	79 — 81	..	4 6 5
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord. ..	100	Nil	..	34 1/8 — 35	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	3½	..	3/32 — 13/32	..	..
Do. 5 % Pref.	1	0	5	1/16 — 1/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	3/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3 3/32 — 4	— 1/32	Nil
Do. "A"	1/-	..	..	1/32 — 13/32	— 1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	109 —111	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	90 1/2 — 91 1/2	—1	6 11 2
Yorkshire (West Riding), Ord.	5	Nil	..	5/8 — 5/8	..	Nil
Do. 6 % Pref.	5	3	1½†	3 3/8 — 3 7/8	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/8 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	+ ½	4 5 1
Do. 4½ % Deb.	100	4½	4½	96 — 98	+ ½	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10 3/4 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	95½ — 96½	..	6 4 4
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/8 — 7 5/8	+ ½	5 5 0
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	+1	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	126 —129	..	6 4 0
Do. Pref. Ord.	100	6	6	102 —115	..	5 4 4
Do. 5 % Pref.	100	5	5	102½ —105½	+ ½	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —108	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 8
Calcutta Trams, Ord.	5	7½	..	5 3/4 — 6 1/4	..	5 12 0
Do. 5 % Pref.	5	5	5	4 7/8 — 5 1/8	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1 1/16 — 1 3/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5 5/16 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	5/32 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	25 — 35	..	..

La Plata Elec. Trms, Ord. ..	1	..	..	13/32 — 17/32	..	..
Do. Pref.	1	4 3/5 d.	6	3/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 3/32 — 1 11/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1 1/4	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4 3/4 — 5 1/8	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7†	7	98½ — 100½	..	6 19 4
Do. Gen. Con. 5 % Bonds ..	..	5	5	89½ — 91½ xd	+ ½	5 9 3
Do. 6 % Bonds	100	5	6	93½ — 95½	+1½	6 5 8
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4 3/4 — 5 1/8 xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ — 100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5½	..	1 1/8 — 1 3/8	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 1/8 — 102 1/2	..	4 17 6
Do. 5 % Mort. Bonds ..	100	5	5	95½ — 96½	..	5 3 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 — 104	..	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 90	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4 5/8 — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 1/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	6	6	27/32 — 29/32	..	7 2 6
Babcock & Wilcox	1	16	..	3 1/16 — 3 3/16	..	5 0 5
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord. ..	1	..	..	1 1/16 — 1 1/16	..	..
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 3
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 8
B.I. & Helsby Cables	5	10	..	8 — 8½	+ ½	5 17 6
Do. Pref.	5	6	6	5 3/4 — 6½	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 3/4 — 95 3/4	..	4 14 0
British Westinghouse, Pref. ..	3	Nil	..	7/8 — 1 1/16	—1/16	Nil
Do. Deb...	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	85½ — 40½ xd	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	..	10 3/4 — 11½	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 1/16 — 3 3/16	..	5 4 11
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	3/8 — 9/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	7 18 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1 1/4 — 1 3/4	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	5	..	1 — 1 1/4	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	6	6	9 3/4 — 10½	..	5 14 3
Do. Deb...	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb...	100	4½	4½	101—103	+ 1	4 7 5
India-Rubber, G. & T.	10	7½	..	12 3/4 — 13 3/4	..	5 9 1
Do. Pref.	10	5	5	9 5/8 — 10 3/8	..	4 18 9
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb...	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 1/2	..	Nil
Do. Deb...	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

TRADE STATISTICS OF MEXICO.

The following figures, showing the imports of electrical and similar materials into Mexico during the year ended June 30th, 1912, are taken from the recently-issued official trade statistics; the figures for the previous year are given for purposes of comparison, with notes of increases or decreases:—

Peso = 2s. 0½d.

	1910-11. Pesos.	1911-12. Pesos.	*Inc. or dec.* Pesos.
Copper, brass or bronze wire, covered with other materials.—			
From Germany	83,000	64,000	— 19,000
„ Austria	2,000	—	— 2,000
„ United States ...	461,000	458,000	— 3,000
„ France	1,000	1,000	—
„ Great Britain ...	4,000	1,000	— 3,000
„ Other countries ...	9,000	1,000	— 8,000
Total ...	560,000	525,000	— 35,000
Copper, brass or bronze wire, bare.—			
From Germany	40,000	38,000	— 2,000
„ United States ...	364,000	180,000	— 184,000
„ Great Britain ...	9,000	8,000	— 1,000
„ Other countries ...	7,000	17,000	+ 10,000
Total ...	420,000	243,000	— 177,000
Cables of copper, brass, &c., not armoured.—			
From Germany	23,000	47,000	+ 24,000
„ Austria	8,000	1,000	— 7,000
„ United States ...	231,000	500,000	+ 269,000
„ Great Britain ...	20,000	3,000	— 17,000
„ Other countries ...	30,000	6,000	— 24,000
Total ...	312,000	557,000	+ 245,000
Cables of copper, &c., armoured.—			
From Germany	50,000	162,000	+ 112,000
„ United States ...	129,000	121,000	— 8,000
„ Great Britain ...	121,000	71,000	— 50,000
„ Other countries ...	2,000	12,000	+ 10,000
Total ...	302,000	366,000	+ 64,000
Insulators of glass or porcelain.—			
From Germany	17,000	39,000	+ 22,000
„ Austria	3,000	5,000	+ 2,000
„ United States ...	84,000	99,000	+ 15,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	105,000	145,000	+ 40,000
Commutators, interrupters, contacts, safety cut-outs, &c.—			
From Germany	92,000	307,000	+ 215,000
„ Austria	1,000	3,000	+ 2,000
„ United States ...	277,000	362,000	+ 85,000
„ France	11,000	1,000	— 10,000
„ Great Britain ...	4,000	6,000	+ 2,000
„ Other countries ...	5,000	2,000	— 3,000
Total ...	390,000	681,000	+ 291,000
Incandescent electric lamps.—			
From Germany	233,000	183,000	— 50,000
„ Austria	26,000	11,000	— 15,000
„ United States ...	398,000	442,000	+ 44,000
„ France	11,000	7,000	— 4,000
„ Great Britain ...	2,000	1,000	— 1,000
„ Switzerland ...	1,000	—	— 1,000
„ Other countries ...	11,000	3,000	— 8,000
Total ...	682,000	647,000	— 35,000
Machines for industries, mining, &c.—			
From Germany	2,955,000	2,526,000	— 429,000
„ Austria	6,000	3,000	— 3,000
„ Belgium	139,000	146,000	+ 7,000
„ Canada	5,000	—	— 5,000
„ Spain	43,000	21,000	— 22,000
„ United States ...	16,661,000	15,001,000	—1,660,000
„ France	394,000	354,000	— 40,000
„ Great Britain ...	3,158,000	2,725,000	— 433,000
„ Italy	46,000	107,000	+ 61,000
„ Sweden	219,000	109,000	— 110,000
„ Switzerland ...	125,000	242,000	+ 117,000
„ Other countries ...	18,000	15,000	— 3,000
Total ...	23,769,000	21,249,000	—2,520,000
Arc lamps.—			
From Germany	16,000	52,000	+ 36,000
„ United States ...	35,000	34,000	— 1,000
„ Other countries ...	1,000	1,000	—
Total ...	52,000	87,000	+ 35,000
Scientific instruments and apparatus.—			
From Germany	114,000	94,000	— 20,000
„ United States ...	218,000	151,000	— 67,000
„ France	74,000	100,000	+ 26,000
„ Great Britain ...	13,000	11,000	— 2,000
„ Italy	29,000	7,000	— 22,000
„ Other countries ...	8,000	7,000	— 1,000
Total ...	456,000	370,000	— 86,000

HIGH-FREQUENCY ALTERNATORS AND THEIR USE IN RADIO-TELEGRAPHY AND TELEPHONY.

Use of Sustained Oscillations in Wireless Telegraphy.—Hitherto the oscillations employed in wireless telegraphy have generally been obtained by the sudden discharge, by means of a spark, of an oscillating system comprising a condenser and self-induction. The discharge current then flowing is heavily damped, and, as a function of time, is represented by an equation of the form $I = A e^{-\alpha t} \sin \omega t$. By induction, the generating system will give rise to oscillating currents in a second oscillating system even if the period ($2\pi\sqrt{LC}$) of the latter is not identical with that of the former. By analogy with the phenomena of sound, one would expect the "resonator" only to respond to stimuli possessing its own natural frequency. That this is not the case is due to the fact that heavily damped oscillations produce, in a circuit having a smaller coefficient of damping, the same effect as a blow on a pendulum; the equilibrium of the resonator is disturbed, and oscillations then follow with the natural frequency of the circuit concerned. Bjerknes' classical formulæ, expressing the behaviour of various resonators under the influence of a given exciter, show that under the ordinary conditions of practice, the energy received is greater the more nearly the natural frequency of the receiving circuit coincides with that of the exciter and the smaller the damping in the latter. On the other hand, for a given difference between the natural frequencies of the two circuits, the energy received is less the less the damping in the exciting circuit. It is, therefore, doubly desirable to reduce the damping of the exciting system, since the efficiency of excitation of the transmitting aerial is thereby increased and syntony is improved—*i.e.*, the receiving system becomes less affected by stimuli of frequency other than its natural frequency. The advantages of syntonic working are too well known to need recapitulation.

It is rather fortunate that very lightly damped waves could not be generated in the early days of wireless telegraphy, for, using them, the crude regulating devices then employed would have given poor results. Moreover, the first used detector, the coherer, depended for its action not on the total energy received but on the amplitude of the first oscillation in each train, hence the degree of damping was of little importance. Improvements in receiving apparatus and the substitution for coherers of electrolytic, and particularly of crystal detectors, depending for their action upon the total energy received, have, however, rendered more and more necessary the generation of lightly damped and even sustained oscillations, such as are provided by alternators; sustained oscillations are especially desirable in radio-telephony.

The telephone almost exclusively is used at the present day for the reception of wireless signals. The electrical oscillations set the receiver membrane in oscillation, but with a frequency far above the limit of audibility. Where damped waves are used, subsidiary membrane vibrations are set up corresponding to the discontinuity of the numerous trains of waves which go to make up each signal, but sustained radiations of constant amplitude produce no effect in the telephone audible to the ear. If, however, the amplitude of the oscillations be varied periodically with suitable frequency, a note of corresponding frequency is heard in the telephone, and if, in the transmitting circuit, the amplitude of the sustained high-frequency oscillations be varied by aid of a microphone, corresponding sounds are reproduced in the receiving telephone, *i.e.*, wireless telephony is achieved.

The necessary high-frequency fundamental oscillations were obtained during the first wireless telephony experiments by the well-known arc system, but this apparatus operates with some irregularity, which can be overcome by the use of high-frequency alternators.

High-Frequency Alternators.—The first endeavours to realise alternators providing current of suitable frequency were directed towards a sufficient increase in the number of poles and R.P.M. of generators of the same type as had hitherto been employed to supply 50 or 100 cycles per second in central-station networks. It is easy to show that even when driving the rotor at the absolute maximum peripheral speed permitted by the centrifugal stresses thereby set up, the pole pitch required for the generation of

frequencies of the order desired becomes impracticably small, at least so far as concerns the generation of any considerable power. The pole thickness can hardly be reduced below 2 or 3 mm., and before this limit is reached, inefficiency is incurred by the serious magnetic leakage between poles, by heating and windage losses and hysteresis and by eddy iron losses (increasing respectively with the frequency and the square of the frequency). Abnormal rotor speeds necessarily involve high windage losses, and the use of iron in a high-frequency alternator inevitably involves heavy hysteresis and eddy-current losses. For instance, to an alternating field of 150 kcy., steel plates, 0·05 cm. thick, offer an apparent permeability of 15 and, in a field of 2·2 gauss, the losses are 30 watts per kg. Silicon-steel plates, 0·022 cm. thick, offer an apparent permeability of 63 and the losses rise to 150 watts per kg. These results correspond to a true permeability between 150 and 200, indicating (says R. Jouast in a recent article from which these notes are abstracted), a change in the magnetic properties of iron at high frequency. These losses may be diminished considerably by subdividing the iron, but a limit is soon reached in this direction. It is very difficult to utilise satisfactorily iron wire; manufacture becomes a delicate matter and the cost of the machines high. On the other hand, it is difficult to obtain high output from ironless alternators. Finally, the small space available for the windings compels the use of fine wire, and hence involves high copper losses in the machine.

Up to 1901, 16 types of high-frequency alternator had been built (see also Fleming, "Principles of Electric Wave Telegraphy and Telephony," pages 5-13), but none had proved capable of supplying sufficient power at sufficiently high frequency. Tesla built two machines in 1889 and 1891, but no particulars of their performance appear to have been published. Pyke and Harris built a 200-watt, 8·7-kcy. machine for Sir David Salomons, and Parsons built a 400-watt, 14-kcy. alternator for Ewing, but these machines were of too small capacity and far too low frequency to be of any use for wireless work. Duddell obtained a suitable frequency (100 kcy.) in his alternator, built on the principle of Wien's siren, but, though needing a powerful motor to drive it, the output of this alternator was only 0·2 watt. In 1904, Lamme (Westinghouse, Pittsburg) built a rotating-iron alternator yielding 2 KVA. (150 volts, 13·3 amperes), at 10 kcy., but in this machine (which was designed for Leblanc's multiple telephony experiments) the air losses amounted to 3·3 KW., and the peripheral speed of the rotor when running at 3,000 R.P.M. was 1,075 ft. per second.

Between 1905 and 1907, Fessenden constructed and used two alternators of the Ferranti type, in which the use of iron was avoided in all parts where the flux was variable. The output of these machines was 1 KW. at 81·7 kcy., and 2·5 KW. at 75 kcy. It does not seem, however, that these machines achieved all that had been expected from them, for Fessenden continued his researches in collaboration with Alexanderson, whose 1910 alternator was the first industrially successful machine to yield 100 kcy. supply.

Referring to fig. 1, which shows the essential features of this machine, the rotor is of nickel chrome steel shaped approximately to the form of a solid of uniform resistance; its diameter being ca. 12 in., the peripheral speed at 20,000 R.P.M. approaches 1,000 ft. per second. The rotor disk has closed slots in its periphery and runs in the air gap of an electro-magnet formed by the yoke B D E and the field windings A. The passage of the rotor slots provokes flux variations in the portion E of the yoke and this part—the only one in which the flux is variable—is laminated (0·1 mm. plates) and pierced by holes, from each of which to the next the winding is wound in the form of a zig-zag. The rotor has 300 slots and the stator 600 tunnels. To reduce windage losses, the rotor slots are filled with non-magnetic material—soldered and mechanically locked in place. The portions B of the yoke being screwed in D, the air gap length can be adjusted. Its normal length is about 0·4 mm. As in the Laval turbine, a certain degree of flexibility is provided in the shaft in order that slight errors in balancing may be self-compensating; the shaft diameter at the extremity is 0·6 in. and the distance between bearings 28 in.

Two critical speeds are passed when starting up: at 1,700 R.P.M., the shaft vibrates between its bearings; and at 9,000 R.P.M., the rotor oscillates from side to side of its plane of symmetry, the shaft inflecting in S form. Auxiliary bearings near the rotor (which are idle when the latter runs steadily at full speed) limit the amplitude of these vibrations. Any magnetic irregularity tending to produce lateral displacement of the rotor results in heating of one auxiliary bearing, and the resulting thermal expansion of the shaft in the neighbourhood corrects the rotor position automatically.

The short-circuit current of the machine is 20 amperes, and the open-circuit pressure 100 volts. A current of 30 amperes produces 45° temperature rise. When excited so as to produce 110 volts on open circuit, the terminal pressure falls to 60 volts when the output is 15 amperes. Operation is improved when a condenser is connected across the terminals, as is the case when the machine is used for wireless purposes. Although the copper is only 0·41 mm. in diameter, its temperature rise is only 25° C. when traversed by 15 amperes, owing to the intimate thermal contact with the surrounding iron. The windage losses amount to 5 KW. and increase as the 2·7th power of the speed. The iron losses are from 500 to 600 watts, and the overall efficiency is obviously very low.

Subsequently, Alexanderson built a 200-kcy. machine, in the construction of which fresh difficulties were encountered. It was impossible to double the speed of a machine of the above type (owing to mechanical considerations and the excessive windage losses incurred), and the dimensions of the machine would not permit the number of teeth to be doubled. In the new machine 800 armature tunnels were provided, and the winding was so modified that at the same rotor speed as before, the frequency was doubled

The enormous speed at which the rotor has to be driven in all the types of alternators so far considered inevitably introduces mechanical complications and excessive windage losses, hence various attempts have been made to obtain the desired results by combining mechanical rotation with the properties of rotating fields.

The principle of such machines was indicated in 1894 by Jarvis-Patten and Arnold. Suppose two two-phase induction-type alternators to be mounted on the same shaft, the first to be excited by D.C., and the sections of its rotor to be connected in series with those of the second alternator. The F frequency current generated by the first alternator produces in the rotor of the second machine

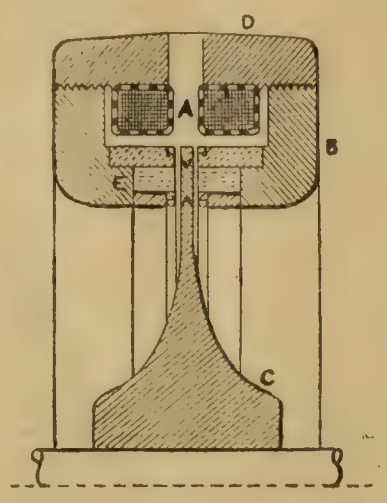


FIG. 1.

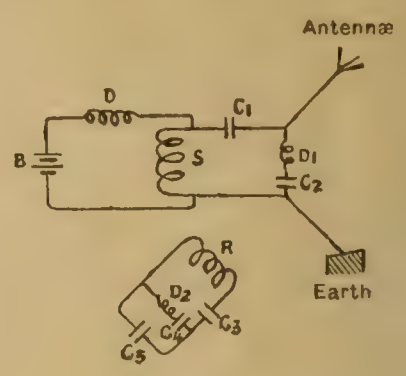


FIG. 2.

a field rotating at the speed corresponding to F with regard to this rotor (owing to the crossing of the intermediate connections). This field clearly induces currents of frequency 2 F in the stator of the second alternator, and, by placing n alternators on the same shaft and adopting the above system of connection throughout, current of (n F) frequency is ultimately obtained; but the efficiency of each alternator affects the resultant overall efficiency, and in order that the latter may be high, the number of machines must be few, and hence the frequency of the first high. Under these circumstances the two-phase winding (two slots per pole) stands at a disadvantage as compared with a one-phase winding, and single-phase alternators can be used quite as well in the above system.

The alternating field produced by an A.C. system traversing the winding of a one-phase machine can be resolved into two fields rotating in opposite directions with regard to the winding concerned (Leblanc's theory), hence, in any one of a number of one-phase alternators connected as above, a current of (n F) frequency produces two hypothetical rotating fields—the one useful, and of ($n + 1$) F, the other idle, and of ($n - 1$) F frequency. By aid of condensers, the latter component can be suppressed so far as concerns its action on the windings, but it inevitably sets up supplementary losses in the iron. In Goldschmidt's alternator. this difficulty is overcome by using only a single alternator. between the stator and rotor windings of which energy is "reflected" to and fro with continuous increase in frequency. Combinations of condensers and inductances permit the selection of the desired high frequency, and all components of lower frequency neutralise each other, thus securing comparatively high overall efficiency, and comparatively large output at the desired frequency.

Referring to fig. 2, the alternator is excited by D.C., which circulates in the circuit B D S of the stator, and generates a current of frequency F in the rotor circuit R C_3, C_4, D_2; the condenser C_3 is designed to annul the inductance of the rotor, and D_2 and C_4 are tuned to the frequency F, and thus constitute a short-circuit path for currents of this frequency. The heavy current of F frequency thus obtained produces a field of frequency 2 F, and induces a current of corresponding frequency in the stator circuit S C_1 D_1 C_2, where C_1 annuls the stator inductance, and D_1 C_2 are in resonance at 2 F cycles. Thence is produced a current of frequency 3 F in the winding R C_3 C_5, which is designed to offer negligible impedance to currents of this frequency. By yet another reaction between the rotor and stator, current of 4 F is generated in the latter, and circulates in the circuit formed by S, the antenna and earth, which circuit is tuned to the frequency 4 F. The circuit D_1 C_2, which acts as a short-circuit to currents of frequency 2 F, presents high impedance to currents of frequency 4 F.

Although the Goldschmidt alternator contains only single-phase windings, it behaves like a series of alternators in cascade, all being polyphase except the last one. Thus the single-phase current of frequency (n F) produces component fields of frequency ($n - 1$) F and ($n + 1$) F, which may be considered as belonging respectively to polyphase alternators of lower and higher frequency. Since the efficiency decreases with increase in the number of "filter" circuits, only four of the latter are actually used, hence the initial frequency F must be high.

Several alternators of this type have been built by Lorenz, and one was shown at the Radio-Conference in London (June, 1912). This machine, which furnished current at 60 kcy. (corresponding to a 5,000-m. wave), employed an initial frequency of 15 kcy., and ran at a peripheral velocity of nearly 500 ft. per sec. At first ball bearings were used, but subsequently ordinary bearings with ring lubrication were employed. The condensers were of mica, and the inductances were of stranded insulated wire wound as flat spirals, and oil-immersed. The output claimed was 9 KW. at 60 kcy., and 12 KW. at 30 kcy.; the efficiency 80 per cent. As to the accuracy of the latter figure there appears some doubt; windage losses must

be high, and unless special ammeters* are used to measure currents of such frequency, 30 per cent. error may easily arise. All high-frequency test data must be accepted with extreme reserve unless the instruments used are specified.

The Lorenz Co. has under construction four 150-KW. Goldschmidt alternators running at 8,000 R.P.M., and having 1 mm. gap.

As mentioned above, the last circuit of a Goldschmidt machine operates as a one-phase alternator, a fact which somewhat diminishes its efficiency, and to avoid this defect, Latour has devised a machine in which the rotor winding is single and the stator winding two-phase (fig. 3). The stator phases in series act as a single-phase circuit for the intermediate frequencies, but for the frequency utilised there are superposed on the one-phase output, two-phase currents which respectively lag and lead 90°, and which produce in the stator a field rotating oppositely to the rotor and exactly annulling the parasitic field due to the one-phase current utilised.

Despite the special difficulties encountered in high-frequency polyphase alternators, Bethenod has devised a system in which four two-phase alternators of the induction type are mounted in cascade with their windings crossed as explained above. In these machines, the laminations are 0·05 mm. thick†; each machine has 240 rotor and stator slots (width 0·25 cm.). The gap = 0·3 mm.; internal diam. of stator, 38 cm.; speed, 6,000 R.P.M.; initial frequency 6 kcy., final 24 kcy.

In order to utilise both phases of generation, two suitably adjusted aerials might be used, but this expedient is costly, and a single aerial can be made to serve by adopting the arrangement shown in fig. 4. One of the phases is connected to the aerial, the secondary of a Tesla coil, an inductance and a condenser; the other is connected to the primary of the Tesla coil, an inductance and a condenser. The condensers are adjusted to annul the inductance of the windings, and by adjusting the coupling of the Tesla coils, the load can be made equal in each phase.

To avoid the necessity for a "ticker" in the reception of undamped waves, Goldschmidt and Bethenod use not D.C. but A.C. of musical frequency to excite the primary windings of their machines. The amplitude of the undamped waves is thus varied periodically and in the receiving telephone a musical note is heard corresponding to the frequency of the alternator exciting the transmitting alternator.

It may be possible to realise high-frequency alternators operating on quite a different principle. If a series wound D.C. dynamo (the field cores of which are far from being saturated) is connected to an oscillating circuit, the latter becomes the seat of oscillations of period $T = 2\pi\sqrt{LC}$ (L = total inductance; C = capacity). The frequency obtained is independent of speed variations in the dynamo, and Rudenberg has shown that the apparatus may be given a form closely resembling an A.C. commutator motor, by closing the armature circuit on the short-circuited brushes and placing in series the inductance, capacity and the field coils. In order, however, to produce undamped oscillations, the resistance of the circuit must be less than a certain limit depending on the characteristics of the machine. That it may be so, the laminations must be very thin, and eddy losses in the commutator must be reduced as far as possible. The self-induction of the field coils being always considerable, it is difficult to attain high frequencies.

It is reported that, during 1912, Arco built an alternator capable of furnishing large output at 120 kcy., but little information is yet to hand concerning this machine. The principle employed is said to be the cascade connection of a number of static frequency transformers depending on the asymmetric magnetisation of iron. The theory of such apparatus was developed some years ago by M. Joly, and its construction and operation were recently described in these columns (see ELEC. REV., August 29th, 1913). The primaries of two transformers are connected in series, the secondaries in opposition and D.C. exciting coils are added, the M.M.F. of which adds to the primary alternating M.M.F. in one transformer and opposes that in the second transformer. The E.M.F.'s induced in the secondary winding contain even harmonics, which add, and odd harmonics which cancel. A suitable capacity in the exciting circuit, resonated for the first even harmonic with the inductance of the secondary, raises the efficiency of the apparatus to a satisfactory value.

Utilisation of High-Frequency Alternators.—Certain of the alternators described above will yield current of 100 kcy. frequency, but the realisation of these machines appears to have been a veritable *tour de force*, so that satisfactory operation at these frequencies in industrial service can hardly be anticipated.‡ There is no doubt, however, that 10 to 30-kcy. alternators of considerable capacity and high efficiency can now be built, and we can profitably consider what part such machines may play in long-distance radio-telegraphy and radio-telephony.

Radio-Telegraphy.—Wave-lengths of 3 to 6 km. have, so far, been employed for long-distance work, and long experience seems to justify the opinion expressed by Poincaré, that long-distance transmission is only practicable by the use of long wave-lengths.

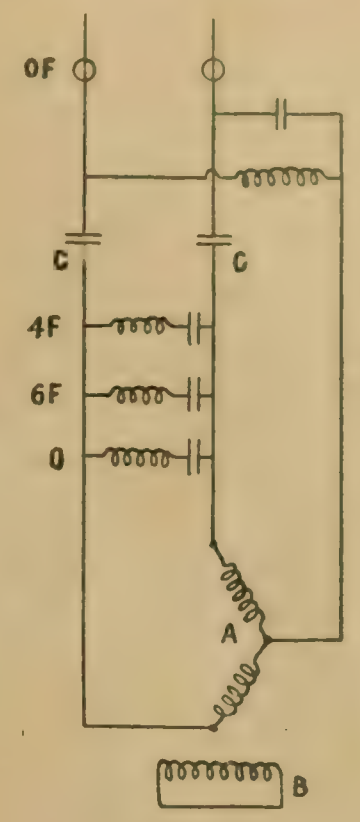


FIG. 3.

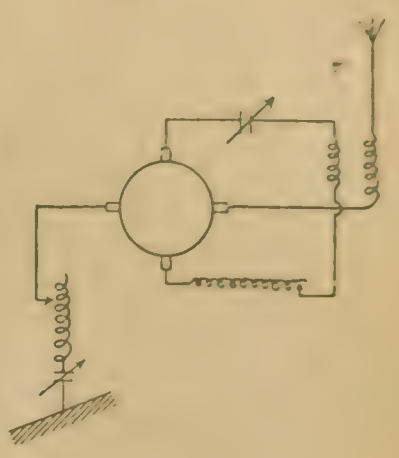


FIG. 4.

Certain authorities have stated that frequencies so low as 10 kcy. (30-km. wave) could be employed for radio-telegraphy, but hitherto all tests with undamped waves have been made with comparatively short wave-lengths (less than 2 km.), and the radiations employed have generally been produced by Poulsen or Moretti arcs, the unstable operation of which has done much to discredit transmission by sustained waves.

Count Arco recently compared undamped waves of 1·75 km. length (produced by an alternator) with damped waves provided by a system having 0·05 decrement, and producing 1,000 wave trains per second. No appreciable difference in reception was observed. On the other hand, it was easier to receive damped waves emitted by sparks of musical frequency, since these differentiated themselves better than undamped waves from parasitic oscillations. Probably, however, this distinction would disappear, or be reversed, were the alternator excited by high-frequency A.C.

Contradictory to these results, we find those reported by the Federal Co., who have established communication between San Francisco and Honolulu, using Poulsen sustained oscillations. Communication was effected over 3,200 km. by night, using a 30-KW. arc, but was impossible using a spark fed by a 60-KW. alternator. The wave length employed was 4 km. The aerial current was only half as great using sustained oscillations as when using the spark system, but the energy received at 1,600 km. was equal in both cases.

To some extent the contradictory results reported during recent years are doubtless explained by the fact that investigators have not always been impartial, and it cannot be disguised that recent progress in spark systems has reduced the interest attaching to the generation of sustained oscillations for wireless telegraphy work. By theoretical considerations, Eccles reaches the conclusion that radiating equal energy, the energy received where the latest spark systems of transmission are employed is 90 per cent. of the energy received using sustained oscillations.

Under these circumstances, the efficiency of high-frequency alternators becomes a crucial factor, and, that it may be high, low-frequency long waves are desirable. The outstanding advantage of alternators lies in the possibility of radiating greater power than has hitherto been available at high frequency. Obviously a great part of the benefit anticipated from the use of sustained waves is sacrificed if the alternator frequency be unconstant, hence the speed at which the machine is driven must be constant within 0·25 per cent. Finally, it must not be overlooked that the construction of suitable antennæ is a matter inseparably connected with the efficient utilisation of sustained oscillations.

Radio-Telephony has not yet attained commercial success, but there is little doubt that satisfactory communication by this means will involve the utilisation of sustained oscillations of frequency exceeding 15 or 20 kcy., and it is probably in this field that high-frequency alternators will find their chief application. In 1907, Fessenden, using one of his own alternators, effected radio-telephonic communication between Brant Rock and New York (190 miles), and a 100-kcy. Alexanderson alternator has been used in similar tests. The relative failure to date of radio-telephony is not due to the impossibility of generating suitable sustained oscillations, but to the lack of a suitable microphone. The day on which the latter becomes available will see the birth of commercial radio-telephony.

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* The first industrial high-frequency ammeter was invented by Broca in 1908, since when Hartmann & Braun have built an instrument depending on practically the same principle.

† The success of recent high-frequency alternators is largely attributable to that progress in metallurgy which has rendered available plates of silicon steel sufficiently thin to reduce iron losses to a permissible value. The fragility of these plates makes manufacturing costs high.

‡ Since these notes were written, the Commission appointed to consider the technical features of the Imperial wireless chain scheme has expressed the opinion that although the future belongs to high-frequency alternators, no machines submitted to it appeared suitable for commercial traffic. Vessels in the German Navy are provided with apparatus for generating damped waves, as well as with Poulsen sustained oscillation apparatus. In military applications, sustained oscillations offer the important advantages that signals can only be received in stations provided with tickers, and communication can be established under such conditions that blocking by an enemy's signal becomes very difficult.

APPARATUS ON HIRE.

By T. C. PARSONS.

It is maintained by some people that electrical apparatus should not be hired out by a municipal authority, but that such work should be left to private traders. The objection to this from the municipal engineer's point of view is twofold :—

1. Very few private traders are willing to hire out apparatus.

2. Firms other than electric supply authorities carrying out a hiring scheme must make their profit out of the hiring scheme itself, and cannot therefore give consumers the same advantages as they would obtain from a supply authority, who only need to cover expenses. If the supply authority are a private company, no exception is taken to their hiring out any apparatus they wish on any terms they choose, and if it is right for a municipality to own a supply undertaking, it is illogical to object to their extending their business in any way that would be considered perfectly legitimate for a private company, if it can be carried out by them in an equally satisfactory manner as by a private firm.

Motors.—Advantages of Hiring Scheme.

1. Enables small firms to adopt electric driving without incurring much initial outlay.

2. Increased reliability, due to supervision of the supply authorities, is a great inducement to many firms to hire instead of purchasing, especially in the case of consumers who are not engineers and who have not got an engineering department. The authorities' inspectors give frequent and efficient attention to the hired motors, instruct the hirers how to clean and look after the machines, *and see that it is done regularly*, and expensive repairs are often prevented in this way.

When the writer was burgh electrical engineer of Govan (which is now incorporated in the Glasgow municipal area), there were several cases where people discarded their own motors in order to hire from the Corporation. In one case a firm which had all their machinery electrically driven, had a breakdown with one of their motors. They hired one from the Corporation to tide them over their difficulties, but when their own machine was repaired they sold it and kept the Corporation motor, and shortly after sold both their other motors and hired three in their place from the Corporation (although their installation was only between three and four years old), because they felt that they had much greater security when the Corporation were maintaining the motors.

Another advantage is that the Corporation keep a stock of spares, and in the event of anything going wrong with a hired motor, it can be quickly repaired, or, if necessary, a spare armature, field coil or a complete spare motor put in with the delay of a few hours only.

3. Many people are not convinced that electric driving will suit their particular case, and will not, therefore lay out any capital, but if the supply authority will rent motors, they are prepared to give them a trial.

There were several instances of this sort in Govan, where firms tried electric driving with hired motors, found it satisfactory, and purchased for themselves electrical equipment for their whole works. One firm that started in this way ultimately installed over 1,200 h.p.

A point that appeals to many people is that if the supply authority have sufficient faith in electric driving to be prepared to find the necessary capital, then there must be a considerable chance that electric driving will be suitable in their case.

4. The supply authorities have at their command data with regard to electric driving for all classes of machinery

TABLE I.—Particulars of Motor-hiring Department of Govan Corporation.

Year.	No. of motors installed.	h.p. of motors installed.	Net capital.* £ s. d.	Total depreciation as at May 15th. £ s. d.	Percentage of capital.	Rent received for year. £ s. d.	Percentage of capital.	Attendance. £ s. d.	Repairs. £ s. d.	Total attendance and repairs. £ s. d.	Percentage of capital.	Total attendance, repairs, depreciation, interest and sinking fund. £ s. d.	Percentage of capital.
1904†	2	40	188 6 11	—	—	13 17 0	14·7	—	—	—	—	5 3 6	5·5
1905	17	230	1,075 15 3	44 9 7	4·13	97 1 9	9 0	0 16 0	8 11 3	9 7 3	·87	110 8 10	10·2
1906	42	454	2,549 2 5	203 1 4	8·0	242 0 4	9·5	21 2 2	17 1 2	38 3 4	1·5	325 15 1	12·75
1907	55	586·75	2,991 8 1	451 11 10	15·1	422 5 6	14·1	34 3 7	10 8 5	44 12 0	1·49	441 17 1	14·7
1908	56	621·75	3,597 2 9	550 16 6	15·3	427 7 7	11·9	48 9 4	51 10 10	100 0 2	2·78	405 6 10	11·3
1909	66	759·15	3,900 2 4	723 2 5	18·5	541 2 0	13·85	67 12 5	33 18 5	101 10 10	2·59	448 6 9	11·5
1910	68	745	3.885 12 3	862 0 3	22·2	574 0 1	14·75	55 15 5	51 15 3	107 10 8	2·76	459 19 9	11·8
1911	72	788·6	4,084 8 2	1,055 10 10	25·8	626 6 11	15·3	58 15 11	121 9 2	180 5 1	4·4	648 18 2	15·9
1912	104	1.056	4,609 2 4	1,483 9 1	32·2	731 6 0	15 9	83 10 10	42 19 6	126 10 4	2·74	727 7 10	15 8

* Gross capital, less cost price of motors sold to hirers. † Six months only.

TABLE II.—Particulars of Motor-Hiring Schemes in 18 Towns.

Town.	Years scheme in operation.	No. of motors, 1912.	h.p. of motors, 1912.	Capital, 1912.	Attendance and repairs as % of capital, 1912.	Av. attend. and repairs as % of capital since scheme started.	Depreciation, per cent.	Rent. Simple hire.	Rent. Hire-purchase.	Remarks.
					%	%	%	%	%	
1	10	59	125	745	4½*	4½—5*	10	20—30	See Note A	*Percentage on depreciated value.
2	10	62	250	1,539	·34†	·05†	10	20	50	†Attendance not booked.
3	10	362	1,555	15,500‡	—	—	10	—	—	‡£6,000 taken out of revenue.
4	12	388	2,156	15,226	1·88	—	10	·10	—	
5	10	337	1,045	5,000	9	9	12½	14	—	
6	10	70§	670	3,756	4½	4½	See Note B	12½	—	§308 motors, totalling 2,552 h.p., purchased by hirers.
7	10	66	262	2,190	—	—	10	14	—	
8	6	28	188½	1,155	5·92	7·23	10	16·9	—	
9	6	35	432½	1,800‖	2·13	2·0	—	15	—	‖Includes wiring.
10	9	50	369	2,473¶	6·0	5·0	7½	16	—	¶Written down to £1,271.
11	8	104	1,056	4,609	2·74	2·39	6·08	13·04	—	
12	9	615	2,894	5,454	3·4	3·15**	See Note C	14	—	**Average for last three years.
13	10	98	675	2,236	—	—	12½	—	—	
14	9	79	354	3,138	4·1	3·63	—	20	20††	††Maint. not included in hire-p'rch'se.
15	10	90	500	3,500	4·0	4·0	10	16—20	30‡‡	‡‡5 years' purchase.
16	10	126	954	8,146	1·6	—	—	10	—	
17	10	120	666	2,993	2·0	—	10	12	—	
18	12	149 (hire) 82 (hire-p'ch.)	1,006 1,129½	6,772	3·0	3·0	9	—	—	

A.—If hirer wishes to purchase, 15 % is added to cost price, and from figure so obtained one-third of total rent paid is deducted.
B.—£2,675 repaid to date. C.—Life of motor taken at 23 years.

and can advise as to the most suitable type and power of motor, and if in any particular case a mistake is made and too small a motor put in, there is no difficulty about taking it into stock and installing a machine exactly suitable.

MOTOR VALUATION BOOK.

GOVAN CORPORATION ELECTRICITY DEPARTMENT.

MOTOR VALUATION.

Motor. H.P..... Speed..... Voltage..... Corporation No.....
Maker..... Maker's No..... Price.....
Rails price..... Date received.....
Starter. Maker..... Maker's No..... Corporation No.....
Price..... Date received.....
D.P. Switch. Size..... amps. Maker..... Price.....
Fuses. Size..... amps. Maker..... Price.....
Total Value of Equipment £...s...d. Rent per Annum £...s...d.

INSTALLED AT

Name.	Address.	Date sent out.	Date brought in.

AMOUNT OF RENT RECEIVED.

Year end'g	£	s.	d.	Year end'g	£	s.	d.	Year end'g	£	s.	d.	Year end'g	£	s.	d.

TOTAL VALUE OF EQUIPMENT.

Year end'g	£	s.	d.	Year end'g	£	s.	d.	Year end'g	£	s.	d.	Year end'g	£	s.	d.

MOTOR REPAIRS.

Date.	Nature of repair.	£	s.	d.

5. The Corporation supply authority having a stock of motors of various sizes are in a position to put in motors at a few hours' notice in the case of a breakdown of steam or gas plant, and in such a case if the firm owning the plant which failed is not already a consumer, it will probably become one permanently.

Hiring Department.

The success of a motor hiring department depends on getting first-class apparatus and in giving efficient attention. The rental will depend on the capital cost of the motor, and the better the machine the less liable it will be to require expensive repairs.

It is desirable to keep to one or two makes of motors only, to keep down the stock of spares and to increase interchangeability.

Low-priced starters, especially in the higher horse-powers, are a fruitful source of trouble, and, in the end, far more expensive than first-class articles.

With regard to attendance, all motors should be inspected once a fortnight, and in special cases such as bakers and other works where there is much dust flying about, once a week. Frequent inspection materially reduces the repair bill. In the case of the Govan undertaking the average cost of maintenance and repairs taken over a period of eight years was 2·39 per cent. of the capital outlay, the highest being 4·4 per cent. in one year when it happened that three fairly large armatures had to be rewound, and the lowest ·87 per cent. Particulars of these charges incurred in the Govan undertaking are given in Table I, of which a short explanation may be given here.

For the first 18 months, when there were only a few motors hired out, there was no special attendant, but the inspections were made by the mains superintendent as he went round his district, which accounts for the small amount allocated to attendance for that period. After that period, however, a man was specially told off for that and other work, and all his time carefully allocated. Nothing, however, has been allowed for general supervision by the mains superintendent.

The amount allowed for depreciation is heavy, due to the fact that the prices of motors have been steadily falling, owing to the general cheapening of manufacture, but chiefly to the introduction of fan blades, which allow the output of a given size of machine to be increased by about 25 per cent., and consequently the values of motors without fan blades had to be written down.

Taking the sum for the whole period since hiring was started, the rents received were £3,675 7s. 2d., and the total expenses (maintenance, depreciation, interest and sinking fund) were £3,573 3s. 10d., giving a credit balance of £102 3s. 4d. The average rent was 13·04 per cent., and the average depreciation 6·08 per cent., which was really too large. The average rent of 13·04 per cent., as is mentioned in Table II, is the average of the rent received for eight years, and is a percentage of the total capital including spare motors.

Table II gives figures obtained from 17 other towns in addition to Govan.

Rental Charges.

Rent should in all cases be payable in advance.

Simple Hire.—Allow for interest, sinking fund, attendance, repairs and sundries (office charges, capital charges on stock motors, &c.).

It is customary in some undertakings to charge the hirer with all repairs, but in the writer's opinion, this should be included in the rent, the authority being protected against wilful damage or neglect by a special clause in the agreement. This is a perfectly safe course, and in nine years the total charge that had to be made against hirers on this account by the Govan Corporation amounted to a little over £5.

Taking the life of a motor at 20 years, and assuming the loan repaid in that period, the sinking fund—based on allocation of a sum which, improved at 3 per cent., will equal the loan in 20 years—will be 3·72 per cent.; the interest, 3·5 per cent.; attendance and repairs, 3·5 per cent.; and for sundries allow 3·28 per cent. The total charges will then be :—

Interest	3·5 %
Sinking fund	3·72 %
Repairs, &c.	3·5 %
Sundries	3·28 %
Total	14·00 %

It will not be necessary to allow anything for depreciation, because the loan is repaid well within the life of the motor. Sir W. Preece, in his report some years ago to the Bristol Corporation on the machinery at the electricity station, gave it as his opinion that the useful life of a motor was 25 years, with a residual value of 9 per cent.

When it is not desired to make a profit out of the actual hiring, but simply to cover expenses, 14 per cent. is a perfectly safe figure; and when a large number of motors are installed by one firm, a considerably lower figure might be charged.

Hire-Purchase.

During the term of hire-purchase, the supply authority attend to and maintain the motors in exactly the same way as for simple hire, and for this and for the use of the capital an addition of about 8 per cent. per annum should be made to the price of the motor. The charges would then be :—

Years to complete purchase.	Number of quarterly payments.	Percentage of capital cost for each quarterly payment.
1	4	27 %
2	8	14·5 %
3	12	10·4 %
4	16	8·25 %
5	20	7·0 %

Stock Motors.

If motors are purchased from one or two firms only it will not be necessary to keep a very large stock of motors, one of each size usually being sufficient.

During the nine years that the Govan undertaking hired out motors, 146 motors were purchased and the stock rarely amounted to more than eight motors, but no difficulty was ever experienced with regard to spares. A good many

pulleys of various diameters were stocked, so that one motor would frequently serve as a spare for several speeds of motors of the same size frame, the armature of the stock motor with a different size pulley being put into the fields of a defective motor temporarily, whilst its own armature was being repaired. When the field coils failed it was usually the outer layer only and was easily repaired at the station in an hour or two.

Special Books, &c.

Motor Valuation Book.—This book (suggested form of which is appended) is a very useful one as it gives at a glance the complete history and value of the motor, where it has been installed and the cost of repairs.

Although the life of the auxiliary apparatus is not as long as that of the motor, it would introduce unnecessary complication to have separate valuation books for the switchgear.

The switchgear is purchased in the first place out of capital and maintained out of revenue, and if any part of it fails beyond repair a new article is purchased out of revenue, given the same number as the apparatus that failed and put in its place without altering the amount entered as the total value of the equipment.

Each year the value of the equipment is written down by the amount of the sinking fund, which will increase each year according to the following table.

This is not depreciation as separate from the sinking fund, but gives the value of the machine at which it can be sold at any time without loss to the supply authority, should the hirer who has taken the motor on simple hire, wish to purchase it at any time.

As it is assumed that the sinking fund is improved at 3 per cent., the amount written off will increase each year :—

		Percentage of first cost to which at the end of the year the equipment will be written down.
1st year	... 96 28	
2nd ,,	... 92·45	
3rd ,,	... 88 4	
4th ,,	... 84·33	
5th ,,	... 80·14	
6th ,,	... 75 83	
7th ,,	... 71·38	
8th ,,	... 66·81	
9th ,,	... 62·1	
10th ,,	... 57·24	
11th ,,	... 52·24	
12th ,,	... 47·1	
13th ,,	... 41·8	
14th ,,	... 36·34	
15th ,,	... 30 71	
16th ,,	... 24·92	
17th ,,	... 18 95	
18th ,,	... 12 8	
19th ,,	... 6·47	
20th ,,	... 00	

In allocating the accounts at the end of the year the proceedure would be to deduct from the rents received, the charges for interest, sinking fund, attendance, repairs and general charges, and place the balance to a motor reserve fund.

On the page set apart for each motor in the motor valuation book is entered a short note of the nature of repairs, date and amount. Small repairs that the motor inspector does by himself, and the cost of which is chiefly his time, should not be entered, but regarded as attendance.

Hirer's Register.—For a small undertaking a hirer's register is hardly necessary, as the Motor Valuation Book practically answers the purpose, but where there are many motors let out on hire, probably the best form of register would be on the card index or loose-leaf principle, the card or loose leaf being ruled as follows :—

Name .....

Address .....

Corp. No.	H.P.	Speed.	Date installed.	Date removed.	Rent per annum.			Rent per quarter.	
					Rails.	Motor.	Total	Rails.	Motor.

Such a system is very convenient when sending out the accounts for hire.

(To be continued.)

REVIEWS.

Introductory Electricity and Magnetism. By C. W. Hansel, B.Sc. London : W. Heinemann. Price 2s. 6d. net.

This book forms one of Mr. Heinemann's series of Science Manuals. These manuals are attractively produced, well bound and printed, and the material in this particular book must be said to reach a fair standard of excellence. But it is difficult to understand exactly the *raison d'être* of this series ; they will probably become widely used in the grammar schools up and down the country, but, after all, it must be admitted that the statement that a book is intended to be "a complete first course in electricity and magnetism" is delightfully vague and unsatisfying.

Mr. Hansel, however, appears to have a tolerably clear idea of the people for whom he is writing, and he has produced a very good little book. The subject is treated very clearly and thoroughly, and the illustrations are wisely chosen and well drawn. He has perhaps erred on the side of extravagance in his variations in size of type, but this is not a serious fault. The experimental side of the work is emphasised, but not to the exclusion of theory, and on the whole the book should serve to tide the average student well over the matriculation standard and give him a sound knowledge of the fundamental principles of electrical science.

Electricity in Mining. By Siemens Bros. Dynamo Works, Ltd., with plans and illustrations. London : Chas. Griffin & Co. Price 10s. 6d. net.

It has long been known to technical students that correct and complete descriptions of the design (and often the theory) of instruments are more often found in catalogues than in text-books, and it has become no uncommon practice among physics students to consult the elaborate catalogues issued by some of the best instrument firms for exact and up-to-date information on such subjects, for example, as pyrometry and electrical measuring instruments. It has, however, been left to Messrs. Siemens and Griffin to compile a glorified catalogue, and deliberately to publish it in the form of a text-book.

But while it is necessary to explain the peculiar status of the book before us in order to remove any misconception as to its purpose, we would also point out that there appears to be no weighty reason why ambitious advertising and the propagation of reliable and accurate information should not go hand in hand, and, indeed, "Electricity on Mining" would serve as an excellent example of the possibilities of this novel idea.

The book is extremely well produced, the printing and binding being good and the illustrations excellent, and there is very little of importance in the electrical working of mines that has not received fairly complete treatment in its pages.

It is, of course, unnecessary to enlarge upon the unique experience of the Siemens Company which renders them so competent to write with authority on electrical mining machinery, and the mere fact that they are not specialists on one branch only, but on all branches of their profession, frees their book from any stigma of one-sidedness which might attach to similar publications emanating from less renowned companies.

"Electricity in Mining" gives exhaustive accounts of all the most important mining concerns in which electrical plant has been set up by any of the numerous Siemens companies scattered over the earth ; and when the names of these concerns are mentioned, it is abundantly evident that the plant described includes some of the largest and most modern mining machinery in the world. In Great Britain Messrs. Siemens have equipped the Powell-Duffryn Co., the Cambrian Collieries, Ltd., and many of the supply companies in the Newcastle-on-Tyne district. Abroad their installations include 32,000 kw. at the Gelsenkirchen Bergwerks, 2,000 kw. at Rio Tinto Copper Mines, and supplies for the Baku Oil Field and the Chile Nitre Beds. Detailed descriptions and plans of all these distribution systems are given, together with lists of the power users and the uses to which it is put.

The first part of the book treats of power stations of all types; steam engines, steam turbines, gas engines, Diesel engines and water power have all come within the purview of Messrs. Siemens's experience, and illustrated examples with comparisons of efficiency and local conditions are given of all these systems. In all modern supply stations for long-distance transmission, high-pressure generators are employed, and three-phase generators working at about fifty cycles, 2,000 to 4000 volts, appear to be the most usual types.

Transmission and transformers are treated very fully, and examples are given of installations ranging from quite low pressure up to 70,000 and 100,000 volts. Winding, hauling, sinking and pumping are also fully treated, and there is an illuminating chapter on haulage by electric locomotives. The subject of electrical rock-drilling by percussion and rotary drills is also given some attention, while shot-firing and mine illumination are touched upon, but not treated fully. There is a complete index to the contents, and a list of Siemens companies is printed at the end of the book.

As a catalogue of Messrs. Siemens's electric mining installations, this publication must be given unstinted praise; as a text-book of mining electricity, the practical engineer will undoubtedly find it of considerable value, but he will probably consider that half a guinea is a high fee for a book that reminds him so much of a catalogue.

The National Form of Building Contract (annotated and explained), together with suggested Alterations and Amendments to meet particular cases. By W. Valentine Ball, M.A. (Cantab.), Barrister-at-Law, and W. H. Hope, Legal Adviser to the Northern Counties Federation of Building Trade Employers. London: The Local Government Journal Publishing Offices. Price 6s.

This book attempts to provide contractors and architects with a guide to the Agreement and Schedule of Conditions of a Building Contract, published under the sanction of the Royal Institute of British Architects, and agreed by the Institute of Builders and the National Federation of Building Trade Employers of Great Britain and Ireland.

This agreement, in one of its two usual forms, is in very extended and—on the whole—satisfactory use. Its peculiar features have to a large extent received interpretation in the Law Courts. The agreement is either made out in the form of a lump-sum contract in which the total sum to be paid is stated in an unqualified single lump sum, or what is termed a QB/c contract, in which a detailed bill of quantities is embodied in the contract and the lump sum, if given, is qualified by reference to the bill of quantities. The authors are of opinion that on the whole the QB/c form of contract is preferable from the point of view of both employer and contractor.

The book takes the clauses of the agreement seriatim, and details notes of legal interpretations which have been given to them and also suggestions as to their correct interpretation.

The authors point out the risk which all parties run if they alter such a well-known and carefully-constructed document, by modifications of their own. They give as a particular instance of this a contract made in 1906 between Messrs. John Barker & Co., Ltd., and the Hurlingham Club to do certain work at the Club's Fulham premises. In the contract a clause was added to the effect that "No extras whatever will be allowed, except upon a written blue order signed by the employer and the architect, the cost being first ascertained and approved by the Committee." In the end there was a sum of about £1,470 in dispute, and in October, 1912, the case was heard in the King's Bench Division. By a curious printer's error this date is given in one part of the book as October, 1913. After hearing all sides, the three Judges trying the case agreed that the new clause referred to entirely new work and that alone, and that it did not govern the omissions and extras which were included in the original contract.

The book is very useful, as in addition to its commentary upon the duties and responsibilities of employers, architects, clerks of works, contractors and sub-contractors, it points out what care should be taken in pricing out a bill of quantities and in signing a contract drawn up in this form.

To the uninitiated it often seems that the phraseology and detail of a building contract is obsolete and unnecessary, but the authors take pains to point out that there is reason in most of the apparent madness. They are both experts in building law, and they imply, rather than directly state, that the usefulness of the present procedure is proved not by the isolated cases in which disagreements take place, and recourse to the Courts becomes necessary, but by the many, many cases of complicated contracts which are pleasantly and successfully carried to completion under its auspices. It is well to point out that in these conditions the right of the contractor to arbitration by an independent arbitrator is carefully maintained. There are a few unimportant exceptions, such as regards decisions respecting discrepancies in drawings, demands for dismissal of unacceptable workmen, questions as to opening up finished work, and the removal and non-use of improper materials. While the conditions of building and engineering work are so different that the subject matter of the book has little direct interest for the engineer, we strongly recommend all engineering contractors whose work involves questions of buildings, sewers, conduits or foundations, to read this book and afterwards keep it for reference on their bookshelves. It will far more than repay its cost.

Dynamo Laboratory Outlines for Students in Electrical Engineering. By J. F. Wilson, B.S. London: Hill Publishing Co., Ltd. Price 4s. 2d. net.

This book is interesting in that it provides us with a summary of the laboratory work in electrical engineering in the schools and colleges of the United States. In his preface the author explains that the preparation of these outlines was undertaken with the idea of supplying a laboratory manual of limited scope and cost, yet containing such material as would meet the requirements of electrical engineering courses generally. To this end a study was made of all available information regarding a large number of American Universities and Technical Schools, and, although it was found impossible to include every experiment listed by these schools, the substance of every experiment having general engineering interest has been incorporated in this volume.

The book is divided into two approximately equal sections, one dealing with direct currents and the other with alternating currents, the whole being preceded by some short notes concerning resuscitation from electric shock and general laboratory instructions.

The outlines consist of short but explicit instructions regarding the performance of each experiment, and conclude with a list of well chosen questions, both on the theory and on the practical operation of the apparatus studied. The author appears to have steered a middle course between the heuristic method on the one hand, and the "spoon feeding" method on the other, and he is quite right in insisting upon a proper outline of instructions for experimenting, as well as a proper use of the faculties of observation by the student. In an apt illustration he points out that the tourist visiting Colorado saves time and gains more information by employing a competent guide than by starting out alone to "discover" Pike's Peak; the tourist, however, gains little information by simply following the guide—he must use his faculties of observation.

Another good point about the book is that it asks the student as a preliminary to experimenting on electric machines to "study the electrical and mechanical construction" of the various types of dynamo, to draw diagrams of the electric circuits and to make sketches of the important parts. This preliminary survey is frequently omitted from electrical engineering courses, and a student often finds that after studying one particular machine for some days, he is still hopelessly incompetent to express an opinion as to whether the next machine is of the shunt, series or compound-wound type.

No attempt has been made to explain the theory of the experiments, but the student is referred to text-books at the end of each experiment. It would, however, have made the

book more useful if definitions of "characteristic," "external characteristic," "regulation," &c., had been given in the text instead of being merely referred to in the questions at the end of the experiment. The references are, of course, mainly to American text-books, and consequently the book's usefulness in English colleges is badly crippled.

The sections on "Stray Power" and "Magnetic Leakage" are especially useful and suggestive.

Part II—on alternating currents—includes a far larger number of experiments than any English college course can boast, probably owing to the more extensive use of A.C. transmission in the States. The same method is adopted as in Part I, and some useful sections on Transformers, Converters, and Rectifiers are included.

The author claims that the results of these outlines in the University of Michigan have been most satisfactory, and we can imagine that some such laboratory book would be welcomed in many of our own electrical engineering laboratories; but perhaps Mr. Wilson's outlines are a little too American for English colleges to accept them *en bloc*.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,205. "Method of electrically-operating railway signals." R. Meakin. August 25th.

19,212. "Multiple way insulating sleeve as separator between conductors on cable joints." R. B. Mitchell and F. J. Cooper. August 25th.

19,220. "Telephone call recorders." D. J. McGauran. August 25th. (Complete.)

19,229. "Electrolytes for the electro-deposition of zinc." S. O. Cowper-Coles. August 25th.

19,249. "Selecting apparatus for telephones." H. Hull. (Convention date, August 26th, 1912, United States.) August 25th. (Complete.)

19,268. "Electric clocks." T. Rushton. (Addition to 10,100, 1913.) August 25th.

19,270. "Damping device for meters or like delicate instruments." E. F. C. Seignol. (Convention date, September 6th, 1912, France.) August 25th. (Complete.)

19,271. "Electric devices for calling any one of several stations connected to the same line." Siemens & Halske Akt. Ges. (Convention date, August 24th, 1912, Germany.) August 25th. (Complete.)

19,272. "Method of determining the amount of ozone in ozonised gases or gas mixtures." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) August 25th. (Complete.)

19,276. "Wire-drawing apparatus." W. Frese. August 25th. (Complete.)

19,277. "Process and apparatus for the subsequent treatment of drawn or rolled wires." W. Frese. August 25th. (Complete.)

19,305. "Telephone exchange systems." E. R. Corwin. August 26th. (Complete.)

19,313. "Magneto-electric machines." H. C. H. Smyth. August 26th. (Complete.)

19,388. "Electric switches." J. H. Tucker. August 27th.

19,395. "Interchangeable alternating and direct-current electric motor." H. Ashdown and F. H. Robinson. August 27th. (Complete.)

19,421. "Telephone exchange systems." F. R. McBerty. (Divided Application on 25,174/12, November 2nd. Convention date, November 3rd, 1911, United States.) August 27th. (Complete.)

19,442. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 27th.

19,443. "Starting and controlling mechanism for electric motors." British Thomson-Houston Co., Ltd., and R. D. Given. August 27th.

19,444. "Mercury switching devices." H. S. Hatfield. August 28th.

19,445. "Alternator with multiplied frequency." M. Breslauer. August 28th.

19,456. "Construction of rotary baths for the electro-deposition of metals and their alloys." C. Haythorpe. August 28th.

19,478. "Dynamo-electric machinery." A. Koerner. August 28th.

19,496. "Electric rat traps." B. F. Ash. (Convention date, August 28th, 1912, United States.) August 28th. (Complete.)

19,498. "Safety devices for use in electric circuits." C. A. Newell. August 28th.

19,512. "Electric transformers and welding, smelting and like apparatus." R. Mack. August 28th. (Complete.)

19,517. "Polyphase alternating-current commutator motors." E. F. W. Alexanderson. (Convention date, August 28th, 1912, United States.) August 28th. (Complete.)

19,518. "Circuit arrangements for automatic and semi-automatic telephone systems." Siemens & Halske Akt. Ges. (Convention date, August 28th, 1912, Germany.) August 28th. (Complete.)

19,521. "Telephone systems." W. Aitken. (Addition to 16,906/12.) August 28th.

19,524. "Electric starters for internal-combustion engines." E. V. Hartford. August 28th. (Complete.)

19,551. "Electric fuse." W. B. Boyd and J. B. Tannahill. (Addition to 12,273/12.) August 29th. (Complete.)

19,564. "Transformation and distribution of electric currents for lighting, power and other purposes." D. Suchostawer and J. Orchard Oxley. August 29th.

19,588. "Continuous-current transformers." P. M. J. Boucherot. (Convention date, September 18th, 1912, France.) August 29th. (Complete.)

19,592. "Selector switches for telephone systems." Sterling Telephone and Electric Co., Ltd. (Telephonfabrik Akt. Ges. vorm J. Berliner, Germany.) August 29th. (Complete.)

19,603. "Insulative rail joints for railways and the like." B. R. Wills and J. C. Sykes. August 29th.

19,605. "Magneto electric switching devices." H. S. Hatfield August 29th.

19,606. "Galvanic cells and hand lamps." J. C. N. Eastick. August 30th.

19,619. "Electrically-heated cooking and like appliances." Unit Engineering Co., Ltd., and F. A. Brown. (Addition to 759, 1913.) August 30th.

19,640. "Electric railways." A. L. Simon. August 30th.

19,648. "Polyphase current starters." Voigt & Haeffner Akt. Ges. (Convention date, December 23rd, 1912, Germany.) August 30th. (Complete.)

19,650. "Electric relay apparatus." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. August 30th.

19,654. "Galvanic batteries for pocket lamps." G. Engisch. August 30th.

19,668. "Rectifiers for electric currents." O. W. Richardson. August 30th. (Complete.)

19,669. "Electrolytic recovery of metals from their solutions and apparatus therefor." U. C. Tainton and M. F. L. A. Aymard. August 30th.

19,676. "Tuning apparatus for making and breaking electric circuits." K. F. Richmond. August 30th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Alarm Devices for Use with Wireless Telegraph Systems. W. H. Shepherd and A. E. McKechnie. 11,479. May 14th.

Electrically-heated Devices. E. C. R. Marks. (Landers, Frary & Clarke.) 15,958. July 8th.

Vapour Electric Devices. British Thomson-Houston Co. (General Electric Co.) 18,371. August 9th.

Wireless Telegraphy and Telephony. J. T. Sibley. 18,422. August 10th.

Electrical Ignition and Starting and Lighting Systems for Internal-combustion Engines. W. E. Lake. (J.B.M. Electric Co.) 18,444. August 10th.

Electric Secondary Clock Alarm. G. Lange. 18,479. August 12th.

Dynamo-electric Machines. Brolt, Ltd., B. Brooks and W. Holt. 18,913. August 19th. (Addition to No. 26,880 of 1910.)

Construction of Heating Elements for Electric Radiators and the Like. C. R. Belling. 19,054. August 20th.

Electrically-heated Cooking Ovens and the Like. H. J. Piper and R. A. Bridgwater. 19,064. August 20th.

Electrical Connections. W. E. Lake. (Soc. Anon. le Carbone.) 20,357. September 6th.

Electric Pendulum and Switch for Controlling Electric Clocks. W. J. Parker. 21,115. September 17th.

Electrically-operated Means for Restoring Equilibrium of Inclined Bodies. J. M. Smits. 21,832. September 25th. (Divided application on No. 15,667 of 1912, August 7th.)

Electric Oil Switches. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 21,867. September 25th.

Railway-control Telephone Systems. J. N. C. Kennedy. 22,131. September 28th.

Electrical Regulators. A. A. Tirrill. 22,419. October 2nd. (October 5th, 1911.)

Regulation of Dynamo-electric Machines. Allgemeine Elektricitäts Ges. 23,372. October 12th. (October 13th, 1911.)

Electric Shade Carrier. A. E. Otway, J. H. Ormrod and W. J. Purdue. 23,520. October 15th.

Means for the Interruption of Electric Circuits. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric and Manufacturing Co.) 26,809. November 21st.

System of Duplex or Multiplex Wireless Telegraphy or Telephony. S. D. Williams. 28,042. December 5th.

Electrical Potential Regulators. M. Fuss. 28,061. December 5th. (December 6th, 1911. Addition to No. 7,220 of 1911.)

Apparatus for Heating Water or other Liquids Electrically. W. H. Bennett. 28,270. December 7th.

Catoptric Light Apparatus. A. Blondel. 28,297. December 7th.

Electric Switches. P. S. Turner and A. E. Roberts. 30,060. December 31st.

1913.

Telephone Receivers. V. Anderson. 2,507. January 30th. (April 3rd, 1912.)

Telephone Systems. Telephon Apparat Fabrik E. Zwietusch & Co. 2,700. February 1st. (March 15th, 1912.)

Shade Holders for Incandescent Electric and other Lamps. D. G. Saunders, jun. 3,931. February 15th.

Electric Fuses. F. Gruneberg. 6,156. March 12th.

Telegraph and other Signalling and the Like Apparatus. H. O. A. Jensen. 6,292. March 13th. (Divided application on No. 18,985 of 1912, August 19th.)

Electric Warp Stop Motions for Looms. J. Hancq. 7,570. March 31st.

Sealing Terminals and Connections for Electric Cables. F. A. Cortez-Leigh and G. Broughall. 7,996. April 5th.

Manufacture of Electrodes for Arc Lamps. J. Roubal. 10,210. April 30th.

Electric Incandescent Lamps. Allegemeine Elektricitäts-Ges. 14,048. June 17th. (September 18th, 1912.)

Material for Accumulator Cases. W. E. W. Richards. 223. January 3rd.

Storage Battery Plates. W. M. McDougall. 770. January 10th.

Electric Switches. Fried. Krupp Akt.-Ges. 3,825. February 14th. (March 15th, 1912.)

Electricity Meters. J. Elster. 4,847. February 25th.

Transmitters for Wireless Telegraphy. C. Schou. 5,040. February 27th.

Gyroscope Compasses. Hartmann & Braun Akt.-Ges. 6,570. March 17th. (March 18th, 1912. Addition to No. 23,575 of 1910.)

Apparatus for the Manufacture of Insulated Conductors or Coils for Electrical Purposes. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 6,647. March 18th.

Switch Controlling Mechanism for Electric Motors. O. Decker. 8,878. April 15th.

Telephone Relay. F. Majorana. 10,154. April 30th.

Driving Dynamos Attached to Vehicles. C. E. Pehrsson. 16,979. July 24th. (Divided application on No. 18,482 of 1912, August 12th.)

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NEW ZEALAND TRADE.

IN recent issues of the ELECTRICAL REVIEW we have had occasion to refer to certain reports on the trade of our various Dominions prepared by the Trade Commissioners and published by the Board of Trade. The publication of these reports marks a new departure which should be welcomed by all who are desirous of witnessing a development of inter-Imperial trade. For many years British firms have experienced a serious lack of information regarding the trade of the Dominions overseas and of assistance in extending their trade within the Empire. Having in mind the large organisations established in these Dominions for the purpose of extending foreign trade, the absence of any British representation was all the more to be regretted. The new Imperial organisation in the interests of British trade, established some few years ago, was consequently welcomed cordially and subsequent experience has more than proved its necessity. It only remains for the organisation to become more widely known and for firms to take full advantage of it, in order to bring about an ever greater security for British trade in the Empire than has already been possible. The publication of the annual reports, to which we have referred, and the notice which has been given to them in the Press, should do much to achieve this end.

We are constrained to refer to this matter again by the fact that the Board of Trade have just published a report on the trade of New Zealand for 1912, written by Mr. W. G. Wickham, the British Trade Commissioner there, and we would now recommend our readers to obtain this new report which contains some useful hints. Extracts from the report itself are given elsewhere in this issue. In dealing with the general trade position in New Zealand, the Trade Commissioner observes that the adoption of the country of invoicing of goods as a basis for deciding the country of origin of imports results in inaccuracy and misconception; consequently, the trade statistics are not entirely reliable as a guide to the amount of foreign competition, and are particularly misleading in their statement of the share of the trade taken by the United Kingdom, since a large quantity of foreign goods shipped through the United Kingdom is classed as British. This faulty classification is a serious matter, and it is satisfactory to learn that legislation will probably be introduced at no distant date to provide for classification according to actual country of origin. In the case of goods for which there is a preferential tariff the statistics may be more safely taken as a guide, but the imports of such goods are less than one-third of the total.

The total imports into New Zealand in 1912 amounted to £20,976,434, an increase of £1,430,555 as compared with 1911, and of this amount the share of the United Kingdom, as shown in the statistics, is 58 per cent. The imports of goods in which there is a preference amounted to

£6,476,752, and the British share of this amount was 67 per cent., which proves how useful the preferential tariff has been to British trade. As in other Dominions, moreover, the British share is really more important than the actual percentage shows, since a large part of foreign trade is in goods such as natural products in which United Kingdom competition is impossible. There was a marked increase in the imports of electrical goods in 1912, viz., £71,000, and of this total increase the United Kingdom's increase was £49,000.

The Trade Commissioner points out that buyers in New Zealand show a preference for British goods ; "the tariff itself provides for preferential duties on British goods on about one-third of the total of imports ; preference for British goods is also shown by the Government in the purchases of State Departments and by municipal bodies and harbour boards, some of which will not buy elsewhere than in the United Kingdom ; many agency firms will not, if they can help it, take agencies for other than British firms ; retail as well as wholesale firms may be found who will not handle anything but British goods wherever this is possible ; and among the purchasing public generally many may be found who will put themselves to considerable trouble in order to procure what they require of British make." All this is very encouraging, but there is, unfortunately, another side to the picture, and that is, that New Zealand firms are often under a misconception as to what can or cannot be produced in the United Kingdom. In our extracts from this report on another page we quote the Trade Commissioner on this subject. The obvious conclusion is that if New Zealand firms are unaware of the capability of the British manufacturer to make goods, and of the intrinsic merit of the goods themselves, the manufacturer only is to blame. It must be remembered that New Zealand is 13,000 miles away from the United Kingdom, and that facts which are known to everybody at home are therefore not necessarily known in New Zealand. American firms with their extraordinary, and not always laudable, instinct for advertising, will do their best to prevent knowledge of facts detrimental to their own business, and with a zeal which does not stop at exaggeration, will emphasise the quality of their own goods in comparison with others. If we fail to tell firms abroad that our goods are available, and are the best, and do not bring these goods directly under their notice, it is our own fault if the facts are not known.

There is another outstanding point dealt with in this report which deserves the attention of firms in the electrical trade since it refers chiefly to installation work which takes time to complete. This is the question of manufacturers' responsibility for the efficiency of deliveries. We consider this point of sufficient importance to quote here the Trade Commissioner's remarks on the subject. He says : "The British manufacturer, especially of machinery, has one great asset in the intrinsic merit of the goods he sells, and it may be presumed that manufacturers generally would not seek buyers who from ignorance or other causes failed to get good results out of their purchases. They would realise that if they did so they would lose in the end by earning, quite wrongly, a reputation for selling a bad article. To sell goods and not to be willing to take any responsibility for their quality after they have left the works, may seem sound business, but it may at times also be interpreted to mean lack of confidence in the real value of the goods delivered.

"It is a common practice to consign goods, say, a particular class of machinery, to an agent, but to draw on him in full against documents or at short sight, irrespective of the purpose to which the machinery is to be put. *I would state bluntly that any maker who values his reputation and that of his machinery will not consider any sale transaction closed until that machinery is in use and giving satisfaction.* In cases where there is delay (and these are not a few) in getting the plant installed and working, wherever the fault lies and whatever the normal terms of agency may be, the manufacturer should work loyally with his agent and take responsibility for his goods. Confidence begets confidence, and in the ideal agency the agent has a feeling of *esprit de corps* and loyalty to his principals ; but he must be backed up by his firm if they expect him to back them.

"But apart from this, economy can be effected. If a manufacturer, who obviously knows his goods better than anyone else can, is not prepared to back them until they are giving satisfaction, how can the agent be expected to do so ? If one or other has to allow a margin for contingencies, it is perfectly obvious that the agent, who does not know the facts as accurately as the people who made the machinery, will normally and quite rightly allow the bigger margin. If he gets the contract for which he is tendering he gains, but in a very large number of cases he will lose the contract owing to his margin of safety being excessive. Further than this, an agent relieved of responsibility for machinery which he did not make, and for delays and difficulties which are not of his seeking, will work on a finer margin to get business. It may be added that this is not pure theory, as it has been tried with good results."

Though, as our readers are aware, we do not join with those who continually bewail the shortcomings of our home firms, we are not sure that there is not on occasion too much of the take-it-or-leave-it attitude on the part of manufacturers here. If a manufacturer is not prepared to back his own goods, how can he expect others to believe in them sufficiently to give an order ? To the buyer, particularly when he is so far away from the source of supply, the backing of machinery means the deferring of payment until he is sure of its capacity in actual working.

There are many other matters in this report which are deserving of comment, but we must leave them to the consideration of firms sufficiently interested to read our extracts or to obtain a copy of the report for themselves. From our own point of view we regret that the report contains no reference to the development of electrical enterprises in the Dominion, which at the moment are of considerable interest both to the Dominion itself and to our manufacturers at home.

One fact brought out in the report, however, is worthy of note in our columns, and that is, that the Trade Commissioner has been able to safeguard the British telephone instrument trade. When the duty on telephones was to be abolished it was found possible to induce the Government to retain a 10 per cent. duty on foreign instruments, while abolishing the duty on British. It is work of this practical kind which is proving the success of this organisation for the encouragement of British trade in our Dominions, and which will, we hope, eventually bring about a considerable increase in our already important share of the trade. If this is to be brought about firms here must co-operate with the Trade Commissioners, and one way in which they can do this, as this report points out, is by seeing that the Trade Commissioners are supplied with their catalogues and with information as to their present methods of business.

Copper. The last American production returns were fully up to the most sanguine anticipations which had been formed by dealers in copper, there being a considerable further decrease recorded in the surplus unsold stocks at the United States refineries, while the output also underwent a reduction during the month of August, the strike at the Lake Mines showing itself. As things stand now the position of copper is one of wholly unparalleled strength, and the future can only be viewed with genuine apprehension. Actually the world's reserves are down to the lowest on record, and the immediate outlook is for a further contraction, though this process cannot be carried far now, since there is not room for any material further contraction. According to the August American statistics, the United States refinery production amounted to 58,764 tons, a falling off of 3,000 tons or so compared with July, while the home trade takings and exports combined totalled 65,586 tons, an increase of 4,200 tons. The stocks at the United States refineries were reduced to the record low level of 17,104 tons, compared with 23,926 tons a month previously, the reduction being thus about 7,000 tons.

It was not surprising that the publication of the figures caused a good deal of selling on the market, for many people had purchased on the strength of an excellent statistical showing, and the figures proving in every way satisfactory, they naturally took their profits. On the top of this there was also a certain amount of bear selling, which came mainly from the Continent, where a poor opinion seems to be entertained of the metal. Certainly Hamburg is exceedingly bearish, and has stood at well below London parity with a heavy depreciation in far forward deliveries. It is by no means an assured thing that Hamburg is on the right side of the market, for the present indications point unmistakably towards serious scarcity soon, but the symptoms of receding trade generally are no doubt specially influencing Continental operators, and they are certainly not to be disregarded. The point, however, as regards copper, is whether or not the trade recession in sight is likely to be discounted by the falling-off in the copper production over the next few months arising from the labour troubles in the Lake Superior region and elsewhere, and the revolutionary disturbances which have entailed the closing for months of some of the most important producers and smelters in Mexico. The position in this respect has become serious across the Atlantic, so much so, that in order to supplement the material upon which the local refineries can work, the Amalgamated Copper Co. have been buying rough copper, such as Chile bars and English and French material, and taking it out of warehouses in London, Liverpool and Havre, and shipping it to New York. This material will be refined at one of the American plants of the Amalgamated Co., and in all probability the refined copper will then find its way back to Europe. The transactions clearly enough show the gravity of the position in the United States, and it is the opinion of those best informed that the next few weeks will see no relief from the present scarcity. It is specially significant that on occasions lately the cheapest sellers have been the producers, dealers not having material to offer for sale, and naming comparatively excessive figures. A very large business has been done, and one of the big electrical companies which left the filling of its October requirements rather late, had to pay a fairly stiff price, for, unable to obtain metal from producers, it was forced to take its needs from dealers, and from one of the English refiners who had a little metal over for sale. There may be fluctuations, but there really seems a very good chance of prices running up further before the position is permanently relieved.

The Aisgill Inquiry.

The evidence given at the resumed inquiry conducted by Major Pringle into the circumstances attending the recent disaster at Aisgill was in some respects of an extraordinary nature. So far as the origin of the fire was concerned, the testimony of Capt. Walter Hill appears conclusive—though previous witnesses had already practically settled the matter. Capt. Hill said that he first noticed "a big flare of light outside the carriage," which was already on fire when he got out (about two minutes after the collision occurred); the fire was *in the roof*. "Before getting out he could hear the roar of the gas flames which were coming out from underneath. They were playing on the bottom of the third compartment." "All was silent except for the roar of the gas." One of the railway officials "got underneath the train and tried to hammer down the pipe from which the gas was playing on the bottom of the carriage."

Another witness, Mr. Roland Brander, was asked: "Did you see or hear the roar of burning gas?" He replied: "Yes, several times. It was like the roar of the lights used at night time while the roads are undergoing repair."

Capt. Eustace Jotham, another passenger, said: "He saw a blaze as soon as he got out of the train. He thought it was caused by gas, because it flared up and went out again. If it had been wreckage burning it would not have gone out so quickly." Mr. T. E. Maley, a passenger, said: "The flame he saw in the roof of the carriage was certainly the flame of gas, because it was a steady and continuous light and did not flicker."

So much for the part played by gas; we cannot imagine that anyone with an open mind on the subject will retain any doubt regarding it. But the most remarkable statement was that made by Sir Guy Granet, general manager of the Midland Railway, who, after detailing the steps that had been taken to comply with the recommendations of Major Pringle in connection with the Hawes Junction accident, including the provision of an automatic valve to prevent the outrush of gas (not fitted to the coaches that were burnt), said that taking the statistics of accidents over the whole country for the last 32 years, there had been 1,602 cases, in 23 of which fire occurred. Two of these fires were attributed to oil lamps, three to electrical causes, seven to fires from locomotives, and eight to gas. This is the first time that we have ever met with the definite statement that a train fire after an accident was due to electricity—an astounding statement, for, as Major Pringle pointed out in his report three years ago, "it is a simple matter to prevent danger from short-circuiting of electric wires by the proper provision and arrangement of fuses," and with the low voltage employed on trains—far less than that used in a modern *telephone* exchange (24 volts as compared with 40) an arc cannot possibly be maintained. We unhesitatingly stigmatise the statement that electricity was the cause of fire as a ridiculous assertion, and we are certain that no Board of Trade Inspector could be persuaded to entertain it for one moment. Let Sir Guy produce a Board of Trade report in which that view is taken—if he can!

Sir Guy goes on to say that his company investigated foreign practice, and found that the consensus of opinion abroad was in favour of gas rather than electricity, and adds: "I am informed, but I have not yet verified this information, that the German and Austrian railways . . . . . have 60,000 passenger vehicles, and there is not one of them which is lighted by electricity."

This statement takes one's breath away. Has Sir Guy Granet never travelled on the Continent? If so, he must surely have been aware that a considerable proportion of the German and Austrian coaches, as well as of French, Swiss and Russian trains, are lighted with electricity, and have been for years past, and he ought to know that governing bodies have repeatedly urged the adoption of electric lighting owing to the frequency of train fires on gas-lighted trains, as mentioned elsewhere in this issue. There are two aspects in which this remark of Sir Guy Granet strikes us as particularly unfortunate, if not reprehensible: first, in that it suggests that the Midland Railway Co. look to foreign practice for guidance—surely the British railways have always claimed to lead the world!—and, secondly, in that the manager's information regarding the practice which he cites is so ludicrously and palpably erroneous. He ought never to have put forward such a statement without verification; and he could not have verified it if he had tried.

For the information of Sir Guy Granet, we may add to the list of British train fires due to gas, to which he confines himself, the following cases on the Continent, whither he professes to go for *some* of his facts:—Wannsee, 1887; Limito (Milan), 1893; Offenbach, 1900; Berlin, 1908; Vienna, June, 1908; Vienna, July, 1908; Marbourg, 1909; Herlisheim, 1909; Saint-Nazare, 1909; Innsbruch, 1909; Uhersko, 1909; Villepreux, 1910—and in the United States, Trenton, 1909.

From the evidence of Mr. Bain, carriage and wagon superintendent, it appears that *tin cans* are provided as part of the train equipment, to put out a gas fire by popping the can over the end of the broken pipe! He held that all the gas must have escaped from the cylinders within two and a half minutes after the accident; that may be so, but Capt. Hill saw the gas alight and heard the roar *before he got out*, and he was out in two minutes! He also believed that if the carriages had been of the new type with steel frames, the passengers would only have had a very bad shaking. Then, why are the Midland Co. using ancient coaches like those that were burnt—built "about 1900 or before," with wooden underframes—on their main-line expresses? The more the officials of the company say, the worse the light in which they make the company appear.

THE POWELL SACCHARINE PROCESS FOR SEASONING AND PRESERVING TIMBER.

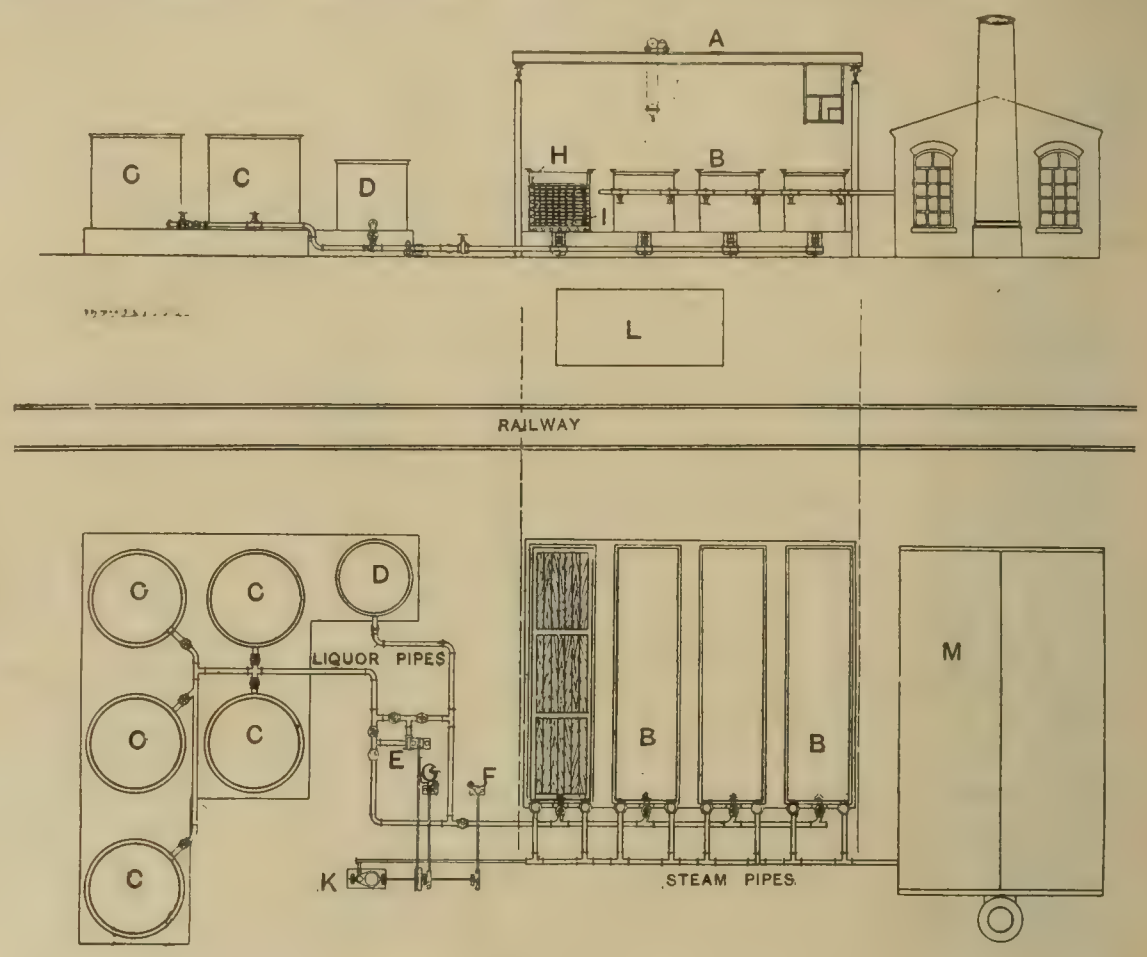
By R. E. NEALE.

It is strange that, although experiments were carried out on a commercial scale at Stratford in 1904, the Powell timber seasoning and preserving process is only now becoming widely known in this country. In Australia, New Zealand and India, large Powellising depôts have been erected, and the process has been successfully applied for years past.

The process originated in the use of saccharine materials to fill the interstices of timber and prevent ingress of the mycelium of dry rot. The preliminary experiments showed that by impregnation with a solution of sugar and its by-products, timber can be seasoned rapidly and without deterioration. Moreover, the stable hydrocarbons of the sugar are incapable, in the absence of soluble nitrogenous matter, of nourishing septic organisms, while, by the addition of arsenic solution and other poisons, insect attack can be repelled. The solution, the exact composition of which varies with the density of the timber, and the use to which it is to be applied, penetrates every cell and fissure of the timber without the application of pressure or vacuum, and the interstices are filled with a material which has a reasonable approximation to an amorphous form of timber. The seasoning and preservative action thus consists in replacing moisture and unstable juices by a substance which appears to enter into molecular combination with the timber, and then to remain absolutely inert. As compared with air drying, the process is very rapid, and fills the interstices with preservative material of appreciable mechanical strength instead of leaving them shrunken and empty.

A Powellising equipment comprises processing and storage tanks and drying kilns, a steam boiler and feed and circulating pumps, and a water reservoir if the supply be at all irregular. The general lay-out of the plant is clearly shown by the accompanying plan and key. The liquor in B, C and D is heated by steam supply from the boiler M, and the circulating pump E is used to fill or empty the processing tanks B, which are fitted with steam heating pipes; F is used to pump cold water through the coils I, in order to provide rapid and efficient temperature control in the processing tanks. The whole equipment is now arranged on one level, the use of a centrifugal circulating pump, costing £15 or so, being much more economical than arranging overhead tanks, as was formerly the practice.

The telegraph poles or other timber to be processed are stacked in the open tanks B*, suitable spacing and pinning-down cross pieces being used. Liquor at about 140° F. is then pumped in till the timber is completely submerged, and the temperature is gradually raised to about 215° F., rapid temperature control being effected as and when necessary by aid of the coils I in B. During this stage, which occupies about 15 hours, according to the size and density of the timber, all the contained air bubbles out of the timber, and the sap juices (which boil at a temperature below that to which the saccharine solution is raised) are driven off; the albuminous materials in the timber are meanwhile coagulated. During the cooling stage, which occupies about the same time as the heating, the absorption of the liquor chiefly occurs, and every interstice in the whole bulk of the timber becomes filled with poisoned saccharine matter, which is subsequently visible neither as syrup nor crystals, and which will not leach out under any exposure to weather.* Any degree of dryness (and hence a high insulation resistance) can be secured without injuring the subsequent properties of the wood, but the only materials removed from the wood are air and moisture, for which are substituted preservative matter and such materials as arsenic, required to repel insect attack. Telegraph poles and the like need not be taken from the processing tank to the drying room or kiln, but cross-arms and such smaller pieces should be so dried. When sufficiently desiccated, the wood is absolutely seasoned and ready for use. The total time occupied in seasoning and preserving green timber varies, according to the size and density of the latter, from a few days to three or four weeks.



A, Travelling crane; B, Processing tanks; C, Liquor cisterns; D, Syrup preparing cistern; E, Centrifugal pump, arranged to carry liquor from D to C, C to B, or B to C, according to needs; F, Centrifugal pump supplying cooling coils in B; G, Spare centrifugal pump; H, Holding down irons; I, Coils used for heating and cooling; K, Engine driving pumps; L, Dipping tank for treated timber; M, Boiler house. Plant shown will treat about 3,000 c. ft. of sleepers or poles per 24 hours.

Powell Saccharine Process Plant.

An installation suitable for the treatment of 80 telegraph poles (or 320 9 ft. × 10 in. × 5 in. railway sleepers) per diem comprises two 40 ft. × 4 ft. × 6 ft. 2 in. processing tanks, five circular liquor cisterns and one dissolving tank, and costs, complete with a 7 ft. × 26 ft. Lancashire boiler and the necessary piping, feed and circulating pumps and engine for the same, about £1,300 f.o.b.

The cost of treatment naturally varies with the nature of the timber and the cost of materials and labour. Under English conditions, the cost of treating telegraph poles, &c., is about 2d. per cb. ft. (the cost of the material absorbed being about 1d. per cb. ft.), to which must be added the patentees' royalty†; in the case of small parts, needing kiln drying after impregnation, the cost of treatment is from 50 to 100 per cent. greater. The cheaper grades of sugar by-products are quite good enough for telegraph poles, railway sleepers, piles, platforms, &c., and, in cases where a darker colour improves the appearance of the timber (*e.g.*, mahogany, walnut, oak, elm, &c.), the cheaper materials are distinctly advantageous even for high-class work. Where the light colour of timber is to be preserved (as in sycamore, pine and other white woods), raw sugar or glucose should

* Being run in on trucks if the tanks are some distance from the wharves or timber stacks, &c. By hand filling, some 30 per cent. more timber can be got into each tank, and the cost of treatment is correspondingly reduced.

* Experiments show that the saccharine can only be extracted by prolonged boiling of finely powdered wood. Similarly the poisonous material can only be recovered by destroying the wood with concentrated nitric acid—prolonged soaking in water removes no appreciable trace of arsenic.

† The Powell Syndicate has such faith in the future of the process that it prefers to take shares in payment for permission to Powellise timber. Rights are only sold on a royalty basis to Government and railway companies or other concerns, the chief business of which does not depend on timber preservation.

be used and the cost of special materials is somewhat increased. The cost of arsenic salts and other materials is hardly appreciable.

In Bombay, the syndicate charges 5d. per cb. ft. for treating sleepers in its own works, and the chief engineer of the West Australia Railway quotes as the average cost of treating sleepers, 3·68d. per cb. ft. plus royalty to patentees.

Typical data as to the amount of solution absorbed by various timbers are given in the following table. Naturally the absorption of each timber varies largely; for instance, there are seven or eight mahoganies, the softer ones of which absorb two or three times as much solution as the harder varieties.

Absorption of Solution by Various Timbers.

	Absorption.	
	Lb./cb. ft.	Per cent. of weight of timber.
Ash	5½	12½
Basswood	15	over 50
Beech	26	60
Mahogany	13	30
Pine*	3½	8-10

* The strength and toughness of this timber is greatly increased. White pine absorbs rather more solution than red or yellow pine.

Characteristics and Applications of Processed Timber.—Timber is not rendered gritty or sticky by the Powell process, and is as easy to "convert" as air-seasoned timber. Processed timber is not corrosive to the flesh or to metals; it is non-odorous, and can be painted more economically than the more absorbent air-seasoned wood. The filling material is not, like creosote, inflammable, but renders timber distinctly less flammable by filling its pores with inert material. By a modification of the standard process, most timbers can be made flame-resisting at a slightly increased cost.

Powellised timber is practically non-absorbent to moisture under ordinary conditions of weather exposure; even during prolonged submersion the wood absorbs less than 50 per cent. (20 per cent. in the case of beech), as much moisture as unprocessed timber, and the preservative and poisonous materials are not leached out appreciably. Powellised timber is used in the construction of dies for brickmaking machinery, and in other applications where it is exposed to steam, heat and moisture, without appreciable softening or warping, and without permitting corrosion of screws embedded in it. Timber processed by a solution specially prepared to resist teredos has been satisfactorily employed for piling in waters infested with these worms. White ants are a terrible pest in many countries, and mere surface protection, however perfect in itself, is insufficient, since the termites gain access through cracks or nail holes to the central, unprotected wood, and soon completely destroy the latter, while leaving practically no outward evidence of their inroads. The complete impregnation secured by the Powell process has proved the only effective means of preserving sleepers, cable troughing and telegraph poles in Australia and other white-ant countries.

Owing to the fact that they have been subjected neither to vacuum nor to pressure, the cell walls and fibres of Powellised timber retain their original strength, which is augmented by the coagulation of albuminous materials and the intimate absorption of saccharine matter; this increase in strength is particularly noticeable in the sapwood, which becomes practically equal to heartwood. A number of tests on Australian, New Zealand and American timbers show 20 per cent. to 35 per cent. decrease in weight and 30 per cent. to 50 per cent. increase in strength in hard woods; and 30 per cent. to 35 per cent. decrease in weight and 30 per cent. to 40 per cent. increase in strength in soft woods, due to Powellising.

As compared with untreated wood delivered ready for use, Powellised timber has an ultimate tensile strength greater by 6 per cent. to 26 per cent. in the case of Indian teak, 14 per cent. to 32 per cent. American pitch pine, 29 per cent. to 40 per cent. best white pine, and from 56 per cent. to over 100 per cent. in the case of yellow deal. All timbers become distinctly stronger in bending and compression when processed, and the increased bonding of the fibres is clearly evidenced by its effect on the strength of the wood.

The Powell process has proved equally successful in seasoning green timber for fine cabinet and all heavier constructional purposes, and in seasoning and preserving paving blocks, piles, troughing, sleepers and telegraph poles. In short, it is applicable to all timbers, whatever their subsequent application. By erecting processing plant near forests (an easy matter in view of the simple equipment required), timber can be completely seasoned and preserved within a few weeks from the date it is felled. This remarkable claim has been fully justified by work carried out in various countries during the past five or eight years, and it is hardly too much to say that the process is destined to revolutionise the timber trade by conserving timber supplies and making it unnecessary to hold large seasoning stocks.

In conclusion, it should be emphasised that the Powell treatment is not a new process. It has been tested and its efficacy proved under all conditions of climate, and under exposure to all fungus and insect attacks. Incontrovertible evidence is forthcoming from all quarters as to the reliability of the process, which certainly deserves to be better known and more widely employed in this country. Among the applications which have already been found for the process in electrical work may be noted the seasoning and preservation of telegraph poles and cross-arms, insulator pins, cable troughing, tanks, panels and base-boards and the woodwork in tramcars, &c.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Metalite Meeting.

My attention was drawn to your report of the Metalite shareholders' meeting, and, as a shareholder, I am perfectly disgusted with the whole matter. I had no notice of such a meeting, neither had my friends, also shareholders.

We are more than grateful to Mr. Harrison for his attention to the interests of the shareholders. If he would kindly publish his address there are many who would communicate with him, and I feel sure would support him financially in any action he may deem proper to take.

I would like to ask Mr. Harrison whether it is true that he never transferred the patents mentioned in the prospectus, because it is rumoured that he was never paid for them. I am told that they still stand in his name; if this is so, how does it come about?

Mr. Harrison was the works manager and engineer to the company. Will he give his reason for leaving the company?

In Mr. Metcalfe's evidence, before Mr. Justice Eady, and in the presence of Mr. Stewart (who is chairman of both vendor companies, also the promoting company, Electrical Trust, Ltd., and the Metalite, Ltd.), he stated, on oath, that the Bryant Trading Syndicate, Ltd., was in a profit-earning condition. Then why is it that this vendor company does not pay a dividend? also, why does it not pay the calls due on the shares of Metalite, Ltd.? Mr. Stewart did not contradict Mr. Metcalfe's statement.

The whole matter appears to me to come under a category bearing a very unpleasant name, having most serious consequences.

I am desirous of hearing of any combined action on the part of the shareholders.

A Northern Shareholder.

Continuity.

I presume that some of your remarks on the latest Birmingham Address are "writ sarcastic," for the "Advancement of Science" (the *raison d'être* of the British Association) is not helped by statements and assertions for which no evidence is offered; but scientists on a holiday are only human, and they must be allowed their little jokes!

Now, to business. You end your article with the following quotation:—

"The actions of the Deity make no appeal to any special sense . . . . we are deaf and blind, therefore, to the immanent Grandeur around us, unless we have insight enough to appreciate the Whole, and *to recognise in the woven fabric of existence*, flowing steadily from the loom in an

infinite progress towards perfection, *the ever-growing garment of a transcendent God.*"

And I shall be happy to pay you or anybody else £5, or to give the money to the I.E.E. Benevolent Fund, if any sense can be made of the words I have underlined. They sound to me like

Tosh.

London, *September* 18*th*, 1913.

[Sir Oliver Lodge, whose admirable address has evoked a chorus of applause on all hands, may or may not think it worth while to take cognisance of our correspondent's inability to understand it—we have our doubts. But the former has the courage of his opinions, whereas the latter merely labels himself "Tosh"! We leave it at that.—Eds. Elec. Rev.]

The Durability of Electric Plant.

Those who have been associated with the development of the electrical industry from the earliest days will readily call to mind how the question of depreciation of electrical plant used to be a frequent subject for discussion and debate; interesting facts are now being established which indicate that some of the most sanguine expectations are likely to be fulfilled. For instance, I well remember Col. Crompton claiming that the depreciation of electric motors and dynamos might possibly prove to be 1 per cent. or less. Recalling this prophecy, I think your readers will regard the following case as of interest:—

Ten years ago I provided a factory with a complete generating plant and electric motors for driving all machinery. This plant has been running a steady 10 hours a day for these ten years, and in only one or two cases do the commutators show the slightest sign of wear, and the same applies to the bearings. The bulk of the motors run sewing-machine benches driving direct to the pulley shafting, the speed being about 400 revolutions; on the commutators of these machines not the slightest depression can be detected under the carbon brushes. Slow speed is, of course, an advantage, and it is only fair to state that the machinery has been supervised by myself throughout the 10 years, regular bi-monthly inspections being made. Employers of machinery are, as a rule, wonderfully supine as to the advantage of placing their plant under expert supervision, and often have to pay heavily through placing too much reliance upon a not too well educated staff.

The sewing-machine motors referred to have made some 75 million revolutions.

W. Poynter Adams.

Westminster, *September* 11*th*, 1913.

[This appears to be the installation described in our issue of July 31st, 1903.—Eds. Elec. Rev.]

Apparatus on Hire.

In view of Mr. T. C. Parsons's interesting article on the advantages of municipal motor hiring last week, perhaps it may be as well to state, on the other hand, a few of the objections to such schemes, though to the ordinary electrical trader or business man several are at once obvious.

In the first place, as things stand at present, a municipality or Corporation can usually buy motors or other apparatus at a price considerably below that at which even the largest electrical trader or contractor is able to, and if the municipal hiring or sales department is then deliberately run at a loss, as appears to be advocated, or, what amounts to the same thing, is made to show only a negligible credit balance after several years of working without any charge being made for supervision, then it is doing a very serious injury to the electrical industry.

The prices for the whole of the electrical trade, just as for any other trade, are based on the assumption that the ultimate purchaser and user of the goods shall pay a certain price which shall be somewhat above that at which a trader dealing in the goods could buy them. If a Corporation department sells or hires out motors or other apparatus on a lower basis than this, the position of the local trader or contractor is not a very enviable one, and he surely has a distinct grievance. The remedy appears to lie in the way of making Corporations, who are not out for profit, pay the ordinary customers' prices for their goods, and it would be difficult to suggest anything that would put the electrical industry more quickly on a sound basis, if it could be done. Municipal undertakings, however, though they can always borrow money and go on paying back merrily to the rates, are not all of them in a position to run even a hiring department at a loss, and it appears quite possible that future legislation will enforce the keeping of separate accounts with a correct apportionment of establishment charges in the case of all municipal trading departments, so that the full amount of these losses will have to be accounted for.

With regard to the reliability and maintenance of the motors, there would appear to be no reason why private firms should take less interest in their property than municipalities, and, generally, a company, either by its own experienced staff or through the experienced staff of the large insurance companies specialising in the work, can give better attention than a Corporation department where young assistants are generally employed, who are working for experience only and are practically unpaid.

The stock of motors, namely, eight, mentioned by Mr. Parsons, appears very inadequate and is quite insignificant compared with the number held in stock by firms specialising in the hiring out of electric motors.

The Electric Motor and Stove Hiring Co., Ltd.
H. S. Ingleby, *Secretary.*

Leeds, *September* 15*th*, 1913.

The City Guilds Examinations.

I have read with interest the letter by Mr. Perren Maycock, which you published on the 12th inst., and consider it worthy of serious consideration by professors and teachers who have to coach students for the examinations of the City and Guilds of London Institute.

Mr. Perren Maycock is well known as an author and lecturer on various electrical subjects, and I do not doubt that his remarks will have the effect of stirring up those who are responsible for the selection of the text-books recommended.

It is essential in all things electrical to be up-to-date, and a student who requires a useful book should know what is best suited to his studies; the C. and G. does not assist him, although it is intended to do so.

The suggestion of consulting a number of professors and teachers on the above subject might, with advantage, be extended to the subject matter of the examinations, which lack lamentably the practical modern needs of the industry.

Co-operation would produce more useful papers, and would result in employers recognising the certificates as a standard of efficiency useful to their business, a feature at present not existing. A contractor will not employ a certificated wireman because he knows the exact method of making a T, Y, or married joint, which are forbidden by the rules of the I.E.E. and similar bodies. He needs a man practised in systems, diagrams, &c., all of which should be attended to more fully in technical schools than at present.

W. Ellerd-Styles.

Leytonstone, *September* 15*th*, 1913.

An Echo of the Marconi Contract.

My attention has been called to your references to myself in your issues of August 1st and 15th.

I am unaware of having done or said anything to call for such discourteous personal comments.

Courtesy or discourtesy, however, is a matter of your own taste, but inaccuracy justifies me in asking you to publish a correction.

On August 1st you say of me: "But as a member of a Departmental Committee, would he not show better taste by refraining from polemics in the public Press?" The War Office Wireless Committee, of which I was chairman, was a confidential inquiry which had no relation of any kind whatever to the Marconi contract or to my visits to long-distance wireless telegraphic stations. Nobody but yourself has ever thought of attempting to make any connection between the two.

On August 15th you say of me: "For instance, Sir Henry Norman, who has seen 'every big station in Europe' (but has he seen one big Marconi station?)" . . . I have

never said that I have visited "every big station in Europe." What I did say was that I have visited, and carefully examined, every type of high-power long-distance wireless station in Europe. This I have done. The Marconi station that I visited was that at Coltano, which Mr. Marconi regards as the latest form of Marconi station of its class.

I may add that the criticisms of the two Imperial Wireless Contracts have had for effect, first, the distribution of royalty payments (*a*) among patents, and (*b*) among stations; the securing of an opportunity for competing systems to tender if they are able, within the next few months, to show successful results; and, third, the establishment in this country of a permanent national Laboratory for Radiotelegraphic Research.

I should have thought that these results would be regarded by a scientific journal like your own as a matter for congratulation, rather than for criticism.

Henry Norman.

Haslemere, *September 12th*, 1913.

[We are at a loss to understand why Sir Henry Norman regards our references to himself as discourteous. As a Member of Parliament he is surely aware that the leaders of any public movement such as that in which he has taken a very prominent part must be prepared for criticism; we certainly criticised his actions, but we deny that we treated him with discourtesy.

On July 25th we recorded the fact, on the authority of the *Times*, that "a deputation from the War Office Wireless Committee, comprising Sir Henry Norman, M.P., and Commander Silvertop, accompanied by Captain Lefroy, R.E., who is in charge of the experimental wireless work at Aldershot," had visited Vienna to inspect the Poulsen system, and that on the homeward journey the party would visit the Goldschmidt station near Hanover and the station at Laeken.

If the *Times* report was true—and we have not seen it contradicted—Sir Henry's visits to long-distance wireless stations were undertaken by him as a member of a *deputation* from the War Office Wireless Committee. How, then, can he maintain that his visits were totally unrelated to that Committee, of which he was chairman? The Postmaster-General conferred with the War Office on the subject of the Marconi contract, and we claim that our comment of August 1st was justified.

In that issue we quoted from Sir Henry Norman's own letter, published in the *Times* of July 28th, the statement that he had recently "visited, minutely examined, and taken copious notes of every type of high-power and long-distance wireless station in Europe." But on August 8th Sir Henry Norman, in the House of Commons, in the discussion on the new Marconi contract, said "he knew every big station in Europe" (*Times* report). He also said "he had seen every long-distance station in operation," (*ibid.*) in the same speech. We had that speech before us when we said in our issue of August 15th "Sir Henry Norman, who has 'seen every big station in Europe' (but has he seen one big Marconi station?)" He now tells us that he never said he had visited "every big station in Europe." Let him reconcile this with his other statements—we cannot.

The Coltano station may be the latest of its class, but it was at Clifden that the Parker Committee was shown duplex working, automatic transmission, and the Marconi continuous high-frequency generator at work on trans-Atlantic communication.

How far the results claimed for the criticisms of the two contracts are really attributable to them is a debatable question, but the points to which Sir Henry Norman particularly addressed himself, in the guise of an amateur expert—namely, the formation of a State Department to erect the wireless-stations, and the abolition of the royalty—have not been conceded.—Eds. Elec. Rev.]

France.—La Société des Véhicules à Transmission Electrique Crochet is the name of a new company which has just been formed in Paris (6, Quai de Gesvres) to develop a new electrical transmission system for motor vehicles.

THE BRITISH ASSOCIATION.—I.

On Wednesday, September 10th, as already briefly noted in our issue of the 12th inst., the British Association commenced its meetings at Birmingham, with Sir Oliver Lodge's brilliant address.

Although there were notable absentees, the meeting was a thoroughly representative one; and fine weather, excellent organisation and lavish hospitality combined to make it successful.

The list of members and associates present shows that there is no falling-off in the support of the foremost workers in each branch of the huge field which the British Association cultivates. But perhaps it would be more appropriate to speak of its operations as harvesting rather than cultivation. A notable fact is the advancement of women in the field of science as exemplified at this meeting, not only in the large numbers of clever and enthusiastic camp-followers, but also in the presence of women whose work is world-famous.

Amongst the names is that of "Madame le Professeur Curie, Sorbonne, Paris"—a great woman, whose fame may well give encouragement to many of her sex who still chafe under the restrictions of an old-fashioned and deep-rooted, but decaying prejudice.

The occupation of the Presidential chair of Section K (Botany) by Miss Ethel Sargant, F.L.S., has proved not only that, for the pursuit of some branches of science, there is nothing (except the aforesaid prejudice) to check the career of a clever woman, but that she can control a mixed assemblage with dignity and success.

A prejudice is a negation of science; and it is satisfactory to note that an open mind and an open door were special features of this meeting, no less than a fine spirit of hope and progress. As usual, Sections A and B took a leading place. The study of radiations and their relation to long-established laws of physics occupied the physicists and mathematicians, and carried them far out of the depth of the non-expert.

Sir John Caird's gift of £1,000, which we noted last week, is to be devoted to the study of radio-activity; and he may yet have the privilege of seeing wonderful results from the application of his generous gift. At all events, it is safe to say that it will not, in the hands of Section A, be money wasted.

With regard to the work of the Sections, many of the old difficulties remain. The most important meetings are crowded out by a migratory body of camp-followers, who go from Section to Section to see or to hear "some new thing," and occasionally loyal adherents and supporters fail to get into the meeting of the Section to which they belong. The printing of Abstracts appears to be quite inadequate, and even in the Press room there is frequently a shortage. The speed with which printed matter disappears is extraordinary. This year the President's Address and the abstracts of papers were bound separately for each Section and sold for 6d. in the reception room. Unfortunately, the supply was not equal to the demand, and the book for Section A was unobtainable within a very short time after its appearance.

There is room for great improvement in the supply of printed matter, and the experience with these 6d. books appears to show that the cost need not be considered, as such matter can be easily sold at a price to cover the cost.

The Sections opened on Thursday, September 11th, and, as usual, Section G was deferred an hour in order to give its members an opportunity to hear Dr. Baker's address to Section A on "The Place of Pure Mathematics."

An address which made an appeal to all Sections was that of the Rev. Philip Wicksteed to Section F. As might be expected from such a versatile and original mind, it was sympathetic and humane, a fine attempt to make a deeper appeal on the part of the "Dismal Science."

It was full of good things, such as, for instance, that "A man can be neither a lover, a saint, nor a poet, unless he has recently had something to eat."

Prof. Gisbert Kapp's address to Section G called attention to the electrification of railways, and showed the great progress that is being made in this direction in Germany

and in Switzerland. We give a full abstract of it in our later pages.

Prof. Silvanus Thompson, in moving a vote of thanks, said he felt sure that Prof. Gisbert Kapp's address could not fail to produce a profound effect as soon as it had been considered by the railway engineers of this country.

It was a fine example of a moderate and reasoned discussion of conflicting views and problems. In one respect particularly nature had been kind to the electrical engineer, and that was in making the turning moment of an electric motor more uniform than that of any other motor. It was a curious and interesting point that any slight inequality in the diameters of the driving wheels of an electric locomotive corrected itself by wear on the tires in a very short time.

The first paper was a note on the proceedings of the Committee on Gaseous Explosions. The main item of information was that Prof. Dalby had obtained means to provide for a permanent research assistant, and that the new laboratories of the Imperial College of Science would be equipped with one bay specially fitted up with internal-combustion engines, Dr. Dugald Clerk co-operating with Prof. Dalby in this work.

A joint paper, by Prof. Asakawa and Prof. Petavel, on "The Effect of Compression Ratio on the Efficiency of a Gas Engine," was next taken.

Experiments had been tried on a 25-H.P. gas engine burning town gas to ascertain to what extent the theoretical laws of efficiency were attained. The general conclusion reached was that at light loads an increase of the compression ratio does not improve efficiency, owing to the influence of friction.

Prof. Burstall followed with a paper on "Solid, Liquid and Gaseous Fuels." He foreshadowed the splitting-up of coal by distillation, the oil and tar being fully utilised. He discussed the question of the gas turbine, and arrived at the usual conclusion, viz., that metal suitable for making a turbine blade which will stand the impingement of flame has not yet been found.

Dealing with fuel oil, he estimated the world's production of oil at 50 million tons a year, and coal at 1,200 million tons. It was clear, he said, that the world's oil supply was totally inadequate to replace coal. He advocated the distillation of coal on such lines as to get the highest possible yields of fuel oil and tar, instead of aiming at the maximum production of gas, sulphate of ammonia being obtained as a by-product. The theoretical yield was as high as 120 lb. of sulphate of ammonia to the ton, the practical yield being about half that figure.

A coke should be produced which would be suitable for domestic burning, the gas being used for the generation of power, either at the pit head, or by means of pipe-line distribution at any distant point where electrical energy was required.

He calculated that, in order to compete with the steam turbine for power purposes, the gas would have to be reckoned at about 4d. per 1,000 cb. ft.

Sulphuric acid could be recovered from the exhaust gases. Sulphur ash only need be bought. Propulsion of ships by internal-combustion engines was an interesting problem; but the danger of "gassing" the ship's company from the possible escape of carbon-monoxide in such a small enclosed space must not be lost sight of.

In conclusion, he pointed out that there should be no real rivalry between gas and electricity, but the first should be used to produce the second.

In opening the discussion, Mr. Mordey said he had no hope of seeing a successful gas-turbine for many years to come. He had been much interested in the Humphrey gas pump, and he believed that a high efficiency of propulsion could be obtained on board ship by using a Humphrey pump to pump in water from the bow and expel it at the stern, thus propelling the vessel by means of a water jet without mechanism.

Another member spoke of the immense loss in the deposit of sooty matter upon the surface of our large towns. In the centre of the city there was about six times as heavy a deposit as in the suburbs. It was calculated that 500 tons per sq. mile per annum was the amount of deposit in the City of London.

Prof. Hudson Beare spoke approvingly of the proposed combination of Humphrey pumps to secure a head of water, with water turbines for the generation of electricity, and was of opinion that a high overall efficiency could be obtained.

On Friday, the event of the day was the discussion in Section A upon Radiation, opened by Prof. J. H. Jeans, F.R.S.

The debate, which was largely attended, was a model of its kind. While it was clear that there were great divisions of opinion, the discussion was carried on with the utmost good nature and yet with great animation. There was no vain repetition, and though Prof. Lorentz, of Leyden, was allowed to speak several times, it was clear that the audience would not have been satisfied with anything else. The charm of his manner, and his sincerity and modesty, must have made it a pleasure to be demolished by him.

The calculations and the speculations were on a level of very high mathematics and difficult enough to follow, but to the expert and the non-expert alike it was fascinating to watch the process by which science is endeavouring to fit in the established laws and theories with the newly discovered facts.

Prof. Jeans introduced the subject to his distinguished and highly critical audience in an admirable address. Prof. Lorentz, of Leyden, Sir Oliver Lodge, Prof. Pringsheim, of Breslau, Dr. M. Bohr, Prof. Love, Lord Rayleigh, Sir Joseph Larmor, Sir J. J. Thomson, and Dr. S. D. Chalmers, all took part in the discussion, and Prof. Jeans replied.

This discussion occupied a good deal more than the time set apart for it, and not much time remained for a paper by Prof. Bragg, of Leeds, on some important work done by himself and his son on crystals examined by X-rays, an investigation throwing a good deal of light on the structure of crystals and at the same time upon the X-rays themselves.

A paper by Sir J. Larmor on "Lightning Rods" was also taken somewhat hurriedly.

A discussion on "Inland Waterways" took place in Section F.

In the evening Sir H. H. Cunynghame gave the first evening discourse, on "Explosions in Mines and the Means of Preventing them."

Saturday was entirely devoted to pleasure and sight-seeing, a large number of successful excursions being made in pleasant weather into the beautiful country, so rich in historical associations, within easy reach of Birmingham.

Main-Line Electric Traction.

By Prof. Gisbert Kapp, D.Eng.

(*Abstract of Presidential Address to the Engineering Section.*)

As regards urban and suburban lines, not only the possibility of electric traction, but its immense superiority over steam traction, is fairly generally admitted. Where we get on debatable ground is when we begin to discuss main-line traffic. We see year by year more lines being electrified. Some are failures; but the very fact that, in spite of these failures, the process of electrification is going on, shows that the failures are remediable. When we see that in all countries a vast amount of labour is devoted to, and capital is spent on, the electrification of main lines, we cannot but come to the conclusion that this new application of electricity is bound to progress.

The present tendency in electric traction is in the direction of simplicity, in the sense that mixing up of different types of current and dependence of one train on another is avoided. In France the Compagnie du Midi is electrifying on the single-phase system nearly 400 miles of track; the German Government have already electrified the Dessau-Bitterfeld section of the Leipzig-Magdeburg line, and are electrifying the line Lauban-Koenigszelt, in Silesia, to say nothing of some smaller private lines in the South of Germany, which have been in operation for some years. In Switzerland the Berne-Loetschberg-Simplon railway, already in operation, and the Rhætian Alp railway, nearing completion, also employ single-phase electromotives. Both in France and Germany the type of electromotive to be finally adopted has not yet been settled, but half a dozen different types, supplied by as many different makers, are being tried, and in this respect one may look on single-phase traction as still in the process of development. As regards the Loetschberg the period of trial is over. Three years ago the railway company ordered a 2,000-H.P. electromotive, and have had it at work ever since with such satisfactory results that they have decided to adopt this type definitely, and have ordered 13 more engines, of 2,500 H.P. on the 1½-hour rating.

The first application of the three-phase method of working took place on a small Swiss line; then followed the well-known Valtellina line, and, later still, when the Italian Government took over the railways, the Government engineers decided to extend the

application of three-phase traction to some other lines—a decision which practical experience has shown to have been perfectly justified. The total power represented by three-phase electromotives either at work or on order in Italy to-day exceeds 200,000 H.P. (95,000 H.P. in service, and 120,000 H.P. building). Ten years ago the three-phase system was the only possible one for main-line working, but later on there came on the scene the single-phase, and, later still, the high-pressure continuous-current systems, and between the advocates of the three systems there has been waged a fierce battle, each claiming that his is the best and the others very inferior. It is a futile war, for there is no such thing as a best system generally. One system is the best for one set of conditions and another for another set.

It is curious to note that the three most obvious objections which have been raised against three-phase electromotives by theorists have been found to have but little weight in practical work. These objections were: the complication of a double overhead wire, the danger that the motors would not share the load fairly, and the inability to run without rheostatic waste at intermediate speeds, or to run at a higher than synchronous speed to make up for lost time.

That an overhead wire is inconvenient must be readily admitted, but the inconvenience applies to all methods of main-line working, for the so-called third rail is not applicable to high pressure, and even if it were, the consideration of the safety of the platelayer would preclude its use. The question then is: are two wires twice as objectionable as one? Possibly, but the most objectionable feature is not the wire itself, but the posts or gantries on which it is carried, and the number of posts is the same, whether we use three-phase, single-phase, or continuous current. There is a little more complication at the cross-over points and at the switches; but this is not a serious matter, if one may judge from the perfectly smooth working of so extended a yard as that at Busalla, near Genoa, where there are five miles of track, connected by thirty-seven switches and crossings. The other objection—as to the motors not sharing the load equally—is theoretically sound. The torque developed by the motor is proportional to the slip, and in order that the two motors on an electromotive shall share the load equally their slips, and consequently also their speeds, must be the same. Now, it is conceivable that, owing to a slight difference in the size of the drivers, that motor which is geared to the larger drivers will, by reason of its lower speed and consequently greater slip, take more than its fair share of the load. In practice, however, this difficulty does not arise. With reasonably good workmanship there should be no sensible difference in the size of the wheels; but even if we admit the possibility of there being a difference of ½ per cent. in the diameter of the wheels, this would, with the usual slip of 3 per cent., only mean that the motor geared to the larger wheels develops 8 per cent. more, and the other 8 per cent. less, than its normal power. The larger wheels will develop 16 per cent. more tractive effort than the smaller wheels, and having thus a greater wear, the difference originally existing will diminish in service. For the same reason, any tendency to wear unequally, say, in consequence of unequal material, is counteracted by the slip adjustment of the motors. This point has been tested practically by the makers of the Simplon three-phase electromotives. It was found that if originally a slight difference in diameter of the drivers had been permitted to exist, after a short time this had vanished. That is as regards the conditions on one electromotive; but if we come to the case of a train being hauled by two engines, then a sensible difference in the size of their wheels may exist. In this case it is necessary artificially to adjust the slip so as to make each motor take half the load. This problem has been solved by Mr. v. Kando in the electromotives which he designed for the Italian State railways. In these engines only liquid resistances are used in the rotor circuit for starting and speed regulation. The liquid is raised or lowered in the rheostat chambers so as to cover more or less of the contact plates, and the level of the liquid is controlled by a solenoid under the influence of the working current. The working current, and, therefore, also the tractive effort exerted by each motor, is thereby automatically kept constant, notwithstanding any difference that may exist in the size of the drivers on the two electromotives. Incidentally, it may be mentioned that this method of liquid rheostat control has also the advantage of a perfectly constant acceleration during the starting period—a point which makes for comfort of travel in a three-phase train.

The third objection advanced by theorists against three-phase traction is against the waste of energy consequent on rheostatic speed control and the inability to run at more than synchronous speed so as to make up for lost time. The obvious remedy for the last-named difficulty is to fix the time-table so that the synchronous speed should be high enough for making up lost time and to employ motors which can run economically at less than synchronous speed. As a matter of practical experience, three-phase trains are not more unpunctual than any other kind, steam not excluded. A train pulled by a series motor (C.C. or A.C.) runs slower on an up-grade or if abnormally heavy; this is one of the characteristics of the series motor, and it is valuable, because it limits the excess load thrown on to the source of power; but it is clearly not a condition making for good time-keeping. With a series motor time lost cannot be recovered on an up-grade, whilst with a three-phase motor the speed on an up-grade may be kept practically the same as on the level or on down-grades, so that the process of gaining time is not restricted to the easy parts of the line.

The problem of speed control without rheostatic waste has been solved in various ways. One of the simplest and generally adopted solutions is that of cascade and single working. If the two motors are put into cascade connection the speed is halved. The cascade is used in starting and on heavy grades (unless time has to be made up), and on the easy grades or on down-grades the motors work singly—that is to say, in simple parallel connections. Intermediate speeds may be obtained by some pole-changing device. Ordinarily, such devices have to be applied to stator and rotor, but in some of the Simplon electromotives only the stator is arranged for pole-changing, the rotor being a squirrel cage. In this arrangement the advantage of cascade-working has to be given up, but the system has the merit of great simplicity. The number of poles may be changed from twelve at starting to eight, six, and four at top speed. Thus, four different speeds, all without rheostatic waste, are possible. The single bars in the squirrel-cage rotor are connected at their ends by resistance-connectors made of an alloy having a high temperature coefficient. At starting the rotor current is large and heats up these strips, thus automatically providing a starting resistance. When the motor is running the current is less, and by reason of the fanning action of the connecting strips these get cool so as to bring their resistance down to a permissible amount. Thus the efficiency of the motor when running under load is only a few per cent. less than that of a motor with a wound rotor. A valuable feature of the three-phase system is the automatic recuperation of current whenever the speed exceeds synchronous speed by a few per cent.; and connected with this property is the further advantage that it is impossible for a train to race on a down-grade. Obviously recuperation can only take place if power is given to the motor. This is provided partly by the electromotive itself, and partly by the train pushing it on a down-grade. This means that the train is braked in front only, and railway engineers have raised the objections that such a method is contrary to the accepted rules for safe working, which require that even on a down-grade all the couplings should remain in tension, which means that each coach must be independently braked. Here we have again a case where the theorists' objections have been proved to be without foundation in actual practice. It is, no doubt, objectionable to brake a train in front only, if the braking action is jerky; but with the automatically controlled liquid rheostat the braking comes in quite gradually, and is throughout so even that it has been found possible to permit a higher down-grade speed with recuperation than with ordinary braking. On the Italian State railways the regulation permits on heavy down-grades a speed of 30 km. per hour for steam trains, but the electric goods trains are permitted to run at 45 km. per hour. This concession is not extended to passenger trains. Nevertheless the economic effect is considerable. Recuperation saves 17 per cent. on the coal bill, and this amount is sufficient to provide for interest and sinking fund on the electrical plant at the generating station.

One advantage of three-phase traction over steam traction is the lessened weight of the locomotive in comparison with its tractive force and power. As an example, we may take the Giovi line in Italy, where steam trains, consisting of 310 tons of rolling stock and 202 tons of locomotive (one in front and the other at the back), have been replaced by three-phase trains, consisting of 380 tons of rolling stock and two electromotives, each weighing 60 tons (also placed front and rear). Thus there has been a saving in total weight of 12 tons, and at the same time an increase in useful weight hauled of 70 tons. The average grade of this line, over which passes the whole traffic between the Port of Genoa and the Plain of Lombardy, is 27 per mille, and the maximum is 35 per mille (3½ per cent.). This traffic is now worked with 40 electromotives, each of 60 tons weight. These engines have five driving-wheels connected to two 8-pole motors by gearwheels and rods. The pressure on each driving-axle is 12 tons. Each electromotive develops 2,000 H.P. at the hour rating; thus 1 H.P. is obtained for each 30 kilogrammes weight of engine.

The number of patented designs for single-phase traction motors is very large; but, notwithstanding considerable difference in matters of detail, all motors which have been successfully applied in practice may be ranged under three great groups—namely, the so-called repulsion type, the repulsion type with additional excitation of the rotor, and the straightforward series motor. The present tendency is rather in favour of the series motor, and the practical results obtained with it are certainly very promising. The latest design made by Dr. Behn-Eschenburg shows a remarkable weight efficiency. His 2,500-H.P. electromotives (at a one and a half-hour rating) weigh only 108 tons, so that at this rating 1 H.P. is obtained with a total weight of 43 kilogrammes. This compares favourably with the high-pressure C.C. system, where 50 to 70 kilogrammes per horse-power may be taken as normal values.

The so-called "repulsion motor" invented by Prof. Elihu Thomson has been applied to railway work in the slightly modified form due to Mr. Deri, where, instead of there being only two brushes per pair of poles, double the number is provided, and the adjustment for speed and torque is made more accurate, whilst at the same time the commutation, being split up into two steps, becomes easier. In the matter of simplicity, an electromotive fitted with Deri motors cannot be surpassed by any other arrangement. There are no rheostats, contactors, control switches, or other gear; all the regulation is effected by mechanical transmission of the movement of a hand wheel placed in the driver's cab to the brushes of the motors. At one time it was hoped that this system would win its way to a general application; but, unfortunately, the motor must run somewhere near synchronous speed, and becomes therefore rather heavy with the low frequencies alone possible in traction. Moreover, as the power-factor obtainable is only about 0·80, that is, considerably below the value obtainable with other motors, there does not seem to be any great future for this system for heavy work, although its great simplicity may still turn the balance in its favour on lines with a light traffic. For heavy lines the choice at present lies between the induction-motor with direct rotor excitation and the straightforward conduction-motor, where

rotor and stator are traversed in series by the same current. The former type of motor—also called the Latour-Winter-Eichberg motor—depends for its working current in the rotor on electromagnetic induction, which produces the working current in the rotor much in the same way as the current in the secondary circuit of a transformer is produced by induction. Since the motor has in part the character of a transformer its weight would, as is the case with any transformer, be unduly augmented by too great a reduction in the frequency. Experience has shown that a frequency of 25 periods per second is high enough to render the transformer action effective, and at the same time not so high as to introduce serious difficulties as regards E.M.F. of self-induction and commutation. This frequency has been adopted in most cases where electrification of main lines has been carried out by motors of this class. One valuable feature of this motor is that at a speed slightly exceeding synchronism the power-factor may be brought up to unity. At this speed the commutation takes place under conditions which may be described as theoretically perfect. A fair number of Continental lines have been electrified by using these motors, and they have also been adopted, with very satisfactory results, in the electrification of the London, Brighton and South Coast lines between Victoria and London Bridge and to some distance south of London. On this line no locomotives are used, but only motor coaches. It is, therefore, not possible to make a direct comparison as to weight efficiency with a locomotive. The latter has only to carry the propelling machinery, whilst the former has to provide accommodation for passengers as well. The 600-H.P. motor coaches on the Brighton line weigh 50 tons, or at the rate of 83 kilogrammes per H.P. A 1,000-H.P. C.C. electromotive taking current at 1,200 volts weighs 74 tons. By making a suitable reduction for the extra weight of the passenger accommodation in the A.C. coach, its weight per horse-power comes out at something like 60 kilogrammes, against 62 kilogrammes in the C.C. engine.

Series motors are employed on the electrified lines of the Midland Company between Heysham, Morecambe, and Lancaster. Also in this case motor coaches, and not electromotives, are used. At the hour rating a motor coach develops 420 H.P., and as its total weight is about 35 tons, we have here the same weight efficiency as on the Brighton lines—namely, 83 kilogrammes per horse-power for the whole coach.

Of high-pressure C.C. lines there are many examples, both in Europe and America. The term high-pressure does, of course, not imply the same order of magnitude as in single-phase A.C. lines. There high-pressure may mean anything up to 15,000 volts, the pressure which is likely to become a standard in future electrifications; but in C.C. work one must class anything over 1,000 volts or 1,500 volts as high pressure. The general use is to employ motor coaches, and not electromotives; but there is a private line belonging to a steel works in Lorraine, where two electromotives, each of 600 H.P. (four C.C. motors of 150 H.P.) are working the mineral trains under a pressure of 2,000 volts, which is the highest C.C. now at work. The Southern Pacific Railway also employs C.C. electromotives of 1,000 H.P. each. Each engine weighs 74 tons, and hauls a train of 270 tons on grades of 40 per mille. This is a remarkable performance, rendered possible by the fact that with the even torque exerted by the electric motor a much larger coefficient of friction than is possible in steam traction may safely be permitted. Electrical engineers generally base their calculation of the possible tractive effort on a coefficient of 0·17, without sand, and as high as 0·25, or even 0·28 if sand is used. The voltage in the case of the Southern Pacific engines is only 1,200 volts, taken by two motors in series, and there is provision made to change over from the overhead wire to third rail, with 600 volts, when the motors are all in parallel. On European C.C. lines the voltage is higher—generally 2,000 volts, as on the Chur-Arosa and some other Swiss lines—and the tendency is still in the direction of higher pressures. Continental makers are now prepared to go as far as 1,200 volts per motor, so that with the usual system of series-parallel control a line-pressure of 2,400 volts becomes possible. The greatest step in advance in this direction has, however, been made in England, where Messrs. Dick, Kerr & Co., Ltd., have adopted a line pressure of 3,500 volts as their standard, involving the use of motors constructed for 1,750 volts. After having experimented with this high-pressure system for two years, they have undertaken the electrification of a short section of the Lancashire and Yorkshire Railway with continuous current at 3,500 volts. I am indebted to the firm for the following particulars: The current is collected by pantograph from an overhead wire with catenary suspension. The train consists of a motor coach and two trailers. The motor coach is equipped with four 300-H.P. motors, and weighs 62 tons; the trailers weigh each 26 tons. From these figures it will be seen that the weight of the motor coach per H.P. is only 52 kilogrammes, and thus considerably below what the weight of an equivalent single-phase motor coach would be. It is especially the saving in weight and the avoidance of any telephonic disturbances which renders the C.C. system so attractive that, in spite of a natural reluctance against the use of high pressure on a commutator, designers are giving increased attention to the use of continuous current for electric traction. The difficulties which some engineers anticipate with commutator and brushes seem, however, rather imaginary than real, if we may judge from the experience with the 3,500-volt motor coach. The makers inform me that they estimate the mileage for a set of carbon brushes at 50,000 miles. The motors drive the car-axles by single-reduction gear, and are controlled by contactors operated from a master controller. The current for operating the contactors, driving the air-pump motor, and for the general service of lighting and heating, is obtained from a small motor-generator, fed on the primary side at 3,500 volts, and delivering C.C. at 210 volts. All motors have commutating poles—a practice which has become universal in C.C. traction work.

From the figures quoted above it will be seen that where motor coaches are employed the C.C. system has an advantage in point of weight over the single-phase A.C. system. But main-line traction, including goods trains, is not going to be done by motor coaches, and if we come to large electromotives of some 2,000 to 3,000 H.P. then this advantage is likely to vanish. No high-pressure C.C. electromotive has as yet been built for so large a power, and it is therefore not possible to make a direct comparison; but, if we may judge from the largest engines yet built for moderate-pressure C.C., there is little probability that the C.C. system for high pressure can beat the single-phase system, and none whatever that it can beat the three-phase system.

In the early days of single-phase traction some trouble was experienced in the matter of telephonic disturbance. A systematic investigation carried on for over a year on the Seebach-Wettingen line, chiefly by means of the oscillograph, showed that this trouble was due, not as had originally been suspected, to the commutator, but to the employment of open slots in the rotor, and the trouble nearly ceased when new rotors with semi-closed and spiralled slots were used. To further improve the telephonic service the usual remedy of metallic return and drilling the telephone lines was employed. Although by these means it is possible to render telephonic speech over a line alongside a single-phase railway nearly, and perhaps quite, as clear as it is along a C.C. railway, there still remains the danger that the telephone lines may, by electrostatic induction, acquire a very high potential. The remedy against this danger, first applied on some Swedish experimental lines, is to short-circuit the two wires of each circuit by a choking coil of very high inductance, the centre of which is earthed. The static charge is thus carried off to earth, while the telephonic currents are only inappreciably weakened.

One of the advantages possessed by the alternating over the continuous current is the simplicity of regulation. There are no contactors and no rheostats used, the power and speed of the motors being adjusted by the use of tappings on the secondary side of the transformers. The only difficulty that still remains is that of sparkless commutation, but this also has been overcome. The

Italian State Railways Electrified on the Three-phase System.

Location of line.	In service. Lecco Colico Sondrio Chiavenna.	In service. Campasso Ponte-derimo Rusalla.	In service. Bussoleno Bar-donecchia Modane.	In construction. Savona S. Giu-seppe Ceva.	In construction. Lecco Monza.	In construction. Genova Sampier-darena Ronco.
Length, in kilometres...	107	19	58	45	38	28
Heaviest grade per mille	22	35	30	25	12	17
No. of transforming stations	10	4	7	4	4	2
Transmission voltage...	20,000	13,000	59,000	62,000	25,000	57,000
Trolley voltage ...	3,000	3,000	3,300	3,300	3,300	3,000
Frequency (cycles per second)	15	15	16⅔	16⅔	16⅔	15
Source of power ...	Water	Steam	Water	Water	Water	Water
No. of electromotives...	14	20	15	Steam reserve 61 for the 3 lines		
No. of motor-coaches...	10	—	—	—	—	—
Weight of trains minimum	150	190	—	not given		
Weight of trains maximum	370	380	220	not given		

Three-phase Electromotives on the Italian State Railways.

Type	034	036	038	050	030
Maker	Ganz	Ganz	Ganz	Westing-house	Westing-house
Number in service ...	2	3	4	40	—
Number building... ...	—	—	—	45	16
Total weight, tons ...	45	62	62	60	66
Weight on drivers ...	45	43·5	43·5	60	48
No. of driving axles ...	4	3	3	5	3
Total No. of axles ...	4	5	5	5	5
Weight on drivers, tons ...	11·3	14·5	14·5	12	16
Diam. of drivers, mm. ...	1,396	1,600	1,600	1,070	1,630
Frequency (cycles per second)	15	15	15	15	16⅔
Method of transmitting torque of motor to driving axles	Quill and flexible coupling	Cranks and connecting rods.			
Speed, in kilometres per hour	30	32-64	22-45-63	22·5-45	37·5-50-75-100
Method of speed regulation	—	Cascade	Cascade	Cascade	Cascade and pole-changing

frequency of 15 has advantages over that of 25. The Commission of Experts called together in 1904 by the Swiss Government to establish standards for the electrification of the Swiss railways decided that 15 should be the standard frequency, with

a tolerance down to 14, and up to 16⅔. Since then other States have fallen into line, so that 15 is now the standard frequency nearly all over the continent of Europe. The standard pressure is likely to be 15.000 volts. For three-phase traction the standard pressure is 3,000 to 3.300 volts.

On page 450 I give two tables referring to the Italian State Railways. I am indebted for the information to Mr. v. Kaudo, who may justly be described as the father of three-phase traction.

The most recent example of single-phase electrification is that of the Loetschberg line establishing direct communication between Berne and the Simplon line. The total weight of the electromotive is at the rate of 43 kg. at the 1½-hour rating.* This is a remarkably high weight-efficiency, which has up to the present not been reached by any continuous-current electromotive, and has only been surpassed by the three-phase 2,000-H.P. electromotives (taken at the one-hour rating) of the Italian State railways, which works out at 30 kg. per horse-power.

In conclusion, let us briefly glance at what is being done in the electrification of the Gothard line, that main link of commerce between Germany and Italy. I am indebted for the following notes on the subject to Mr. Huber-Stocker, the scientific adviser to the Swiss Government in the matter of railway electrification :— The part to be electrified first is that between Erstfeld and Bellinzona, a total length of 110 km., of which about 29 per cent. is in tunnel. This part also contains the longest and heaviest grades, so that the limitations of steam as compared with electric traction are here most prominent and a relief most urgent. On this section the average daily train movement, taking both directions together, was, in 1911, not less than 1,680,000 km.-tons, and the maximum on any day 2,282.000 km.-tons. It is estimated that in 1918 the average train movement will have increased by 35 per cent. over 1911, and in 1928 by a further 30 per cent. In the 45 km. on the north side of the tunnel the train climbs 569 metres, and in the 65 km. on the south it descends to Bellinzona 900 metres, with a steepest grade of 27 per mille. The section Erstfeld-Airolo is to be opened for electric traction in four years from now, and the southern section one year later. The present arrangements are made with the intention of extending the electric service on the north to Lucerne (60 km.), and on the south to Chiasso (55 km.) at some future date not yet fixed. There will be two large power stations, one at Amsteg, where at first 32,000 H.P. will be available on the turbine shafts, and 56,000 to 60,000 when the station is completed ; and the other at Piotta, where at first 40,000, and finally 50,000 H.P. will be available. The head of water in the northern power house is 267 metres down to the Reuss, and an accumulation of one million cubic metres is provided for, to compensate for diurnal variations. In the southern power house the head of water is 900 metres, and there the Ritom Lake offers a natural reservoir, with 19 million cubic metres, to compensate for annual variation in the water supply. The power-current will be sent along the line by two independent cables, each capable of carrying the full power at twice 30.000 volts, with earthed neutral. The current will be transformed down to 7,500 volts at first, and 15,000 volts later on, if the experience gained with the lower pressure should warrant the increase to double pressure. This will not involve any additional plant, since the secondary winding of transformers both along the line and on the locomotives can from the first be arranged with this alteration in view. It is also contemplated to establish sub-stations in Biasca, Goeschenen, Lavorgo and Bellinzona. There will be no motor coaches, only electromotives. It is intended to haul express trains weighing 420 tons with a speed of 50 km. per hour on grades of 26 per mille, for which service the electromotive will have to develop 3,000 H.P. on the rails. Goods trains weighing up to 670 tons will run with a speed of from 27 to 28 km. per hour, and have two electromotives, one in front and one in the rear, each rated at 2,800 H.P. Passenger trains will be heated by steam, the boiler being carried in a special heating coach.

The Internal-Combustion Engine Applied to Railway Locomotion.

By F. W. Lanchester.

The author in his paper reviewed the various attempts that were being made to displace the steam locomotive on railways. He showed that electrification schemes on the one hand, and cars fitted with internal-combustion engines on the other, were displacing the steam locomotive under certain conditions of traffic. Mr. Lanchester then described in detail a self-propelled railway coach built by the Metropolitan Wagon Co., and equipped with internal-combustion engines, &c., by the Daimler Co. It is a 60-ft. bogie coach, with a seating capacity for 60 passengers. There are two power units on the coach, each consisting of a six-cylinder sleeve-valve Daimler engine. The cylinders are of 6-in. diameter and 6-in. stroke. The engines drive by means of a triple tandem six-speed epicyclic gear-box, in which the speeds are grouped into three low gear ratios used for starting with high acceleration, and three high gear ratios, which are exclusively used for running at speed. The whole of the gears are actuated by magnetic clutches. One axle on each bogie is driven from a cardan shaft by means of a right angle transmission. This consists of a bevel drive, in which the bevel pinion on the cardan shaft gears simultaneously into two crown wheels on the axle. Either of these wheels can be connected by means of an alternate dog clutch, and in this way the reversal of the car is effected. The two power units are disposed symmetrically on opposite sides of the vehicle and drive on to opposite ends, which gives a completely symmetrical arrangement.

The coach can be controlled from either end by means of duplicate controllers placed in the driver's cabins. The electrical equipment consists of two dynamos coupled direct to the crankshafts of the two engines, and an accumulator battery.

Electricity is used to start the engines, to light the coach, and for driving the electric air compressor, which operates the air brakes. The aggregate H.P. of the two engines is nominally 100, but on trial they have developed 110 H.P. The acceleration obtained on trial was 2·5 ft. per second per second. The consumption of petrol was found to be 170 ton-miles per gallon, as the coach ran five miles per gallon. With the H.P. provided, there was no difficulty in maintaining a speed of 60 miles per hour on a run between Nuneaton and Coventry ; and a maximum speed of 70 miles per hour had been reached. The coach with 60 passengers would be able to do the run from Euston to Birmingham at a cost of only 12s. for fuel, at the large contract rates for petrol.

Prof. H. S. Hele-Shaw opened the discussion, and pointed out that the transmission gear was a step-by-step one, which was not, for certain reasons, so good as an apparatus giving continuous speed variation. Even the electric driving of vehicles involved a step-by-step control, in which there was a considerable waste of energy except at certain positions of the controller. There were three ways of obtaining a continuous speed variation. The first was a frictional drive, which was out of the question, as it wasted energy. The second was the compressed-air system, and the third the hydraulic transmission in which he was interested. The last two systems were undergoing trials, and it would be interesting to see which would ultimately gain the confidence of railway engineers. The car with the hydraulic gear designed by him was now on trial, and he hoped to have definite results shortly. He showed a drawing of the car with pump and accessories for the continuous speed control.

After Mr. Lee had raised some question as to the cost of maintenance, the Author replied, stating that whichever gearing gave most satisfaction would find a large field in self-propelled railway vehicles. The advantage of internal-combustion engines was largely one of weight, and this was so low that they had to be used on passenger vehicles rather than on the locomotives. If such engines were placed on locomotives, weight would have to be added to give the necessary adhesion for the driving wheels.

* For a description of the locomotive, see Electrical Review, August 29th, 1913, page 339.

PROCEEDINGS OF INSTITUTIONS.

Electric Cooking.

By W. H. Alabaster (Vice-President).

(*Abstract of Paper read before the* Victorian Institute of Electrical Engineers, *July*, 1913.)

Although it is only within the last few years that the design of electrical cooking apparatus has received serious attention, so much progress has already been made that electricity will shortly become a serious competitor with coal and gas. Cleanliness, freedom from noxious gases, and a perfect control of temperature are amongst its obvious advantages, making much better culinary results attainable, while the very small amount of heat radiated during use permits the kitchen to remain as cool as any other portion of the house. Seeing that in the conversion from coal to electricity only about 7 per cent. of the heat units are retained, the necessity for obtaining a high electrical efficiency will be at once recognised.

As regards the oven we may say that the heater is of first importance, and this should be designed to carry the current continuously without any deterioration. At the present time nichrome wire is almost exclusively used for cooking appliances on account of its high specific resistance (approx. 60 times that of copper), its freedom from oxidation and its ability to withstand high temperature.

The position that the heater occupies in the oven differs according to the make of the stove, but care should be taken not to occupy unnecessary space, and to supply a fairly uniform heat throughout the oven. With a view to obtaining the latter condition, the Bertram Thomas oven is equipped with side deflectors, which create a steady circulation of hot air in the oven. To enable the cook to effect the desired browning of the cake or joint, it is an advantage to have a portion of the heater placed at the top of the oven, and this should preferably emit radiant heat, in the direction of the joint.

Loss of heat may be caused either by insufficiency of lagging between the interior of the oven and the outside case, escape of hot air through badly fitting doors, or the conduction of heat from the inside to the exterior, which often occurs at the rim of the door. The efficiency of the oven is also materially affected by the method of control, which should preferably be automatic, and it is desirable that there should be as small an amount of metal in the oven as is practicable.

Efficiency curves of several makes of ovens are shown in fig. 1, and their performances are also shown in the accompanying schedule. The early portion of these curves gives an indication of the amount of air and metal which has to be heated before the oven reaches the required temperature, and the remainder of the curves shows the thermal efficiency.

The consumption of energy required to raise the ovens to 400° F. and then to maintain them at that temperature for a further 1½ hours is shown in a separate column, and also for an approximate comparison this is stated in watt-hours per 1,000 cb. in.

Electric Ovens.—Particulars of energy consumed while raising to and maintaining internal temperature at 400° F.

No.	Make of stove.	Useful capacity in cubic inches approx.	Particulars of lagging.	Consumption in watt-hours.			Total consumption during heating up and maintaining temperature at 400° for 1½ hours.	
				½ hour.	1 hour.	1½ hours.	Watt-hours.	Watt-hours per 1,000 cb. inches.
1	Bertram Thomas	5,130	2-in. slag wool	692	1,030	1,308	1,396	272
2	Archer	4,200	Slag wool	914	1,518	2,054	2,329	554
3	General Electric Co., U.S.A.	3,672	Asbestos...	630	1,030	1,376	1,474	402
4	Tricity	3,243	None	486	860	1,178	1,218	375
5	Nightingall Auto.	3,217	Slag wool	610	910	1,165	1,240	386
6	Experimental	3,207	¾-in. slag wool	344	470	584	604	188
7	Eclipse	3,075	Slag wool	990	1,548	2,020	2 500	815
8	Nightingall Steamer	3,036	Slag wool	536	760	928	1,048	346
9	Nightingall	2,704	Straw chaff	648	969	1.256	1,342	497
10	Simplex	2,161	Slag wool	764	1,140	1,460	1,604	742
11	Nightingall Non-Auto.	2,028	Slag wool	460	788	1,112	1,177	580
12	Nightingall Non-Auto.	2,028	Slag wool	480	800	1,108	1,180	581

capacity of the respective ovens. The consumption should not, however, increase in proportion to their capacity.

The Tricity cooker, which is devoid of lagging, and is made of brightly polished sheet metal, depends on its bright surface for limiting radiation, and is very efficient when used for not more than 1½ hours at a time. This oven will meet the requirements of a small household, but for large establishments, restaurants, &c., where the oven is required to be used for longer periods, a well lagged oven, such as the Nightingall or Bertram Thomas, will prove more efficient.

Mr. Prentice has recently had made in England an oven without a door; and, with a view to investigating its efficiency (see curve 6, fig. 1), I have had a somewhat similar oven made locally (see fig. 2). It will readily be seen that this design makes for a reduction in the energy consumption and the first cost of the apparatus. Further, when the dome is raised, the escape of hot air is extremely small when compared with that which takes place on the opening of an oven door.

In the efficiency curves of ovens I have included a curve of the Nightingall steamer, which is a very useful and efficient apparatus for steaming vegetables, puddings, &c. It consists of an oven with a special heater, which raises a small quantity of water to boiling point and fills the oven with steam, the regulator automatically cutting off current when boiling point is reached.

The curves in fig. 3 give a comparision of the heat insulating values of different kinds of lagging. These show the energy consumption required to maintain various temperatures inside a tin 5 in. diameter by 7 in. high, surrounded by 1½ in. of lagging, the whole being contained in a tin with bright exterior. It will be seen that slag wool gives very good results, but, unfortunately, it has a tendency to crumble and get out of position, thus leaving unlagged spaces; and it is desirable that means be taken to keep the wool in its proper position. Further, the slag wool should not be packed very tightly, otherwise the effect of the lagging is diminished; this fault was found to cause a difference of 10 per cent. in the efficiency of an oven. Cork granules, which give the highest efficiency, and are extremely light, promise very well, and the charring which would occur at the high temperature could be overcome by placing a thin layer of, say, asbestos sheeting next to the interior of the oven.

For the purpose of obtaining the curves of the ovens a Nightingall regulator was used for maintaining the temperature at 400° F., but it would not be possible for the majority of ovens to obtain such results under ordinary working conditions, as the Nightingall automatic stove is the only one so equipped. This regulator consists of a thermometer which closes a relay circuit operating a switch in the heater circuit, in such a manner that the temperature is maintained within a very few degrees of the heat selected by the switch. This regulator works in a most satisfactory manner, not only effecting considerable saving in energy, but also ensuring uniformity of temperature. The personal factor, which in ordinary cooking is so important, becomes almost negligible, and people with little or no skill obtain uniformly good results. Curves Nos. 11 and 12 in fig. 1 were taken at different times from the same oven, and will show how closely this regulator works.

Non-automatic stoves are generally supplied with two switches —one for raising the oven quickly to the required temperature, and the other for maintaining the oven at the cooking temperature. The amount of current required for the latter heat can be very closely estimated, so that the oven can be kept at a practically constant temperature.

The hot plates are next to be considered, and these, owing to their constant use, are scarcely less important than the oven. The hot plate itself should have a smooth and even surface of sufficient area to allow the kettle or other vessel to conduct away the heat as fast as it is generated. The question of suitable insulation between the wire and the plate is of considerable importance, as, although mica is a high electrical insulator, and also a very fair conductor of heat, it unfortunately changes its physical condition when raised to a very high temperature.

The curves in fig. 4 give the overall efficiency obtained by using various types of hot plates to raise three pints of water to boiling point. These are based upon the theoretical figure of 55 watt-hours being required to raise one pint 150° F. As these curves include the heat of the kettle and the radiation from it, they cannot be taken as absolute figures of efficiency of the hot plate, but are intended as a comparison of the efficiencies of various types when performing similar work.

In some instances two or more curves are shown illustrating the same plate used with different current consumption, and it is interesting to note the results obtained from such tests. Every plate will give its maximum efficiency at a certain current consumption and if that consumption is increased additional energy is required to raise the plate to a higher temperature, and radiation losses are also increased; whilst in running the plate with a lower con-

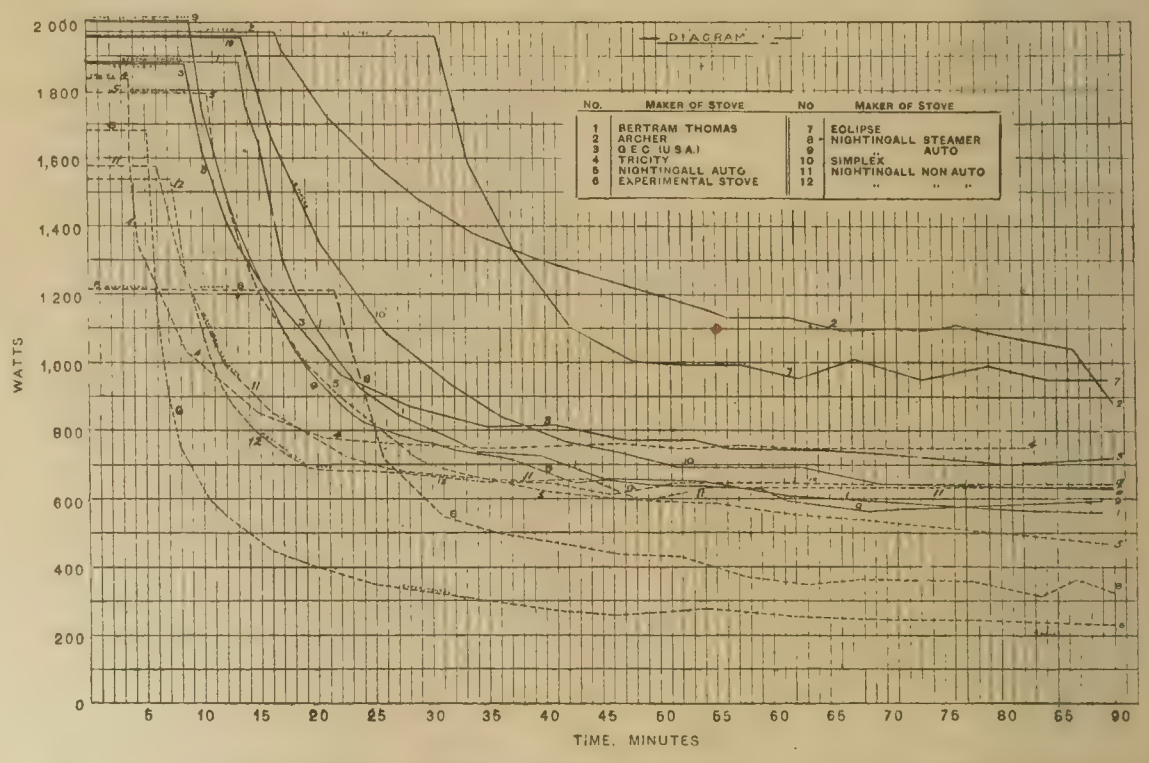
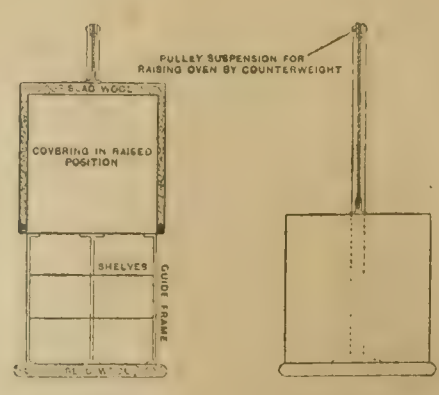


Fig. 1.—Electric Ovens: Consumption in Watts whilst raising to and maintaining Temperature at 400° F.



Inner frame, carrying shelves, also outer covering in section.

Oven in position, with suspension, side view.

Fig. 2.—Prentice Model Oven.

sumption the additional time required to perform the work accounts for increase in radiation from hot plate and kettle. It will be noticed that the watts dissipated per sq. in. of heating surface vary considerably ; but, apart from the question of efficiency, it is not advisable to exceed, say, 40 watts per sq. in., as there will be a tendency for the hot plate to overheat, at the risk of injury to the insulation. The heating element should consist of nichrome wire, so arranged that it will dissipate heat uniformly throughout its length, and distribute it over the whole of the plate.

In fig. 5 are given some results obtained whilst investigating the insulating properties of mica when working with high temperatures. It will be seen that, with rising temperatures, the insulation resistance falls steadily until a point is reached at which, and beyond which, the insulation improves. The tests disclosed the existence of a critical point in the life of mica, for, with the temperature maintained at or about a certain point, the mica becomes brittle, and ultimately allows the resistance wire to break through it. It will be seen that two samples of mica tested changed at about 1,200° and, as the wire of a hot plate runs at about 600°, there is no very large factor of safety, which points to the desirability of improved insulation for this class of work.

There is generally much room for improvement in reducing the amount of metal present, and limiting the excessive losses due to radiation. The G.E. Co. of U.S.A. have shown marked attention to these two points in the design of their 4-in. hot plate, and, on account of the metal being provided with a bright nickel surface, the radiation losses of a Hot-point plate are minimised. It was found that when they had attained their final temperature, the Hot-point and G.E. hot plates respectively radiated 22 per cent. and 24 per cent. of the energy put into them. The bottom of the hot plate should consist of some strong material of high value as a heat insulator, rather than of iron, as is usual at present.

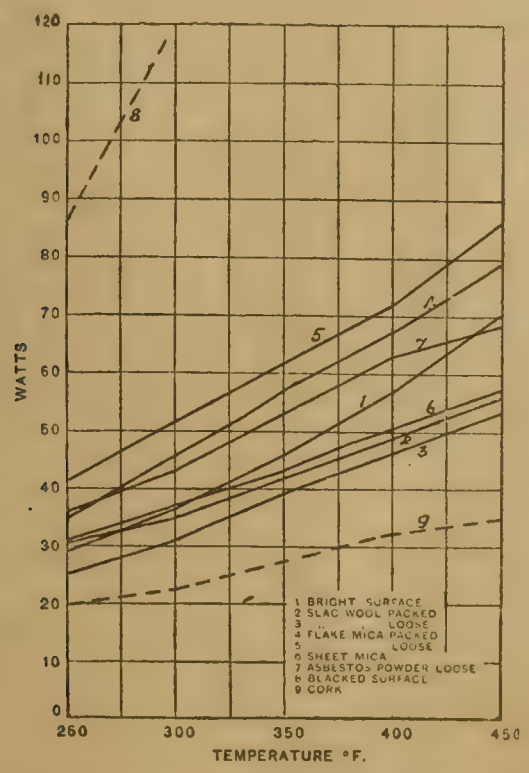
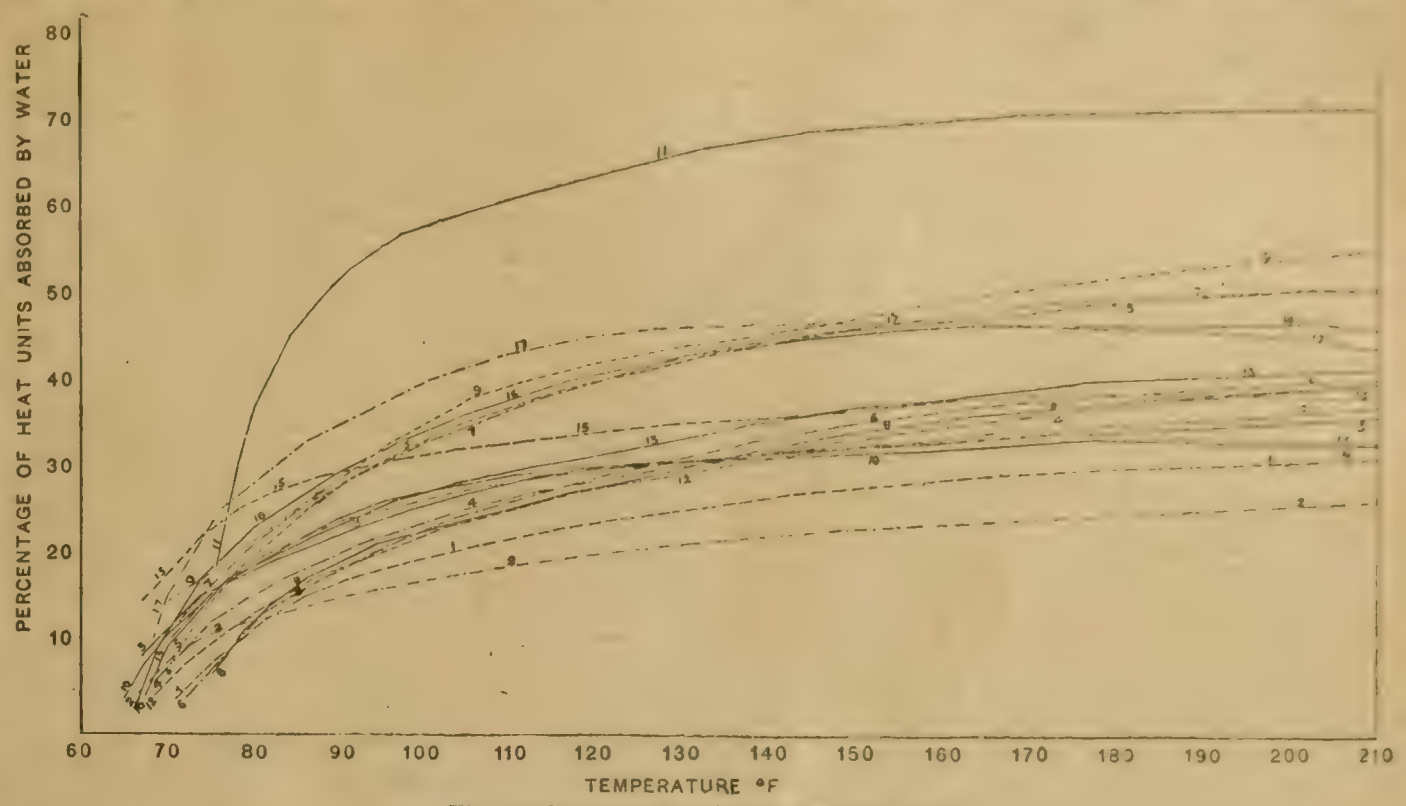


Fig. 3.—Laggings : Comparison of Efficiencies.

Hot plates are generally made with a considerable amount of iron, with the idea that it will act as a buffer and dissipater of heat in the event of the vessel in use being removed and current not being switched off. To avoid this I have devised a simple form of automatic switch, which works in the following manner :—When the weight of the kettle is removed, the hot plate or stand is tilted, causing mercury amalgam in a tube to run down to one end, and so opening the electrical circuit. In preference to using hot plates for boiling water, kettles with self-contained elements will be found quicker, and much more efficient. The heater, encased in copper, should be placed in a false bottom of the kettle, the copper being in metallic connection with the same, so that the heat may be directly conducted to the water.

Another article which has not been largely used up to the present, but possesses great advantages both in efficiency and general utility, is the immersion heater, of which the flat disk type made by the A.E.G. Co. is an excellent example. This is provided with three different ranges of heat, and can therefore be used either for simmering or boiling. Unfortunately, with present rates



The numbers correspond with the table below.

Fig. 4.—Hot-Plate Efficiencies.

of charge for energy, the economical heating of water in large quantities is not practicable.

Owing to the perfect control of temperature and the absence of currents of air in the oven, the loss of weight of meat during cooking is considerably less than is the case with other sources of heat. The generally accepted figure for gas is from 25 per cent. to 30 per cent. of the initial weight, whereas the following figures have been obtained with electric cooking under ordinary working conditions :—

Hot Plates.—Comparative efficiencies when raising 3 pints of water (in 7-in. tin kettle) to boiling point.

Make.	Diameter of hot plate. Inches.	Rate of consumption in watts.	Watts per sq. in. of hot plate.	Time in minutes taken to boil.	Average efficiency throughout test.	Momentary efficiency at end of test.
Archer	8	1,355	26·95	20·5	32·2	40·0
G.E.C. of U.S.A.	8·5	1,341	23·63	26·25	27·2	31·5
Simplex ...	6·5	1,070	32·30	24·0	37·0	40·5
Eclipse... ...	7·25	1,030	24·97	22·75	41·0	42·6
Nightingall ...	7	884	20·31	20·25	51·8	60·9
Tricity... ...	7	871	22·61	25·0	41·4	50·0
Bertram Thomas	7	848	22·15	21·0	52·0	59·5
Eclipse... ...	7·25	810	19·61	27·5	41·0	54·3
Hot Point ...	6	650	22·98	25·5	56·4	73·7
Gen. Elec. Co.	8·5	647	11·41	45·5	33·8	31·8
Gen. Elec. Co.	4	562	44·75	22·25	72·8	73·5
Simplex ...	6·5	560	16·88	44·0	38·3	56·5
Eclipse... ...	7·25	536	12·96	41·0	42·6	55·0
Gen. Elec. Co.	8·5	356	6·27	77·0	34·0	30·9
Simplex ...	6·5	326	9·85	75·0	39·2	38·6
Nightingall ...	7	321	8·35	62·0	47·5	40·3
Tricity... ...	7	216	5·62	96·0	45·2	44·0

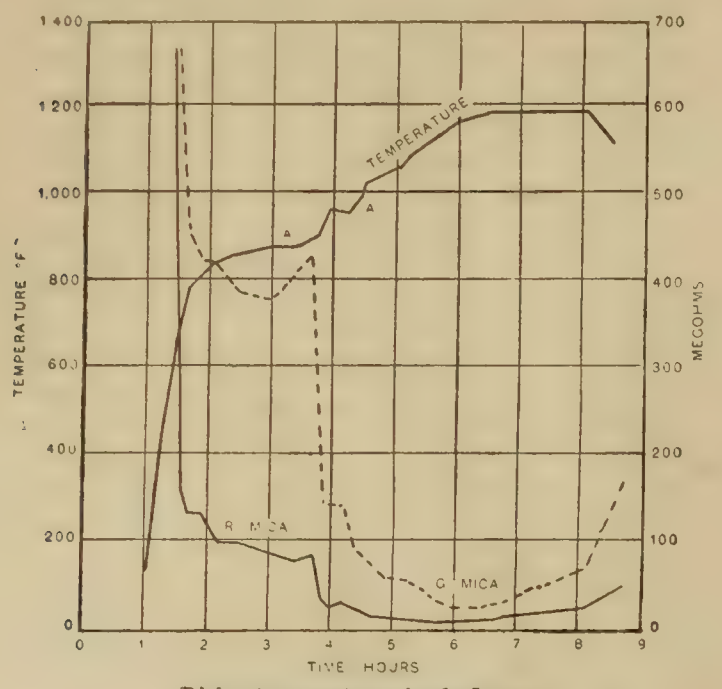
Ordinary weight of joint. lb.	oz.		Loss during cooking. oz.		Percentage of loss.
3	4	...	7	...	13·46
4	12	...	12	...	15·78
4	8	...	12	...	16·6
4	7½	...	12¼	...	17·1

In cooking meat it is advisable to raise the oven to from 400° to 450° F., and then insert the joint, and, after the meat has been subjected to this temperature for about 20 minutes to close the pores thoroughly and seal up the juices in the meat, the temperature should be maintained at about 300°. In this connection it is noticeable how commonly electrically-cooked meat is remarked upon for its excellence of flavour. Further, electricity is particularly suitable for casserole cooking, and the merits of this method of cooking are unquestionable.

With a view to disproving the oft-expressed opinion that the cost of cooking by electricity is so excessive as to restrict its use to the wealthy, I append the records of the cost of same in two installations, giving the number of persons composing the households of each. These figures are based upon the present rate charged by the Melbourne City Council, but it is only reasonable to expect that

any considerable demand for current for this purpose would be met with an adjustment of tariff.

It may be anticipated that the consumption for cooking will be fully five times the amount required for lighting. The rate at which current is taken, and the time of day at which demand is made, are very important points to the electric supply undertaker, and will have a material bearing upon the rate to be



Rising temperature checked at A.

FIG. 5.—EFFECT OF TEMPERATURE UPON MICA.

charged. Although the daily load factor of the supply (*i.e.*, the ratio of mean demand to the maximum) to the individual installation is very low, there is a considerable diversity in regard to the time of day at which the maximum demand occurs, and consequently the average load factor throughout a year or for a number of installations will probably be of a much higher order, and in the vicinity of 25 per cent. to 30 per cent. per annum.

WEEKLY COST OF COOKING.

HOUSEHOLD A.—TWO ADULTS AND TWO CHILDREN.

Week.	Apparatus used.	Units used per week.	Weekly cost at 1¾d. per unit.
1.	Tricity outfit	23·3	3/4·7
2.	Tricity outfit	22·6	3/3·5
3.	Tricity outfit, with a Nightingall kettle	19·3	2/9·7
4.	Do.	16·3	2/3·7
5.	Do.	17·1	2/5·0
6.	Do.	20·7	3/0·0
7.	Do.	15·2	2/2·6
8.	Nightingall non-auto stove, with a Nightingall kettle and A.E.G. immersion heater ...	18·0	2/7·5
9.	Do. do.	13·7	1/11·9
10.	Do. do.	13·3	1/11·3

HOUSEHOLD B.—THREE ADULTS.

1.	Eclipse outfit	42·0	6/1·5
2.	Do., with a Nightingall 5-pint kettle and two G.E. 4-in. hot plates and immersion heater	29·5	4/3 6
3.	Nightingall non-auto, with two G.E. hot plates, kettle and immersion heater	26·5	3/10·3
4.	Do. do.	20·2	2/11·3
5.	Do. do.	15·9	2/3·8
6.	Tricity outfit, with immersion heater and Nightingall kettle	18·2	2/7·8
7.	Tricity outfit, with Nightingall kettle	14·1	2/0·7
8.	Do. do.	12·1	1/9·2
9.	Do. do.	10·8	1/6·9
10.	Do. do.	14·0	2/0·5

To avoid the use of separate tariffs for cooking and lighting, it will probably be found advantageous to charge for all energy required for domestic purposes at a special domestic rate on some such lines as the following :—

(*a*) A fixed monthly sum per KW. of maximum demand to cover the capital charges entailed to supply same.

(*b*) A charge of ——— per unit to cover the supply costs.

A device would have to be installed limiting the maximum demand of each consumer, but he would have the power of increasing this amount at any time should it prove inadequate. Such a system of charging would undoubtedly have the effect of improving the load-factor, and at the same time would greatly encourage the use of domestic appliances. For instance, the dinner being cooked, the consumer could use the current for radiators at probably less than half the present rate charged for it.

At the present time the majority of cooking outfits cost from £15 to £20. This may not be a serious objection to the wealthy, but the middle-class householder will want a complete outfit at from £5 to £6, and I see no reason why this demand should not in time be met. The apparatus should preferably be installed and connected by the supplier of the article, so as to avoid division of responsibility. It is absolutely necessary that this work be carried out in the best possible manner, and that every care be taken to ensure reliability of working and to avoid possibility of shock.

The selection of suitable switches is an essential point, as a number of those at present on the market cannot be relied upon for regular and continuous work.

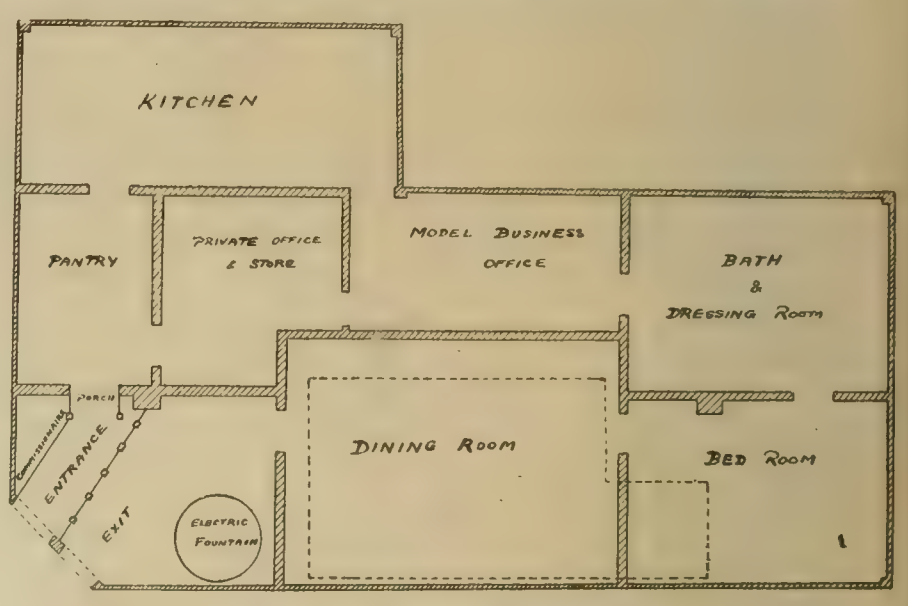
From a safety point of view, it is necessary that all apparatus should be earthed, if installed in such a position that it is possible to touch it and make contact with independent earth at the same time. Ordinary flexible cords are a source of weakness, and where possible should be replaced by flexibles with an earthed armouring. Judicious use of pilot lights is also desirable in order to keep down the consumption of current, to save the apparatus from overheating, and the cook from the chance of burning herself.

A wide field of usefulness awaits the application of electric heating in the home. As an illuminant it, of course, stands unrivalled, and as the cleanest, healthiest, surest and most convenient source of heat and power, it will rapidly gain favour as a means of cooking and room heating, and in connection with those varied mechanical appliances to which the housewife will turn, to find at least a partial solution of the domestic labour problem.

LA MAISON ELECTRIQUE AT OLYMPIA.

THROUGH the agency of the Electric Supply Publicity Committee, a number of London Electric Supply Companies are arranging an electrical exhibit at the forthcoming Ideal Home Exhibition, which opens at Olympia on October 9th next. The exhibit will take the form of a fully equipped electric house, and will be known as "La Maison Electrique." This title has been chosen for the reason that the most striking features of "La Maison Electrique," which has been so successful in Paris, are to be specially brought over for this occasion. The chief of these, of course, is the electric dining table illustrating the possibility of a dinner being perfectly served without the visible intervention of servants. Thus M. Knap's wonderful dining table with its ingenious combination of electrophone, periscope, service lift and travelling rails and its accompanying decorative details, however unattainable it may be for the ordinary householder, will serve to draw the attention of all visitors to the Committee's stall.

This will be arranged on the plan shown below. The exterior will present the appearance of a building in old English style, in which a number of apertures have been cut to enable the passer-by



PLAN OF LA MAISON ELECTRIQUE.

to look into the rooms. The entrance and exit will be through a garden forecourt daintily dressed with climbing roses and flowering plants, and containing an ornamental fountain illuminated from below by coloured lights.

Those who wish to make a closer inspection of La Maison Electrique than is possible from a walk round outside, will be admitted on presentation of visiting card or on signing the visitors' book, and small parties, each in charge of a demonstrator, will be conducted through the suite of rooms forming the interior. These rooms in the order visited are: pantry, kitchen, business office, dressing and bath room, bedroom and dining room, the tour ending by the visitors seating themselves at the dining table and taking part in its operation.

In the course of their tour the visitors will have had their attention drawn to every style of electric lighting available for domestic purposes, special ceilings being erected in the office and dining-room for the display of indirect and semi-indirect fittings. They will also have seen every kind of apparatus for heating, cooking, ventilating, ironing, cleaning, polishing, and many other operations. These will all be shown in actual use, the bigger articles being in charge of special attendants, whose duty it will be to keep them in constant operation.

It may be stated that the staff employed at La Maison Electrique to maintain it in full activity will number nearly 30, and we are

informed that no effort will be spared to provide the public with a show at once instructive and interesting.

Over 100 electrical appliances will be displayed, and the great difficulty before the Committee has been to avoid showing more than one or two types of the same thing. This difficulty has, however, been avoided, except in the case of appliances such as radiators, vacuum cleaners and fans, of which it is possible to show a different make in each room. No duplicates will be found together in any one room. One purpose achieved will be to show the public that there is hardly a single piece of domestic work to which electricity may not be applied with advantage. The possibility of mere bewilderment at this hurried lesson in electricity counteracting its educational value, has been foreseen, and each visitor to La Maison Electrique will be presented with a 30-page booklet containing information and argument in favour of the cleanliness and convenience of the electric domestic service. In the production of this book the assistance of a large number of manufacturers has been secured. An edition of 100,000 copies is being prepared, and it is hoped that the good work of the exhibition will be supplemented and carried on for many months by the presence of this book in the homes of those who have visited La Maison Electrique. In order to attract attention to the House, the Committee has produced an effective poster, of which some 4,000 copies will shortly appear. These will naturally be displayed, so far as the Electric Supply Publicity Committee is concerned, in the districts of those companies which are bearing the



La Maison Electrique Poster.

financial burden of this enterprise, but all who wish to excite the interest of their own local residents can buy copies from the Committee. A reduced reproduction of this poster is given above. It is also issued in the form of a coloured postcard, and as a label for attaching to correspondence, and supplies of these may likewise be purchased by those who desire to make use of them. As our readers already know, a strong bid for popular favour is shortly to be made at the National Gas Exhibition, and it is considered that the Ideal Home Exhibition affords an opportunity for providing an antidote to the impression that the gas companies will seek to create. We are informed that it is offered to the electrical industry in London and the surrounding districts through the public enterprise of a few only of the many undertakings operating in the area, and the fullest advantage should be taken of it. It is to be regretted that financial support has not been given more widely, but we learn that those who are associated on this occasion will be content if their action results in better co-operation for the future.

LEGAL.

Electricity in Mines: Prosecutions.

At the Old Hill Police Court on Wednesday in last week, Messrs. Robert Brown Fellows, Ltd., proprietors of the Corngreaves Colliery, Cradley Heath, were summoned for unlawfully permitting certain cables in the mine, not being flexible cables for portable apparatus or signalling wires, to wit, cables in the main dip and in the roadway to the right at the foot of the main dip, not to be covered in certain parts with insulating material, contrary to Rule 12 of the electricity rules. They were summoned for unlawfully permitting the live parts of certain electrical terminals in the mine, to wit, the switchboard ammeter terminals in the 7-H P. motor house in the main dip, not to be so constructed and installed that they were so protected or enclosed as to prevent accidental contact by persons, contrary to Rule 10 of the electricity rules. Two similar summonses were preferred against Isaac Meacham, of Perry Park House, Blackheath, the manager of the colliery. Messrs. Fellows, Ltd., and Mr. Meacham were further summoned under the Factory and Workshops Act for permitting a certain fuse to be in use in the electrical generating station which was not so constructed, or so guarded or placed, as to prevent danger from arcing or the scattering of hot metal when in operation, contrary to Regulation 5 of the electricity regulations.

Mr. Hugh Johnstone, Chief Inspector of Mines, who prosecuted, explained that electricity, for reasons of efficiency and economy, was largely used in coal mines, but if not properly installed and maintained, the apparatus was a source of great danger. It was of the greatest importance that all live parts should be sufficiently protected, for any failure in this respect might result in persons coming into contact with them receiving a shock, which, under ordinary conditions, might be serious, and under certain circumstances might prove fatal. The Government laid much stress upon this point, and also provided that examinations should be made and reports of them placed before the manager of the colliery. On May 27th last Mr. Felton, an Assistant Inspector, visited the pit in company with Mr. R. Nelson, an electrical inspector appointed by the Home Office, and in the course of their examination they found a number of defects in the electrical apparatus which might have had serious consequences. As a matter of fact, they discovered 16 bare parts in the cables. Each part constituted a separate offence against the Act, but he had decided to proceed upon two summonses only. They also found that the fuses at the generating station were so constructed as not to prevent danger from arcing or the scattering of hot metal when in operation.

Mr. Robert Nelson, electrical expert from the Home Office, said he visited the colliery on May 27th, and found there were two systems of electricity, a direct current with 220 volts, and an alternating system with 200 volts. Either of the systems would cause a shock which might result in a fatality. He followed the cable down the dip, and he found faulty wires, which showed evidence of poor maintenance. He also saw some bare parts. Near the bottom of the dip was a motor driving a pump, and close to the switchboard was an ammeter on which were bare terminals. On the road to the right at the bottom of the dip he found two defects in the cables. In the main road he saw thirteen defects, and one on the switchboard at the top of the dip, making sixteen in all. It would not require an expert to find them. A lamp had been cut away, and the ends were live.

In reply to Mr. W. Waldron, who defended, witness agreed that most of the bare parts had probably been caused by the dropping of some material from the roof. The inspection, it was added, lasted two-and-a-half hours, and all the defects could be repaired within two hours. Mr. Waldron submitted that as Mr. Robert Fellows took no part in the management of the colliery, he could not be held responsible. In the case of Mr. Meacham, he was not conversant with the electricity regulations, the work being delegated by him to a qualified electrician. He contended, therefore, that the latter was the proper person who should have been proceeded against.

In the result, Messrs. Fellows, Ltd., were find £2 and costs for permitting the cables to be exposed, and the other case against the company, that relating to the Factory Act, was dismissed on payment of costs. The cases against Meacham were also dismissed.

In Hamilton Sheriff Court on 5th inst. two prosecutions under the Coal Mines Act were called. In the first, Robert Wilson Drod, mining engineer, Bearsden, and James Dalglish, colliery manager, Motherwell, were the parties charged, the former being agent, and the latter manager of Dalzell and Broomside Colliery, Motherwell, occupied by the Wishaw Coal Co. The complaint libels 12 different offences in the mechanical and electrical fittings of the pits mentioned between March 15th and April 16th last. The electrical section of the complaint alleges (1) failure to have certain fuses in the distributing box forming part of the electrical apparatus in No. 2 pit so protected and enclosed as to prevent contact by persons; (2) failure to cover with insulated material a number of unarmoured cables; (3) failure to have properly secured by some non-conducting and readily breakable material certain cables; (4) in certain seams in No. 2 pit failure to take adequate precautions to prevent the signal wires getting attached to the cables therein; (5) failure to have an earth conductor at the gate-end box in the black-band seam of No. 2 pit; and (6) failure to have a flexible cable for the portable apparatus in the pony level. In the second prosecution, James McNeil, colliery electrician, Wishaw, is charged with eight offences, all relating to alleged defects in the electrical apparatus and equipment of the colliery for which he is responsible. Before the respondents were asked to plead, the Fiscal agreed to an adjournment of the cases so as to permit a discussion on certain pleas dealing with the relevancy of the charges.

In the Hamilton Sheriff Court on Friday last, a point was raised before Sheriff Hay Shennan in reference to the statutory duties of colliery electricians. The matter arose in connection with a prosecution, at the instance of the Home Office, against James McNeil, colliery electrician, Wishaw, who was charged with permitting defects in the electrical apparatus and equipment of Dalzell and Broomside Colliery, Motherwell.

Mr. Nicol F. Cameron, writer, Glasgow, who appeared along with the respondent, submitted that the first seven of the eight charges formulated were irrelevant. The duties of an electrician under the Special Rules were the examination of apparatus, the

examination and testing of new apparatus and the keeping of a log-book. There was nothing in the Rules about supplying anything. In the complaint there was reference to four fuses, which respondent was charged with having failed to see properly constructed and installed; and he was also alleged to have failed to keep certain coverings, earth conductors and flexible wires properly secured. He submitted that these were outside respondent's duties.

The Fiscal said that if Mr. Cameron's interpretation of the Rules was correct, the whole tenor of the Act was to be disregarded, as, according to the view now submitted, the electrician was a non-entity at a pit. The electrician, he held, had to discharge his duties in accordance with the whole of the electrical Rules, and not merely a particular section of them.

Sheriff Shennan said he would reserve judgment on the point raised, but in respect of the eighth charge, he fixed Friday, 26th inst., as a diet for proof.

Sheriff Shennan on Monday issued a written judgment, in which he gave his opinion that the objection to the relevancy must be sustained. His Lordship said he failed to find any duties specifically imposed on the electrician, except those contained in sub-heads (*c*) and (*d*) of Special Rule 14, namely, (1) the thorough examination of all apparatus as often as may be necessary to prevent danger; (2) the examination and testing of new apparatus and of apparatus re-erected; and (3) the keeping of a log-book. He did not find what might be called executive duties imposed on the electrician. It seemed to him (Sheriff Shennan) that the scheme of the Rules was to put the electrician in the position of technical adviser, and the results of his examination and inspection being entered in the log-book, it then became the duty of a colliery manager to see that the necessary work was carried out.

Workmen's Compensation.

Joseph Clegg, of 34, Roundthorn Road, Oldham, whilst employed as a labourer by the Brush Electrical Engineering Co., Ltd., of Falcon Works, Loughborough, injured himself at the Oldham Corporation Electricity Works on October 22nd, 1912, by falling through a movable floor. Until January 27th, 1913, Clegg was totally incapacitated from work, but he has since been continuously employed at a lighter task. He received 16s. 10d. per week as compensation till March 31st, and the company now paid £20 to terminate the liability. At the Oldham County Court on Thursday last week, applicant was allowed that amount.

An Acquittal.

Before Judge Lumley Smith, at the Central Criminal Court, last week, Hubert Eustace, 41, described as a traveller, was found not guilty of a charge of obtaining three small sums of money by false pretences from his employers, the Electrical Co., Ltd., of Charing Cross Road, W.C., and was discharged.

The X.L. Electric Co.'s Litigation.

A further stage in this litigation was reached when on Wednesday, September 17th, application was made to Lord Justice Swinfen Eady to stay proceedings under the order made by the Vacation Judge the previous week in the debenture-holders' action of Wiener *v.* the X.L. Electric Co., Ltd., restraining the company from abandoning an application for final protection of an invention sold by Mr. Aron to the company.

The application was made under Sec. 52 of the Judicature Act of 1873, and his Lordship was asked to make an interim order to prevent the claim of the defendant company being prejudiced pending the hearing of an appeal.

Counsel, in support, stated that Mr. Justice Bailhache as Vacation Judge had made what was in effect a mandatory order, after hearing merely a short statement of facts and without having the respondent's evidence before him.

His Lordship pointed out that he was not hearing the appeal; all he had to do was to see that the applicants were not prejudiced by the interim order. How, he asked, would they be prejudiced if they complied with the order?

Counsel said that there was an application pending for a further patent which was partly comprised in the patent in question. The new patent would come within the plaintiff's charge, so he would in no way be prejudiced.

Counsel for Captain Wiener pointed out that the new patent was being applied for by Mr. Aron and Mr. Harrison, both of whom were hostile to him.

His Lordship said the application was made on insufficient evidence. He thought the applicants had made out no case for any interference with the order made by the Vacation Judge. The application therefore failed, and must be dismissed with costs. His Lordship added that he was, of course, merely dealing with the matter of prejudice, and nothing he had said would in any way affect the appeal.

Concert.—The Fulham branch of the Electrical Trades Union held a smoking concert at Fulham Town Hall on Saturday last, September 13th, in aid of the widow and five young children of the late Brother Alexander Sinclair. Mr. John Pearce, of 11, Bendemere Road, Putney, acted as hon. secretary.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Townshend's New Table Cooking Devices.

A new coffee machine has recently been developed by Messrs. Townshend's Art Metal Co, Ltd., of 62, Holborn Viaduct, E.C. The apparatus is based on a well-known system of coffee extraction, which has been simplified and adapted to electrical working, and is illustrated in fig. 1. When current is switched on, hot water is raised from the highly plated metal flask into the upper glass bowl, where it is agitated with the ground coffee by steam bubbling through it from below. When the current is switched off, the residual heat in the element is sufficient to complete the process of making the coffee, which is then automatically forced through a filter pad by atmospheric pressure. The coffee produced contains



Fig. 1.—Townshend Coffee Maker.

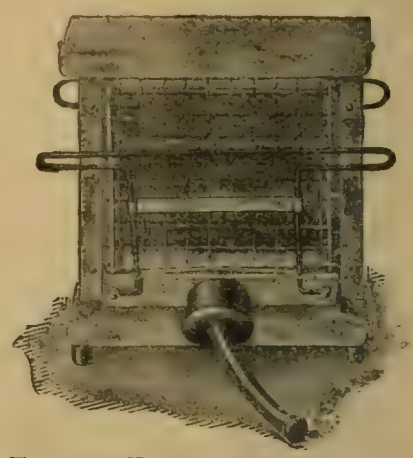


Fig. 2.—Townshend Toaster.

the whole of the soluble extracts from the berry, and is absolutely free from sediment. If hot water is used, and current applied from any ordinary lampholder, the cost of the electricity consumed is inappreciable, being about $\frac{1}{30}$th of a unit.

As the heating is effected by the condensation of steam, the temperature is never great enough to drive off the volatile oils from the coffee, and the whole of the aroma and fragrance of the coffee is retained in the infusion.

The toaster illustrated in fig. 2 has been specially introduced to meet the demand for an effective toaster at a moderate price, and is ornamentally constructed in hammered aluminium and nickel-plate. In addition to being an ornament to the table, it is scientifically constructed, the heating element being carefully graduated to produce a uniform temperature over the whole of the toasting surface—no gaps are permitted. As the element is run at a temperature below red heat, the effect of oxidation is eliminated, so that the apparatus is practically indestructible. Care is taken that both heat and electricity are insulated. Non-conducting feet are provided, and the electrical connection is made of one piece of substantial material, provided with a spring to prevent wear on the flexible cord. The current taken is 1½ amperes, so that it can be connected to any lampholder without special wiring. The toast produced is uniformly browned, and is crisp without becoming dry.

"Lotolite" Glassware.

The British Economical Lamp Co., Ltd., of 9, Old Bailey, E.C., are marketing, amongst various patterns of crystal glass reflectors, the two types illustrated in figs. 3 and 4, the former

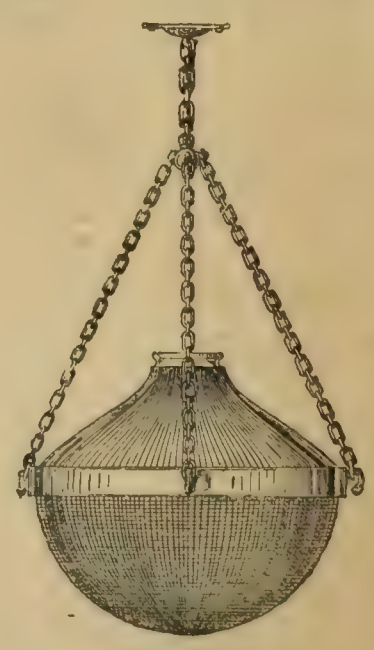


Fig. 3.



Fig. 4.

"Lotolite" Crystal Fittings.

being a concentrating hemisphere used with a reflector to give uniform floor lighting and suitable for shop lighting, &c., and the latter a distributing sphere for giving uniform lighting in all

directions, the lamp being entirely enclosed. The sphere is particularly well adapted for the lighting of public rooms, hotels, cafés, &c. Both glassware and fittings are supplied, the sizes varying from 10 in. to 16 in. diameter.

Ironclad Crane Panels.

A new form of crane panel has recently been designed by the General Electric Co., of 67, Queen Victoria Street, E.C., which is intended to meet the very exacting demands of crane work. It consists of a standard Salford switch and a distribution board mounted on a strong iron framework, together with pilot lamps and an inspection lamp plug. The switch is completely separate from the distribution board, and the main fuses are contained in the switch case. These fuses are enclosed in separate fireproof compartments, and the interior of the case is protected by insulating material against any arc from the switch.

The inspection lamp plug is connected to the top contacts of the switch, so that the crane driver can use the light irrespective of whether the main switch is open or closed. In order to afford the operator an indication as to whether the power is on his controller, two pilot lamps are provided which are alight the whole time the

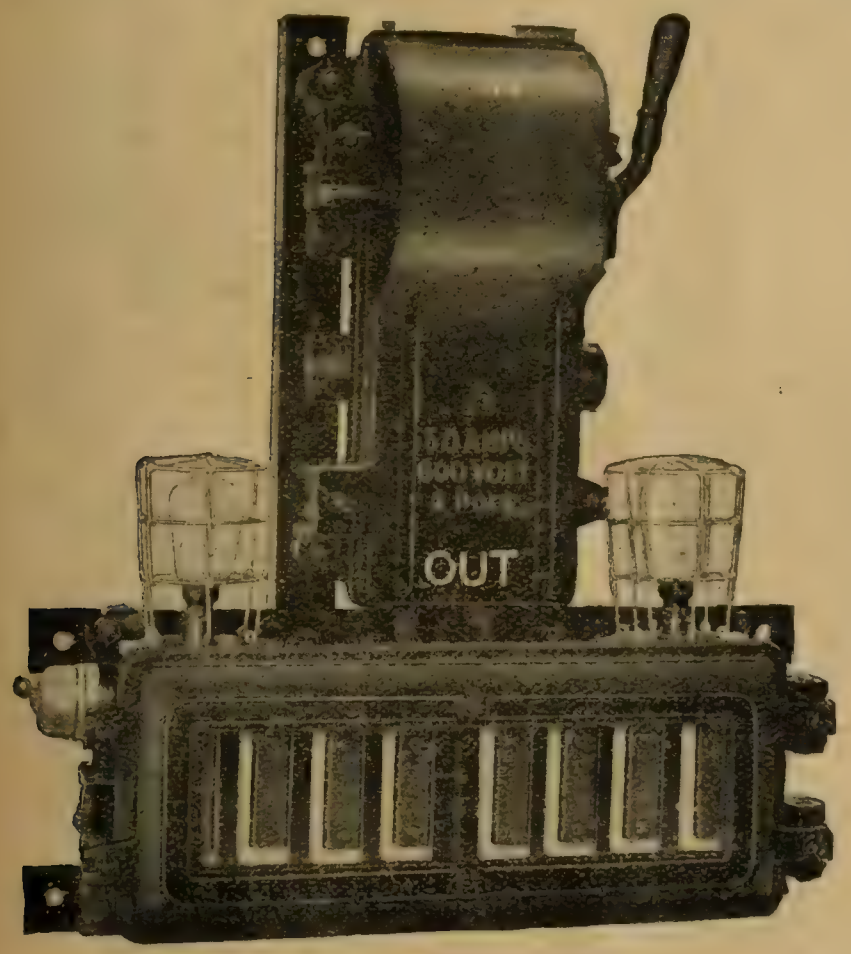


Fig. 5.—G.E.C. Ironclad Crane Panel.

switch is closed. The switch blades are interlocked with the cover of the switch, so that it is not possible to close the switch with the cover open, or to open the cover with the switch closed. Both the inspection lamps and the pilot lamps are protected by fuses fixed on either side of the switch case.

In view of the heavy loads which may be imposed upon the fuses in the distribution board, great care has been taken to ensure that the clearances between the fuses are adequate, and no attempt has been made to sacrifice safety to compactness. The fuses are of the Home Office pattern, and it is impossible for the hand to touch a live part accidentally whilst inserting or removing a fuse. The cables from the bottom of the main fuses can be conveyed from the switch case to the distribution board in conduit. These crane panels are made for D.C. and A.C. work, in sizes from 50 to 200 amps. at 500 volts.

G.E. Co. Continuous-current Motor Starters.

The General Electric Co., Ltd., have developed a line of standard D.C. starters, in which facilities are provided for the renewal and adjustment of those parts subject to the most wear. The new patterns range from ¼ H.P. to 100 H.P., for pressures up to 500 volts. A noteworthy feature in the small sizes is a self-aligning contact block, which adapts itself to the irregularities in the contacts which inevitably occur in practice through arcing. The contacts of all G.E.C. starters are ground true in place on the face plate. Several outside improvements have also been included in the larger sizes, Nos. 4 and 5. No. 5 is shown open in fig. 6. All the contacts are renewable from the front, so that should one require replacement, it is only necessary to take out two screws and it comes away bodily. In the running position the resistance is short-circuited by a brush, and both the stops against which this short-circuiting brush rests are adjustable, so that if, after considerable wear, the brush exerts an uneven pressure on the two contacts, they may be readily adjusted. No-volt coils are usually set to release at 75 per cent. of the normal voltage, but users are often mistaken in the exact voltage of supply. They overstate the pressure, with the result that the no-volt coil may sometimes have an insufficient holding-on power. To meet this in the G.E.C. starters, the no-volt coil is made detachable, and special instructions are sent out attached to each no-volt coil so that, should it not hold on sufficiently well the user will know how to take it out for return. This can be performed in a few seconds. For making the main contact in the larger sizes of starters there



Fig. 6.—Type 5 G.E.C. Starter with Cover Removed.

are two brushes, one a carbon brush and the other a brass or copper brush, the carbon brush taking any arc that may be formed, and so preserving the contacts. Other features are a self-aligning contact block, solid terminals for the incoming cable, and an overload trip adjustable over a wide range. These starters are built in the open, semi-enclosed and totally-enclosed cover patterns, the latter having a window, through which the contacts may be inspected. A waterproof pattern can also be supplied.

BUSINESS NOTES.

Half-Watt Lamps.—In connection with recent Press announcements regarding this epoch-making invention, we are asked by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., to state that the Osram works are at the present time manufacturing half-watt lamps under full patent rights, and will be in a position to place same on the market in the very near future.

Strike in Russia.—A strike of 250 employés of the Allgemeine Electricitäts Gesellschaft at Riga has taken place.

Embezzlement in Sweden.—At the Helsingfors branch of the Allgemeine Elektricitäts Gesellschaft embezzlements to the extent of £10,000 have occurred. A female cashier and a manager have been arrested.

Electric Sign Business.—A London evening paper last week contained a prediction by Mr. A. H. Brackensieck, of the Franco-British Electrical Co., Ltd., of a coming boom in electric advertising signs. He said that during the last 10 years the rent of good wall spaces for electrical sign advertising had increased by between 100 per cent. and 150 per cent. Despite this increased cost he says that there is undoubtedly a boom in prospect for the new method of advertising. Big American cities have gone the "whole hog" on big animated signs, and Paris and Berlin are far ahead of London in advertising devices. But London is waking up. Glasgow is the next British city and Liverpool third in importance to go in for the new method. An order for an electrical sign in Hindustani came from India. The "clown juggling sign," which popularised Terry's cinema in the Strand, has been copied in Bristol and Glasgow, and is to be copied in Hong Kong. The juggling will there be done by a clown and a Chinaman. Some novelties in advertising in London are promised shortly.

Private Arrangements.—Thomas Osborne Morgan (trading as the South Wales Accessories Co., formerly the Electrical Wiring and Accessories Co.), Boot Chambers, Market Street, Aberdare, wholesale electrical, motor and general engineers' merchant. —A meeting of the creditors interested in the above matter was held on Thursday, September 11th, at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, London, E.C., when Mr. Rich, representing Messrs. Siemens Bros. Dynamo Works, Ltd., was elected to the chair. A statement of affairs was presented showing liabilities amounting to £2,474, and net assets £834, or disclosing a deficiency of £1,640. The liabilities were made up of the claims of trade creditors, £839; cash creditors (debtor's father, £500; debtor's wife, £300; bank overdraft private account, £304; business account, £451), £756; and contingent liability expected to rank, £79. The assets were as follows: Stock-in-trade (£519), estimated at £386; fixtures and fittings (£46), estimated to produce £23; office furniture (£22), valued at £11; motor-car (£100), expected to produce £50; good book debts, £350; doubtful and bad book debts (£247), expected to produce £30; and cash in hand £4. The assets, therefore, totalled £856, from which had to be deducted preference claims amounting to £22. Mr. Houston (Messrs. Corfield & Cripwell) dealt with the statement of affairs. Considerable discussion took place. Mr. Thomas, the debtor's

solicitor, said that a writ had been issued, and something had to be done to protect the whole of the creditors. He personally knew the debtor's father, who was in a very good position, and one of the best respected men in Aberdare. Mr. Morgan, the debtor, entered the business when electricity was just being introduced into Aberdare. An electrical scheme had just come into force in the town, and the speaker thought that if the debtor was given an opportunity of going on he would be able to recover himself. Mr. Morgan, he said, had not neglected the business in any way, he was a very good worker, and he thought there was every prospect of the business being carried on successfully in the future. He was authorised to offer a composition of 5s. in the £, cash down. The creditors present declined to accept this offer, and pressed for 10s. in the £, but Mr. Thomas said he could not possibly see his way to offer this. After conferring with the debtor, however, he said he would stretch a point, and increase the offer to 7s. 6d. in the £ off his own bat, as it were. After some discussion, it was proposed by Mr. Rich (Siemens Bros. Dynamo Works, Ltd.,) and seconded by Mr. Hodd (Falk, Stadelmann & Co.), that a deed of assignment should be executed in favour of Mr. C. E. Corfield, with power to resell the estate to the debtor's nominee for a sum equal to 7s. 6d. in the £ on the amount of the liabilities to trade creditors, and all expenses incidental to the deed and costs of suing creditors, the cash necessary for the composition to be deposited with the trustee within 14 days, the trustee to have the power to realise the estate in the event of the money not being deposited as agreed. A committee of inspection was also elected. The following are creditors :—

Armorduct Manufacturing Co.	£65	Kynochs, Ltd.	£73
British Westinghouse Co.	12	Metallic Seamless Tube Co.	23
Calmont, King & Co., Ltd.	92	New Gutta-Percha Co., Ltd.	18
City Glass Co.	15	Spencer, J. E. & S.	20
Crosbie, Marriner & Co., Ltd.	12	Siemens Bros. Dynamo Works, Ltd.	101
Drake & Gorham, Ltd.	28	Simmons, E. & R., Ltd.	19
Electric and Ordnance Accessories Co., Ltd.	63	Wholesale Fittings Co., Ltd.	14
Falk, Stadelmann & Co.	22	Creditors under £10	217
General Cable Manufacturing Co.	40		

Book Notices.—"The Management of Public Electric Supply Undertakings." By A. Hugh Seabrook. 1913. London: Office of *Electrical Times*. Price 7s. 6d. net.

"The President's Address and Sectional Addresses at the British Association Meeting, Birmingham, 1913." London: The Offices of the Association. Price 2s.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 4. August, 1913. Toronto: The Society.

"Determination of Sulphur in Illuminating Gas." By R. S. McBride and E. R. Weaver. "Dehydration of Clays." By G. H. Brown and E. T. Montgomery. Washington: The Government Printing Office.

"*Journal* of the American Society of Mechanical Engineers." September, 1913. New York: The Society. Price 35 cents.

"*Journal* of the American Institute of Architects." August, 1913. Harrisburg, P.A.: The Institute. Price 20 cents.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. August, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 6. August 30th, 1913. Liége: The Association. Price 5 fr.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 16. August 30th, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

The Central for September contains, amongst other interesting items, articles on Cable Laying in the Antipodes, by B. S. Lion—an expedition in which five old Centralians were engaged; the Low coal engine and petrol engine; the Leclanché Battery, by M. Solomon; and the Science of Eating, by Dr. E. F. Armstrong—altogether a very good issue.

A neat folder giving standard metric equivalent tables, based on official figures, has been issued by the Central Translations Institute, of 265, Strand, W.C., and is arranged in a very convenient form for quick reference.

Bankruptcy Proceedings.—Roger William Wallace, K.C., 36, Campden Hill Gardens, Kensington.—A first meeting of creditors was held at the London Bankruptcy Court on 12th inst., when Mr. Egerton Gray (Official Receiver) reported that the debtor had submitted a statement of affairs showing unsecured liabilities £73,678 and assets estimated to produce £75,070. For some years his income at the Bar averaged £6,000 or £7,000 per annum. During the last five or six years he had given practically the whole of his time to experimenting in chemistry and had patented inventions for the making of nitric acid, ammonia, and various by-products from the electrical treatment of air. No company had yet been formed in connection with them, but the debtor valued them at a quarter of a million; he had been interested in some 20 public companies and was at the present time a director of seven, his fees amounting, roughly, to £1,300 per annum. The principal debt, £35,000, was due to Mr. Henry Du Cros, in connection with Gas Traction, Ltd. Debtor does not admit that he is insolvent, and attributes his position at the moment to the general financial depression during the last year, which precluded the finding of the capital necessary to finance his inventions. He considered that there would be ample funds for all his creditors if he were left to deal with the patents. Mr. Burn asked for the meeting to be adjourned for three weeks, to enable a scheme of arrangement to be submitted. Mr. H. Crewdson Howard, chartered accountant, was appointed to act as trustee and administer the estate in bankruptcy, with the assistance of a committee of inspection. The Chairman will give debtor eight days' notice of his application to the Court for an order of adjudication.

John Dale Nixon (J. D. Nixon & Co.), electrical and mechanical engineer, 65, Mill Street, Crewe.—Receiving order made September 5th, on debtor's petition. First meeting, September 18th; public examination, September 26th.

C. H. Steel, electrical engineer, Bradford, late of Cardiff and Merthyr Tydfil.—Trustee (Mr. G. David) released July 21st.

— Prested, electrical engineer, St. John's Lodge, St. John's Park, Holloway.—A bankruptcy petition has been presented by H. Hall, and will be heard on October 1st.

F. L. Woilliard-Rigg and H. E. Scarborough, electrical and mechanical engineers, Halifax.—Supplemental dividend of 1s. 2½d. in the £, payable September 20th, at 12, Duke Street, Bradford.

American Factories in Canada.—The F. B. Sturtevant Co., of America, have decided to establish a factory at Galt, Ontario, where they will manufacture for the Canadian market their fans, blowers, heating and ventilating apparatus, &c. Governor Foss, of Massachusetts, is interested in this company, and relevant to the new enterprise he makes the following statement: "All over the United States the tendency among the principal manufacturing interests is toward the establishment of plants in Canada. This movement has been going on for many years, and it is estimated that from three to five hundred million dollars of United States capital is now invested in these Canadian plants. The Sturtevant Co. must join the procession in order to meet the conditions of the industry, for the movement has now proceeded to a point where corporations which fail to follow are faced with serious embarrassment. American manufacturers have completely filled the American market, and their production is now greatly in excess of the domestic demand. Under these conditions the expansion of their domestic plants is impossible, and it is becoming necessary for them to curtail production. This movement of American manufacturers to Canada could be stopped and they could remain intact in this country if it were not for the absurd conditions created by our tariff legislation."—*Commercial Intelligence.*

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Twelve-page catalogue of special designs of semi-indirect lighting fittings ranging from under a sovereign to £10. The firm supplies four different kinds of glassware for use with indirect lighting, namely, "Luxuro," "Intaglio," "Onyx," and "Alabaster." "Real Alabaster" bowls can be quoted for where required. In most cases the fittings are also made suitable for use with the new inverted dish-type of Holophane reflector for semi-indirect lighting, and prices are given for fittings using this glassware.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Sheet No. 404/1 giving description with illustrations, prices and dimensions of their totally-enclosed emergency switches of the self-resetting type for cranes, hoists, lifts, or for signalling purposes.

Messrs. Johnson & Phillips, Ltd., Victoria Works, Charlton.—Thirty-six-page catalogue ("K"), giving full information respecting their arc lamps and accessories. In the several sections there are published descriptions of the "Metroflam" flame lamp and the "Orb" enclosed-type lamp, with many pages of pictures giving examples of street, works, railway and other lighting effected by their lamps. Prices are tabulated clearly, and there is a comparative estimate of high-pressure gas and flame arc lighting. Illustrations and prices also appear of line resistances, transformers, choking coils, switches, control gear, brackets and pillars, and raising and lowering gear.

Messrs. A. Schonfield & Co. (Glasgow), 21, Hope Street, Glasgow.—Twelve-page pamphlet, containing illustrated description of the Grundy system of automatic temperature control and their patent hygienic "Hestia" electric stove. The control apparatus can be used on other types of heater as well. The Hestia stove is shown with and without luminous panel and also wholly luminous. Prices and other cost particulars are included.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—24-page catalogue (C. 535) containing brief particulars, illustrations and prices of their telephones and telephone switchboards for private installations.

Messrs. John Dugdill & Co., Failsworth, near Manchester.—32-page catalogue showing a great variety of applications of their patent movable fittings for electrical, gas, telephone, textile and engineering works, and other purposes. Prices are quoted.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—No. 2 of the "Scholey Magazine" (September) contains a photograph of Mr. A. H. Stanley, of the London underground systems, notes on flame arc lighting with a description of the "Flarion" lamp, an illustrated article (part II) on the automatic electric lift, and particulars of the firm's other specialities including the "Indesca" bell transformer, the Vulcan electric wax melter and the Vulcan electric soldering tools.

Messrs. Belling & Co., Derby Road, Edmonton, N.—Twenty-six-page catalogue concerning Belling electric fires. Many patterns are illustrated for office purposes and private residence service. Features of the list include a combined heater and afternoon tea-tray and a large dog grate. Dimensions, particulars as to finish, and prices, are included.

The Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Twenty-page list (No. AE 77), of electric tools. Descriptive information is given relating to portable electric drills and grinders, bench drills, drill posts (mechanical and electromagnetic), commutator grinding outfits, electromagnetic chucks, fixing plates, &c. Prices, weights and dimensions are given.

For Sale.—Two second-hand de Laval steam turbines and shunt dynamos 34·5 KW. 230 volts, are offered for sale by the Devon County Asylum authorities. See our advertisement pages to-day for particulars.

Bennis Stoker Contracts.—MESSRS. E. BENNIS & CO., LTD., have recently secured the following orders:—

Mersey Railway Co. Power Station, Shore Road, Birkenhead.—Two chain grate stokers, 11 ft. wide by 9 ft. 2 in. long.

Keighley Electricity Works.—Two stokers and self-cleaning compressed air furnaces for an 8-ft. Lancashire boiler (repeat order).

Bexley Heath Urban District Council Electricity and Trams Department.—Two self-cleaning compressed air furnaces.

Stirling Electricity Works.—Four stokers and self-cleaning compressed air furnaces for 8-ft. diameter Lancashire boilers.

Catalogues Wanted.—MESSRS. PRINTZ & CO., LTD., Esk Street, Invercargill, New Zealand, want catalogues and export terms for electric fittings, motors and dynamos (A.C. and D.C.), electric signs, &c.

Electric Baths at Ilford.—In preparing the plans and estimates for the erection of swimming baths, the surveyor has been instructed to make provisions for two rooms for electric bath purposes.

Mill Lighting at Cawnpore. — The Victoria Cotton Mill, one of the largest of its kind in the Cawnpore district, is illuminated throughout with Osram drawn wire lamps. The lamps in question are installed principally over the looms and other machinery, and are continuously subjected to very severe vibration, which they withstand successfully. They took the place of the old carbon-filament lamps, and a sufficient saving in current consumption has been effected to enable the mill to entirely shut down one of the dynamos previously used for lighting purposes.

Electric Clocks for Southport.—The Town Council, on the 9th inst., decided to install a new electric clock at the Town Hall, connected up with 12 other new electrical clocks in the Town Hall and offices, but not to strike or chime, at a cost of £154.

Car-Building in Australia.—Councillor Naylor, in a report to the Prahran (Victoria) Council, said that he feared that the orders for new bogie cars to be given out by the Prahran and Malvern Tramway Trust were going out of the State as all other such work had done. One reason for this was that the Wages Boards had made the wages of car-builders higher in Victoria than in any other State.

Trade Announcements.—THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109-111, New Oxford Street, London, W.C., have secured the sole selling rights in this country for the electrical tramway and railway equipments formerly sold by the Via Co. These include a complete range of overhead line material, including poles and fittings, all standard types of strain insulators, section switches and lightning arresters, hangers, bolts, ears, frogs, crossings, rail bonds, automatic signalling systems, and so on. In addition, the firm have a special rail-cleaning car, particulars of which will be forwarded to anyone interested.

THE LEA RECORDER CO., LTD., of Manchester, have appointed their assistant, Mr. W. H. Lund, as their representative in London and the South of England. His address is 44, Caxton House, Westminster, S.W.

MR. R. B. BEATTIE, electrical light and power contractor, of Burnley, has opened a branch business in Willow Street, Accrington.

THE CRYPTO ELECTRICAL CO. announce that, owing to large and continued increase in business, they have again found it necessary to build an addition to their factory at Willesden; this new building increases the area by considerably more than double. The new factory is now being equipped with new plant, and will be in full working order within the next few weeks. This will enable the firm to put machines through in very much larger quantities than hitherto and will expedite deliveries.

MESSRS. TETLEY & CO., Salford, have removed to Exchange Buildings, 6, St. Mary's Gate, Manchester.

MESSRS. C. C. WAKEFIELD & CO., manufacturers of lubricating oils and mechanical lubricators, will, on September 29th, remove to their new offices, Wakefield House, 30-34, Cheapside, E.C.

LIGHTING and POWER NOTES.

Ballater.—A discussion took place at a meeting of the T.C. in regard to a proposal to have an electric light installation for the burgh, but no definite decision was arrived at.

Ballyconnell.—Last week Dr. McCarthy, L.G.B. Inspector, held an inquiry into the application of the Bawnboy R.D.C. for urban powers to carry through a scheme for the lighting by electricity of the town of Ballyconnell.

Barrow.—By the end of this month the T.C. electricity undertaking will give a supply of electricity to the air-ship shed being built by Messrs. Vickers on Walney

Bexhill.—The E.L. Committee, after considering the question of the supply of electricity for the purposes of cooking and heating, has decided that as regards houses where there is a substantial user for lighting purposes, current for cooking and heating may be supplied at a reduction, after 800 units per quarter have been consumed for like purposes, from 2d. to 1½d. per unit for additional units.

The L.G.B. has sanctioned a loan of £3,000 for mains and house services.

Bexley.—The U.D.C. on September 10th adopted a recommendation by the electrical engineer to install a 50-KW. rotary converter.

The Council has decided to amend the tariff for current for cooking and heating, so that under a guarantee consumers may be supplied at 1d. per unit over and above a minimum of 500 units per quarter.

Birmingham.—At a special meeting of the Electric Supply Committee, on the 9th inst., the tenders for the supply of coal to the department for the year commencing October 1st, were considered. The total required for the 12 months was 205,000 tons, 160,000 tons to be used at the Summer Lane station, 40,000 tons at the Chester Street station, and 5,000 tons at the station in Water Street. The aggregate amount of coal offered in the tenders was 1,451,000 tons. The Committee spent a considerable time over the matter, and eventually was able to place contracts at an average price which was slightly more favourable than last year. Twelve months ago the quantity of coal contracted for was 160,000 tons.

Bishop's Castle.—The Council has agreed to grant permission to an electric lighting company to supply electricity by overhead wires with wood or iron posts, the work to be completed in 12 months.

Bispham.—The U.D.C. has given formal notice that application has been made to the B. of T. for sanction to place electric transmission lines between points on Blackpool Road.

Blackpool.—In connection with the scheme for the Autumn illuminations, a commencement was made on the Princess Parade this week.

Burslem.—The Stoke-on-Trent T.C. has applied to the B. of T. for consent to utilise overhead wires at Burslem for the transmission of current at a pressure of 440 volts.

Canada.—The Winnipeg Electric Railway Co. find that their power plant at Lac Du Bonnet, on the Winnipeg River, 40 miles from Winnipeg, is unsatisfactory and fails to supply sufficient power for the wants of the company, necessitating the utilisation, very frequently of late, of the auxiliary steam plant. The company have decided to build another extensive power plant at Bonnets Falls, 20 miles nearer Winnipeg, also on the Winnipeg River. The contract for this work has been let to the J. B. White Company, for between four and five million dollars.

The inner working of the Ottawa municipal electric light plant is conducted in secret, and so the people know only results, which however, have been satisfactory. The refusal of the acceptance of the lowest tender, in a matter of $2,500, has been the cause of a sudden desire lately on the part of the ratepayers to have the business conducted in the open. The Electric Commission, on their part, object on the plea that on account of sharp competition it is necessary to conduct the business in secret.

A new agreement between the British Columbia Electric Railway Co., the largest electrical company in the West, if not in all Canada, and its employés, was signed on the 2nd inst., for two years. The present wage schedule was renewed, but the company made various concessions regarding hours and working conditions.

WINDSOR.—*Canada* states that the Essex Light and Power Co., a subsidiary corporation of the Edison Co., Detroit, will be able to supply power to Walkerville this month. The price, it is understood, will be $24 per H.P., which is considerably lower than the power rate included in the contract made by the City of Windsor with the Hydro-Electric Commission.

The *Canadian Engineer* states that the Canadian Northern Railway is about to install electric apparatus for the operation of the big elevator plant in Port Arthur, Ont. It is estimated that with the additional unit to be constructed to the elevator in the near future, the plant will require from 1,100 to 1,500 H.P.

Cheltenham.—Some switchgear and a transformer, costing £160, are to be provided in connection with the new condensing plant.

Crowle.—At the last meeting of the Council, complaints were made of the prices charged for the supply of gas—4s. 7d. per 1,000 ft. for private consumers with gas cookers, and 4s. 9d. per 1,000 ft. for ordinary consumers—and it was suggested that some other means of lighting should be considered.

Cuba.—Judging from reports just to hand, there is just now a large amount of electrical work in hand in Cuba, central electric lighting stations being in course of establishment in the towns of Madruga, San Nicolas, Cataluna de Guinès, Jaruco, Carebello, Bainoa, and San Antonio, in the Province of Habana; at Jovellanos, Calimete and Manguito, in the Province of Matanzas; at Moron (Province of Camagues); and at Los Arabos and Isabella de Sagua (Province of Santa Clara).

East Barnet Valley.—The U.D.C. has sanctioned the proposal of the North Metropolitan Electric Power Supply Co. to depart from the scheme comprised in their undertaking of January, 1912, subject to certain extensions being made. Providing the company agree to make such extensions, consent is to be given to the proposed mains being laid under the footway. The company have agreed to these amended conditions.

The Council has accepted the company's quotation on a contract of not less that five years for the lighting of 22 spans on Barnet Hill:—One 100-C.P. lamp per span, at £2 18s. The surveyor reported that the cost would be £64, the price including all-night lighting during the five nights extending over Barnet Fair.

Ellon.—The T.C. has decided that it cannot entertain the conditions set forth by Messrs. T. C. Smith & Co., of Aberdeen, on which the electric light could be obtained.

Enfield.—The North Metropolitan Electric Power Supply Co. have submitted to the U.D.C. a plan showing the route of trunk mains which are to be laid from Ponder's End to Edmonton, and supply cables in the Hadley Wood district. The Council has decided to raise no objection to the proposed work.

Frodsham.—The laying of mains has been commenced here by the Mersey Power Co. Most of the leading tradesmen have decided to have installations, and the question of adopting electricity for public lighting is under discussion.

Great Harwood (near Blackburn).—After interviewing Mr. S. J. Watson, of Bury, the U.D.C. has decided to approach the Accrington Corporation to ascertain the terms upon which the latter would supply electricity within the township.

Harrogate.—The Corporation is applying to the L.G.B. for sanction to the borrowing of a further sum of £2,000 for cable extensions and £500 for transformers. The recommendation of the engineer for the obtaining of a centrifugal pump and spraying nozzles for the purpose of more quickly cooling the hot water from the condenser discharge duct, was approved.

Hastings.—At the last Council meeting it was decided, on the recommendation of the Electricity Committee, to establish a uniform charge of £5 14s. each per annum for the public double-burner incandescent electric lamps.

Heywood.—The Corporation has decided to apply to the L.G.B. for sanction to borrow £11,750 for cables, buildings, &c. The expenditure is necessary in order that provision can be made to receive a "bulk supply" of electricity from the Bury Corporation, with which an agreement has been entered into.

Hornsey.—A L.G.B. inquiry was held on 5th inst. respecting the Council's proposal to borrow £540 for a sub-station site at Fortis Green.

Hull.—A special meeting of the City Council will be held next month, when Alderman Hanger will move that application be made to the B. of T. for a prov. order authorising the Corporation to supply electricity within the Parish of Sutton.

India.—We learn from India that the Government has approved of an electric supply scheme for the town of Dehra Dun, in the United Provinces. Power is to be supplied from the generating station of the Mussoorie hydro-electric scheme, which was carried out by Messrs. Bruce Peebles & Co., in 1907. As mentioned in our "Contracts Open" section, tenders are being invited locally in connection with this new scheme for the supply, delivery and erection of two 625-K.V.A. water-driven generators, also for some 50 odd miles of high and low-tension transmission lines, together with sub-station equipment and road lighting, &c.

Japan.—In view of the strong popular opinion against the project and on the advice of the authorities, the projected amalgamation of the Tokio Electric Lighting Co. and the Nippon Electric Light Co. has been abandoned.

Kirkby Lonsdale.—The U.D.C. has been approached on the E.L. question by a Bradford gentleman who proposes to form a company. The Council will go into the question fully at a future meeting.

Llanidloes.—The T.C. refused to accept a contract with the gas company for a period of five years, and has accepted a proposal submitted by Mr. Alderman Edward Hamer, in which he undertook on behalf of a company to light the public lamps in the town for the present season by electric light on the terms named by the gas company—viz., equivalent to 30s. per light for the season, with an additional £10 in lieu of paying a lamplighter.

London.—ST. PANCRAS.—Having regard to the satisfactory position in which the undertaking's reserve fund now stands (£46,865), the Finance Committee has decided to allocate to the rates a sum of £10,470, leaving the revenue account at March 31st last with a balance of £522. The Electricity Committee has had under consideration a report by the chief electrical engineer advising that an arrangement should be entered into by the Council with consumers at business premises to supply and maintain their outside electric lamps, as the gas company, by an arrangement for the fixing and maintaining of high pressure and ordinary gas lamps, are now securing customers under agreements for from three to five years. The Committee considers it important that the Council should be in a position to offer similar facilities, and has, therefore, decided to prepare a scheme.

BERMONDSEY.—The L.C.C. has sanctioned the borrowing of £8,282 for mains, repayable within 25 years and £400 for plant (switchboard panels) repayable within 15 years.

Oldham.—Mr. T. C. Ekin, one of the inspectors of the L.G.B, held an inquiry at Oldham on Wednesday last week concerning the application of the Corporation for sanction to borrow a sum of £30,000 for extensions and additions to the electricity undertaking. Mr. S. W. Newington, the electrical engineer, said that the total number of units sold in the year ended March 25th, 1913, was 6,463,416, against 5,992,476 in the preceding year. Mr. Garside said that the money was required to cover the cost of additional plant, mains, transformers, and switchboard to enable the Corporation to supply power upon the high-tension system to several mills and workshops in the district. Provisional arrangements had been entered into to supply two cotton spinning mills—the Belgrave and the Industry—and applications had also been received from the owners of the Newbreck Mill and from Messrs. Asa Lees & Co. The new plant required included two motor-generators, each of 500-KW. capacity running at 500 R.P.M., which would cost £3,000; one turbo-alternator, £4,975; one condenser; motor-driven circulating pumps, pipes, cables, switchboard, &c. Mr. Newington said that an extension of the buildings at Greenhill would be necessary to accommodate the additional plant. The new mains were estimated to cost £9,100, the average cost being 20s. per yard. The Corporation had unexercised borrowing powers on a sanction granted a year ago for about £5,000 for low-tension mains, and the Inspector observed that he thought the Board would approve of that being diverted to expenditure on high-tension mains. The borough treasurer said that the total expenditure on the undertaking was £313,414 to March 25th last, of which £305,645 was money borrowed on the sanction of the board, and the balance was paid out of reserve and current account.

A canvass of Royton to ascertain whether electric supply should be given there is proceeding. So far 60 or 70 premises have been secured.

Ouseburn.—The York Corporation has asked the Rural Council's consent to it supplying electricity in bulk in the rural district.

Paisley.—The T.C. Health Department is considering the advisability of purchasing a machine from the Rapid Magnetting Machine Co., Ltd., for removing iron from the refuse destructor clinker.

Perth.—The T.C. has now fixed a flat-rate of 1d. per unit for all current used for cooking and heating purposes, and a determined effort is, consequently, to be made in order to push this class of business amongst present consumers and others. With this end in view an exhibition of various appliances is to be held in the City Hall on October 8th, 9th and 10th. Cookery lectures will be given by a lady demonstrator, and a large gathering of the "Fair maids" is anticipated. Any manufacturers who would care to forward appliances for this exhibition should communicate with the burgh electrical engineer or any of the local contractors. The Corporation is to bear the cost of the Hall and give a free supply of current.

Plymouth.—A L.G.B. inquiry was held, on September 10th, into the application of the T.C. for a loan of £5,000 for plant extensions at the electricity works. There was no opposition.

Pontefract.—The Pontefract Guardians are contemplating a change from their present steam-raising appliances to electric power for driving their machinery, and have decided to obtain the loan of an electric motor, in order to test the cost of running the machinery by electricity, as compared with the cost of steam, before making a change. The Building Committee has accepted the tender of the Morley Electrical Engineering Co. for the loan of a motor.

Portrush.—A site costing £350 is being purchased by the Urban Council for the electric generating station.

Portsmouth.—The T.C. last week discussed and adopted the balance-sheet of the Electric Lighting Committee which recommended that the balance of £3,604 carried to the appropriation account be dealt with as follows:—£2,500 to the relief of rates; £500 to fire insurance account; £500 to reserve fund, and £104 carried forward. Alderman Foster said that but for the fact that coal had been much more expensive they would have finished their year's working £1,500 better off. An amendment was moved, referring back the recommendation to put £2,500 to relief of rates and instructing the Committee to reduce charges for street lighting by a similar amount, but only five members voted for it, and the report of the Committee was adopted. Alderman Foster said that they were out for business where it could be done at a profit, not for that which would show a loss.

Rawtenstall.—The Providence Baptist Chapel, Lumb, is to be lighted by electricity.

Rosario.—Engineer Ernesto Newberry, director of electrical and mechanical installations, and acting director of public lighting of the municipality of Buenos Ayres, has gone to Rosario to assist the technical committee of that municipality to adjudicate upon the tenders for the electric lighting of Rosario. —*Review of the River Plate.*

St. Albans.—The St. Albans R.D.C. has consented to the Watford U.D.C. giving a supply of electricity to the premises known as Wall Hall.

Salford.—At a meeting of the Electricity Committee last month, a report of a Special sub-Committee was approved relative to the suggested appointment of the city electrical engineer of Liverpool to advise the Committee with regard to a proposal to

modernise the generating plant at the electricity station, Frederick Road, and a resolution was adopted that the city electrical engineer of Liverpool be appointed to report upon the proposal, subject to satisfactory terms being arranged.

Shrewsbury.—The net profit for the year (after payment of sinking fund contribution and interest on loans) was £100. The capital expenditure during the year was £914, of which £401 was expended out of loans. The total outlay to date amounts to £59,289, and the outstanding debt on March 31st, 1913, was £31,655.

South Africa.—Harrismith, O.F.S.—Mr. John Roberts, the Durban borough electrical engineer, who has been investigating the possibilities of the generation of electricity for the lighting of Harrismith from the water supply on the Platburg Mountain, overlooking the town, has just presented an exhaustive report thereon. He adversely criticises the scheme in view of the limitation of the water which, while sufficient for the present demands, does not give sufficient margin for much extension in the future, and, as an alternative, he suggests the installation of a gas-engine plant which, at the last meeting of the Town Council, Mr. Roberts was asked to make a full report on. Mr. Roberts suggests the desirability, when calling for tenders, of allowing tenderers to submit alternative propositions for Diesel engines using crude oil.

Stanley (Co. Durham).—After receipt of a letter from the B. of T. respecting the electric lighting order, which was granted 11 years ago, and has not been acted upon, the U.D.C. has asked the Board to cancel the order.

Swanage.—The Electric Lighting Co. has commenced the laying of mains in the town.

Swansea.—The borough electrical engineer has been instructed to report upon an application received for consent to erect poles to take electric power from the Rhondda Valley to Penllwyngwent Colliery. Sanction has been received from the L.G.B. to the borrowing of £40,000 for electricity purposes. The chairman and vice-chairman of the Electric Lighting Committee, together with the electrical engineer, have been authorised to purchase four sets of converting machinery and accessories for sub-stations. Plans and specifications are being prepared for the erection of a sub-station at the Uplands. Main extensions are to be carried out in various parts of the districts. A temporary supply of energy is to be laid on to the Council's new training college now in course of erection. Arrangements are being made with the Electric and Ordnance Accessories Co., Ltd., for a continuation on the same terms, for a period of one or two years, of their contract for the supply of electric motors. Tenders are invited for an annual or biennial supply of starting switches.

Swinford.—The L.G.B. has approved of the plans and specifications for lighting the workhouse electrically.

Swinton and Pendlebury.—The D.C. has still under consideration what system to adopt in the electric lighting of the tramway route. The experiment along Manchester Road is to continue, and lamps of different illuminating powers are to be tried before a final decision is arrived at.

Truro.—The T.C. has decided to ascertain upon what terms the Cornwall Electric Power Co., of Hayle, will supply electricity in bulk. A site has been provisionally selected for the erection of a generating station at a cost of £600.

Walsall.—At the meeting of the Council on Monday, the Electricity Committee reported that a rotary transformer at the Butts Road sub-station had been seriously damaged. The initial cause of the difficulty, the Committee stated, was a fracture in the low-tension shunt circuit of the machine, and a contributory cause was the failure of the low-tension switch to clear the machine from the low-tension mains when it operated automatically on the reverse cut-out, the consequence being that the transformer raced away and the armature and field coils were wrecked. Alternative estimates obtained from the engineer show that the net cost of repairing the old machine (which is a 100-KW. continuous-current transformer, erected in 1903 at a cost of £1,126) would be £387, as against a net cost of £800 for a 250-KW. A.C. rotary, and of about £600 for a 100-KW. A.C. rotary. Having regard to the fact that the repair of the old D.C. transformer would only give 100 KW. capacity of what is practically an obsolete type of plant, whereas for an additional expenditure of £250 an additional capacity of 150 KW. of the most modern type of plant could be obtained, the Committee has accepted the recommendation of the engineer that the old transformer be not repaired, and has deferred the question of putting down an additional A.C. rotary pending the consideration of the proposed extension scheme.

Warrington.—The Electricity and Tramways Committee has authorised the engineer to employ Mr. Percy Silcock to prepare a plan and estimate for the extension of the buildings at the electricity station.

Whitstable.—The U.D.C. on September 9th approved of a draft agreement with the Whitstable Electric Supply Co., Ltd., for public lighting, and consented to the company's engineer consulting Messrs. Strachan & Weekes as to the advisability of the Council's adopting electric power for sewage pumping purposes.

Wishaw.—The annual report of the Electric Lighting Department shows a net profit of £53. Last year there was a deficit.

Yarmouth.—The L.G.B. has sanctioned the borrowing of the following amounts required in connection with the electricity undertaking: £3,650 for generating plant, £820 for new switchboard, £150 for travelling crane, £2,000 for prospective expenditure on house services, £200 for cooling tower, and £1,635 for public lighting. The Board, in arriving at the sum of £820 for the new switchboard, made a reduction of £180 in respect of the debt outstanding on the existing switchboard, which was to be superseded; and the loan was sanctioned on the condition that the extra cost of the new board would be defrayed to the extent of £180 out of current income. As regards the loan for public lighting, the Board stated that it was against its practice to sanction a loan for prospective expenditure on that account. Tenders are required for the new generating plant above mentioned.

Yeovil.—Mr. E. W. Pelter, of Yeovil, has informed the T.C. that he intends applying to the B. of T. for a prov. order for electric lighting. When the matter came before the Corporation on September 11th, the Mayor said he did not think they should object to the application. Some years ago the Council obtained its own order, the object being to keep away competition from the gas works, but that order had been revoked. The Council decided to acknowledge the receipt of the notification.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—At a meeting of the Corporation Tramways Committee, Mr. Pilcher, the general manager, reported regarding the requirement of six additional top-covered cars. Authority was given to have the Brill trucks ordered, and to accept tenders for the electrical equipment. The Committee resolved to recommend that, with the view of carrying out the extension scheme which the Council has already approved, notice be given of its intention to apply in November for a provisional order. Under this order power will be sought to construct lines along Midstocket Road and in Torry, to run a railless trolley system in certain districts, and to run motor-'buses within the city boundary. It is proposed that the surplus profits of the undertaking be applied either for relief of rates, for public improvements, or to the common good. Borrowing powers to the extent of £50,000 are also to be sought.

Ayr.—Mr. W. Grant, general manager of the Corporation tramways, in his annual report, states that the total revenue for the year amounted to £16,295, being the highest in the history of the department. The passengers carried during the year numbered 3,880,850, an increase of 3·62 per cent. over the number carried in the previous year. Halfpenny fares represented 55·33 per cent. of the passengers and 28·63 per cent. of the receipts; 1d. fares, 17·86 and 18·49; and 2d. fares, 12·29 and 25·46 respectively. The net balance from the year's working amounted to £3,378, of which £2,040 was carried to the depreciation and renewals fund, and £1,337 transferred to the burgh general assessments. The depreciation and renewals fund now amounts to £9,918, while there is also a reserve fund of £5,000.

Belfast.—A provincial newspaper states that the Irish Local Government Board auditor has surcharged as illegal the payment of £2,800 made in May, 1912, to the employés of the tramway department of the Belfast Corporation as bonus for long service, good conduct, &c. The surcharge has been made on the three members of the Corporation—an alderman and two councillors—who by their signatures authorised the payment. The effect of this surcharge, it is understood, will be that practically every employé in the Corporation tramway service in receipt of a weekly wage will have his allowance reduced by an average of about 1s. 9d. a week. The Corporation holds that this is a perfectly legitimate charge, and is, in fact, allowed in some Government departments, and the auditor's action will be disputed in the Irish Courts.

Birmingham.—The B. of T. has confirmed the Birmingham Corporation (Quinton) Light Railway Order, 1913, authorising the construction of a light railway in the City and County of Birmingham, and in the Parish of Warley, in the Urban District of Oldbury.

Bradford.—The fifteenth annual report of the Corporation Electric Tramways undertaking, dated to the end of March last, was issued on Wednesday last. The manager, Mr. C. J. Spencer, describes the situation as being at the "half-way house," inasmuch as the loans for tramway purposes were granted generally for 30 years, and nearly half the capital borrowed for these purposes has been repaid. In 1899 there were 5 miles of electric Corporation tramway in the city, 1,542,000 passengers were carried, and the takings were £8,870. In 1900, on the same 5 miles, 4,120,000 passengers contributed an income of £20,109. In 1912 there were 56 miles, and £289,335 receipts; in 1913 57 miles, 62,005,976 passengers, and £299,102 receipts. The years 1912 and 1913 include 1¼ miles railless electric traction. In 1898, the year in which the tramways were opened, the average distance a passenger could travel was 1·05 miles; to-day it is 1·6 miles. Mr. Spencer expresses great satisfaction with the continued increase of revenue, notwithstanding the heavy decrease in fares for early morning traffic. The railless department shows a loss on the face of the accounts, but, says Mr. Spencer, it is impossible to say

whether that is a real loss or not. The vehicles are of the pioneer type, and are to be replaced by more modern cars. The report refers to the rather extraordinary operating difficulties which exist in the city, by reason of the steep gradients, heavy wear and tear, and the low density of population per route-mile, owing to the widely-spread area of the city, and says that in view of these difficulties the Corporation may be congratulated upon being able to pay good wages, meet all dues and demands, contribute annually a substantial amount to the relief of rates, and possess a reserve and renewals fund amounting to about £90,000.

Dover.—At a recent meeting of the Electricity Committee, reference was made to the decreased consumption of energy (25 per cent.) by the electric tramcars, due largely to the use of meters. The chairman said that they ought to have had the meters years ago.

Dunfermline.—Correspondence which has passed between the Town Council and the proprietors of the Pitreavie estate indicates that a tramway system for Rosyth is being considered.

Greenock.—The question of the municipalisation of the tramways is being discussed. The line between Gourock and Port Glasgow is held on lease by a company. Under the lease there is a break in 1914, so that next year the Corporation will have the power to take over the Greenock portion, a length of four miles, as a going concern.

Japan.—The Awa Electric Light Railway Co. has secured a concession from the Japanese Government to construct and work a light electric railway between Horie and Itanishi, in the prefecture of Tokushima.

London.—Traffic at Golder's Green was held up late on Monday night owing to the falling of an overhead wire. The trolley of a tramcar in Finchley Road began to burn, and one side of the tramcar caught fire. The flames were quickly put out, and no one was injured. Some distance up the road a section box caught fire, and several wires were burnt through.

The L. & S.-W. Railway Co. has commenced the work of the electrification of the Kingston loop, which it promised to put in hand first, and on the 10th inst. a gang of men was employed at Teddington in placing the rails in readiness for the fitters.

Mumbles.—The *Western Mail* states that the chairman of the Swansea Tramways Co. and its allied concerns, the Mumbles Railway and Pier (Mr. Tegetmeier), visited Swansea, in company with Mr. A. M. Little, consulting engineer, last week, and, with the local manager (Mr. David James), inquired into the possibility of installing an electric traction system on the Swansea and Mumbles Railway. A proposal is now under serious consideration which will probably render possible the provision of a 10-minute service of trains, capable of carrying between 400 and 500 passengers. The line would have to be doubled, or passing-places provided, and an expenditure of £40,000 to £50,000 would be necessary.

Worsley.—The clerk to the D.C. has been instructed to write to the B. of T. informing it that representations had on several recent occasions been made to the Council respecting the condition of the cars on the Worsley section of the South Lancashire Tramway Co.'s system, and requesting that an inspection of the same be made as early as convenient.

TELEGRAPH and TELEPHONE NOTES.

Bahamas.—The radio-telegraphic station at Fort Charlotte, Nassau, has been formally inaugurated. The system adopted is the quenched-spark system of the Anglo-French Co.

Japan.—Negotiations are at present in hand between the Japanese Government and the Great Northern Telegraph Co. with reference to the purchase by the former of the telegraph cable between Nagasaki and Shanghai.

Telephony in Mining. — A demonstration of the Reineke wireless telephone adapted for use in mines was recently given at the Annandale Pit, Kilmarnock, belonging to the Carrington and Auchlochan Coal Co. The tramway lines in the mine were utilised for connection, and conversations were carried on from the pit bottom to the extremity of the workings, a distance of 400 yards. In the absence of rails the system can be worked through solid coal. It was stated that with a portable apparatus in case of an accident, when ordinary telephone wires would be broken, it would be possible by this wireless system to converse with entombed miners through a solid fall. The officials of Dinnington Main Colliery, Yorkshire, where the system has had a six months' test, are in the habit of speaking from the pit-head or the pit-bottom to an operator in the cage while in motion. They have also, it is stated, spoken with success through a mile of solid coal.

The Goldschmidt System.—It is rumoured that the British Marconi Co. is negotiating for the purchase of the entire patent rights of Prof. Goldschmidt, which, according to the *Frankfurter Zeitung*, formerly belonged to the High-Frequency Co., of Berlin, and were sold last year to the Cie. Universelle de Télégraphie et de Téléphonie sans Fil, of Paris, a company with a paid-up capital of £100,000.

Wireless Strike.—The strike of Italian operators of the Marconi wireless installations on board steamers at Genoa was promptly settled last week, and the men returned to work.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

Sydney.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

October 14th.—For the P.M.G. A common-battery multiple switchboard.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

Melbourne.—October 1st. Lead-covered cable, for the City Council. See "Official Notices" to-day.

October 7th.—Six 60-K.V.A. and one 30-K.V.A. single-phase transformers, for the City Council. See "Official Notices" to-day.

October 7th.—33,300 carbon-filament lamps, for the City Council. See "Official Notices" to-day.

Melbourne Railways.—October 15th. 20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" to-day.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 12th.

Belgium.—October 18th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine) are inviting tenders for the supply and laying of a quantity of telephone cable in the Malines district.

Burnley.—September 22nd. The Guardians of the Burnley Union invite half-yearly tenders for the supply of electrical requirements.

Canterbury.—September 29th. Supply and fitting of electric motor to deep well pump, for the B. of G. Mr. C. A. Blascheck, Electricity Works, Canterbury.

Constantinople.—The Turkish Government having decided to introduce electric lighting into the whole of the islands in the Sea of Marmora, invite international tenders. Particulars from the Ministry for Trade and Public Works.

Dublin.—September 19th. Electric lighting and heating works at the Crooksling Sanatorium for the Dublin Joint Hospital Board. Mr. T. F. McNamara, architect, 192, Great Brunswick Street, Dublin.

Egypt. — October 31st. Ministry of the Interior. Tenders for the installation of the electric light at Damanhur.—*African Engineering.*

France.—September 24th and 28th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders, until the 24th inst., for nine lots of lead-covered telephone cable, with 14 and 28 pairs of conductors; and, until the 28th inst., for five lots of gutta-percha and cotton-covered copper wire. According to another source of information, the dates are October 7th and 8th respectively, and 11 lots of telephone accessories are also required.

Germany.—October 15th. The municipal authorities of Frankfort-am-Main are inviting tenders for four electrically-operated travelling cranes.

Greece.—September 30th. The Harbour Authorities at the Piræus are inviting tenders for the supply and erection of two electrically-operated cranes, one of 10 tons and one of 6 tons capacity.

Halifax.—September 23rd. Electrical fittings for the B. of G. for six months. Mr. A. T. Longbotham, clerk, 4, Carlton Street.

Holland.—September 24th. Tenders are being invited by the Dutch Post and Telegraph authorities at the Hague for the laying of some telegraph cables across the river Yssel at Zutphen.

Hoylake and West Kirby.—Corporation. Steam and exhaust piping. See "Official Notices" September 12th.

Ilkley.—October 6th. (Sec. 1) Prime-movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" September 12th.

India.—September 19th. *Indian Engineering* for August 23rd contains official announcements to the effect that the following contracts have been open till to-day (September 19th):—

Dehra Dun Municipal Board.—H.T. transmission lines; sub-station buildings and equipment; L.T. distribution system and road lighting; and sundries.

Mussoorie Municipal Board.—Two 625-K.V.A. water-driven alternators, complete with direct-coupled exciters, regulators, lightning arrester equipment, &c.

Both notices are signed by W. Bell, electrical engineer to the Mussoorie-Dehra hydro-electric scheme.

Keighley.—October 1st. 6,600-volt 3-phase A.C. transmission line (two miles) for the Corporation. See "Official Notices" to-day.

Leicester.—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" September 5th.

London.—HAMMERSMITH.—September 24th. Borough Council. Underground cables, and sub-station switchgear. See "Official Notices" August 29th.

HAMMERSMITH.—September 24th. Borough Council. One 125-H.P. alternating-current motor. See "Official Notices" September 12th.

BERMONDSEY.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

New Zealand.—October 31st. Telephone instruments and accessories for Lake Coleridge power scheme. Specification may be seen at Board of Trade (C.I. Dept.) in London.

November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire, for two years. Specifications from Electrical Engineer, Dunedin.

December 11th.—Switchboard and accessories for Wellington Corporation E.L. Dept. Specification may be seen at Board of Trade (C.I. Dept.) in London.

Tenders are also asked for the supply of two A.C. pressure regulators for 3,000 and 400 volts. British manufacturers can obtain particulars at the B. of T. Commercial Intelligence Department.

Salford.—September 29th. Compound air compressor, for the electricity department. Specifications, &c., from Borough Electrical Engineer, Frederick Road, Pendleton.

September 29th.—Rotary converters for the Corporation. See "Official Notices" to-day.

Saxmundham (Suffolk).—October 2nd. Sewerage and sewage disposal works, with pumping and electrical plant, dynamos, motors, cables, switches, &c., for the R.D.C. Mr. P. F. Mackenzie Richards, engineer, 53, Victoria Street, Westminster, London. (Returnable deposit of £5 5s.)

Spain.—October 6th. The municipal authorities of Manzanares (province of Ciudad Real) are inviting tenders for the concession for the electric lighting of the town during a period of 25 years.

MADRID.—October 15th. Concession for the public lighting of Madrid by gas, electricity, or gas and electricity. Particulars of the Ayuntamiento de Madrid.

The municipal authorities of Valdaracete (province of Madrid) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Uganda.—December 31st. Electric light and power supply for 10 years at Kampala and district, including 300 32-C.P. street lamps and 200 16-C.P. lamps in Government quarters. Uganda Public Works Department, Entebbe.—*Brit. S.A. Export Gazette.*

Walthamstow.—October 8th. L.T. feeder cable for the Electricity Department. See "Official Notices" to-day.

Worthing.—September 29th. Corporation. Supply, delivery and erection of Diesel engine and D.C. generator. See "Official Notices" September 12th.

CLOSED.

Australasia.—According to the *Australian Record*, the following tenders have been accepted:—

PERTH.—

20 miles wire, tinned copper, No. 20 L.S.W.G., rubber-insulated, copper-covered and braided, £3 19s. per mile.—W. T. Henley's Co., Ltd.

TASMANIA.—

8¾ miles lead-covered cable, £1,820.—B.I. and Hunter Cables, Ltd.
25 detectors, £71 17s. 6d.—British General Electric Co., Ltd.
5 miles wire, twisted pair, tinned annealed copper, £95 2s.—20 miles wire, tinned copper, vulcanised India-rubber, £128.—Ford Brooks & Ford.
5 miles wire, twisted pair, [illegible], £95.—Z[illegible] & Co.
5 miles cable, two-wire V.I.R., copper conductors, £222 10s.—Siemens Bros (Melbourne) Pty., Ltd.
400 protectors, £80.—British General Electric Co., Ltd.
150 registers, electrical, £132 10s.—J. Bartram & Sons Pty., Ltd.
10,000 copper tapes, £20 2s. 6d.; 10 tons wire, galvanised iron, £113 15s.
5 tons wire, bronze, £439 14s.—F. Vanderfield & Co.

A contract for converting a lift from hydraulic to electric working, for the Public Works Department at Sydney, has been placed with Messrs. Standard Waygood, Ltd., at £770.

Belgium.—Nine concerns—five German, one Swiss and three Belgian—submitted tenders last week to the municipal authorities of Liége for the supply and installation of a 4,000-KW. steam turbine and alternator. The lowest offer was that of the Société A.E.G. Union Electrique, of Brussels, who quoted £6,760 and £11,120, according to the design selected.

Bexhill.—The Council has accepted the tender of Messrs. Myers, Rose & Co., Ltd., for 1,000 tons of Shipley peas for the electricity works, at 19s. 1d. per ton.

Bexley.—The U.D.C., on September 10th, accepted the quotation of the Hart Accumulator Co., Ltd., for renewing and enlarging the battery, at £500.

Blackpool.—Mr. R. Barron, electrician, of Fleetwood, has obtained the contract for installing electric light at the new extension at Cleveley's Hydro, and for Arnold House School, South Shore, Blackpool.

Bournemouth.—The Council has accepted the tender of Messrs. W. Griffith & Co. for tramways construction works.

Brighton.—The B. of G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for electrical fittings, at £76.

Canada.—A Canadian correspondent writes that the contract for the conduit system at Hamilton, Ont., has been provisionally placed with Mr. G. M. Gest, Montreal, at $177,822 for laying conduit. This does not include cables, which will be looked after by the various concerns interested. The other tenders were as under:—

F. T. Ley & Co., Springfield, Mass., U.S.A., $180,371.
J. W. Turner Improvement Co., Des Moines, Iowa, U.S.A., $197,366.
H. E. Fox, New York, U.S.A., $292,806.

All four firms are really American, as Mr. G. M. Gest was only in New York until it became necessary to open a Montreal office to look after the conduit contract for that city which they also secured. All rough labour is to be local. The conduit will actually be laid along 8½ miles of street, covering every street in the centre ½-mile square, and the two main streets which run diagonally through the city.

The *Canadian Engineer* reports the placing of the following contracts:—

CARLYLE, SASK.—

Return tubular boilers, stack, steam piping.—Waterous Engine Works Co.
High speed vertical engine.—Goldie & McCulloch Co.
Alternator and switchboard (for Swedish generator).—General Supplies, Ltd., Calgary.
Copper wire.—E. F. Phillips Electric Co., Montreal.
Transformers.—Canadian Maloney Electric Co.
Line erection.—E. Smith Electric Co., Melville, Sask.
John Galt Engineering Co., Winnipeg, are the consulting engineers.

WINNIPEG.—

The Board of Control has awarded the Canadian Westinghouse Co. the contract for supplying three generators for the municipal power house at Point du Bois. The contract price is $103,800. There were five other tenders submitted.

OTTAWA.

The Electrical Commission has awarded the Imperial Wire and Cable Co., Montreal, the contract for supplying wire cable required for the conduit work.

Ilford.—The T.C. is purchasing from the British Insulated and Helsby Cables, Ltd., a mile of tramway trolley wire, at 9 9/16d. per lb., less 2½ per cent. discount. The tender of the Edison Accumulators has been accepted, at £689 10s., for the supply of a motor tower wagon.

Italy.—Messrs. Langen & Wolf, of Milan, have secured a contract from the municipal authorities of Cerignola for a 200-H.P. Diesel heavy-oil engine for the central electric lighting station, at £1,780.

Lincoln.—The T.C. has sealed the following contracts:—

Willans & Robinson, Ltd.—Turbo-alternator, &c.
Howden Boiler Co.—Water-tube boiler, &c.
Geo. Robson & Co.—Coal-elevating and conveying plant.
Thornhill Bros.—Extensions to the electricity works.

Malvern.—The U.D.C. has accepted the tender of Messrs. M. Wilesmith & Son for a year's supply of coal to the electricity works.

Paraguay.—The Paraguay Government has authorised the Minister of Interior to sign a contract with Messrs. Siemens-Schuckert for the installation of ten wireless telegraphy stations.—*Review of the River Plate.*

Simla.—*Indian Engineering* states that the Simla Municipality has accepted Messrs. Siemens Bros.' tender for appliances for lighting the bazaar with electricity.

Southampton.—The T.C. has accepted the tender of Messrs. Briggs, Jones & Gibson, Ltd., for 180 pairs of trousers for tramway motormen and conductors, at 13s. 6d. per pair.

Sunderland.—The T.C. on 10th inst. accepted the following tenders :—

B.I. and Helsby Cables, Ltd.—Cable.
Stave'ey Coal and Iron Co.—Cast iron piping.
Alley & McLellan.—Non-return valve.
Phœnix Dynamo Co.—Rewinding a ternator.

Walsall.—The Corporation Electricity Committee has accepted estimates for the purchase of a 250-KW. A.C. rotary and a 100-KW. A.C. rotary, at £800 and £600 respectively.

Yarmouth.—The tender of the British Westinghouse Electric and Manufacturing Co., Ltd., has been accepted by the T.C. for 24 tramcar gear wheels, at £2 13s. 6d. each.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, Sept. 13th. At 10.30 a.m. Visit to the works of Messrs. R. Waygood & Co., Ltd., Falmouth Road, London, S.E.

Salford Technical and Engineering Association.—Saturday, September 20th. At 7 p.m. Lecture on "Grinding Wheels, Grinding Machines, Grinding," by K. D. Morgan.

Municipal Tramways Association.—September 23rd to 26th. At Sheffield. Annual Conference.

NOTES.

National Chamber of Trade.—The autumn meeting of the Executive Council of the National Chamber of Trade is to be held on Thursday, the 25th inst., at the Leeds Town Hall. Some interesting resolutions are upon the agenda for consideration. In regard to the Insurance Act, the resolutions contain a protest against the obligation upon employers to produce a private wages-book to the Inspectors—the ground of objection being that the information in such books is of a private and confidential nature—and the Insurance Commissioners are urged to be content with the production of the employés' cards, if these are properly stamped. There is also an expression of regret that there is no provision for adequate representation of employers on the Local Committees, and that amendments designed to prevent employés being able to claim full wages during sickness, in addition to sick benefit, were not favourably considered by the Government. Other resolutions favour all general holidays being at fixed, instead of movable dates, a Registration of Firms Bill, the appointment of a Select Committee to consider telephone questions, a Sunday Trading Bill, a Central Waterways Board, reform in the incidence of local rating and taxation, reforms in railway law, the Daylight Saving Bill, a Bill making highways a national charge, and providing for a tonnage rate on motor vehicles used for merchandise, and a general arrangement for wholesale traders to pay carriage on goods in the first instance.

Olympic Fund.—Mr. Richard Burbidge, managing director of Harrod's, Ltd., has offered to subscribe £100 a year for four years, from 1913 to 1916 inclusive, towards the Olympic Fund, on condition that not fewer than 10 other firms in the United Kingdom do the same.

Foreign Trade in August.—The official trade returns for the month of August show an advance of £322,008 in exports and a decrease of £3,683,782 in imports, as compared with the corresponding month of 1912. The following figures relate to the electrical and machinery trades :—

	Month of August.	*Inc. or dec.*
IMPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	£120,108	+ £16,781
Machinery	530,652	+ 5,021
EXPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	285,191	− 67,477
Machinery	2,885,774	+ 151,746

Fatalities.—ABERDEEN.—An electrical engine attendant at the Central Post Office, while attempting to adjust a belt on a pulley while the engine was in motion, was caught by the belt and sustained fatal injuries.

STIRLINGSHIRE.—A pit fireman, residing at Denmyloanhead, was electrically killed in Broomrig No. 2 Pit of the Bankhock Coal Co., Ltd., while helping to extend the cable of an electric coal-cutting machine.

At the bulk supply station at Dramburg, Germany, an engineer, named Bergmann, while seeking to remedy a disturbance in the service, received the full force of the high-pressure current with fatal effect. His body was burnt beyond recognition.

Educational Notes. — MUNICIPAL SCHOOL OF TECHNOLOGY, MANCHESTER.—We have received a set of copies of the Departmental Prospectuses of the Part-time (evening and Apprentices' Day) courses to be held at the School of Technology during the next Session, and we are informed that for the first time everyone of the 4,300 Part-time students in the school will be supplied free of charge with full particulars and syllabuses of the classes he is attending. The number of evening students has reached the limit of the accommodation provided by the present building, but the demand for advanced courses continue to increase. It has, therefore, been found necessary to abandon some of the more elementary classes, and to raise the fees in other cases. A special feature is the large proportion which the advanced work bears to the whole. This evening work in the case of a number of courses is of the same standard as that given to third-year students reading for an honours degree in a British University. There is also provided a considerable number of classes for students who have been engaged in industrial occupations since obtaining their degrees, and who wish to keep in touch with the recent developments of theory and practice with which their daily work has made them familiar. The prospectuses are admirably produced, and their contents are well calculated to whet the appetite of students for the acquisition of learning their craft. Prof. Miles Walker is the head of the department of electrical engineering.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.—Particulars appear in our advertisement pages of a special advanced course of instruction commencing next month by Dr. S. P. Smith on "The Principles, Design and Manufacture of Electro-Magnetic Machinery and Transformers, including electro-magnetic machinery." Series I: Synchronous and Induction Machines.

ROYAL COLLEGE OF SCIENCE FOR IRELAND.—Particulars of courses of instruction and professors, &c., are announced in our advertisement pages to-day.

UNIVERSITY ENGINEERING COLLEGE.—We have received Prospectus No. 7 from this Institution, which carries on tuition by correspondence, the principal being Mr. John G. Davis, B.Sc.Eng. (Hons.), London. A wide choice of courses is offered, ranging from work for beginners to advanced work for specialists, and special courses or contributions are arranged to suit individual requirements. A special feature is made of coaching for the entrance examinations of the various Institutions, amongst which must now be included the Electrical and Mechanical Engineers, and for engineering degrees. From the copies of testimonials accompanying the prospectus, it seems that the writers have had every reason to be gratified with the assistance given them by the College.

Municipal Tramways Association.—Next week the annual Conference will be held at Sheffield, commencing on Wednesday and ending on Friday. Full particulars of the agenda were given in our last issue.

Electric Supply Cricket League.—Below are given particulars of the points scored during last season by the clubs affiliated to this League, from which it will be observed that the Chelsea Electricity C.C. are the winners of the cup this year :—

Chelsea Electricity C.C.	10 points.
Kensington and Knightsbridge Electric C.C....	9 „
St. Pancras Electric C.C.	5 „
St. James's Electric C.C....	0 „

Mr. A. W. Seabright, the hon. secretary and treasurer, of 19, Cadogan Gardens, S.W., will be pleased to furnish Electricity Supply Cricket Clubs with any information they may desire to have in connection with the League.

Another Moulders' Strike.—The *Financial Times* states that upwards of 1,000 journeymen moulders and 500 apprentices are affected by a strike of moulders, which began in Sheffield on Saturday. All the big steelworks in Sheffield are concerned, and it is feared the dispute may be a protracted one and within a short time throw out many thousands. The men are striking against the employment of non-union labour at Messrs. Edgar Allen & Co., Ltd., Tinsley. A short time ago they came out on strike for three weeks without notice, but the Union executive refused to sanction it and they went back and gave proper notice.

Fall of a Steel Chimney.—At Workington Iron and Steel Works, on Tuesday, a steel chimney shaft, 180 ft. high, fell upon a rolling-mill shed, killing five men and injuring others. It is said that the fall was due to a gas explosion in the flues underneath the chimney. The exhaust main of a new turbo-generator recently installed was cut in two.

Annual Sports.—The Ordnance Athletic Club (The Electric and Ordnance Accessories Co., Ltd, Vickers, Ltd.), held their third Annual Sports meeting on their ground at Witton on Saturday, 13th inst. The full programme of 24 events (all closed to members) was carried through with great success. Two special prizes of considerable value were given by the superintendent of the works, Mr. W. L. Topple. The other prizes were handsome and numerous and were much appreciated by winners to whom they were presented by Mrs. Topple. The weather was all that could be desired, and a delightful afternoon was enjoyed by a company of 600 members and friends.

Rifle Match.—On the 6th inst., the Siemens Dalston Works Miniature Rifle Club met the Western Electric Co.'s Rifle Club on their open-air range at Plumstead, the result being a win for the Siemens team. The average score of Siemens team was 89 5, the total score being 537 out of a possible 600

Association of Electrical (Station) Engineers.—A meeting of the Grimsby branch was held on Friday, September 12th (Mr. A. Nuttall in the chair). It was reported by the hon. secretary (Mr. W. M. Fowler) that the grievances of some of the branch members with regard to number of working hours, &c., had been remedied through representations made by the Association, and the meeting expressed approval with the way in which the matter had been dealt with. A paper was read by Mr. P. B. Roberts, entitled "Running a Steam Turbine." A very interesting discussion followed. The Grimsby Corporation is extending its plant by adding a steam turbine, and Mr. Roberts's paper being purely practical, it was specially appreciated by members of the Corporation staff. The vote of thanks was passed to Mr. Roberts for his paper, and the next meeting was arranged for October 6th. Now that the holiday season is nearly at an end, and shift arrangements are normal, a number of meetings are being arranged at all important centres, details of which will be advertised. The principal object of these meetings will be to discuss a "bold progressive policy" for the Association.

Gas Fires on Trains.—The following timely letter appeared in the *Westminster Gazette* of Wednesday :—

Sir,—Whether the recent conflagration of the telescoped coaches during the Aisgill disaster will result in the substitution of electricity for gas remains to be seen. That gas-tanks are highly undesirable was again made apparent yesterday at Victoria Station on a L.B. and S.C.R. Co.'s train. The accident has not found its way into the papers, doubtless because no loss of life followed, but as I was an eye-witness I will describe it. A train ready to start, and full of passengers, was standing at No. 1 platform. Suddenly the gas-tank under the last coach burst into flames; immediately the tube to the main also caught fire. The noise of the flaring gas was tremendous, and the flames speedily set fire to the step of the coach. Guards rushed shrieking down the platform calling to the passengers sitting in the train to get out. Others arrived with extinguishers—three of these were brought to bear on the burning woodwork, which was put out, but the extinguishers failed to extinguish the burning flare from the gas-tank. Then the train was moved out, still burning, some few yards, and a workman put out the flames by turning the key of the tank. The moral is that had the train been in motion, instead of standing in the station, an accident would have been inevitable.

The ugliest part of the story is that I heard an official say to another: "Keep it dark; if the papers get it there'll be trouble."—I am, Sir, yours faithfully, RICHARD R. KNOWLES.

September 16th.

This communication affords a fitting comment on the recent statements of railway officials.

We may supplement the remarks in our leading columns regarding the use of electric lighting on Continental trains by mentioning that one firm alone—that of Brown, Boveri—has supplied 1,060 equipments to the Paris-Orleans Railway; the same system is also used almost exclusively on the Swiss Federal Railways, and is largely employed on the Austrian and Russian State Railways.

International Electrotechnical Commission.—The second plenary meeting was held in Berlin from September 1st to 6th last. It was attended by some 70 delegates from 24 nations, five of which represented Spanish-speaking countries. Amongst several official Government delegates were those of Canada, India and Great Britain.

In the regrettable absence of Prof. Dr. E. Budde, President of the Commission, Dr. E. Warburg, President of the Physikalische Technische Reichsanstalt, presided at the official opening. On behalf of the German Government, an address of welcome was given by Dr. Lewald, Director in the Ministry of Interior. In conformity with the custom of the Commission, a chairman was elected to preside over the unofficial meetings at which the work of the various Special Committees, appointed at Turin, was considered in detail. Mr. C. O. Mailloux, President of the American Institute of Electrical Engineers, was unanimously chosen for this post, than whom no fitter member of the Commission could be found, more especially because of his wonderful linguistic abilities.

The Special Committees were presided over by Dr. S. P. Thompson (Nomenclature), Dr. K. Strekker (Symbols), Mr. Huber-Stockar (Rating), and Dr. Zoelly (Prime Movers).

As regards nomenclature, a list of some 80 words and definitions was adopted. This does not appear much of an accomplishment, but it nevertheless represents much conscientious work on the part of the members. The Commission has decided to add German and Spanish equivalent terms with their definitions to this list.

Dr. Warburg presented, in person, a report on the question of an international standard for copper, the recommendations in the report having been drawn up by Dr. R. T. Glazebrook, in consultation with the National Laboratories of America, France and Germany. The adoption of this report will have the result that all future tables for copper will be calculated on an identical basis.

A number of definitions dealing with the terminology of water-power plants in conjunction with electrical works were adopted.

A list of 36 symbols was adopted, together with a number of guiding rules relating to symbols generally.

The name of "Siemens" instead of the "mho" is to be put before the San Francisco Congress.

The rating of electrical machinery gave rise to a prolonged and interesting discussion. It will be remembered that a Special Committee to study the subject was appointed at Turin in 1911, and that the Committee has met in Paris and Zurich. At Zurich certain limiting temperatures for modern insulating materials were put forward, and, broadly speaking, these have been adhered to. Much discussion centred round the question of the cooling air temperature. The distinction between the ideal rating which is useful for the purposes of comparison, and the available output which is dependent on the geographical position, came out most clearly in the debate. The majority of delegates were in favour of 40° C. as the limit of the cooling air temperature; three delegates, however, preferred 35° C. As it was not possible to arrive at a decision on this important point, involving, as it does, the fundamental question as to what temperature rise should be allowed in first-class modern electrical machinery, the Commission, rather than force a vote on a subject not yet ripe for decision, referred this particular point back to the National Committees for further consideration. It is hoped that a definite decision, satisfactory to all, may be arrived at in San Francisco in 1915. M. Maurice Leblanc was unanimously elected the new president, and the statutes having been modified accordingly, he will assume office for two years. Colonel Crompton was re-elected hon. secretary. The Spanish delegates invited the Special Committee to hold their next meeting in Madrid, and the Russian delegate, on behalf of his Committee, invited the I.E.C. to go to St. Petersburg in 1917. A most cordial telegram was received from the Kaiser in answer to one dispatched at the close of the official opening.

Appointments Vacant.—Assistant telegraph superintendent for the Great Indian Peninsula Railway (Rs. 500 to Rs. 700 per month, passage paid); shift engineer for Rathmines U.D.C. (35s.); electrician attendant for the County Asylum, Rainhill, near Liverpool (£50 +); shift engineers for the Waihi Gold Mining Co., New Zealand, for their new hydro-electric power station at Hora Hora (£4 per week + quarters). See our advertisement pages to-day.

Inquiries.—Makers of the White-Bartlett Static Electro-Medical Apparatus are asked for.

Accidents.—On Monday, the 8th inst., a fireman named Taylor met with a serious accident while attending to the coal-elevating and conveying plant at the Stretford U.D.C. Electricity Works. Shortly after his coming on night-shift duty some trouble occurred with the working of the overhead worm conveyor to boiler hoppers, and while attending to the gearing Taylor was caught in the machinery and his right arm was terribly mutilated. The injured man was subsequently removed to the Manchester Infirmary, where later his arm was amputated. Taylor's condition was at first reported critical, but it is believed he is now well on the way to recovery.

An employé named Nield, at the Oldham Corporation Electricity Works, Greenhill station, was suffocated on Monday, 15th inst. Deceased fell into the bunker while attending to the unloading of a coal truck. Efforts were ineffectually made to rescue him by means of a rope, but he gradually sank under the coal heap, which continued to shoot on him from the wagon. After an hour's hard work in emptying the bunker, the unfortunate man was extricated, but life was then extinct.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Aylesbury U.D.C., which intends carrying out an electric lighting scheme for the town, has appointed MR. W. A. TURNBULL, of Stoke-on-Trent, as resident engineer, at £200 a year.

The Malvern Urban Council has chosen three candidates for an interview, out of forty applicants for the post of gas and electrical engineer, vacant through the resignation of MR. W. J. RENDELL BAKER, who has secured an appointment at Mansfield. The salary is £350, rising to £400. The selected candidates are :—Mr. F. H. G. Goodwin, assistant constructional engineer to the Salford Gas Department; Mr. W. H. Johns, resident assistant engineer and superintendent, Saltley Gas Works; and Mr. H. Marsden, gas and electrical engineer to the Honley Urban District Council.

On September 4th the marriage of MR. PERCY M. SHEARS, of the Hackney Borough Council Electricity Department, to Miss Ada Glass, was solemnised at St. Thomas' Church, Upper Clapton. A presentation was made to Mr. Shears from his many friends on the staff of the Borough Council.

The Shoreditch B.C. Law and Establishment Committee recommends that the salary of MR. W. S. CLARK, the chief clerk of the electricity supply department, be increased from £250 to £275, as from September 30th, with a further annual increment of £25 to £300 maximum.

On Tuesday MR. W. J. RENDELL BAKER, gas and electrical engineer at Malvern for nine years, and now leaving for Mansfield, was presented with an upright grand piano by the employés of the

department and many friends. Councillor Moerschell, chairman of the Gas and Electricity Committee, made the presentation. On Monday Mr. Baker was the guest of a number of friends at dinner, and was presented with a pair of solid silver candlesticks.

Tramway Officials.—The salary of Mr. R. L. Horsfield, manager of the Walsall tramways, is to be increased from £400 to a maximum of £500 a year by half-yearly increments of £25.

Mr. Henry Mozley, general manager to Burnley Corporation tramways, who has been nominated a vice-president of Burnley Chamber of Commerce, is, along with Councillor John Holden, a delegate at the autumnal meetings of the Associated Chambers of Commerce of the United Kingdom.

Mr. C. W. Shepherd, manager of the Edinburgh tramways, who recently underwent an operation for appendicitis, is progressing favourably.

Mr. Wm. German, who has been associated with the traffic and engineering department of the Blackpool Corporation tramways for 14 years, has now left the service to take up duties at the new Palatine Road schools. His late comrades presented him with a gold watch, the gift being handed over by Mr. C. Furness, general manager.

Mr. L. Johnston, general manager and engineer of the Gloucester tramways, has been appointed tramway manager at Southampton; 38 applications were received for the post.

General.—Last Friday night the employés of Messrs. T. W. Broadbent, Ltd., of Victoria Electrical Works, Huddersfield, made a presentation to Mr. Victor Broadbent (nephew of the head of the firm), who is to be married in London on Saturday next, September 20th. The presentation took place in the drawing office, the secretary, Mr. W. Dickens, occupied the chair, and called upon Mr. J. L. Stokes, foreman of the pattern department, to make the presentation. Mr. Stokes, in doing so on behalf of the employés, wished Mr. Broadbent and his future partner much happiness. Mr. Broadbent in suitable terms, acknowledged the present, which took the form of an electric clock mounted in oak case. At the close of the meeting Mr. Dickens stated that Mr. Victor Broadbent had just been made a member of the board of directors, and hoped that his connection with the firm would be a long and happy one.

Mr. H. Drury, who has for 12 years been in the cable department of Messrs. Johnson & Phillips, Ltd., Charlton, is leaving for Cleveland, Ohio, and he has been presented by those engaged in the department with a purse of gold and a smoker's outfit.

It is announced that Mr. Walter Hull, formerly of Stalybridge, has been appointed chief engineer to an English firm who are about to establish works in South Africa. Mr. Hull was, until lately, chief electrical engineer to the Priestman Collieries, Ltd, and prior to securing that position was with Messrs. Cammell, Laird & Co., at Sheffield.

Mr. Henry Hirst, of Ashton-under-Lyne, has been appointed head-master of the Hyde Technical School.

Mr. John Buchanan, foundry manager to Messrs. Willans and Robinson, Ltd., who has resigned, has been presented by the employés with a roll-top desk, and a silver card-case for Mrs. Buchanan.

On the occasion of his marriage to Miss D. M. Barton, Mr. Frederick George Broadhead, of the engineering staff of Siemens Bros. Dynamo Works, Stafford, has been presented by his colleagues with a silver tea and coffee service, a silver spirit kettle and stand, a silver tray and a service of table glass, while from the shop engineers at the works he received a case of fish-eaters and table glass.

The *Australian Record* states that Mr. W. Corin has been appointed chief electrical engineer at the Department of Public Works.

Our Australian exchange, the *Mining and Engineering Review*, states that Mr. Percy Rosling, who for some years past has been Australasian manager for W. T. Henley's Telegraph Works Co., Ltd., and who recently visited London, is returning by the R.M.S. *Macedonia* which left Melbourne on August 26th. "Mr. Rosling will in future reside in London, and be associated with the same firm. His departure will be greatly regretted by the Victorian Institute of Electrical Engineers, of which he is a past president and member of the council. . . . A sad circumstance in connection with Mr. Rosling's return is that on Monday last he received a cable announcing the death of his wife. Mrs. Rosling had been in indifferent health for some time past."

Mr. A. R. Wood, late manager of the electrical cooking and heating department of the General Electric Co., Edgbaston Works, at Birmingham, has resigned his position in order to take up a similar appointment with the Carron Co., of Stirlingshire. This firm is now extending its works in order to cope with the ever-increasing demand for electric cooking and heating apparatus. Mr. Wood has had 14 years' experience with the General Electric Co.

Obituary.—H. Aron.—We regret to announce the death of Prof. Hermann Aron, which occurred suddenly, in his sixty-eighth year, at Homburg v.d. Höhe, on August 29th last. The name Aron has been carried all over the world by the clock meter which Dr. Aron devised in 1884 when the electrical industry was in sore need of a reliable and commercial instrument for measuring electrical energy, and by the Aron two-wattmeter connection for the measurement of three-phase power. This connection and the formulæ to be used with it were evolved quite theoretically, Aron having no three-phase supply available with which to verify his deduction. His first book, published in 1876, dealt with the theory of condensers, and among his later works were volumes treating of the theory of the microphone, and the theory and application of secondary cells. Besides placing a number of successful commercial instruments and apparatus on the market, the professor carried out much experimental and speculative work in electrotechnics and physics, and was intimately associated with many German technical societies and commissions.

The death has occurred in his fifty-sixth year of Councillor Alfred Ebbs, chairman of the Electricity Committee of the Hammersmith Borough Council.

NEW COMPANIES REGISTERED.

Ajax, Ltd. (130,899.)—This company was registered on September 4th, with a capital of £2,500 in £1 shares, to take over the business of manufacturers and vendors of electric appliances and dry cell batteries carried on by C. A. Cooper, at 25, Holborn Viaduct, E.C., as the "British Electric Institute," and to carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers of, and dealers in, "Ajax" dry cell batteries, and magnetic, electric and other appliances, &c. The subscribers (with one share each) are:—F. Stretton, 147, Nelson Road, Hornsey, N., clerk; W. Berner, 4, Leinster Road, Kilburn, clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. A. Cooper and T. W. Norman, chairman (both permanent). Registered office, 25, Holborn Viaduct, E.C.

G. C. Accumulator, Ltd. (130,888).—This company was registered on September 3rd, with a capital of £250 in 1s. shares, to carry on the business indicated by the title, and that of financiers, promoters, bankers, underwriters, concessionaires, &c. The subscribers (with one share each) are:—R. Warner, 10, Walbrook, E.C., accountant; E. Brooker, 10, Walbrook, E.C., secretary. Private company. Table "A" mainly applies. Registered by R. Warner, 10, Walbrook, E.C.

Liverpool Electric Welding Co., Ltd. (130,892).—This company was registered on September 3rd, with a capital of £1,000 in £1 shares (700 5 per cent. cumulative preference), to carry on the business of welders by means of electricity, welders of steam and other boilers, furnaces, combustion chambers and boiler shells, boiler makers and repairers, &c. The subscribers (with one share each) are:—W. A. M. Wachsmuth, 28, Madelaine Street, Liverpool, boiler maker; E. Jones, 53, Beaconsfield Street, Liverpool, boiler maker; H. Woods, 31, Patterdale Road, Liverpool, gentleman. Private company. The first directors are W. A. M. Wachsmuth, E. Jones and H. Woods; solicitor, H. T. Ellis, 6, Castle Street, Liverpool. Registered office, 16, Seaton Buildings, 17, Water Street, Liverpool.

Brilliant Signs Letras Morgan (South America), Ltd. (130,885).—This company was registered on September 3rd, with a capital of £5,000 in £1 shares (4,000 7 per cent. cumulative preference), to carry on the business of manufacturers of and dealers in brilliant sign and other letters, tablets, show cases, shop fittings and decorative panels, &c., to acquire from R. H. Morgan the business carried on by him at 951, Calle Uruguay, Buenos Ayres, Argentina, and the registered trademark or name of Letras Morgan, together with all agencies held by him, and to adopt an agreement with the Brilliant Sign Co. (1907), Ltd. The subscribers (with one share each) are:—W. Holtham, 46, Navarino Road, Hackney, N.E., clerk; T. W. Doran, 4, Fernleigh Drive, Leigh-on-Sea, clerk. Private company. The number of directors is not to be less than two or more than five; the first are not named; remuneration as fixed by the company. Registered by Ingle, Holmes, Sons and Pott, Capel House, E.C.

Atmospheric Nitrates (Kilburn Scott Patents), Ltd. (130,902).—This company was registered on September 4th, with a capital of £12,600 in £1 shares (12,500 ordinary, 10 founders' "A," and 90 founders' "B"), to acquire from E. K. Scott the benefit of and turn to account certain existing inventions relating to the fixation of nitrogen from air, to carry on the business of electrical engineers and contractors, chemists, druggists, drysalters, oil and colourmen, manufacturers of and dealers in acids, &c. The subscribers (with one share each) are:—E. K. Scott, Osborne House, Belvedere, Kent, electrical engineer; R. McDougall, City Flour Mills, German Street, Manchester, corn merchant and miller; I. McDougall, 68, Port Street, Manchester, manufacturing chemist. Private company. The number of directors is not to be less than two or more than seven; the first are E. K. Scott, R. McDougall, I. McDougall, F. Howles, and S. McDougall; qualification, 200 shares; remuneration as fixed by the company. Solicitors: Richard Hankinson & Co., Manchester. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

Grindell Matthews Radiophone Syndicate, Ltd. (131,006).—This company was registered on September 11th, with a capital of £10,000 in £1 shares, to carry on the business of a telephone, telegraph, general engineering and finance syndicate. The subscribers (with one share each) are:—G. W. Edgelow, 341, Clapham Road, S.W., clerk; P. B. Keeble, 19, Hamilton Square, S.E., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Hennen, Edgelow & Castellan, solicitors, Quality Court, Chancery Lane, W.C.

Clonakilty Electric Light and Power Co., Ltd. (4,037).—This company was registered in Dublin on September 8th, with a capital of £2,500 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, &c. The subscribers (with one share each) are:—J. Crowley, Homeville, Clonakilty, national teacher; J. Connolly, Mill Street, Clonakilty, merchant. Private company. The number of directors is not to be less than three or more than five; the first are P. W. O'Donovan, J. McCarthy, P. O'Sullivan, P. Hill and M. Sheehy; qualification, £100; remuneration, two guineas each per annum. Registered office, 43, Sovereign Street, Clonakilty, Co. Cork.

Brown & Parsons (1913), Ltd. (130,962).—This company was registered on September 9th, with a capital of £2,000 in £1 shares, to take over the business of an electrical, mechanical and general engineer and contractor, carried on by S. Hill, at 63, Parade, Leamington, in succession to "Brown and Parsons, Ltd." The subscribers (with one share each) are:—F. E. Brown, 63, Parade, Leamington Spa, electrical engineer; G. Williams, 156, Edmund Street, Birmingham, solicitor. Private company. Table "A" mainly applies. Solicitor: G. Williams, 156, Edmund Street, Birmingham. Registered office, 63, Parade, Leamington.

Woolnough, Lang, Ltd. (130,958).—This company was registered on September 8th, with a capital of £5,000 in £1 shares (1,000 founders), to carry on the business of electrical and mechanical engineers as formerly carried on by F. Woolnough, at Norwich, as the St. Stephens Engineering Works. The subscribers (with 12 shares each) are:—F. Woolnough, St. Stephens Engineering Works, Norwich, electrical engineer; C. H. D. Lang, 14, Greencroft Gardens, Hampstead, N.W., electrical engineer. Private company. The number of directors is not to be more than two; the first are F. Woolnough and C. H. D. Lang (both permanent, subject to holding 100 shares each); qualification of ordinary directors, five ordinary shares. Registered office, St. Stephens Engineering Works, St. Stephens Street, Norwich.

Electric Motor and Stove Hiring Co., Ltd. (130,965).—This company was registered on September 9th, with a capital of £5,000 in £1 shares, to let out on hire, hire-purchase, or to sell outright, electric motors, generators, cookers and radiators, &c. The subscribers (with one share each) are:—J. C. B. Ingleby, Woodville, Old Park Road, Roundhay, Leeds, electrical engineer; H. S. Ingleby, Woodville, Old Park Road, Roundhay, Leeds, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are J. C. B. Ingleby, E. J. Ingleby, H. S. Ingleby, and E. C. Ingleby (all life directors); qualification, £100; remuneration as fixed by the company. Registered office, 92, Elland Road, Leeds.

I.L. Syndicate, Ltd. (130,968).—This company was registered on September 9th, with a capital of £2,600 in £1 shares, to acquire from F. L. Hollister certain patents, rights and protections relating to machines for generating electric current for ignition, illumination and otherwise; to carry on the business of electricians, engineers, &c. The subscribers are:—G. J. Lothian Nicholson, 25, Walpole Street, Chelsea, S.W., engineer, 25 shares; A. A. Holle, 22, Clarges Street, W., engineer, 100 shares. Private company. The number of directors is not to be less than three or more than seven; the first are A. A. Holle, G. J. Lothian Nicholson, A. G. Morrish, F. L. Hollister and W. E. Dommett; qualification, £25. Registered office, 34-36, Gresham Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dartmoor Electric Supply Co., Ltd.—"B" debenture dated August 22nd, 1913, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital (subject to a first mortgage deb. issue of £1,200). Holders: Lloyds' Bank, Ltd., Lombard Street, E.C.

James Jackson & Co., Ltd.—Mortgage dated May 20th, 1913, to secure £475, charged on buildings, workshop and yard at Eckington, Derby. Holder: W. E. Booth, Batley (filed August 27th, pursuant to order of Court).

Cable Accessories, Ltd. (93,345).—Capital, £7,000 in £1 shares. Return dated May 22nd (filed May 28th), 1913. All shares taken up. £1 per share called up on 2,612, 10s. on 172, and 5s. on 1,166. £2,989 10s. paid. £3,050 considered as paid on 3,050 shares. Mortgages and charges: Nil.

Hong Kong Tramways Co., Ltd. (75,486).—Capital, £81,250 in 5s. shares. Return dated May 29th, 1913 (filed June 5th, 1913). All shares taken up. £81,250 considered as paid. Mortgages and charges: £190,000.

D. Hulett & Co., Ltd. (29,463).—Return dated August 11th, filed August 21st, 1913. Capital, £35,000 in £5 shares. 6,000 shares taken up. £5 per share called up on 1,900. £9,500 paid. £20,500 considered as paid on 4,100 shares. Mortgages and charges: Nil.

D.P. Battery Co., Ltd. (44,084).—Return dated June 22nd, filed June 28th, 1913. Capital, £10,000 in £1 shares (4,996 "A," 4,996 "B," and eight others). All shares taken up. £10,000 paid. Mortgages and charges: £12,000.

W. Parsons & Co., Ltd.—Particulars of £300 debentures, created August 28th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Allen West & Co., Ltd.—Particulars of £6,000 debentures, created August 20th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

J. G. White & Co., Ltd. (66,568).—Capital, £200,000 in 15,000 pref. shares of £10 each, and 50,000 ord. shares of £1 each. Return dated July 10th, 1913 (filed July 14th). All shares taken up. £10 per share called up on 15,000 pref. £150,000 paid. £50,000 considered as paid on 50,000 ord. shares. Mortgages and charges: Nil.

Merthyr Electric Traction and Lighting Co., Ltd.—Capital, £100,000 in £5 shares (10,000 pref. and 10,000 ord.). Return dated June 2nd, 1913 (filed July 8th). 6,000 pref. and 8,000 ord. shares taken up. £5 per share called up on 6,000 pref. and 6,000 ord., and £3 per share on 2,000 ord. £66,000 paid. Mortgages and charges: £48,400.

Dartmoor Electric Supply Co., Ltd.—Issue on August 22nd, 1913, of £700 debentures, part of a series of which particulars have already been filed.

Electromobile Co., Ltd.—Issue on September 8th, 1913, of £184 17s. 6d. debentures, part of a series of which particulars have already been filed.

Ajax, Ltd.—Particulars of £2,000 debentures, created September 8th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act of 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

Ennig Electric Light and Power Co., Ltd.—Debenture dated September 4th, 1913, to secure £200, charged on the company's property, present and future, including uncalled capital. Holder: W. Jones, Gendre, near Talgarth.

Spagnoletti, Ltd.—Charge on freehold land in Cumberland Avenue, Willesden, dated August 21st, 1913, to secure all moneys due or to become due from the company to London County and Westminster Bank, Ltd., 41, Lothbury, E.C.

CITY NOTES.

Yorkshire Electric Power Co.

The half-yearly meeting of this company was held at the Hotel Metropole, Leeds, on 16th inst. The chairman (Mr. A. G. Lupton) said that in accordance with their custom they had not issued a printed copy of the accounts for the half-year, but the report showed that very material progress had been made. At their corresponding half-yearly meeting in September, 1912, they had to speak of the difficulties with which the company had been struggling, and shareholders accepted the assurances of the directors that these were temporary and would shortly be overcome, and that the year 1912 must be considered as quite exceptional to the steady progress of the company. Now they were in the more satisfactory position of being able to point to the fulfilment of these anticipations. The revenue for the half-year, which in 1912 was £20,357, had this half-year amounted to £30,132, an increase at the rate of 48 per cent. The prices of coal had been heavy, but in spite of this the accounts showed a profit of £6,971 for the half-year. This, after payment of £2,667, the dividend on the preference shares, would leave £4,308 to carry forward, and the directors anticipated with confidence the balance-sheet which they would be able to present at the end of the present half-year. Included in this revenue was £529, dividend on the company's investment of nearly £9,000 in the Distribution Co., which had now reached a very satisfactory position. The waste heat station at Barugh, for which the first sod was cut in August, 1912, was now practically completed, and the machinery was being tested preparatory to being put to work on the commercial load. The first installation there was a 2,000-KW. turbine, but increasing demands for the company's supply had compelled the directors to place a further order for a 3,000-KW. turbine, and the completed station of 5,000 KW. would be a useful addition to the plant of the company and add greatly both to security and efficiency. Of the further £50,000 issue of 6 per cent. preference shares in this company authorised last year, and the £25,000 5½ per cent. first mortgage debenture stock of the Waste Heat Co., considerably more than half had been taken up, and applications for the balance were steadily coming in. The directors were largely interested in both securities and recommended either of them as a sound investment. Application forms would be sent out with the report of the meeting to all shareholders, so that those who desired might avail themselves of this good rate of interest. Since the first issue of preference shares was made, and the rate of 6 per cent. fixed, the position of the Power Co. had greatly improved, and in his (the speaker's) opinion so soon as this issue had been absorbed, if any further preference shares were offered, they ought to carry a lower rate of interest. They had again found it necessary to oppose provisions in applications made to Parliament which affected the company's powers, and as before had been entirely successful. Unfortunately, some of the local authorities were still in the mental condition of the medieval barons, and to a large extent governed the area which they were elected to serve from the point of view of finding what burdens and limitations they could impose on the manufacturers who brought wealth and prosperity to their districts, but this was gradually changing. The directors believed that the development of the company's supply was as much in the interest of local authorities and manufacturers as of the shareholders of the company, and anything which tended to restrict the operations of the company was to the ultimate detriment of the industries of the county. The company had justified the principles which underlay its formation. It was giving a large supply at prices undreamt of before, and the directors foresaw that future developments would be enormously greater, whilst it was gratifying to find that power-users and public bodies alike were realising that it was in the interests of the county that the supply of the company should be developed as rapidly as possible. The bulk supply of energy to local authorities and companies was steadily increasing. The company had just concluded an agreement with the undertakers of the Pontefract electric lighting order for a bulk supply in that borough, which brought the total agreements made by the company for a bulk supply to 23. Practically all these undertakings were working at a profit, and the directors were convinced that the 27 undertakings at work in the company's area which were not taking a supply from the company would be materially benefited if such supply were taken either in full or in part from their own supply. For some time the directors' attention had been increasingly drawn to one defect in their statutory powers. There were many districts where the population was too scattered to justify the cost of a distributing order, but they were precluded from supplying electricity for lighting purposes except to premises where power was used. Their company was formed amongst the earlier power companies, and to later ones authority had been given to supply current for lighting as well as for power only. It has been suggested to them that they should ask Parliament to give these same powers in those districts where there was no existing distributing company or authority, and the directors had this under their consideration. If this was decided upon, approval would be asked at the annual meeting in February. With respect to the vacancy on the board caused by the death of Mr. Robert Hudson, to whom the company was so much indebted from its inception, Mr. F. J. Kitson had consented to accept this seat on the board. Mr. Kitson had been a large shareholder, and much interested in the progress of the company from the first. The business of which he was chairman, was one of their largest customers, and his advice and assistance would be of great value to the company. The chairman invited shareholders to go over and see the central generating station at Thornhill. Mr. Woodhouse had arranged to show any visitors round the works on the afternoons of September 24th, 25th and 26th.

The report was adopted and the preference dividend authorised.

Dick, Kerr & Co., Ltd.—According to a financial daily, a final dividend of 3 per cent. has been declared on the 6 per cent. cumulative preference shares, payable October 1st.

Victoria Falls and Transvaal Power Co.

The directors' report for the year ended December 31st, 1912, which was issued last week, states that at that date the issued share capital amounted to £3,000,000 and the debenture capital to £4,000,000, having been increased by £1,000,000, as referred to in the last report. The year's business (says the *Financial News*) has resulted in a profit of £446,380, which, with the balance of £45,744 at the credit of the profit and loss account as at December 31st, 1911, remaining after payment of the dividend declared on May 23rd, 1912, makes a gross total of £492,124. The substantial increase in the revenue, of £123,286 as compared with the preceding year, is a noticeable factor in the company's increasing prosperity. This result has been obtained notwithstanding that on October 1st, 1912, the reduction in the price of power came into force, in accordance with the terms of the contracts with consumers, and, further, that £1,000,000 of capital was unproductive, due to constructional work still being in progress. After providing for interest on debentures for the year 1912, amounting to £174,703, and for depreciation, amounting to £102,054, the balance remaining is £215,367. In respect of this balance the directors, on June 5th last, declared a dividend at the rate of 6 per cent. per annum (less income-tax) for the 12 months ended December 31st, 1911, on the amounts for the time being paid up on the preference shares. This dividend was paid to the shareholders on June 14th, 1913, and absorbed £118,580, leaving £96,787 to be carried forward. The period under review has been marked by continued increases in the demands for power made by the consumers of this company and the Rand Mines Power Supply Co., Ltd. The Vereeniging power station, since it came into commission in September, 1912, has proved entirely reliable, the supply of power being delivered and maintained over the 32 miles of transmission line without any of the earlier troubles. In order to meet the demands of the consumers of both companies for power and to provide adequate reserve plants, contracts for further machinery to supply 90,000 H.P. have been entered into.

Stock Exchange Notices.—The Committee has appointed a special settling day, as under :—

Thursday, October 2nd.—International Light and Power Co., Ltd.—Fully-paid scrip certificates for $931,900 common stock in shares of $100 each, and for $1,000,000 6 per cent. cumulative preferred stock in shares of $100 each.

And ordered the undermentioned securities to be quoted in the Official List :—

Alabama Traction, Light and Power Co., Ltd.—$6,000,000 5 per cent. first mortgage 50-year gold bonds, Nos. A 1 to 3,000 of $100 and B 1 to 11,400 of $500 each, in lieu of the scrip.

Mansfield and District Tramways, Ltd.—Further issue of 17,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 60,001 to 77,000.

Application has been made to the Committee to allow the following security to be quoted in the Official List :—

North Metropolitan Electric Power Supply Co.—Further issue of £40,000 5 per cent. mortgages, Nos. 1,501 to 1,900 (registered).

Dundee, Broughty Ferry and District Tramways Co., Ltd.—The directors report that the profit for the past year, including the sum brought forward, after providing for interest on debenture stock, amounts to £5,104. The interim dividend on the preference shares (6 per cent. per annum) less tax, absorbed £1,412. The directors propose to pay the final dividend on preference shares, £1,412 ; putting to renewals fund, £600 ; and to sinking fund for redemption on debenture stock, £600 ; and to pay a dividend on the ordinary shares at the rate of 2½ per cent. per annum for the year to July 31st, less tax, £676, leaving £402 to be carried forward. The receipts have been very well maintained.

Callender's Share and Investment Trust, Ltd.—The directors' report for the period from May 10th, 1912 (the date on which the company commenced business), to August 31st, 1913, shows a gross profit of £19,227, and after providing for debenture interest and calls in advance there is available a balance of £12,205. The directors recommend a dividend at the rate of 5 per cent., place £1,800 to redemption fund, and carry forward £2,135. The meeting was held yesterday afternoon.

Direct Spanish Telegraph Co., Ltd.—The directors announce, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, a dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th last, and payable on October 1st.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the half-year to December 31st, payable October 1st.

Continental.—Switzerland.—The Oerlikon Maschinenfabrik Gesellschaft, of Oerlikon, near Zurich, is declaring a dividend of 7 per cent. for the last financial year, as compared with only 5 per cent. in the preceding 12 months.

Gateshead and District Tramways Co.—The directors announce an interim dividend at the rate of 5 per cent. per annum on the ordinary shares for the half-year.

Winnipeg Electric Railway Co.—A quarterly dividend of 3 per cent. is announced, payable October 1st.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is taking time to get into anything that approaches a regular swing of business. Investment orders remain in the majority. Speculation is rife only in the American market, and even there it comes in gusts. Money, however, is plentiful, if not particularly cheap. Confidence begins to return to the mind of the investor, for whose delectation, we may observe, dozens of schemes are germinating in the active brains of those who want his money. But while Consols improved, Home Rails went flat. Rubber shares drifted to the verge of demoralisation.

The Home Railway market, after holding up with a certain degree of firmness, developed acute depression as the result of the threatened general strike on the London and North-Western Railway system. This, combined with minor causes, such as the re-opening of the Midland inquiry, and the difficulty with some of Tilling's men, led to prices being severely shaken, and in the débâcle all the sections sympathised. Metropolitans dropped 1¼ to 46, Districts ½ to 34¼. Underground Electric shares had been firm, the £10 variety being up to 4 1/16, but they could not withstand the railway flatness, with the Tilling trouble as well, and the price went back to 3¾. British Electric Tractions have come into demand. The first Debenture stock rose 2½, the second gained a point, and so did the 7 per cent. non-cumulative Preferred stock.

Pronounced strength remains the feature of the market for English Electricity Supply shares. It has been helped considerably by rumours revived as to a possible taking-over of the City of London Company by the Corporation of London. Of the truth of these reports we have been unable to obtain satisfactory verification or denial ; all we can say is that some of the people in the inner circles who are holders of the shares are not getting out. It may be recalled that the price went to 23½ when this rumour did duty before, since when the price has been down to 14¼—sufficient evidence of the extremely speculative character of the shares. The Preference shares rose £1 to 13½. County of London Ordinary are a strong market, and, in addition to the rise shown overleaf, there is a dividend of 6s. to be added this week. The Preference recovered the deduction of 6s. made last pay-day. Westminsters rose to 9 ; and the list as a whole, as already noticed, exhibits a strong appearance. Some of the people following the market, point out Metropolitans and South Londons as being cheap at their present quotations at 3⅝ and 3 1/16 respectively. If the flare were to die out of Cities, it might affect the market as a whole, at any rate for a time.

Fresh reports of friction between Mexico and the United States have been taken calmly in the Stock Exchange. Mexican Railway issues have shot up during the past 10 days. The utility companies' issues have quietly moved upwards. Mexican Light and Power First Mortgage bonds rose ½, and the Preferred put on 2½. The group as a whole is steady, and there is more disposition to buy Canadian varieties than there has been of late. Calgary bonds hardened to 92. Montreal shares fell to 210, but regained the drop. Brazilian Traction Ordinary, after dipping to 95, have come up to 97½. Anglo-Argentine Tramway 5 per cent. Debenture stock is a little harder, justifying its recommendation made some few months ago when the price stood 4 points lower. Victoria Falls Power Preference shares improved to 1 3/16 upon the favourable nature of the report. The British Columbia Electric Railway group shows no significant change. Barcelona Trams spurted to 40.

In the Telegraph market the principal movement is a fall of ⅜ in West India and Panama Telegraph Second Preference, reducing the price to 9¼. There was a little pressure to sell, and the market was not anxious to take the stock. Commercial Cable Debenture eased off to 82½, and Anglo-American Preferred is a point down at 106½, the Deferred reacting to 23¼. On the other hand, American Telephone and Telegraph Capital stock rose 1½ upon the strength of the Yankee market, and other things in this section have been on the whole very firm. Great Northerns are 10s. up, as are also Indo-Europeans. Mackay Company's Common and Preferred have both regained their dividends. Monte Video Telephones drooped to 1. Dealings in Marconis have been fitfully active. The parent shares have risen on the negotiations between the Company and the Goldschmidt interests. Americans hardened to 1⅛, Canadians to 12s.

British Insulated and Helsby Cable shares put on a further 5s. at 8½ upon a steady demand which found comparatively few shares about to satisfy it. Castner-Kellners are 1/16 up at 3 1/16 ; and the only fall in the Manufacturing list is one of ¼ in General Electric 6 per cent. Preference shares, which left the middle price 9⅞.

Callender's Share and Investment Trust has published its maiden report, showing a dividend of 5 per cent. The 5 per cent. Debenture stock is quoted at 101½ middle.

The rubber share market has fallen into an extremely unsatisfactory condition, owing to a further shrinkage in the price of the raw stuff to 2s. 2½d. per lb. for plantation, although fine hard Para retains its steadiness at about 3s. 8d. per lb. Authorities in Mincing Lane and the Stock Exchange are nonplussed to explain the severity of the fall in plantation rubber, and admit that they are at a loss to forecast the outlook. Meanwhile the prices of shares continue to down-grade heavily, and the Stock Exchange market has dropped into a condition of extreme sensitiveness.

Lima Light, Power and Tramways Co.—A dividend of 1 per cent. has been declared in Lima for the quarter ended June.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 16th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¼ — 9⅛	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	+1⅜	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	+1	4 5 9
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord. ..	10	6	5†	12 — 13	+1½	4 12 4
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜ xd	+ ¼	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	89 — 91	+1	4 19 0
Hove	5	9	..	7⅜ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 7⅞	..	5 3 8
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	£	2½	..	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	8⅜ — 8⅞	..	5 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	78 — 81	..	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7	6†	6⅞ — 6⅞ xd	..	5 9 10
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 9½	..	5 8 1
Do. 7 % Pref.	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	£	5½	..	2⅝ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	£	7	7	1⅝ — 1⅝	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	..
Do. 5 % Cum. Pref.	5	11	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10†	8¾ — 9¼	+ ⅛	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	..	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	+ ½	5 7 6
Canadian Gen. El. Com. ..	$100	7	7†	113 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 11/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	£0½ — 92½	..	5 8 2
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	..	9/16 — 11/16	..	10 13 4
Kaministiquia Power, 5% G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4	66 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	97⅓ —102⅓	+ 2½	6 16 7
Do. 5 % 1st Mort. Gold Bds.		5	5	91 — 93	+ ½	5 7 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	78 — 80	..	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	74 — 77	..	6 9 10
Montreal, Lt., H. and Power ..	$100	9	10†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	5	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	5½	6†	140 —144	..	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	+1	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	⅝ — ¾	+1/16	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Anaconda Telegraph	10	4½	..	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 96	..	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	134 —136	+1½	5 17 8
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	106 —107	—1	5 12 2
Do. Def.	Do.	30/-	..	23 — 23½	— ¼	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	5	..	7⅜ — 7⅝	+1/16	5 5 0
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81½ — 83½	— ½	4 15 10
Cuba Telegraph	10	6	6†	8¼ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6⅝ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅝ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127 —130	..	5 7 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 6
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	95	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12 — 12½	— ⅛	4 16 0
Great Northern Telegraph ..	10	20	5†	30½ — 32½	+ ½	6 3 1
Indo-European Telegraph ..	25	13	..	56 — 58	+ ½	5 12 1
Mackay Companies Common ..	$100	5	5	86 — 88 xd	+1½	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	66 — 70 xd	+1	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 — 4⅛	+ ⅛	4 16 10
Do. 7 % Cum. Partic. Pref.	1	17	..	3 5/16 — 3 7/16 xd	..	4 18 11
Monte Video Telephone, Ord. ..	1	6	6	1 3/16 — 1 5/16	— 1/32	5 13 0
Do. 5 % Pref.	1	5	5	⅜ — ½	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	..	4 9 1
Oriental Telep. and Elec. ..	1	10	..	1 23/32 — 1 27/32	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1¼ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	+ ½	4 1 3
Reuter's	10	10	10†	9¾ — 10¼	..	9 17 6
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	£	£	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	+1	4 2 6
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅞	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	— ⅜	6 6 4
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12¾ — 13⅛	..	5 5 8
Do. 4 % Deb.	Stock	4	4	91 — 93	+ ½	4 6 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 96	..	4 14 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 16th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	5/8 — 3/4	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	11½ — 13	..	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	48 — 51	+1	5 17 8
Do. 5 % Perp. Deb.	100	5	5	93½ — 95½	+2½	5 3 8
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	+1	5 14 0
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. Pref.	100	4	4	77 — 79	..	5 1 3
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	6	6†	17/32 — 23/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 3 3
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 1/8	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	74 — 79	..	5 13 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Metropolitan Railway Consol.	100	1⅝	1¼†	45¾ — 46½	−1½	3 10 8
Do. Surplus Lands	100	2⅜	2¾†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	−1	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord.	100	Nil	..	34 — 34½	− ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	89 — 92	−1	5 8 8
Potteries, Ord.	1	3½	..	3/32 — 13/32	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 8 % Pref.	1	6	6†	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅝ — 3⅞	— ⅛	Nil
Do. "A"	1/-	..	..	15/32 — 19/32	..	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	109 —111	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89½ — 90½	−1	6 12 7
Yorkshire (West Riding), Ord.	5	Nil	..	3/8 — 5/8	..	Nil
Do. 6 % Pref.	5	3	1½†	8⅜ — 8⅞	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98½ —100½	+ ½	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	97 — 98	+1½	6 2 5
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	125 —128	−1	6 5 0
Do. Pref. Ord.	100	6	6	113 —116	+1	5 3 5
Do. 5 % Pref.	100	5	5	102½ —105½	..	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	93½ — 95½ xd	+ ½	4 9 0
Calcutta Trams, Ord.	5	7½	..	5⅝ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1/32 — 1/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5 5/16 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	..	..	13/32 — 17/32	..	..
Do. Pref.	1	4⅜d.	5	23/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	6†	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7†	7	98½ —100½	..	6 19 4
Do. Gen. Con. 5 % Bonds	..	5	5	90½ — 92½	+1	5 8 1
Do. 6 % Bonds	100	6	6	93½ — 95½	..	6 5 8
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 — 6⅛	..	7 18 10
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102 —103	+ ½	4 17 1
Do. 5 % Mort. Bonds	100	5	5	96½ — 97½	+ 1	5 2 7
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 — 104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½ xd	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	7 7 8
Do. 6 % Pref.	1	5	6	23/32 — 27/32	..	7 2 6
Babcock & Wilcox	1	16	..	3 1/16 — 3 3/16	..	5 0 5
Do. Pref.	1	5	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 5/16	..	..
Do. 6 % Cum. Pref.	1	6	6	15/16 — 15/16	..	6 8 0
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	..	5 5 3
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 8
B I. & Helsby Cables	5	10	..	8¼ — 8¾	+ ¼	5 14 3
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾	..	4 14 0
British Westinghouse, Pref.	5	Nil	..	7/8 — 1 1/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —8/-	..	Nil
Do. Pref.	1	..	..	8/- — 8 6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	..	10¾ — 11½	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	8¾ — 8⅞	+ 1/16	5 8 2
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1½ — 1¾	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	5	..	1 — 1½	..	8 0 0
Do. Pref.	2	7	7	1 13/16 — 2 1/16	..	6 15 9
Greenwood & Batley, Pref	10	7	7	6¾ — 7½	..	9 18 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	6	6	9½ — 10½	− ½	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	10†	12½ — 18	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	12⅜ — 13¾	..	5 9 1
Do. Pref.	10	5	5	9⅜ — 10⅛	..	4 18 9
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	+1	4 1 8
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	¼ — ½	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

THE EFFECT OF OUTER GLOBES ON THE LIFE OF METAL-FILAMENT LAMPS.

With the rapid increase in the use of large metal-filament lamps for street lighting in recent years, the question of the best shape and arrangement of the supports for them has come into prominence. It is still the usual practice to provide an outer additional protecting cover of glass, but, according to some tests carried out by Herr Gustaf Sunden (see *E.T.Z.*, August 28th, 1913) such a cover has a distinctly bad effect on the life of the lamp. He noticed that in a particular installation containing lamps, both with and without outer globes, those with globes became dull after a much shorter time than the others.

He therefore made the following tests on lamps obtained from various first-class makers. Some of the lamps were surrounded with heat-insulating material in a metal tube, so arranged that a steady temperature of 200° C. in the tube was reached, others burnt in the open at the room temperature of 20°, and others again

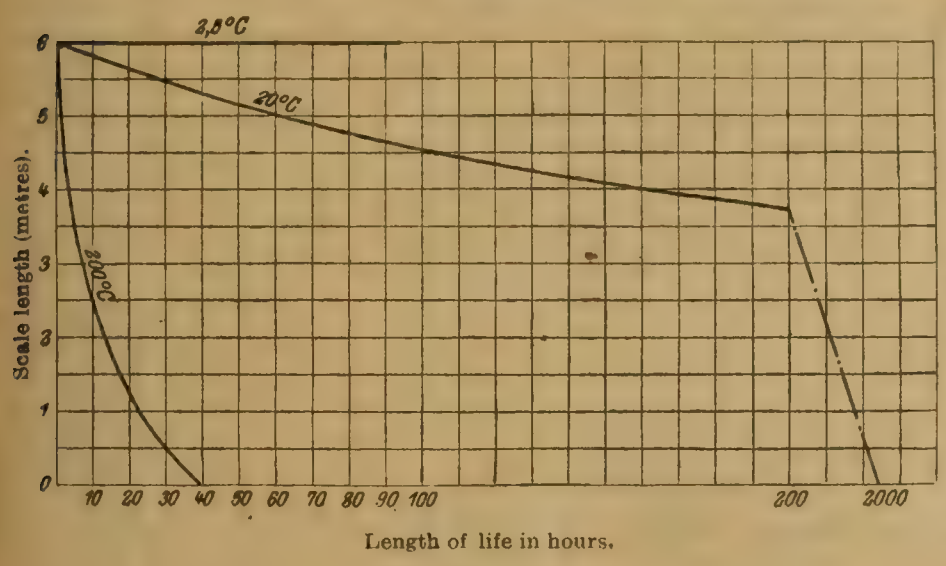


Fig. 1.

were artificially kept at 2·5° C. by a flow of cooling water. The lamps were tested from time to time for mechanical strength of filament in a shock apparatus with a 6-metre scale of the type designed by Th. Müller, of Bern. To begin with, all the lamps stood the full 6-metre test length, but this gradually diminished as the hours of burning increased, the rate of deterioration being very much more marked at the higher temperature. The results are shown in fig. 1, from which it will be seen that the 200° lamps only reached a life of 40 hours, whilst the 20° ones reached about 2,000 hours, and were even then decidedly less blackened than the others. The 2·5° C. test showed no measurable fall in brightness or in strength after 40 hours.

The probable cause of these marked differences is the diminution of the vacuum at the higher temperature through the glass becoming somewhat porous. The larger lamps, such as 300-c.p. ones, showed blackening more quickly than smaller lamps when run at the same temperature (200° C.).

The actual temperatures reached in practice are shown by a test made on a 300-c.p. lamp in an ordinary clear glass outer cover, with

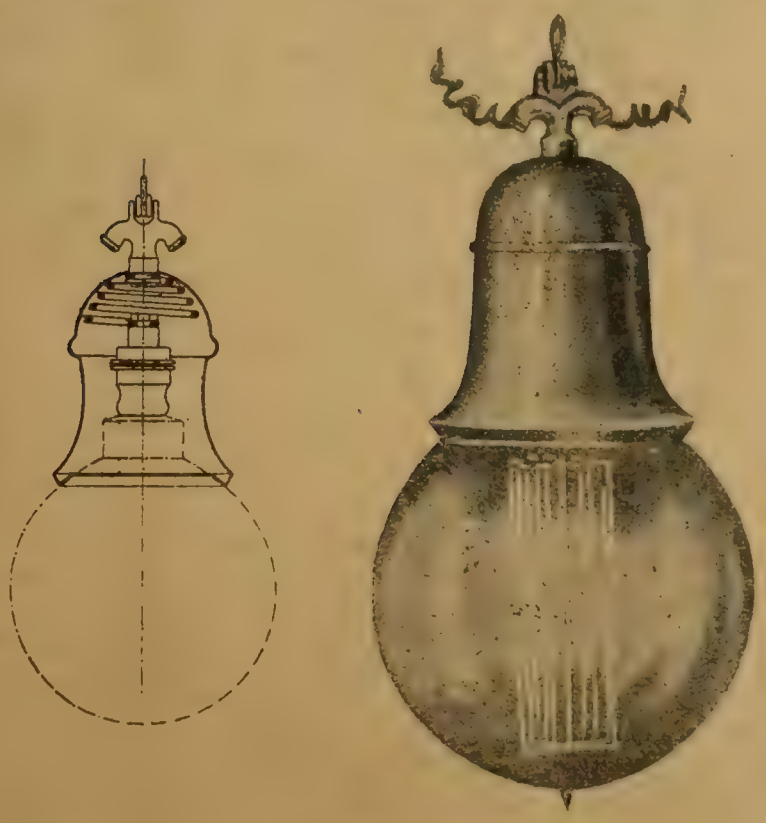


Fig. 2.

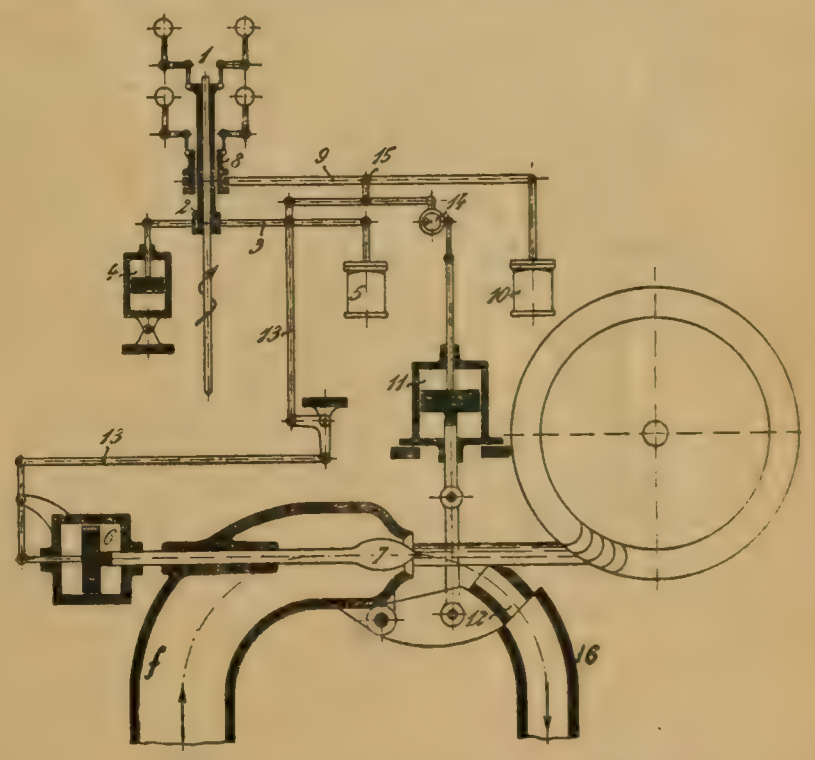
a 20-mm. opening at the bottom. The temperature inside the outer globe reached a steady value of 70° C. after 35 minutes. With an obscured or dusty globe, still higher temperatures would be reached.

In view of these results, the writer has designed the special holder shown in fig. 2 for the purpose of securely holding the lamp bulb itself, and obviating the use of any outer globe. In this design the porcelain contact holder is attached to a strong spiral spring. This spring presses the lamp bulb firmly against the wide flange of the cover. The cover is of ·6 mm. copper, and is not arranged as a reflector, since very little light is thrown upwards from the ordinary metal-filament lamp, and a reflector is, therefore, of little use. The absence of a reflector, besides cheapening the whole construction, also obviates the cleaning of the lamps, as they become automatically cleaned by the rain.

AN INTERESTING 3,000-H.P. PELTON WHEEL.

In the Arniberg (Amsteg) hydro-electric station, a 3,000-h.p. and a 1,300-h.p. Pelton wheel set are at present installed, and accommodation is provided for two further sets. The 3,000-h.p. set offers several interesting features. The wheel is designed to run at 630 r.p.m. under a head of 2,630 ft., and is overhung on the generator shaft. The buckets are of cast electric steel and are riveted between forged steel disks; this construction does not permit of easy renewal of individual buckets, but this is rarely, if ever, necessary since the water (initially clear) is passed through a settling basin before use, hence wear on the buckets is uniform. The water jet driving the wheel is 60 mm. in diameter, and exerts a circumferential force of 8,800 lb. At normal speed, each blade receives 10 impulses per second.

Referring to the accompanying sketch, the supply main is of cast-steel 300 mm. internal diameter, and has an easily detachable delivery nozzle. Since sudden load variations (barring occasional short circuits) have not to be contended with, auxiliary fly-wheels are not used. It was specified that sudden complete removal of full load should not be followed by more than 8 per cent. rise in speed, and to comply with this requirement, a special system of automatic



regulation is employed for the first time. Abrupt diminution of the water-flow in the 1·4 miles of supply mains is, of course, impossible, owing to the serious water hammer which would result. In the arrangement actually employed, the jet is more or less completely diverted from the turbine wheel after sudden load reduction, by the temporary interposition of a curved guide tube 12 (fig. 1) between the delivery nozzle and the wheel buckets.

The double spring governor 1 is driven from the turbine shaft, and carries two sleeves, the lower one, 2, of which is connected to the lever 3 controlling, by means of the valve 5, and the auxiliary 6, the setting of the jet regulator 7. The oil dash-pot 4 prevents rapid motion of this mechanism (and hence rapid checking of the water column in the supply pipes). The upper governor sleeve 8 controls the valve 10 of the auxiliary 11, and hence the setting of the deflecting tube 12.

On small load variations, the oil-braking is hardly operative, so that the two governor sleeves move with equal speed. The section of the jet is reduced, and 12 only moves so as to follow this diminution in section without cutting into the jet. Should a large fraction of the load be removed suddenly, sleeve 8 rises at once, and part of the water jet is deflected into 16, after which the guide tube 12 gradually reverts to its original position, as 7 is closed (slowly, owing to the powerful resistance offered by 4 to rapid movement of 3). Rarely more than 10 seconds elapse before the jet is reduced to the size required by the load now carried, and the blade of the diverter 12 again lies tangential to the jet. Only during this short period does wastage of water occur, unless, of course, some obstruction should prevent the nozzle needle reaching the required position, in which case water would be deflected during the whole of the light-load period and the wheel speed would be kept constant.

TRADE STATISTICS OF NEWFOUNDLAND.

The following statement of the imports of electrical and similar materials into Newfoundland is taken from the recently issued annual trade statistics for the year ended June 30th, 1912; figures for 1910-11 are added for purposes of comparison, and notes of any increases or decreases are given :—

Dollar = 4s. 2d.

	1910-11. Dollars.	1911-12. Dollars.	*Inc. or dec* Dollars.
Belting.—			
From United Kingdom ...	3,000	1,000	— 2,000
„ Canada	5,000	1,000	— 4,000
„ United States ...	18,000	12,000	— 6,000
Total ...	26,000	14,000	— 12,000
Gutta-percha manufactures.—			
From United Kingdom ...	9,000	19,000	+ 10,000
„ Canada	35,000	59,000	+ 24,000
„ United States ...	50,000	59,000	+ 9,000
„ Other countries ...	1,000	—	— 1,000
Total ...	95,000	137,000	+ 42,000
Iron and steel railway bars and fittings.—			
From United Kingdom ...	—	2,000	+ 2,000
„ Canada	2,000	2,000	—
„ United States ...	7,000	3,000	— 4,000
Total ...	9,000	7,000	— 2,000
Radiators, electric light material, &c.—			
From United Kingdom ...	10,000	24,000	+ 14,000
„ Canada	9,000	8,000	— 1,000
„ United States ...	46,000	36,000	— 10,000
„ Germany	1,000	—	— 1,000
Total ...	66,000	68,000	+ 2,000
Machinery for mining purposes.—			
From United Kingdom ...	51,000	44,000	— 7,000
„ Canada	142,000	148,000	+ 6,000
„ United States ...	39,000	58,000	+ 19,000
Total ...	232,000	250,000	+ 18,000
Machinery for local industries.—			
From United Kingdom ...	10,000	4,000	— 6,000
„ Canada	1,000	5,000	+ 4,000
„ United States ...	7,000	16,000	+ 9,000
Total ...	18,000	25,000	+ 7,000
Scientific instruments.—			
From United Kingdom ...	1,000	1,000	—
„ United States ...	—	1,000	+ 1,000
Total ...	1,000	2,000	+ 1,000
Goods for Anglo-American Telegraph Co.—			
From United Kingdom ...	1,000	1,000	—
„ Canada	1,000	—	— 1,000
„ United States ...	3,000	2,000	— 1,000
Total ...	5,000	3,000	— 2,000
Materials for wireless telegraphy.—			
From United Kingdom ...	6,000	4,000	— 2,000
„ United States ...	1,000	—	— 1,000
Total ...	7,000	4,000	— 3,000
Materials for Western Telegraph Co.—			
From United Kingdom ...	15,000	1,000	— 14,000
„ United States ...	1,000	—	— 1,000
Total ...	16,000	1,000	— 15,000
Material for Direct Cable Co.—			
From United Kingdom ...	18,000	1,000	— 17,000
„ Other countries ...	1,000	—	— 1,000
Total ...	19,000	1,000	— 18,000

Electric Mine Blasting.—The whole of the eighteenth level at the Meyer and Charlton mine was fired last week by the electric blasting system. There were 300 shots in the blast, which was effected from a station, only one man being required below for the firing. Cables are now placed to enable blasting to be effected from the surface. The system so far has proved satisfactory. Representatives of other mines are making inquiries with a view to its wider application.—*Daily Telegraph*

TRADE OF NEW ZEALAND.

The following are extracts from a report prepared by H.M. Trade Commissioner in New Zealand, and published by the Board of Trade, to which we refer in our leader to-day. Copies of the report are obtainable from Messrs. Wyman & Sons, the price being 3d.

Import Statistics.

Comments were made in my report for 1911 on the form of the New Zealand statistics of imports, and it was pointed out that there was reason to believe that the adoption of the country of invoicing as the basis resulted in inaccuracy and misconception. Apart from the error caused by the classification as British of a large quantity of goods which are shipped from the United Kingdom but are not of United Kingdom origin, New Zealand suffers from the added complication of receiving many of her imports from a second entrepot in Australia. It is therefore quite impossible to estimate what proportion of imports appearing in the statistics should be credited to any particular country. All who are concerned in knowing how facts stand, and who are not satisfied to accept what is merely apparent and superficial in trade matters, will welcome the legislation promised this year which will provide a correct basis for the statistics of future years.

At present the only lines of trade in which the official statistics could be taken to show, with even approximate accuracy, the actual country of origin, are those for which the tariff grants a preference to British goods; the total imports of these goods as distinct from those on which no preference is granted are therefore shown separately in the following statement of imports in 1912 :—

	Total imports.	Imports from the United Kingdom.	Percentage of imports from United Kingdom to total imports.
Goods not subject to preferential duties :—			
Machinery, cycles, motors and hardware	£2,082,349	£1,115,566	53·6 %
Total of all kinds	13,785,829	7,656,556	55·5 %
Goods imported by the Government and Cable Board (duty free)	227,040	139,118	61·3 %
Goods subject to preferential duties	6,476,752	4,346,098	67·1 %
Grand total	£20,976,434	£12,250,517	58·4 %

The Attitude of the Importer.

In my report of last year I referred to the fact that buyers in New Zealand show a preference for British goods. . . . This must be admitted, but there is another side to the question. I have met firms who having, as they think, been badly treated in the past, whether over agency arrangements or over shipments of bad quality goods, and having magnified their grievances into sweeping and wholesale statements against British methods of business, announce a determination to procure all future requirements from foreign countries. With these isolated instances, however, I do not propose to deal here. There is a very much more serious and more common attitude, traceable in some cases to indubitable facts, but facts of a past day. The view is widely held that British makers in certain directions need not be taken seriously. [Evidence is given of beliefs existing in New Zealand that goods which are manufactured in England of high quality cannot be procured here at all.] When views of this kind have got entrenched behind conservative instincts, nothing but an explosion will dislodge them. Preference for the known and approved article, or for the country which has first invented and perfected an article is, up to a point, only reasonable. It is, perhaps, less easy to accept as excusable the curiously wide spread ignorance as to comparative prices and their composition With the exception of importers who clear their own goods through the Customs, few people in New Zealand seem to have any idea as to what goods are dutiable and what are not. Outside their own line of business duties are not regarded as a matter of interest, and the general public, as a rule, does not concern itself with whether or not duty is included in the price of any article. The cost of commodities may be high in New Zealand, and the subject is a frequent topic for discussion, but hitherto the stress has not been sufficient to cause the average person to investigate closely the comparative prices in other countries, or the component parts of prices here.

British Trade Methods.

Charges for Extras.—I referred in my last annual report to the question of packing and the objections to treating it as an extra to be charged for separately. It cannot, I think, logically be argued that packing, which is an essential and indispensable part of the preparation of goods for delivery to the buyer, is in any sense an extra or can be so charged for. The objection to it in New Zealand is, however, not rooted in logic, but rather in prejudice. It is a point which is brought home to anyone resident in the country that extras of any kind, even if they are charges which exactly represent value received, are objectionable. The New Zealander likes an "overhead" price inclusive of everything, and is apt to consider anything extra to the original price an extortion. Whenever possible, therefore, manufacturers should be prepared to quote a price inclusive of all extras, and where extras are, as packing is, an essential part of the whole, this should be done without fail. Even where accessories are not essential, in the sense that they may

be procured separately, it is better to err on the side of including them in the price and allowing for them if not recognised. Rightly or wrongly, British manufacturers have in the past acquired a reputation for not allowing for the whims and prejudices of their customers. To those few who still afford justification for statements of this kind, it may be pointed out that prejudice on the part of the customer, while acting as a rampart against the manufacturer who would invade the market, acts also as an entrenchment for the manufacturer who has got in. It is only by humouring these prejudices, and wherever possible accepting instead of scoffing at conditions and stipulations which seem absurd, that the password to the defences may be obtained.

Manufacturers' Responsibility.—This question is referred to in our leader on this report.

Agencies.—Many firms are now represented by agents in New Zealand, but a very considerable number more have agents in Australia who cover New Zealand as well. Having in view the necessity for keeping in personal touch with the requirements of distant markets, this is no doubt very much better than having no agent at all. There are very few lines of trade, however, in which it can be shown to be preferable to having a separate agent for the Dominion. To attempt, as many agents do, to cover New South Wales, Queensland and New Zealand, or even the whole Commonwealth as well as New Zealand, has the inevitable result of superficial canvassing and a bulk of orders no bigger than would be obtained from greater concentration on smaller areas, with far less expenditure on travelling. In order to get better results, many firms allow an Australian agent to appoint sub-agents in New Zealand. The only possible justification for this would seem to lie in the fact that the head agent is financially interested in finding as sub-agent the firm who will make most sales; and further, a firm at home having an agent in Australia may find it easier to secure an agent in New Zealand through him than in any other way. On the other hand, it is difficult to see how it can be profitable to subject all business to an extra agency commission when the manufacturer could have an independent agent in New Zealand. It is to be feared that in the majority of cases firms at home do not yet realise that this Dominion has no more to do with the Commonwealth than Canada, that it is 1,200 miles distant, and that market conditions are in many respects different.

Although the above remarks may be taken to apply to stock lines such as hardware, cutlery, drapery, groceries, &c., they apply still more forcibly in regard to machinery, and there are certain lines in which this system of agency is little more than a farce. The stock lines referred to are in demand all the year round, and periodical visits to buyers may secure all the trade that is going; on the other hand, large plant of all kinds is only inquired for occasionally, and in order not to miss these occasions an agent must be on the spot, and on the look out for rumours and Press paragraphs. He must also be prepared to go and work for an order immediately he hears of a possible one. It should be obvious that a man living in another country is not usually in a position to do this. Even if he gets an order he cannot stay over here indefinitely to supervise installation and get his plant in working order. The fact of his not residing here is apt to prejudice the buyer against him, and orders from public bodies are unquestionably lost in this way. If he appoints a sub-agent his over-riding commission may lose him the order. As a matter of fact, this class of business can normally only be handled satisfactorily by having an agent on the spot and paying him a fixed fee and expenses. Offering only a commission on business that is problematical, where orders are few and far between, and where an inquiry may entail spending much time and money without business resulting—as is the case in tendering—is often quite useless. A retaining fee, paid whether there is business or not, and payment of travelling expenses, should be the agent's remuneration, with possibly a small commission in addition on business done.

Catalogues and Trade Journals.—It is disappointing, and the reason is a little difficult to understand, but the fact remains, that even after two requests through the *Board of Trade Journal* and the Press, the number of manufacturers' catalogues on my shelves is absurdly inadequate. There are few places more natural and obvious as a place of reference to catalogues than the Trade Commissioner's office, and yet it seems the very last place that occurs to the majority of manufacturers. I have on my shelves catalogues of British manufacturers which are as well got up in every respect as any I have ever seen, and I know that a very large number of firms grudge no expense in making their goods known. At the same time it remains a fact that most of these are content at present to send them to any place in New Zealand rather than to my office.

United States Competition.

The only very serious competition in imports in New Zealand comes from the United States. It must be remembered also that the route across America is becoming more and more a highway to Europe. Firms going home to get agencies are captured on the way across and are impressed by the scale of manufacture, the hustle, and the big talk, and arrive home with their mouths full and little appetite left. New Zealand has not yet learnt to hustle, but people are full of the notion that they do hustle, and are very up to date (as they are in many ways), and even though they may not admit their partiality for things American they have at least much admiration for the United States manufacturer, who is thought to be so modern and not old enough yet to have become sleepy and self-satisfied. In many lines, goods designed in the United States to suit the home market, and turned out comparatively cheaply owing to the size of that market, have been found very suitable for the not dissimilar conditions here, and as a consequence the idea has spread widely that United States manufacturers are always ready to make what customers want. As a matter of fact, adaptability to the particular whims of a very small market is less likely to be found in America than elsewhere, but the conviction to the contrary dies hard.

United States trade with New Zealand has also been helped by the tariff preference given by the New Zealand Government to Canadian goods, which is equal to that given to British goods. This has encouraged the supply of goods from Canada, and as Canadian firms, even when not branches of United States houses or dominated by United States capital, adopt the United States system of manufacture—aiming at lightness and cheapness, and entailing a lack of durability—the footing which Canadian manufacturers have been able to get in New Zealand, has broken down the prejudice against the United States system of manufacture (as contrasted with the higher finish and durability of British goods). Were the preferential duties to be cancelled, the shipments now coming from Canada would probably come direct from parent works in the United States.

Posts and Telegraphs.

The most important development is the impending installation of automatic telephones. An officer of the Post and Telegraph Department recently visited America, Germany and England, but his report dealt almost exclusively with the first-named. The system which is most favoured is being manufactured in England under the American patents, but the Australasian rights are in the hands of an Australian company not themselves manufacturing but tendering in their own name; the goods they supply are at present made in Chicago. In the past British makers have had very little share in the telephone purchases of this department.

ELECTRIC VACUUM FURNACES.

The vacuum furnace, for years employed only for laboratory and demonstration purposes, has developed into a commercial apparatus since the appearance of the metal-filament lamp. Without this furnace, it is hard to see how the tungsten filament could have been developed. The vacuum furnace is one in which material may be heated or melted *in vacuo* and, for relatively large furnaces and the attainment of high temperatures, electric heating is the only practicable agency available.

A section through an Arsen horizontal furnace, such as is used at Schenectady in the manufacture of ductile tungsten, is shown in fig. 1. The vacuum chamber is of gun-metal, and is tinned internally so as to stop all pores in the casting. Joints are fixed with lead gaskets, screwed and soldered to ensure air-tightness. An outer radiation screen minimises the heat loss by direct radiation, and water jackets are used where necessary to prevent overheating of certain parts. The heater is a resistance element of graphite, which offers the advantages of infusibility and sufficiently high resistance. The furnace being evacuated, burning of the graphite does not occur, but at 2 600° C. sublimation commences to be appreciable, and a heating unit wastes away at first slowly and then more rapidly till failure occurs at the centre point, after about nine hours' service. At 3,100° C. a heater lasts about one hour, and this is about the highest temperature which can be reached in this type of furnace. Up to 2,000° C. (3,630° F.) a graphite heater will last almost indefinitely. Replacement of heaters is a simple and inexpensive matter.

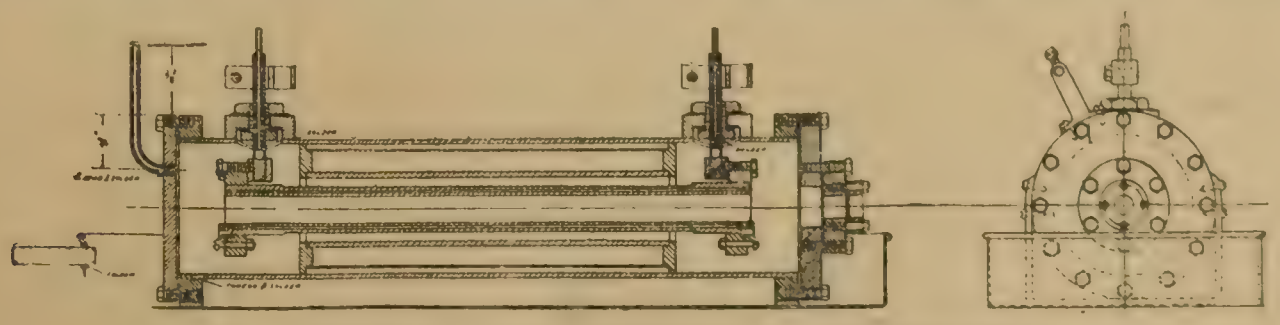


Fig. 1.—Section and End Elevation of Vacuum Furnace.

For laboratory use in the preparation of refractory alloys and compounds, the refining of refractory materials, calibration of pyrometers and general high-temperature work, a small vertical

furnace accommodating a 1¼-in. diameter × 4-in. crucible is convenient. A large vertical furnace used for research work at Schenectady accommodates a crucible 4 in. in diameter × 10 in. high, and a box-type vacuum furnace taking a crucible 4 in. × 8 in. × 12 in. is arranged on the same general principle. A mica inspection port enables the operator to watch the progress of changes within the crucible. To evacuate these furnaces, double-cylinder Geryck and three-cylinder Peckard pumps are employed.

Similar furnaces have been installed by several technical colleges and standardising institutions in the States. The advantages offered by these, as compared with other types of laboratory furnaces, include the possibility of treating comparatively large quantities of material at very high temperatures. Heating *in vacuo* not only prevents oxidation and absorption of nitrogen, &c., but also removes any gases occluded during previous treatment of the material concerned.

APPARATUS ON HIRE.

By T. C. PARSONS.

(*Continued from page* 438.)

Application Forms.—Suggested forms, which the writer used in Govan, are appended. The clause with regard to the landlord's hypothec for rent is applicable in Scotland, but the writer does not know whether it is so in England.

G.C.E.D.

MOTOR ON HIRE (Outward).

MOTOR Corp. No. ... Maker ..... Maker's No. ....
H.P. ..... Speed ..... Voltage .....
STARTER Corp. No. .... Maker ..... Maker's No. ....
D.P. SWITCH Corp. No. .... Maker ..... Size .....
FUSES. Size ..... Maker .....

G.C.E.D.

Motor Equipment detailed on reverse side.

Installed at Name .....
Address .....
Date .....
(Signed) .....
Motor Superintendent.
Entered In Valuation Book and Hirers' Register. .....
(Signed) .....

Motor outward card to be filled in by Motor Superintendent and sent to head office.

G.C.E.D.

MOTOR ON HIRE (Inward).

MOTOR Corp. No. .... Maker ..... Maker's No. ....
H P. ..... Speed ..... Voltage .....
STARTER Corp. No. .... Maker ..... Maker's No. ....
D.P. SWITCH Corp. No. .... Maker ..... Size .....
FUSES. Size ..... Maker .....

G.C.E.D.

Motor Equipment detailed on reverse side.

Brought In from Name .....
Address .....
Date .....
(Signed) .....
Motor Superintendent.
Entered In Valuation Book and marked off in Hirers' Register. .....
(Signed) .....

Motor inward card to be filled in by Motor Superintendent and sent to head office.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

Electricity Works, Helen Street, Govan.

APPLICATION FORM FOR HIRE OF MOTORS.

I (We) ..... desire to hire from the Corporation of Govan, Electric Motors of the following sizes and rentals :—

Motors.		Rent per annum.	Slide Rails.	
No.	H.P.		No.	Rent per annum.

for use at my (our) premises situate at ..... and I (we) undertake to pay for the hire of the motors at the above rates, and for any repairs due to negligence or overloading, and to insure the apparatus against fire for the sum of ....., and to observe the conditions attached hereto, to which I (we) have placed my (our) signature, and a copy of which remains in (my) our possession, and to sign (if required) an agreement to this effect, to be drawn up by the Town Clerk.

Dated this ..... day of ....., 191...

Hirer's Signature .....

Address .....

Conditions.

1. The hirer must agree to take the motor for a period of not less than 12 months.

2. The rent is due quarterly, and MUST BE PAID IN ADVANCE, the first payment to be made before the motor is connected. In the event of the amount for hire, current consumed, or any repairs that may have been executed, becoming overdue, the CURRENT WILL BE CUT OFF.

3. The rent includes starting gear, but all other accessories, such as spare brushes, oil, special pulleys, &c., must be paid for in advance.

A small charge is made for fixing the motors, as per scale below :

Size of motor.	Charge for fixing.
1—7 H.P.	... 7s. 6d.
8—15 H.P.	... 10s. 0d.
16—20 H.P.	... 15s. 0d.
21—35 H.P.	... 20s. 0d.

4. The hirer to provide the necessary foundations.

5. Only oil to be obtained from this Department must be used on the bearings, for which 1s. 8d. per gallon will be charged, which must be paid in advance.

6. Only brushes obtained from this Department must be used, and they must be fixed by the Corporation Inspector. A charge of 1s. per brush will be made.

7. The hirer to provide a double-pole switch and two single-pole fuses near the meter, and the wiring from the meter to the motor.

8. The hirer to pay for any damage done to the motor or starting gear due to fire, negligence or overloading.

9. If required by the Town Council, the hirer shall enter into a stamped agreement with them, embodying the terms of the hire of the motor.

10. The motor not to be loaded above its rated capacity.

11. No motor or fittings belonging to the Town Council shall be subject to the landlord's hypothec for rent, or be liable to be taken in execution under any diligence, or any process of Court, or by any proceedings in cessio or bankruptcy against any person in whose possession the same may be, as provided in the Govan Electric Lighting (Further Powers) Act, 1904.

(Signed) Theodore C. Parsons,
Burgh Electrical Engineer.

Hirer's Signature .....

Address .....

This part to be retained by the Hirer.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

Particulars Relating to the Hire of Electric Motors.

The Burgh of Govan are prepared to let out on hire electric motors of 1 H.P. and upwards upon the conditions stated below :—

1. The hirer must agree to take the motor for a period of not less than 12 months.

2. The rent is due quarterly, and MUST BE PAID IN ADVANCE, the first payment to be made before the motor is connected. In the event of the amount for hire, current consumed, or any repairs that may have been executed, becoming overdue, THE CURRENT WILL BE CUT OFF.

3. The rent, which is given APPROXIMATELY for the different sizes of shunt-wound semi-enclosed motors in the following table, includes starting gear, but all other accessories, such as spare

brushes, oil, special pulleys, &c., must be paid for in advance. Special prices given for totally enclosed motors.

Size of motor in B.H.P.	Voltage.	Standard pulley. Dia.	Standard pulley. Face.	Speed.	Rent of motor per annum.	Rent of rails per annum.
		In.	In.	R.P.M.	£ s. d.	
1	250	3¾	3	1,400	2 0 0	2s.
1·3	..	5	4	640	2 8 0	2s.
2	..	4½	3½	1.350	2 4 0	2s.
2·4	..	5	4	900	2 12 0	2s.
3	..	5	4	1,400	2 10 0	2s.
3·5	..	6	4½	725	3 2 0	2s.
5·25	500	9	6	815	4 10 0	4s.
5	..	9	6	470	5 0 0	4s.
7	..	9	6	690	5 4 0	4s.
7·25	..	12	7	435	6 2 0	4s.
11	..	9	6	990	5 6 0	4s
11·5	..	12	7	630	6 4 0	4s.
11	..	12	7	470	6 16 0	4s.
15	..	12	7	790	6 6 0	4s.
16	..	14	8	550	8 0 0	6s.
20	..	14	8	700	8 10 0	6s.
20	..	15	10	530	10 6 0	6s.
27	..	14	8	950	8 14 0	6s.
27·5	..	15	10	550	11 10 0	6s.
30	..	15	10	805	10 12 0	6s.
30	..	18	12	480	13 12 0	8s.
35	..	18	12	540	13 16 0	8s.
35	..	18	12	430	15 12 0	8s.

A small charge is also made for fixing the motor, as per scale below :—

Size of motor.	Charge for fixing.
1—7 H.P.	... 7s. 6d.
8—15 H.P.	... 10s. 0d.
16—20 H.P.	... 15s. 0d.
21—35 H.P.	... 20s. 0d.

4. The hirer to provide the necessary foundations.

5. Only oil to be obtained from this Department must be used on the bearings, for which 1s. 8d. per gallon will be charged, which must be paid in advance.

6. Only brushes obtained from this Department must be used, and they must be fixed by the Corporation inspector. A charge of 1s. per brush will be made.

7. The hirer to provide a double-pole switch and two single-pole fuses near the meter, and the wiring from the meter to the motor.

8. The hirer to pay for any damage done to the motor or starting gear due to fire, negligence or overloading.

9. If required by the Town Council, the hirer shall enter into a stamped agreement with them, embodying the terms of the hire of the motor.

10. The motor not to be loaded above its rated capacity.

11. No motor or fittings belonging to the Town Council shall be subject to the landlord's hypothec for rent, or be liable to be taken in execution under any diligence or any process of Court, or by any proceedings in cessio or bankruptcy against any person in whose possession the same may be, as provided in the Govan Electric Lighting (Further Powers) Act, 1904.

(Signed) Theodore C. Parsons,
Burgh Electrical Engineer.

Hirer's Signature .....

Address .....

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

Electricity Works, Helen Street, Govan.

APPLICATION FORM FOR HIRE-PURCHASE OF MOTORS.

I (We) ..... desire to purchase from the Corporation of Govan, Electric Motors of the following sizes, and to pay for the same in ..... quarterly payments as given below :—

Motors. No.	Motors. H.P.	No. of quarterly payments.	Amount of each payment.

for use at my (our) premises situate at ..... and I (we) undertake to pay for the hire of the motors at the above rates, and for any repairs due to negligence or overloading, and to insure against fire for the sum of ....., and to observe the conditions attached hereto, to which I (we) have placed my (our) signature, and a copy of which remains in my (our) possession, and to sign (if required) an agreement to this effect, to be drawn up by the Town Clerk.

Dated this ..... day of ....., 191...

Hirer's Signature .....

Address .....

Conditions.

1. The rent is due quarterly, and MUST BE PAID IN ADVANCE the first payment to be made before the motor is connected. In the event of the amount for hire, current consumed or any repairs that may have been executed, becoming overdue, the CURRENT WILL BE CUT OFF.

2. The rent includes starting gear, but all other accessories, such as spare brushes, oil, special pulleys, &c., must be paid for in advance.

A small charge is made for fixing the motors, as per scale below :—

Size of motor.	Charge for fixing.
1—7 H.P.	... 7s. 6d.
8—15 H.P.	... 10s. 0d.
16—20 H.P.	... 15s. 0d.
21—35 H.P.	... 20s. 0d.

3. The hirer to provide the necessary foundations.

4. Only oil to be obtained from this Department must be used on the bearings, for which 1s. 8d. per gallon will be charged, which must be paid in advance.

5. Only brushes obtained from this Department must be used, and they must be fixed by the Corporation inspector. A charge of 1s. per brush will be made.

6. The hirer to provide a double-pole switch and two single-pole fuses near the meter, and the wiring from the meter to the motor.

7. The hirer to pay for any damage done to the motor or starting gear due to fire, negligence or overloading.

8. If required by the Town Council, the hirer shall enter into a stamped agreement with them, embodying the terms of the hire of the motor.

9. The motor not to be loaded above its rated capacity.

10. Until the purchase is completed, the motor and equipment to remain the property of the Corporation, and the hirer must not sell, remove or alter the motor or equipment without the consent, in writing, of the Corporation.

11. No motor or fittings belonging to the Town Council shall be subject to the landlord's hypothec for rent, or be liable to be taken in execution under any diligence, or any process of Court, or by any proceedings in cessio or bankruptcy against any person in whose possession the same may be, as provided in the Govan Electric Lighting (Further Powers) Act, 1904.

(Signed) Theodore C. Parsons.
Burgh Electrical Engineer.

Hirer's Signature .....

Address .....

This part to be retained by the Hirer.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

Particulars relating to the Hire-Purchase of Electric Motors.

The Burgh of Govan are prepared to let out on hire-purchase electric motors of 1 H.P. and upwards upon the conditions stated below :—

1. The rent is due quarterly and MUST BE PAID IN ADVANCE, the first payment to be made before the motor is connected. In the event of the amount for hire, current consumed, or any repairs that may have executed, becoming overdue, THE CURRENT WILL BE CUT OFF.

2. The rent, which is given APPROXIMATELY for the different sizes of shunt-wound semi-enclosed motors in the following table, includes starting gear, but all other accessories, such as spare brushes, oil, special pulleys, &c., must be paid for in advance. Special prices given for totally enclosed motors.

Size of motor in B.H.P.	Voltage.	Standard pulley. Dia.	Standard pulley. Face	Speed.	Quarterly instalments for hire-purchase of motor, starting gear and rails. 1 year.	2 years.	3 years.	4 years.	5 years.
		In.	In.	R.P.M.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	250	3¾	3	1,400	3 8 3	1 16 8	1 6 4	1 0 10	17 8
1·3	..	5	4	640	4 15 2	2 11 3	1 16 8	1 9 2	1 4 9
2	..	4½	3½	1,350	4 8 2	2 7 5	1 14 0	1 7 0	1 2 10
2·4	..	5	4	900	5 2 10	2 15 7	1 19 7	1 11 5	1 6 7
3	..	5	4	1.400	4 18 0	2 12 7	1 17 8	1 9 10	1 5 5
3·5	..	6	4½	725	6 2 0	3 5 5	2 6 10	1 17 4	1 11 7
5·25	500	9	6	815	9 0 0	4 16 8	3 9 2	2 14 9	2 6 7
5	..	9	6	470	10 2 0	5 8 9	3 18 0	3 1 9	2 12 7
7	..	9	6	690	10 10 0	5 11 9	4 0 0	3 3 7	2 14 0
7·25	..	12	7	435	12 0 0	6 9 2	4 12 9	3 13 7	3 2 4
11	..	9	6	990	10 12 4	5 14 4	4 2 0	3 5 0	2 15 2
11·5	..	12	7	630	12 8 0	6 13 4	4 15 7	3 16 0	3 4 4
11	..	12	7	470	13 10 0	7 5 4	5 4 2	4 2 9	3 10 6
15	..	12	7	790	12 10 0	6 14 2	4 16 2	3 16 4	3 4 9
16	..	14	8	550	16 3 0	8 12 6	6 3 9	4 18 6	4 3 2
20	..	14	8	700	16 18 0	9 2 0	6 10 0	5 3 2	4 7 7
20	..	15	10	530	20 8 0	11 0 0	7 17 4	6 5 0	5 6 0
27	..	14	8	950	17 5 0	9 6 0	6 13 0	5 5 2	4 9 6
27·5	..	15	10	550	22 12 0	12 3 0	8 14 9	6 18 0	5 17 2
30	..	15	10	805	21 0 6	11 6 0	8 2 0	6 9 0	5 9 0
30	..	18	12	480	27 4 0	14 12 0	10 9 0	8 6 0	7 1 0
35	..	18	12	540	27 8 0	14 15 0	10 11 6	8 7 6	7 2 6
35	..	18	12	430	31 0 0	16 12 0	11 18 0	9 9 0	8 0 6

A small charge is also made for fixing the motor, as per scale below :—

Size of motor.	Charge for fixing.
1—7 H.P.	... 7s. 6d.
8—15 H.P.	... 10s. 0d.
16 - 20 H.P.	... 15s. 0d.
2 - 35 H.P.	... 20s. 0d.

3. The hirer to provide the necessary foundations.

4. Only oil to be obtained from this Department must be used on the bearings, for which 1s. 8d. per gallon will be charged, and which must be paid in advance.

5. Only brushes obtained from this Department must be used, and they must be fixed by the Corporation inspector. A charge of 1s. per brush will be made.

6. The hirer to provide a double-pole switch and two single-pole fuses near the meter, and the wiring from the meter to the motor.

7. The hirer to pay for any damage done to the motor or starting gear due to fire, negligence or overloading.

8. If required by the Town Council, the hirer shall enter into a stamped agreement with them, embodying the terms of the hire of the motor.

9. The motor not to be loaded above its rated capacity.

10. Until the purchase is completed, the motor and equipment to remain the property of the Corporation, and the hirer must not sell, remove or alter the motor or equipment without the consent in writing of the Corporation.

11. No motor or fittings belonging to the Town Council shall be subject to the landlord's hypothec for rent, or be liable to be taken in execution under any diligence or any process of Court, or by any proceedings in cessio or bankruptcy against any person in whose possession the same may be, as provided in the Govan Electric Lighting (Further Powers) Act, 1904.

(Signed) Theodore C. Parsons,
Burgh Electrical Engineer.

Hirer's Signature .....

Address .....

The rentals shown are approximately those for standard shunt-wound semi-enclosed motors, ironclad switches, fuses and starters, all of first-class make, at prices prevailing in 1912. The charges would be slightly higher for compound-wound, and considerably higher for totally-enclosed or pipe-ventilated motors, special prices for which can be given on application.

Cards.—When a motor has been installed, a "Motor Outwards" card is filled in by the motor superintendent and sent up to the head office, and the entry is made there in the Motor Valuation Book and in the card or loose-leaf register. A similar procedure takes place when a motor is removed from a hirer's premises. Suggested forms of cards, which might with advantage be printed in different colours, are given on p. 474.

(To be continued.)

REVIEWS.

High and Low-Tension Switchgear Design. By A. G. Collis. London : Constable & Co. Price 10s. 6d. net.

The literature of electrical engineering is not overburdened with works dealing with switchgear, and the present work, which has been compiled with the object of giving the result of researches made for the purpose of obtaining accurate data as to the effects of opening and closing electric circuits, is welcome.

The larger portion of the book is expressly intended only as an introduction to the main elements of design, and the subject is treated in such a manner that the essentials may be easily understood by those interested in this class of apparatus.

The scheme of the volume is such that the first four chapters forming Part I deal with alternating-current switchgear, while direct-current apparatus is treated in Part II, also consisting of four chapters.

Chapter I is partly introductory, and deals with switchgear for high-pressure service, the problem of sectionalising, colliery switchgear and the like, the treatment being clear and concise. The author is very severe on manufacturers. After describing the difficulty he had to overcome to make experiments in connection with the subject, he states that : "The tendency is to copy one or another's manufacture, incorporating their particular ideas, whereas design should be primarily based on principles derived from accurate data. Insensate competition and the controlling interest of those who rule the industry and have no intimate knowledge of technique are responsible for the features."

The vital subject of oil-switch design is considered in Chapter II. There is a short account of internal and external reactance in alternators, and the effect thereof on the controlling switchgear. The author does not advise the use of external reactance, as, in his opinion, the safeguard secured in this manner introduces greater evils into the system, which are detrimental to the continuity of supply. This is, of course, in direct opposition to modern American ideas. A number of interesting oscillograph records of short circuits in large systems are given, illustrating the very high rate of current rise incurred, &c. Some information—of a rather scrappy character, however—is given regarding corona phenomena, surges, oscillations, &c.

Chapter III is devoted to the discussion of apparatus for protecting alternating-current circuits, &c. Two formulæ are given on page 85, but the meaning of the symbols used is not specified. These refer to the induced E.M.F. of generators and transformers, and while, of course, they are easily understood by the initiated, the omission to make their meaning clear cannot be commended. A number of connection diagrams are given, some of which are valuable, while others are of the most elementary character.

The concluding chapter of the alternating-current section deals with the measurement of output, and a large number of methods of connecting wattmeters to various types of circuit are given. Some interesting curves illustrating the accuracy, or, rather, the want of accuracy, in wattmeters are a happy feature. Ammeters and voltmeters are briefly treated, together with some other subjects only remotely related to switchgear.

Chapter V, the opening one of the direct-current section, deals with the precautions and the protective apparatus necessary for the paralleling of generators, circuit-breakers, porcelain fuse tests, &c. A considerable number of reproductions from oscillograph tests are included, which, as the author says, repay the difficulty and inconvenience of obtaining them, as the result is beyond dispute.

In Chapter VI we have a brief survey of air-break switches, diagrams of generator and motor-generator panels, and so on. We are glad to see that the author is opposed to the old-fashioned idea of not using the hinge of a knife-switch for current-carrying purposes.

The requirements of switches for mining work, equipment of booster panels, connection diagrams of controllers and the calculation of the resistances for motor starters are discussed in the succeeding chapter, together with some alternating-current work and tables. The treatment is too brief to be of much use to a beginner, in several instances.

The greater part of Chapter VIII deals with subjects quite foreign to direct-current switchgear. For example, we have dissertations on power factor, rotary converters, three-phase transformation, synchronous motors, &c.

The Board of Trade electricity regulations are added as an appendix.

The few misprints that appear are not important, and are quite easily detected. The book abounds with practical "tips," and contains a good deal of original work. The style, however, is somewhat scrappy, and the price appears somewhat stiff for a book which consists of only 205 pages, and is intended to appeal to "the great body of engineers and artisans in all departments of electrical engineering practice."—H. G. S.

Electricity for the Farm and Home. By Frank Koester. 1913. New York : Sturgis & Walton Co. Price $1.0 net.

This book is especially addressed to the American farmer, who will no doubt find it useful in keeping him *au fait* with what has already been done in the way of applying electricity about the farm and homestead. Both examples and illustrations are confined to farms in America and Germany, where the conditions differ somewhat from those obtaining in this country; at the same time much of the practice

described is applicable over here and, in any case, it behoves British agriculturists to keep in touch with the latest developments abroad. What are often referred to as "farms" by the author would be known as large estates in this country, and these are the only examples given of the private generation of electricity for power and lighting. For the smaller farms, it is assumed that current is derived from public mains, or that a number of farmers share a generating station between them.

What appears to make the conditions more favourable to the use of electricity in Germany than in this country is the number of special industries carried on by the farmer, which demand power. For instance :—Beet, potato and other leaves are artificially dried for cattle food, while potatoes themselves are similarly treated, or used in the manufacture of alcohol, starch and potato flour. These agricultural industries make the generation and distribution of electricity a commercial success where similar ventures would fail in English rural districts.

A good deal of instruction and information as regards the details of various types of installation might very well have been omitted, as the reader is frequently urged to employ an expert engineer, who presumably would be well versed in these matters. For example, a table is given in which the losses in B.TH.U. per lb. of coal are analysed for a high-class steam-driven plant, and we are given further on full details of the devices for insulating storage battery cells. Yet the instructions are not nearly complete enough to enable a reader to choose a suitable plant for himself, and install it in the best possible manner. Failing a more popular work, this book may serve to interest the British farmer in the subject, and it contains a good deal of information which should prove useful to electrical engineers specialising in agricultural applications. At the same time, a much more convincing and easily understood book will be needed to cause a clamour amongst the farmers of this country for supplies of electricity.

We believe that in the long run electricity will be used wherever power, light or heat is required, but owing to the peculiar conditions under which it is carried on, the farming industry is likely to form one of the last strongholds of the oil engine.

An instance may be given of a farm of about 400 acres (quite an average size) where a 6-H.P. paraffin engine prepares fodder for 40 horses and cattle, besides a number of sheep. Only about 3 H.P. is really needed, and oil averages 2s. 6d. a week, which does not offer much scope for economy from electricity or any other form of power. On the other hand, if public supplies of electricity were within reach, farmers would assuredly adopt electric power and light if only on account of their safety and convenience. The smaller farmers could still hire threshing tackle as they do now, but the engine would be replaced by a suitable motor.

Electrical labour-saving appliances would not be of much value to farmers under the present conditions, but the industrial unrest is extending to farm labourers, and by the time public supplies are available, the farmer will be as anxious to save hand labour as any other employer.

THE "HAND" OF AN ARMATURE.

By HUMPHRY MacCALLUM, B.Sc., A.M.I.C.E.

In the opinion of the writer, it is eminently desirable that there should be a definite and universally accepted meaning to the terms "right-handed" and "left-handed" as applied to armature windings of the usual drum type; but whereas the leading authors agree upon this point when the obsolete "ring" is under discussion—see fig. 1—it will be found that in many books no reference is made to the "hand" of the modern drum armature, and where the point is dealt with the definitions given are frequently out of date and of doubtful value.

As an example, the following appears in one of the best of modern text-books :—

"In every symmetrical drum, without exception, the rule for finding the hand of the system may be more simply expressed by saying that the winding must be traced from a sector down the path which, at the commutator end, lies nearest to the armature core, *i.e.*, from the commutator end down to the lower arm of the barrel-wound loop, or down the end connector to a short bar in the armature with involute end connections. If we are then led to touch at the

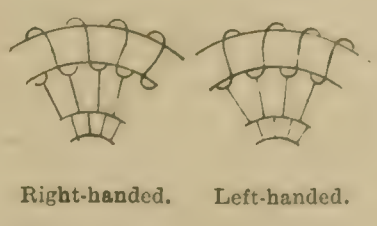


Fig. 1.—Ring Armature Windings.

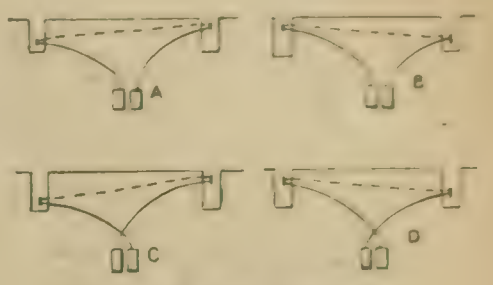


Fig. 2.—Drum Armature Windings.

sectors adjacent to our starting point in a clockwise direction, the system is right-handed, or in a counter-clockwise direction, it is left-handed."

In other words, armatures which are built up of coils A or D, fig. 2, will be right-handed, and those which are built up of coils such as B or C will be left-handed.

In actual practice the difference between A and B or between C and D lies only in the shape of the coil as determined by the way it is "spread" or opened out before mounting on the core, and complete armatures built from either kind of coil, but having the same number of conductors, will be perfectly interchangeable. On the other



Fig. 3.—One Section of a Parallel Winding.

hand, those armatures which, according to the above definition, are of the same "hand," will not be interchangeable, for if run in the same magnet systems they will give opposite directions of rotation.

For this reason the above method of classification must be regarded as unsatisfactory, and it would appear more logical to reserve the terms right and left hand as in the following definitions, for the purpose of distinguishing between those armatures which, under similar conditions, give opposite directions of rotation.



Right-handed armatures are those in which the positive brushes are opposite the N poles of the field magnet when the direction of rotation is clockwise when viewed from the commutator end.

Left-handed armatures are those in which the positive brushes are opposite the N poles of the field magnet when the direction of rotation is counter-clockwise when viewed from the commutator end.

Under such a system all lap-wound armatures built up of coils similar to A and B (fig. 2), or E (fig. 3), will be "left-handed," and those built up of coils C and D (fig. 2), or F (fig. 3), will be "right-handed."

An important advantage of this method of classification is that it applies equally well to the series or the parallel armature (see fig. 4). The essential difference between the two hands in either case is that in the "right-hand" coupling the coil ends or the ends of a "round" cross one another, whereas in the "left-hand" coupling they do not cross, a distinction which gives rise to the following perfectly definite rules :—

1. In all lap or parallel-wound drum armatures if the ends of a section cross one another, the winding is "right-handed," but if they do not cross it is "left-handed."

2. In all wave or series-wound drum armatures, if the

ends of a complete round, consisting of $p/2$ sections, cross one another, the winding is "right-handed," and if they do not cross it is "left-handed."

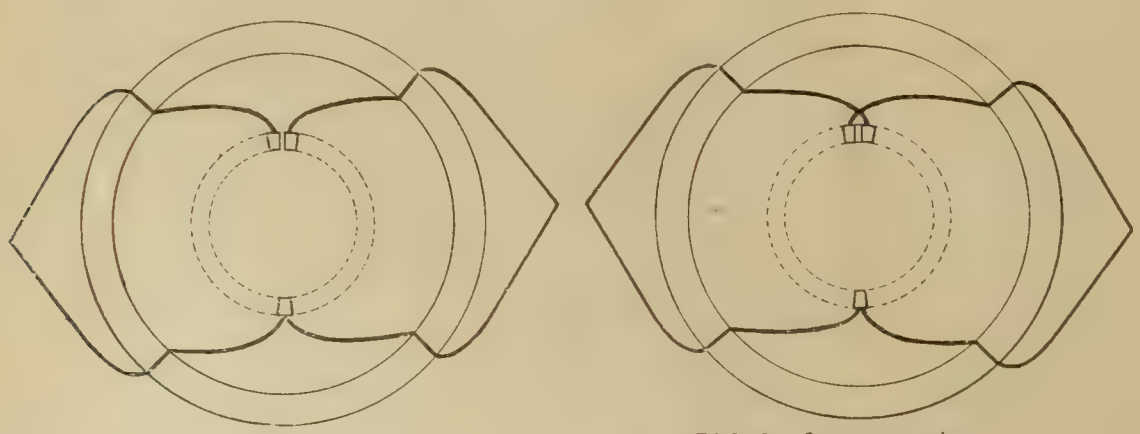
In the case of the wave-wound armature a further distinction between the two "hands" results from the fact that the number of active conductors z must comply with one or other of the following formulæ :—

$$(a)\ z = p\,y - c \qquad (b)\ z = p\,y + c$$

p = number of poles.
y = average winding step.
c = number of circuits.

Formula (a) gives a winding in which the ends of the rounds cross, and which is, therefore, "right-handed," while formula (b) corresponds to a winding in which the ends do not cross, and therefore to a "left-handed" winding.

Objection may be taken to the use of the terms "right hand" and "left hand" on the ground that, in the case of the modern drum armature at any rate, they are of an empirical nature, and have no obvious connection with right-handed or left-handed motion. It will be noticed, however, that in the case of all windings (lap or wave) which are right-handed in accordance with the above system of classification, if a start be made at any com-plate and the winding be followed to the right it will be found to progress to the right, and if a start be made to the left the progress will be to the left. That is to say, a right-handed winding progresses in the same direction as the start. In the case of left-hand windings the opposite holds good, so that the terms "progressive" winding and "retrogressive" winding, which have been suggested by Messrs. Sheldon and Hausmann ("Dynamo-Electric Machinery," page 57, Crosby Lockwood) are alternatives respectively to the more usual "right-handed" and "left-handed" winding.



Left-hand or retrogressive. Right-hand or progressive.

Fig. 4.—One "Round" of a 4-Pole Series Winding.

AISGILL REFLECTIONS.

I.—Continental Railways and Electric Lighting.

Since the Aisgill disaster, numerous suggestions for the avoidance of railway accidents have appeared in the correspondence columns of the daily newspapers and also in the technical Press. Comparisons have also been made between British company-owned and Continental State-owned railways, with a view to showing that on State railways the question of cost is not allowed to stand in the way when the safety of the travelling public is concerned. There may be a germ of truth in this, as a company must of course consider the question of cost, seeing that they have not a free hand in the imposition of passenger fares ; but, on the other hand, no company engaged in a competitive business can afford to ignore its customers' interests.

Seeing that the question of State control has been raised, it will be interesting to look into the past records of foreign railways, when it will be seen that the gas lighting of coaches has been as disastrous on the Continent as in this country, and the records furnish additional arguments for the entire abolition of gas on British railways.

The danger of gas-lighted trains was brought prominently before the German Government early in 1901, when in a terrible railway accident at Offenbach several persons lost their lives owing to the coaches being set on fire by escaping gas. Herr von Thielen, the Railway Minister at the time, stated, during a discussion in the Lower Chamber of the Prussian Diet, that a completely practicable system of electric lighting for trains did not exist, but that when such a method was available, the authorities would provide £2,500,000 which would be needed to effect the substitution of electric light for gas. Trials were subsequently made on the Berlin-Stettin trains with steam turbo-dynamos fixed on the locomotives to supply light throughout the train, and here we would remark that as far back as 1884—17 years before the German experiments—trains were running in England, between Liverpool and Manchester, equipped with an almost identical system, the only difference being that a Tower spherical engine was used instead of a steam turbine.

What was the precise result of the German experiments we cannot say, but six years later, when an accident similar to the Offenbach disaster occurred at Strausberg in 1907, the dangers of gas lighting were again brought forcibly to the front. On this occasion one coach—the mail coach—was electrically lighted, and it is noteworthy that, in contradistinction to the others which were gas-lighted and caught fire, the mail van, although badly smashed, did not ignite. In fact, and this also is important, one of the lamps continued to burn after the accident, and facilitated the work of rescuing the postal officials. The experience parallels that of the Catesby tunnel accident of 1906, when, as pointed out in our last issue, the only carriage which remained lighted and facilitated rescue operations was an electrically-lighted carriage. What becomes of the argument as to the dangers of a short-circuit in view of these experiences ?

Returning to German records, we find that in 1907 when the Strausberg accident occurred—six years after the Government had commenced their electric lighting experiments—but a few trains were electrically lighted ; these included those running between Berlin and Altona, and some of the so-called "D" trains from the East of Germany, but, comparatively speaking, the amount of electric lighting on trains was small.

Commenting at the time on German inaction in the matter, we said in our issue of September 27th, 1907 : "The fact is that gas lighting has obtained such a powerful hold upon the German railways that very little hope exists, notwithstanding the fresh inquiries that are being made on the subject, of any definite proposals being made for the general introduction of the electric light throughout the passenger trains in Germany, unless a repetition of the horrors of Offenbach in the near future should unfortunately occur, and perhaps force the railway authorities to deal with the question seriously. In view of the excellent systems which have been developed in this country, there is no excuse for their inaction."

It is a somewhat ironical comment on the last sentence that we should now be deploring the effects of gas in the Aisgill catastrophe.

Up to the end of 1911 very little had been done in Germany beyond electrically lighting the sleeping cars of the State railways ; but, according to the *Frankfurter Zeitung*, it had then been decided that in future all passenger cars should be equipped with electric light on the Rosenberg system, a system in which each car is provided with a special dynamo driven from the axle, and an accumulator is also provided to give light when the train is at a standstill.

Turning to other Continental railways, and going back no further than the end of 1909, we find from our issue of January 7th, 1910, that during the Christmas holidays a shocking accident occurred at the small station of Uhersko between Pardubatz and Chotzan, to the express which starts at Prague. This express collided with a goods train at the station named above, when travelling at about 50 miles an hour. Immediately after the collision the escaping gas was ignited and set fire to the train, and it was not possible to rescue the imprisoned passengers until after the fire was extinguished. The roll of victims was 9 dead and 16 injured, many of the deaths being due to suffocation. We concluded our report of this accident in these words :—

"We trust that it will not require the sacrifice of a considerable number of British lives to induce our railway companies to adopt electric lighting." Yet since that date we have had to record collisions succeeded by fire at Hawes Junction, Saltley, Ditton Junction, and now Aisgill; surely we may now hope that the human sacrifice is complete, and that if the railway companies will not willingly do their obvious duty, means will be taken to force them to do so.

Following on the accident on the Canadian Pacific Railway early in 1910, when the fatalities directly due to the collision were augmented by the fire occasioned by the gas used for lighting the carriages, there was very considerable alarm felt in Austria in consequence of the Government's persistence in the use of gas. The liveliest dissatisfaction was expressed with the Ministry of Railways, and resolutions were moved in the State Railways Council in favour of the substitution of electricity for gas. According to the policy being pursued in 1910, it had been intended that the incandescent gas system should be in use on all the Austrian State railways by the year 1914, although it is interesting to note that the Royal Mail trains were then electrically lighted.

The public clamour, backed up by the Press, resulting in the resolutions in the Council referred to, was followed in July, 1910, by a request from the Council to the Ministry of Railways to discontinue the use of incandescent gas lighting, and to use electric light exclusively on all passenger cars, on order, or to be constructed in future.

The Government admitted that electric lighting presented economic advantages, and it was stated during the discussion that all the Swiss railways and the great French railways had decided to adopt electric light exclusively in the future.

The decision of the French authorities was no doubt influenced by a serious accident which occurred to a train at Villepreux in June, 1910, when following the accident the train was burnt, having been set on fire by the gas used for lighting.

Whilst it is clear from the foregoing that on some of the Continental State-owned railways the use of electricity for train lighting is increasing, and on others is now compulsory, the latter state of things has only been brought about by the pressure of public opinion, which has arisen out of the needless sacrifice of human life, due to the presence of gas on trains. Only by the strongest expression of public opinion, backed up by all the force of the daily and technical Press, shall we succeed in ousting gas from trains in this country.

We hope in our next article to deal with other aspects of the subject.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The Cedar Rapids Co. are building a plant of 100,000-H.P. capacity, which will later be increased to 160,000 H.P. The Rapids are near Montreal, on the St. Lawrence. The generating equipment has already been ordered, and comprises 12 10,800-H.P. units of 56 R.P.M., with a 30-ft. head.

At Bay Roberts, Newfoundland, the Western Union Telegraph Co. intends to erect an enlarged station of a permanent character to accommodate its trans-Atlantic cables.

Nearly 5,000 miles of telegraph wire will be erected by the C.P.R. between now and the end of this year.

In New Brunswick land is said to have been acquired by the Universal Radio Syndicate, for a wireless telegraph station intended for trans-Atlantic work.

The Montreal Transportation Co. has a vessel named the *Tynemount*, which was recently launched at Newcastle-on-Tyne, and which is of interest to electrical engineers, because in it is employed a combination of a Diesel engine and an electric motor for propulsion. It will be interesting to note whether other shipowners follow the example thus set.

An engineer has submitted plans to the Montreal Council for 12½ miles of double track underground tramway, the estimated cost of the scheme being £4,000,000.

The Medicine Hat Tramways Co., Ltd., proposes to build 11 miles of track, and until conditions warrant the building of a power house, the company will buy its power from the city at 1 cent per KW.-hour.

The Hydro-Electric Power Commission of Ontario is undertaking a great deal of new work at present, necessitated by the rapidly increasing demands for power. New transmission and distribution lines are being erected, new transforming stations built, and some of the old ones extended, the most important of the last class of work being the increasing of the capacity of the step-up station at Niagara Falls from 50,000 H.P. to 75,000 H.P.; a new hydro-electric power station is also being built to supply the Severn district, which is somewhat remote from the Niagara lines.

The rules and regulations recently issued by the Commission are now in force, and municipal inspection departments are being organised by the Commission's Chief Electrical Inspector throughout all Ontario, as these Rules govern work carried out in every part of the Province, and not merely where current is bought from the Commission.

Reference has been made two or three times previously to the excellent work done by the Commission of Conservation in looking after Canadian interests in the matter of water-powers to which this country and the U.S.A. have a joint claim. Capitalists from over the border get up great schemes for utilising large water-powers situated on the boundary line, but when the matter is thoroughly investigated, it usually appears (as is, perhaps, natural) that the lion's share is to go to the U.S.A.

The Commission of Conservation has just issued a report dealing with a proposal made by American capitalists to utilise the power of the Long Sault Falls, on the St. Lawrence River, situated about 75 miles above Montreal; the southern shore of the river is in New York State, and the northern shore in the Province of Ontario. The minimum available H.P. is 618,000, and the head 40 ft.

As in several former instances, the scheme is strongly opposed by the Commission, on the ground that it would be detrimental to Canadian interests.

The proposal of the Long Sault Development Co. involved the damming of the St. Lawrence, and the report in question points out that serious damage might result, apparently from ice jams which might form in an unexpected manner and give rise to unlooked-for difficulties.

The opinion is expressed that navigation would be interfered with; that, owing to the international character of the work, the Government might not have the right to expropriate; and that if it had such expropriation would cost an enormous sum of money.

The report states:—"Looking at the whole scheme, it does not appear that any serious attempt can be made to show that Canadian requirements or Canadian interests are an appreciable factor in the plans of the company. The plans contemplate the absolute monopolisation of the whole power available from the Rapids with a minimum of consideration of Canadian interests." The end of the report is worthy of notice too. "The obvious conclusion from the facts recited seems to be that the plain duty of Canada is to maintain her rights of ownership and jurisdiction absolutely unimpaired and untrammelled."

The Commission of Conservation cannot be too highly commended for the splendid work which it carries out even in guarding the interests of the country in matters of this kind, leaving out of consideration all the other objects of its care, such as forests, crops, the soil, &c.

Flying Race.—It has been decided to hold a flying race from Paris to London, cash prizes to the value of £700 and a trophy having been offered by the International Correspondence Schools; the Royal Aero Club of the United Kingdom and the Aero Club de France (which has offered a very substantial additional prize) are in charge of the arrangements, and it is likely that there will be at least 12 starters.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CHILE.—In a recent issue of the ELECTRICAL REVIEW some information was given as to a proposed new tariff for goods imported into Chile, the effect of which would be to convert the present *ad valorem* tariff into a specific tariff (*i.e.*, certain specified rates on weight, number, &c., of the goods imported instead of rates on the value of the goods). The Board of Trade have now received information to the effect that a new valuation tariff has also been drawn up, and that unless the proposed new specific tariff is passed by the Government this year, the new valuation tariff will probably be put into force from January 1st, 1914. It is understood, however, that the projected valuation tariff now referred to is to be subjected to a further revision at the hands of the Commission, and that it is likely to undergo considerable modification before it is finally approved.

MEXICO.—A Mexican decree just passed states that for the future all import duties are to be paid by means of certificates issued by the Treasury. These certificates will be issued in four denominations—10 pesos, 50 pesos, 100 pesos and 5,000 pesos, and are to be sold for silver currency at their face value.

SALVADOR.—The following decisions as to Customs treatment of certain imported goods have recently been issued :—

Electric accumulators and Edison batteries for producing ignition in gasoline or petroleum motors	1 centavo per kg.
Rails weighing up to 35 lb. per yd. ...	Free

An additional duty of 2 centavos per 46 kg. is also to be levied on all goods, even those otherwise duty free, in order to provide funds for sanitary improvements at the various ports.

1 centavo = about ¼d.

AUSTRALIAN COMMONWEALTH.—The Australian Customs authorities have issued the following decisions as to the duties under the preferential tariff applicable to British goods :—

Attractoscope, an electrical apparatus for projecting advertisements on footpaths ...	10 % ad val.
Electric locomotive for haulage purposes ...	20 % ad val.

NEW ZEALAND.—The Customs authorities have decided that Leskole distance thermometers, arc light projector lamps, and Minin violet-ray lamps for treatment of constitutional and skin diseases are to be admitted duty free.

CONGO STATE.—An Ordinance recently passed provides that importers are required to show on their entry forms the net weight of imported goods as well as the gross weight.

NICARAGUA.—The Board of Trade have received from the Consul at Managua a circular of the Nicaraguan Customs Department notifying that certificates of origin for goods the produce of countries (including the United Kingdom) which are entitled to the reduction of 25 per cent. of the Customs duties, must clearly describe the goods, indicating the marks and numbers of the packages, their contents, their gross weight, the number of the Consular invoice, and the name of the consignee.

The form in which certificates of origin must be drawn up may be inspected at the Commercial Intelligence Branch of the B. of T.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,732. "Process and apparatus for electrically separating suspended bodies from electrically non-conducting, especially gaseous fluids." E. MOLLER. (Convention date, August 31st, 1912, Germany.) September 1st. (Complete.)

19,733. "Process and apparatus for electrically separating suspended bodies from non-conducting, especially gaseous, fluids." E. MOLLER. (Addition to 17,840/12.) September 1st. (Complete.)

19,752. "Impulse-producing mechanism." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) September 1st.

19,753. "Casing for electric miners' lamps." P. PORSCKE, E. KLUNDER and G. KELLNER. September 1st.

19,754. "Air-tight casing for electric miners' lamps." P. PORSCKE, E. KLUNDER and G. KELLNER. September 1st.

19,782. "Solution for use in lead accummulator cells." P. RABBIDGE. (Convention date, September 2nd, 1912, Australia.) September 1st. (Complete.)

19,783. "Process for the preparation of absorbents to be used in the cells of electric dry batteries." P. RABBIDGE. (Convention date, September 27th, 1912, Australia.) September 1st. (Complete.)

19,803. "Heating water by electricity." H. TRENERRY and A. KINGMAN. September 2nd.

19,836. "Electrical musical instruments." D. W. BARTON. September 2nd. (Complete.)

19,838. "Machines for sealing supporting wires into the beads of the glass rods of metal-filament electric incandescent lamps." J. KREMENEZKY (firm of.) (Convention date, April 16th, 1913, Austria.) September 2nd. (Complete.)

19,840. "Process for manufacturing a heat and acid proof varnish." T. ROERIG. September 2nd.

19,846. "Electric switches." E. EBBE. September 2nd.

19,853. "Apparatus suitable for use in telegraphy and for other purposes." F. G. CREED and CREED, BILLE & Co., LTD. September 2nd.

19,854. "Galvanic batteries." J. E. PRESTON. September 2nd.

19,855. "Apparatus for projecting electro-magnetic rays to a distance." G. C. L. V. ULIVI. September 2nd.

19,857. "Electric anti-vibratory device." F. H. REEVES. September 2nd. (Complete.)

19,911. "Apparatus for wireless telephony." P. GEORGE WEBB and J. KRAMMER. September 3rd.

19,914. "Electrically operated winch specially applicable as an ash hoist." A. W. PRIM and F. W. ROPER. September 3rd. (Complete.)

19,916. "Electric lamp sockets." E. P. LE COMPTE and C. W. HODGSON. September 3rd. (Complete.)

19,919. "Electrical transformers." F. COATES, J. MIRREY and A. REYROLLE AND Co., LTD. September 3rd.

19,928. "Circuit arrangements for telephone systems." SIEMENS AND HALSKE AKT. GES. (Convention date, September 11th, 1912, Germany.) September 3rd. (Complete.)

19,938. "Electric incandescent lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) September 3rd.

19,939. "Transmitter devices for copying and like telegraphic apparatus." A. RAPPENECKER. September 3rd. (Complete.)

19,945. "Electric lighting systems." H. E. SMITH. September 3rd.

19,965. "Electric contacts or switches, particularly those used in connection with electric motor horns." W. A. CROSBEE, F. S. C. CROSBEE and T. S. ROGERS. September 4th.

19,966. "Method and apparatus for the transmission of messages or designs such as photographs, clichés and the like." W. P. THOMPSON. (Soc. Anon. des Télégraphes Edouard Belin, France.) September 4th. (Complete.)

19,971. "Electric radiators." SIMPLEX CONDUITS, LTD., and L. M. WATERHOUSE. September 4th.

19,988. "Telephone systems." W. AITKEN. (Addition to 16,906/12, 14,524/13, 16,859/13, 18,349/13, and 19,521/13.) September 4th.

20,008. "Electrometers." B. SZILARD. (Convention date, October 15th, 1912, France.) September 4th. (Complete.)

20,011. "Telephone exchange system." M. L. JOHNSON. September 4th. (Complete.)

20,028. "Electric burglar alarms." A. RENCZEWITZ. September 4th. (Complete.)

20,056. "Electric incandescent lamps." A. H. DYKES and C. W. SMITH. September 5th.

20,064. "Electricity distributing systems." C. CUTHBERTSON. September 5th.

20,065. "Electrical switch cases." H. LUCAS and O. LUCAS. September 5th.

20,097. "Apparatus for projecting electromagnetic rays to a distance." G. C. L. V. ULIVI. September 5th.

20,112. "Saw for cutting mica and the like." E. A. SILK. September 5th.

20,122. "Manufacture of drawn wires from tungsten and the like metals." C. GLADITZ. September 5th.

20,135. "Electrical winches with continuously working motor." G. GARDE and DOEFORD, HAUBERG, MARSTRAND and HELWEG AKTIESELSKABET TITAN. September 5th. (Complete.)

20,127. "Electric light or other lamps." A. H. B. SHARPE. September 5th.

20,170. "Telephone transmission circuits." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, Belgium.) September 6th. (Complete.)

20,191. "A combination of telephone apparatus and mechanical apparatus therewith for road and other services." J. F. WAKELIN and H. L. DENT. September 6th.

20,195. "Bonding clamp for metal-sheathed electric wires and cables." W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., and W. F. BISHOP. September 6th.

PUBLISHED SPECIFICATIONS.

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1912.

METHOD OF INDIRECT EXCITATION FOR OSCILLATORY CIRCUITS. E. Girardeau. 11,703. May 16th. (May 17th, 1911.)

TROLLEYS OR COLLECTORS FOR ELECTRICITY. L. J. Tetlow. 16,549. July 15th.

COMBINED VOLTAGE REGULATORS AND SWITCHES FOR VARIABLE-SPEED GENERATORS. A. Pollak. 16,782. July 18th. (July 31st, 1911.)

ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 16,806. July 18th.

ELECTRIC CLOCK MOVEMENTS AND THE LIKE APPARATUS. C. H. Davies. 18,654. August 14th.

MEANS FOR CONVERTING ELECTRIC CURRENTS. A. R. Bullock. 19,000. August 19th.

ELECTRIC SNAP-SWITCHES. C. J. Klein. 19,073. August 20th.

APPARATUS FOR MEASURING THE ELECTRIC CONDUCTIVITY OF LIQUIDS. M. Coplans. 19,113. August 21st.

APPARATUS OR APPLIANCES FOR ELECTRICALLY OPERATING AND CONTROLLING VALVES. A. Bryan and L. F. Mountfort. 19,203. August 22nd.

SIGNALLING OR LIKE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,255. August 22nd.

ELECTRIC ARC LAMPS. N. H. Balfour and A. B. Hitchin. 19,264. August 22nd.

SELF-CONTAINED PORTABLE ELECTRIC LAMPS. S. Stern and British Ever-Ready Electrical Co. 19,318. August 23rd.

SWITCHES FOR ELECTRIC HAND LAMPS. S. Stern and British Ever-Ready Electrical Co. 19,451. August 24th.

PULSATION TIMING DEVICES FOR USE IN ELECTRICALLY-OPERATED VIBRATORY MUSICAL INSTRUMENTS. M. L. Severy and G. B. Sinclair. 19,870. August 30th.

HIGH-VOLTAGE CONTINUOUS-CURRENT DYNAMOS. C. W. Girvin. 22,270. October 1st.

ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 22,664. October 4th.

SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES AND OTHER PURPOSES. A. J. Riley. 23,404. October 14th.

EVACUATED VITREOUS CONTAINERS HAVING SEALED-IN CONDUCTORS. British Thomson-Houston Co. (General Electric Co.) 23,775. October 17th.

X-RAY APPARATUS. H. C. Snook and E. W. Kelly. 24,046. October 21st. (October 27th, 1911.)

AUTOMATIC REGULATORS FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. and A. H. St. Croix Watson. 26,597. November 19th.

ELECTRIC ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 27,526. November 29th.

ELECTRIC SWITCHES. Siemens Bros. Dynamo Works, Ltd., and R. A. R. Bolton. 27,874. December 3rd.

ELECTRIC CONTACT DEVICES OF THE SWAN TYPE. R. Haddan. (Ludenscheider Metallwerke Akt.-Ges. vorm. Jule Fischer & Basse.) 29,372. (December 20th.)

THE

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ELECTRICAL REVIEW.

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ELECTRIC VEHICLES.

THE announcement regarding the formation of a Committee of the I.M.E.A. to promote the use of electric automobiles in this country will be received with gratification by all who, like ourselves, have this subject at heart; we have felt it our duty, in the interests of the electrical industry, repeatedly to direct attention to the rapid progress made by the electric vehicle in America, and to point out that the conditions in this country are at least as favourable for its development, and we are glad to know that at last the central-station engineer, who really holds the key of the position, is fully awake to the possibilities of this department of electrical activity.

The Committee originally nominated by the Association was a strong one, and is wisely taking steps to co-opt other members representing important interests concerned in the movement. Moreover, with commendable energy, it has outlined a plan of campaign which seems admirably calculated to further the object which it has in view. The prime essential, as it appears to us, is to make it known that electricity supply authorities are willing to provide adequate charging facilities at rates which will enable the electric vehicle to compete with its rivals on a favourable basis, and to this end common action and uniformity of voltage, standard fittings, &c., are indispensable. These considerations are placed appropriately at the head of the Committee's programme. The provision of charging facilities ought really to precede the introduction of the vehicles, although some time must necessarily elapse before there is any appreciable demand for them; it is obvious that if the supply authorities wait for the vehicles to arrive before they provide the charging stations, the latter will never be required. But the cost in the first instance need not be heavy—a single station in each town of moderate size would suffice for a commencement, and might in many cases be situated at or near the electricity works, thus costing nothing extra for supervision.

Publicity, of course, is of the essence of the scheme, and the Committee is to be commended for recognising its importance. There is no reason for any delay in this respect; steps should be taken at once to acquaint the public with the advantages of the electric vehicle and with the arrangements which are being made as regards garaging and charging, as well as for the supply of suitable vehicles. The proposal that technical assistance be rendered to traders in handling what will be to them a totally new line of business is also a good one, and the standardisation of technical details, the formulation of rules for the maintenance of electric vehicles, and the preparation of maps showing charging stations are equally sound. We would suggest that, in addition to the parades of electric vehicles foreshadowed in the programme, competitions be organised between the various makes and types of vehicle which we hope soon to see on the streets, for there is nothing that appeals so readily to the sporting instincts of the nation as a trial of speed or endurance between rival candidates for supremacy. The enlistment of public bodies as users of electro-

mobiles, and, consequently, witnesses to their good qualities, ought not to present great difficulties; we believe the Post Office was within an ace of adopting electricity as the motive power for its great fleet of London postal delivery vans some years ago, when petrol, however, was victorious by a narrow margin, and the excellent electric ambulances and broughams which silently and smoothly run about the streets have familiarised the London public with the idea of electrical propulsion. The example should be set by the electricity departments themselves; if *they* do not use electricity, how can they ask their customers to do so?

In an early issue we propose to illustrate a collection of examples of American achievements in the development of the electric vehicle, and we shall hold ourselves at the disposal of the Committee, which has formulated so admirable a plan, to assist in the work by every means at our command.

Municipal Tramways.

The key-note of the conference of the Municipal Tramways Association, which has been sitting this week at Sheffield, was, as might be expected, motor-'bus competition. But it must not be supposed that there was any suggestion of panic at the inroads made by its rival on the sphere of the tramway; the exaggerated views which have been promulgated in the London daily Press regarding the approaching demise of the tramway system and its supersession by the ubiquitous 'bus are held only by their lay authors and the out-and-out advocates of the motor-'bus, and in the calmer atmosphere of the Provinces the question is considered dispassionately and with due regard to the realities of the case. No one who is familiar with the facts regarding the conditions under which the competition is at present carried on—the carrying capacities of the respective vehicles, their accommodation in wet weather, the heavy burdens that are imposed by law upon the tramways but not upon the omnibuses, the uncompensated destruction of the public roads by the latter, and the peculiar traffic conditions obtaining in London, where the tramways are forbidden to enter the heart of the city—can fail to realise that there is plenty of life in the tramway, and that its abolition would be bitterly regretted by the public were it brought about.

As Mr. A. R. Fearnley pointed out in his excellent presidential address on Wednesday, municipal tramways are by no means at a standstill; not only are numerous extensions under way, but also the cars and their equipment are undergoing continuous improvement, speeds are being increased, and more frequent services provided, while the lot of the employés is being steadily ameliorated. The last B. of T. returns show an increased traffic for the year of no less than 220 million passengers, compared with the previous year's results.

Regarding the future, Mr. Fearnley advocates an open mind, ready to take advantage of all new developments, including the railless trolley system and the motor-'bus itself. While he sees no prospect of the motor-'bus replacing the tramcar for heavy traffic, he recognises its advantages as a feeder to the tramway, and has obtained very satisfactory results with 10 'buses in his own district. We are glad to know that technical data regarding the performance and running cost of these vehicles—so jealously withheld by the big 'bus companies—will shortly be available from the municipalities.

The subject of "Urban Passenger Transport" was dealt with more fully by Mr. J. B. Hamilton yesterday; in his paper he exhaustively discussed the relative costs of motor-'buses and tramcars, so far as they are known, and their respective capabilities for dealing with traffic, and arrived at conclusions highly unfavourable to the former. Further reference to the matter must be deferred to a later issue, and for the present we will close with congratulations to the Association on its exceptionally interesting and useful meeting.

The Bray Explosion.

After many days—to be precise, one year and two months since the accident occurred—the Home Office has issued a report on the explosion at the electricity works of the Bray Urban District Council, which resulted in the death of a fitter, most serious injuries to the engineer, Mr. Sowter, and minor injuries to his assistant, Mr. McDonnell. The report is signed by Mr. G. S. Taylor, H.M. Inspector of Factories, under date March 25th, 1913, and is a model of its kind. Pressure on our space forbids its reproduction in this issue, but we shall reprint a large portion of it later. In the meantime, we may say in brief that the Inspector arrived at the conclusion that the explosion of the blast vessel was caused by the ignition of an oily deposit on its interior, due to the transmission of a flame explosion from the fuel valve casing along the blast pipe. The ignition was facilitated, and the resultant explosions were intensified, by the large volume of compressed oxygen contained in the blast vessel and blast pipe, and for this reason oxygen ought not to be used for recharging air vessels. The latter, he says, should be cleaned every 12 months, and tested every four years, and a device should be fitted to prevent the transmission of flame explosions along the pipes.

In our comments on the accident last year, we expressed the view that compressed oxygen in the presence of oil was the root cause of the trouble, and ought never to be used, and that a non-return valve should be inserted in the blast pipe.

Lead.

There has been a certain amount of irregularity in the lead market of late, but at such a high level of prices as the present this is only what is to be expected, for the market is bound to be sensitive. Quite a sharp fall occurred when it was found that 100 tons of lead from a non-Convention plant in Belgium had been shipped to London and delivered to a London dealer, for it was at once assumed that this meant that there was a secret stock of the metal available for immediate delivery against speculative contracts. As a matter of fact, it had no special significance, but for all this it brought about pretty plentiful selling, and with not the smallest support, a sharp reaction was witnessed. As usual, the weakness was merely a passing phase, and with a renewed demand from dealers and consumers, and some covering by oversold speculators, a rapid and substantial recovery ensued. For all this, however, it would be well to take a rather cautious view as to the future, for the price is high, and on all hands there are more or less distinct signs of a period of industrial reaction being in progress. This must inevitably involve lower, not higher, prices, and if once the Mexican position cleared up sufficiently to allow of the resumption of shipments on even a small scale, the price of lead would be far below the current level. There is not anything wrong with the position in itself, but it must not be forgotten that prices are high, and that the political situation in Mexico is gradually undergoing an alteration for the better. Already some of the long-interrupted copper smelters are at work again, and in the ordinary course of events it can only be a matter of a few weeks before a start should be made with getting the lead plants straight against the resumption of operations. When once Mexico begins to ship lead to Europe again the price of the metal will more nearly approach £15 a ton than £20 or more, which latter figure must prove harmful to consumption. Altogether there are vague indications that the extreme stringency of the market is by degrees becoming relaxed, though there may of course be temporary fits of fright on the part of over-sold parties, which may put up prices. It would be just as well, however, for consumers to begin to take a rather more cautious attitude in respect to the market at large, for values can hardly be expected to go much higher, while a very considerable drop must be expected when once the position in Mexico is clarified. In addition to this there is some idea that production is increasing in Spain, while the boom in silver is bound to tell sooner or later on the output of silver lead. The immediate position nevertheless is strong, and reports from Missouri indicate that the mines there are

not yet working properly, the withdrawal of the miners having caused them to fill with water, but pumping is going on vigorously, and in the course of a few weeks things there will have attained the normal, unless some fresh difficulty crops up. A feature in the market which is not at all liked, is the premium which near deliveries still command over distant. This has, undoubtedly, had a good deal to do with the reluctance of consumers to place contracts, for they are impressed with the suspicion that the position may be under manipulation. This idea is probably quite erroneous, but the mere fact that prices and output of lead are largely controlled by a convention, naturally leads to suspicions being entertained when outside conditions give colour to them.

The Forthcoming Gas Exhibition.

Most of our readers are aware that the gas industry has been endeavouring for some time past to recover the ground lost owing to the introduction of the metal-filament lamp. Facilities for obtaining gas cooking and heating devices have been improved and the appliances themselves have been rendered more efficient. New forms of fittings and new types of mantles have been introduced and a vigorous publicity campaign has been entered upon, which, it must be admitted, is being conducted with considerable acumen and skill. Newspaper paragraphs and short articles have been inspired, attractive folders issued replete with telling and forceful arguments, and a system instituted of sending out advertising literature with every communication emanating from the offices of the gas companies. The effect of the campaign is bound to be felt shortly if it is not already sufficient to be appreciated, and it would appear that the electric supply authorities are either not fully aware of what is being done or that they are seriously underrating the efforts of their competitors.

During October a Gas Exhibition will be held in the Uxbridge Road Galleries of the "White City," which will present several novel features, which show how the industry as a whole is working for the benefit of everyone concerned. The plan usually followed in exhibitions has been abandoned, and in place of the customary rows of stands and stalls advertising the wares of competing firms, the town-gas lions will, so to speak, lie down with the producer-gas lambs and present an appearance of absolute harmony, which cannot fail to have an appreciable effect on the visiting public. In other words, the Exhibition is planned and will be laid out solely with the view of popularising gas, showing what gas can do in the home, the office, the shop and the factory; showing how it can light, warm and ventilate a house or a church; showing how it can cook anything, from an egg to an ox; how it can drive anything, from a sewing machine to a rolling mill. The safety of gas lighting and power will be demonstrated, its wonderful hygienic powers will be proved. It will probably be shown that it cannot dirty a ceiling or injure a growing plant; it may be shown that the headache so frequency experienced by those who live in gas-lighted and gas-heated rooms is really due to some sort of brain reaction caused by the intense enjoyment due to the adoption of that particular method of illuminating and warming the premises. At the time of writing it is not definitely known whether the advantages of gas lighting for express passenger trains will receive more than passing attention, but it is known that no efforts will be spared at this Exhibition to prove to the public that electricity is practically obsolete and that gas, used in any form or for any purpose, is immeasurably its superior.

It is an organised attempt to demonstrate to the public, including, of course, those who are now customers of the large electric undertakings, that for any purpose gas is not only suitable, but is the only thing suitable. We are not, however, fearful regarding its effect upon those who are already electrical consumers. In our last issue we gave particulars respecting an effort that *some* of the electric supply companies are making to provide a counter-blast in the shape of La Maison Electrique, at the Ideal Exhibition which opens at Olympia on October 8th. The Gas Exhibition will be backed by the full force of an industry with a capital running into very many millions of pounds; not so La Maison Electrique, for, as the reader has observed, financial support has not been generously given by electric supply authorities. Maybe some of them are not impressed with the past achievements of the Electric Supply Publicity Committee. There has, indeed, been good ground for criticism, but now that the Committee is trying to do something along attractive lines, we give it our ungrudging good wishes and urge it to cover up its past failings by utilising the Ideal Home opportunity to the full limit of its power. The electric supply manager, however, must not shut his eyes to the need for a strong commercial effort on the part of his own local organisation at such a time.

Monopoly Questions in Germany.

The German Association of Special Electrical Works is unceasing in its endeavours to arouse public and Government interest in the monopolistic efforts of manufacturing companies in the direction of securing the control or ownership of central stations in different parts of the country, so as to obtain an additional permanent customer for electrical machinery, plant and materials. At the recent Leipzig meeting of the Manufacturers' Federation (Bund der Industriellen), Dr. Fasot, Syndic of the Vereinigung Elektrotechnischer Spezialfabriken, was successful in inducing the Federation to unanimously adopt a resolution addressing an urgent request to the Imperial Government and the Federal Governments to devote their attention to questions affecting the public supply of electricity, particularly the grant of concessions to private undertakers, the sale or leasing of communal electricity works, and the establishment of the so-called mixed economic enterprises or joint private and municipal undertakings. The resolution submitted that the availability of cheap electrical energy is of substantial importance in the interest of the competitive activity of German industries in the markets of the world, and that the industries must, therefore, demand that the public supply of electricity should be organised in the first place for the welfare of the general community and a private monopoly be prevented. It was also held that the consuming industries have a considerable interest in seeing that competition is not hindered either in the manufacturing or the installation branches of the electrical industry, and the Federation has consequently asked the Governments to adopt effective measures capable of meeting all endeavours put forth to obtain a direct or indirect monopoly of materials and installation work in connection with public electricity works. As has been previously mentioned in this journal, several of the Federal Governments have issued instructions at various times during the past two years, requesting the Government officials to take action in the direction indicated by the resolution in question. A fresh example has just occurred in Saxony, where the Ministry has published an order repeating the opinion that the public supply of electricity by the communes appears to correspond best to the public welfare as a rule, and the supervising authorities are therefore requested to forcibly support the supply of current by public bodies. In order to be able to do this successfully, the communes have been instructed to give immediate notice to the supervising authorities in every case where they enter into negotiations with a private undertaker in regard to the supply of their districts or the stoppage or sale of their works. The supervising authorities in their turn have to forward the notice to the Saxony Union of Municipal Works, and to the unions of public supply works in their respective districts, in order that the Unions may be able to cope with the threatened private competition. Federal Government orders of this, or a similar, kind, do not, however, prevent a continuance of the monopolistic efforts which, whilst being successful in some instances, meet with a check in others, as, for instance, quite recently at Offenbach and Carlsruhe, and also at Cassel, on September 18th. In the latter case, not only have private overtures been declined, but the Municipal Council has entered into an agreement with the Prussian Government (Weser River Administration) for the mutual supply of energy for a period of ten years.

THE APHEGRAPHE: AN ELECTRICAL INSTRUMENT FOR USE IN GRAPHICAL MATHEMATICS.

The extreme delicacy and accuracy of "electric touch" as applied to measuring machines have already been dealt with in these columns* in connection with Dr. P. E. Shaw's precision measuring machine. The first application of this delicacy and accuracy to graphical mathematics is, we believe, to be found in the "aphegraphe"—an instrument designed by M. R. Guillery† primarily for the investigation of inertia forces in moving parts, but equally applicable to any procedure involving graphical differentiation.

Mathematical differentiation, of course, leads to perfectly accurate results, but not every engineer is familiar with the differential calculus. The mathematical expression of many motions which are simple, as regards the mechanism for

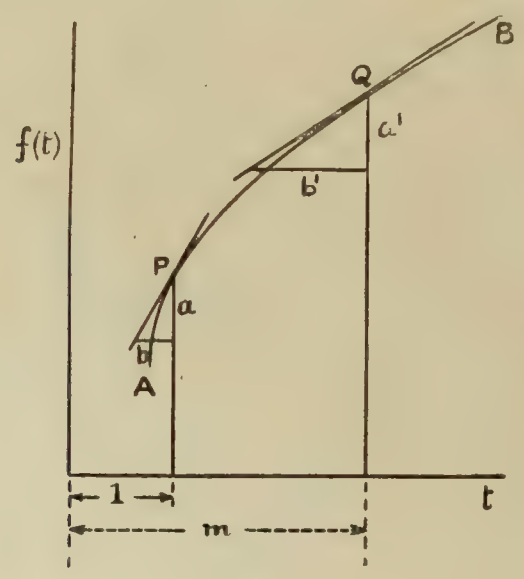


Fig. 1.

their production, is a difficult matter, and many cases arise in the testing of materials and in the investigation of machines and the motions of vehicles, &c., in which mathematical analysis becomes quite impracticable. In such cases, the differential coefficients of a function represented, say, by the curve A B, fig. 1, are determined graphically by measuring the slopes a/b, a'/b', &c., of tangents at points P, Q, &c., in A B, and replotting the

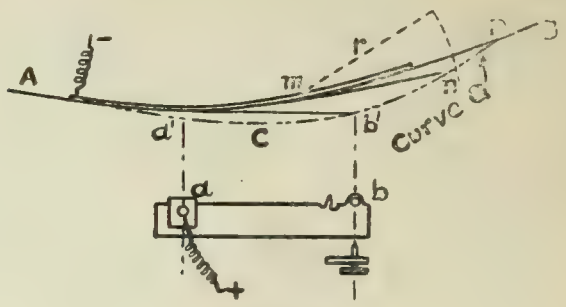


Fig. 2.

values of these slopes as ordinates against the corresponding abscissæ l, m, &c., to yield the first differential derivative of A B. The accuracy of the results obtained depends essentially on the exactitude with which the points of contact of the tangents can be determined. These points can be located with tolerable accuracy when the curvature of A B is great (as near P, fig. 1), but considerable errors can hardly be avoided where the radius of curvature of A B is great (as at Q, fig. 1). In any case, little reliance can be placed on the accuracy of, say, an acceleration curve obtained by successive graphical differentiation of curves of displacement and velocity. The *method* is not at fault; it is in its practical application that errors arise, and the object of the aphegraphe is to make possible the full realisation of the inherently universal applicability of graphical differentiation by making it possible to draw accurately the tangent to any point in the curve to be differentiated.

Referring to fig. 2, a glass base-plate carries a platinum tangent plate a, and a vertical spring needle b, centred accurately in the produced working plane of a. To use the instrument, the curve to be differentiated is first "materialised" by a rigid or flexible metallic template, the working face of which is vertical, and coincides at its lower edge with the curve investigated. The plate a and the template are connected to the terminals of an electric bell circuit.

In using the aphegraphe, a is brought successively into contact with various points on the materialised curve (contact being indicated by the ringing of the signal bell), and when each setting is complete, the needle b is depressed. There are thus pricked out a series of points on a curve G, and when the latter is complete, a tangent can be drawn accurately to any point m in A B by describing from this point as centre and with radius r = distance between a, b in the aphegraphe, a circular arc cutting G in n. The straight line $m\,n$ is then the desired tangent, and having obtained it, its slope and hence the differential coefficient of the function represented by A B at the point m is determined in the usual manner. Experience shows that, using this instrument, second, and if required, third and fourth derived curves can be constructed rapidly, and with very small error. If curves possessing points of inflection have to be investigated, the platinum plate of the aphegraphe should be extended to working faces on both edges of the glass base.

* Electrical Review, July 25th, 1913, p. 127.

† "Bull. Technologique des Ecoles d'Arts et Métiers," Nos. 7 and 8, 1912.

THE BRITISH ASSOCIATION.—II.

The only paper in Section G, on Friday, September 12th, of special interest to our readers, was the paper by Prof. J. T. Morris on the results of one year's working in domestic electric cooking and heating, in a flat having six rooms, kitchen and bathroom. The paper is one of very wide interest, and should prove valuable not only to central-station engineers, but to all householders desiring to get actual facts on this subject.

Saturday, September 13th, was entirely given up to sight-seeing, not even Section A being at work. There was general satisfaction expressed at the excellent organisation of the various excursions to the places of interest around Birmingham. Certainly no part of the country is richer in historical associations, or more beautiful to look upon than some of the districts round the city.

On Monday there was a joint discussion between Sections A and G on "The Investigation of Complex Stress Distribution," in which Prof. Perry, Mr. W. A. Scobie, Mr. W. Mason, Mr. G. Cook, Prof. Petavel, Prof. Coker, Mr. J. J. Guest, Mr. J. S. Wilson, and Prof. S. Dixon took part; followed by a paper by Prof. E. G. Coker on "The Construction of Large Polarising Apparatus for Use in Lantern Projection Work." Afterwards a paper was read by Prof. A. T. Walmisley entitled "Metals for Structure."

The author said that fresh water corroded wrought-iron more rapidly than cast-iron, and malleable iron would rust more quickly in moist air, but would resist salt water better than cast-iron. Steel was more easily oxidised than wrought-iron, and far more easily than cast-iron. Generally speaking, though the oxidation of steel was faster than that of iron, it was more uniform, and the corrosion of both iron and steel was more rapid when partly wet and partly dry than when wholly immersed in water or wholly exposed to the air. He had found that nothing appeared to equal black varnish as a protection for iron or steel against corrosion in tidal waters.

To many of our readers the proceedings in Section B will have the chief interest. In that Section the utilisation of coal was investigated in an interesting series of discussions, initiated by Dr. Beilby, F.R.S., whose remarks will be abstracted in a later issue.

Dr. H. G. Colman came next with a description of the high-pressure gas supply in Birmingham for industrial purposes, the price being stated to be the lowest in England. It varies from 1s. to 1s. 4d. per 1,000 cb. ft., subject to 5 per cent. discount, according to the quantity used.

Mr. J. H. Yates (chairman of Messrs. John Wright and Co., Ltd.) gave an account of a new radiating gas fire, stated by him to be free from the worst objections with older types. The design is based on the use of fireclay tubes, in which there is said to be (when everything is properly regulated) perfect mixture and perfect combustion. As there is only one small bar in front, there is no obstruction to the radiant heat. No reflectors are required, the radiation being direct. It was pointed out that radiation is taking the place of convection in gas-fire design.

Mr. Yates described the radiometer used by Prof. Bone and Dr. Wm. Stroud, of Leeds, for measuring the efficiency of gas and other fires. He claimed now to reach the efficiency for heating rooms of 48 per cent. of the fuel value of the gas, as against 30 per cent. ten years ago. He said that gas fires should be designed of a wider form than hitherto, viz., 17 in. to 21 in. wide, the same width as a coal fire, and he pointed out the absolute necessity of having an air vent clear over the radiants for drawing away the air from the room along with the products of combustion, to secure good ventilation. For this purpose the canopy must be kept much higher than usual. He mentioned that there are no fewer than 350,000 gas fires in London to-day.

Mr. Yates admitted freely and, in our view, very properly, that a gas fire without a flue was a danger to health, and ought under no circumstances whatever to be permitted. The whole meeting (and it was a crowded one) showed its appreciation of this straightforward statement.

Prof. W. A. Bone, F.R.S., followed with a paper on "Gas Producers and the Use of Gas." He commented on the extremely low cost of the high-pressure commercial gas supplied in Birmingham, but remarked that while it was suitable for use in industrial operations on a comparatively small scale, it was still prohibitive in price for such purposes as, for instance, steel melting. It is still necessary for such purposes to use producers installed near the place of consumption.

As compared with 1s. to 1s. 4d. per 1,000 cb. ft. (less 5 per cent. discount) for the Birmingham supply of high-pressure gas, water gas from coke at 12s. per ton, and containing 290 B.Th.U. per cb. ft., could be produced for 4d. per 1,000 cb. ft. Comparing this with the Birmingham supply, it would be equivalent to coal gas at 8d. per 1,000 cb. ft. Thirty-five cb. ft. of water gas were obtained per lb. of carbon. Sixty per cent. of the total carbon appeared in the gas, and the overall efficiency in producing such gas was about 70 per cent.

Producer gas obtained when the fuel was completely gasified by air and steam blast could be produced with an overall efficiency of 75 per cent., and when ammonia was recovered as a by-product the cost per 1,000 cb. ft. of gas containing 145 B.Th.U. per cb. ft. from coal at 15s. per ton was only 1d. per 1,000 cb. ft., which was equivalent to coal gas at 4d. per 1,000 cb. ft.

The use of blast-furnace and coke-oven gas was increasing rapidly, and Prof. Bone said it was now clear that with the coke ovens, blast furnaces, and steel furnaces all on one site with the rolling mills, enough waste gas could be obtained to run the whole plant and even to supply some power outside. He estimated that blast-furnace gas from coke-fired furnaces averaged 168,000 cb. ft. of gas per ton of iron produced. From a furnace producing 1,000 tons of iron per week, there would be a yield of 1,000,000 cb. ft. of gas per hour.

The analysis was CO_2 12 per cent., CO 30 per cent., nitrogen 58 per cent., and the heat value, say 100 B.Th.U. per cb. ft. at normal temperature and pressure.

After heating the Cowper stoves and producing the blast for the blast-furnace itself, there might be 40 per cent. of the total production of gas available for conversion into electrical energy for driving machinery.

The dust was one of the original difficulties, amounting to 5 grammes per cb. metre of gas. But cleaning arrangements had now been adopted which reduced the suspended dust to 0·01 gramme per cb. metre, which was clean enough for use in internal-combustion engines. The power absorbed in the cleaning process was about 5 per cent. of the original total. Therefore, there was available for actual power production, say, 38 per cent. of the gas. M. Hubert, of Seraing, had described at the recent meeting of the Iron and Steel Institute a single gas engine giving 6,500 H.P. on blast-furnace gas.

Dr. R. V. Wheeler next dealt with the composition of coal. In the destructive distillation of coal, he said there were produced two main classes of compounds—first, the paraffin-yielding constituents, which came originally from the resins; and, secondly, hydrogen and the oxides of carbon, which required a higher temperature to decompose them. These originated from the cellulose of the original vegetable growth. It had been found that pyridin had the power of solution of coal, increasing the paraffin-yielding compounds in the process. If the pyridin extract were now dissolved in chloroform one would get 80 per cent. of the volatile constituents. A more rational analysis of coals could be carried out on these lines.

Another promising development was the discovery that coal had an effect on a sensitised photographic plate if left close to it, but not quite touching it, in a dark room for 12 hours or so. The face of the coal must be made sufficiently flat to bring the whole surface fairly equally near to the plate.

The resinous constituents acted on the plate, so that when it was developed it showed by markings of white bands how such resinous constituents were stratified in bituminous coals. The pyrites came out white owing to yellow stains in the plate, while the residues that were insoluble in pyridin having no resin gave no effect. It was probable that coals with caking properties were caking coals chiefly because the resinous constituents were all mixed up with the other constituents instead of being stratified, as in the non-caking coals.

Dr. R. Lessing followed with a note on smokeless fuel and coal oil, and their relation to smoke abatement. He spoke of the probable adoption at no distant date of low-temperature carbonisation, with full recovery of the valuable fuel oils. He stated that in this country there were 210,000 tons of liquid fuel lost every year in the form of soot alone. Three millions of tons of fuel oil could be recovered from house coals alone in a year by low-temperature carbonisation, which would practically make Great Britain independent of outside supplies of fuel oil.

Mr. W. H. Patterson contributed a paper on "The Blending and Improvement of Coals," and stated that on treating small bituminous coal with chlorine, without changing its appearance or its weathering qualities, the coal was made to resemble anthracite in its qualities, and would give less ash and an increased evaporation of 25 per cent., no soot being formed. The meeting seemed a little sceptical about this figure.

A lively general discussion followed. Mr. Arnold Lupton said there was no need for alarm about the rate at which our coal supplies were going. The thing would correct itself, and when coal got dearer more efficient methods of utilisation would be adopted. He advocated a system of rewards instead of fines to abolish the smoke nuisance, and said that we could well afford them. He had computed that the actual loss caused by smoke in the atmosphere in Leeds amounted to a rate of 7s. in the £. He referred to the process of Berghaiser for the recovery of sulphate of ammonia.

Dr. Beilby said his experiments had no pretensions to be on a commercial scale. But he was satisfied that low-temperature carbonisation could be carried out on a large scale for 1s. per ton.

Prof. Armstrong remarked that any figure put forward by Dr. Beilby was sure to be reliable, and the only thing that he regretted about Prof. Bone's contribution was that he had made no reference to the very important work done by him on improved methods of combustion. Both he and other speakers emphasised very strongly the terrible danger which attended the use of any gas stove unprovided with a thoroughly efficient flue, and the necessity of accurate adjustment of all gas burner rings and other heating apparatus, so as to prevent the impingement of the hot flame on the cold heating surface. In fact, it became clear that for the safe working of such apparatus, precautions are necessary which are almost universally neglected at the present time.

For our own part, we regard the line of development as clear: improved combustion, or rather low-temperature distillation, of coal with recovery of fuel oils and ammonia, and utilisation of the gas in gas engines; subsequent

burning or gasification of rich coke for power production, the whole of the power being turned into electricity, which gives bright light and clear heat without burning up the oxygen of the room or risking the poisoning of its inhabitants.

This discussion was, in our opinion, of the highest value, and it would have been well worth the while of Section G to join it officially. As it was, large numbers that rightly belonged to Section G strayed into Section B to take part in it or to hear the speakers.

Amongst the works open for inspection was that of the General Electric Co., Ltd., at Witton, and during a tour of the busy shops a considerable amount of interesting work was observed. There were to be seen in course of erection in the engineering shop a number of large 1,000-kw. rotary converters, turbo-generators, haulage and rolling-mill motors, as well as several generators to be driven by blast-furnace gas engines, the low speed of which necessitates a generator of very large diameter. Two armatures observed in the course of winding had diameters of 3·3 and 3 metres, and commutators 2·6 and 2·4 metres in diameter respectively.

In the switchboard erecting shop a large number of high-tension and low-tension switchboards were observed, whilst the switchgear department was very busy with industrial switchgear in great variety to meet the urgent demand for gear complying with the Home Office regulations for the use of electricity in factories.

In the small motor shop in which Witton fans are constructed, from the small desk fan taking 20 watts, to the large 60-in. exhaust fans, a batch of centrifugal fans for one of the latest super-Dreadnoughts were in process of erection.

In the arc lamp department the Angold Magazine lamp, amongst others, was being assembled in very large quantities, and we were assured that, although this is not the time of year in which arc lamp orders are usually placed, over 80 per cent. of the orders for this lamp which have been received during the summer months have been repeats.

The foundry in which the company makes its own castings was also inspected, together with the stores, which act as a central point for the accumulation of a considerable proportion of the company's stocks.

At the conclusion of the visit to the works, the company's playing fields and dining club for the staff and workmen were inspected, and it was pleasing to observe the encouragement offered by the G.E. Co. to athletics and social gatherings.

The recent fire in the pattern stores has not been allowed to interfere seriously with the output, and a very complete organisation has permitted the prompt replacement of the patterns immediately required. The works are exceedingly busy, and have plenty of work ahead. They employ about 3,000 hands.

A circular issued at Birmingham gives details with regard to next year's meeting in Australia. There is also an invitation from the French Association for the Advancement of Science, to its meeting in Havre next autumn, which was mentioned last year, and which it is understood will be officially accepted, in order that those members who cannot go to Australia may avail themselves of French hospitality. It is understood that a circular with regard to the Havre meeting will be issued in due course.

The Australian meeting offers a splendid opportunity to those who can afford the time and money to visit that great country under the very best auspices. The hospitality offered is almost boundless. Enrolment of members for the meeting will take place after October 6th, but names can be sent in to the assistant secretary, at Burlington House, and will be attended to when the office reopens. New members desiring to join in the trip will only be enrolled after approval on written application to the Council.

Two advance parties, which will spend a week in Western Australia, will leave London by steamer on June 19th or 26th, or overland on June 25th or July 2nd, arriving at Perth, W.A., July 21st or 28th. On August 4th the advance parties proceed to Adelaide, together with the main party, which leaves London on July 8th or 9th by steamer, or overland to the Mediterranean.

A third party will go *viâ* New York, Vancouver and Sydney, and a fourth by Cape Town, the first-named leaving England about June 6th to 11th, and the second about June 22nd-24th. Adelaide, Melbourne, Sydney and Brisbane are the main centres to be visited, but extensive excursions will be made in all directions. Members can count on returning to England by about October 4th or 10th.

Members will receive vouchers entitling them to reduced fares, varying from first class £130, down to second class £65, according to the route chosen.

Particulars are also given of the route by the Siberian Railway.

On the arrival of the visitors in Australia, the State Railways will carry members free, which may be taken as a fair illustration of the generous welcome offered to the Association.

Future arrangements provide for the meeting to be held in Manchester in 1915, and in Newcastle-on-Tyne in 1916.

At an Honorary Degree Congregation of the University on September 11th, degrees were conferred upon Dr. Arrhenius, a pioneer in the theory of electrolytic dissociation and its bearing upon physical chemistry; Madame Curie, the discoverer of radium and "the greatest woman of science of all time"; and Prof. H. A. Lorentz, one of the foremost workers in mathematical physics, especially in connection with the electron theory.

The Nature of the Electromagnetic Waves Employed in Radio-Telegraphy, and the Mode of their Propagation.

By Prof. G. W. O. Howe, City and Guilds (Engineering) College, South Kensington. (*Section G. Abstract.*)

If power be transmitted by means of continuous current from one point to another, not, as is usual, by two parallel circular conductors, nor by a concentric cable, but by two wide strips of thin copper placed face to face and close together, both the magnetic and the electric fields will be approximately uniform throughout the space between the strips in any plane section normal to the direction of transmission. For this reason the consideration of such a transmission line proves an excellent method of approaching such conceptions as are involved in Poynting's theorem and electromagnetic wave phenomena. Although this method has its limitations, it will be seen to yield important results. After considering the continuous-current case, it will be shown that by using the same transmission line for alternate currents one is led to a clear conception of the nature of those gigantic electromagnetic waves which, emanating from a "wireless" aerial, spread over the earth in every direction. It will be shown that some of the fundamental ideas commonly accepted and taught in text-books on radio-telegraphy are fallacious.

Considering first the transmission of energy by means of continuous currents, let i be the current in amperes and e the P.D. in volts. If the resistance of the strips be neglected, the latter will be constant from end to end of the line. If b is the width of the strips and d the distance between them, the strength of the magnetic field between the strips is easily shown to be—

$$H = 4\pi/10 \cdot i/b.$$

If the strips are very close together H will be constant in the space between them and zero elsewhere. The same is true of the electric field, the strength of which is given by the formula—

$$E = e/d \text{ volts per centimetre.}$$

H and E are evidently at right angles and their product—

$$H\,E = 4\pi/10 \cdot ie/bd.$$

Now the power transmitted is ie watts or joules per second, and this power is transmitted through the dielectric space between the strips and not through the strips themselves, which merely act as guides. The walls of a speaking tube act in very much the same way in guiding the energy which is transmitted as sound waves.

The energy transmitted across each square centimetre of dielectric cross-section will be—

$$ie/bd = H\,E \times 10/4\pi \text{ joules per second.}$$

Thus, at any point in space where there is simultaneously a magnetic field H and an electric field E at right angles, there is a transmission of energy in a direction at right angles to the plane of H and E, equal to $10/4\pi \cdot H\,E$ joules per second or watts, where E is expressed in volts per centimetre. This is Poynting's theorem. The relative directions of H, E and the transmission of energy can be seen from fig. 1 to be represented by the first and second fingers and the thumb respectively of the left hand, set mutually at right angles.

If the line is opened at the receiving end the current ceases and there is no magnetic field, but only the electric field. If the line is short-circuited the P.D. between the strips falls to zero and with it the electric field, leaving only the magnetic field. In neither case, however, is there any transmission of energy. For energy to be transmitted the electric and magnetic fields must exist simultaneously in the same space, and must be, to some extent, at right angles to each other. This is an important point often overlooked when considering the nature of the electromagnetic waves by which energy is radiated from an antenna; we shall return to it later.

The inductance of the line per centimetre of length—that is, the flux produced in the space between the conductors by unit current—is evidently $4\pi d/b$ absolute units, or $4\pi/10^9 \cdot d/b$ henries.

The capacity between the strips per centimetre of length is $b/4\pi d$ absolute units, or $b/4\pi d \cdot 1/(9 \times 10^{11})$ farads if the dielectric is air.

We shall now assume that the dynamo or battery is replaced by an alternator with a frequency of $\sim$ cycles per second, and that the

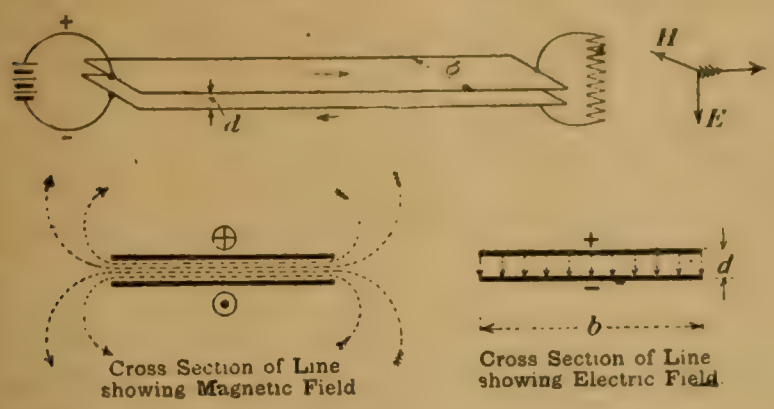


FIG. 1.

load at the far end of the long line is non-inductive. Every centimetre of the line has a certain inductance, L, and a certain capacity, K, the values of which we have just seen. The actual line could be replaced approximately by a number of inductances and condensers arranged as in fig. 2. The conductor resistance and the leakage are

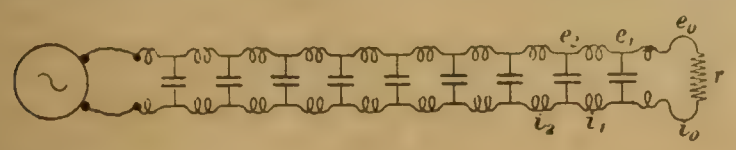


FIG. 2.

both assumed to be negligible. A vector diagram can now be built up by assuming a current through the non-inductive load and gradually working back along the line in the usual way. The vector diagram is greatly simplified, however, if the resistance r, constituting the load at the end of the line, is made equal to $\sqrt{L/K}$. (This ratio is a very important characteristic of the transmission line; it is sometimes called its surge impedance. By German writers it is called its "Wellenwiderstand"—*i.e.*, wave-resistance.)

If $r = \sqrt{L/K}$, the vectors of both current and voltage maintain a constant length—that is, an ammeter placed anywhere in the line will give the same reading, as will also a voltmeter connected between the lines at any point. In addition to this the two vectors will be in phase at every point. This can be readily seen from a consideration of fig. 3. If i be the root-mean-square current at

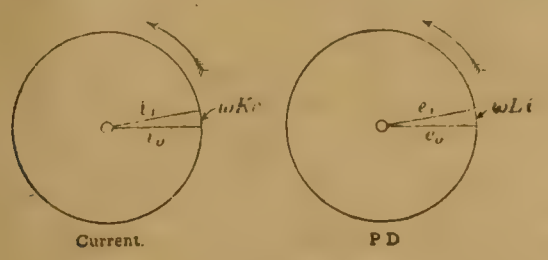


FIG. 3.

any point, the voltage drop per centimetre at that point will have a root-mean-square value of ωLi ($\omega = 2\pi \sim$), and will be 90° out of phase with the current. If e be the P.D. between the lines at any point, the capacity current per centimetre at that point will have a R.M.S. value of ωKe, and will be 90° out of phase with e. For the current and voltage vectors to maintain a constant length and rotate together it is obviously necessary that $\omega Ke/i = \omega Li/e$.

Since $e/i = r$, this is equivalent to $r = \sqrt{L/K}$. With a load of this value the energy is absorbed as fast as it arrives, and there is no reflection back along the line to cause stationary waves. The result is just the same whether the line is short or long. At those points along the line where the current, and therefore the value

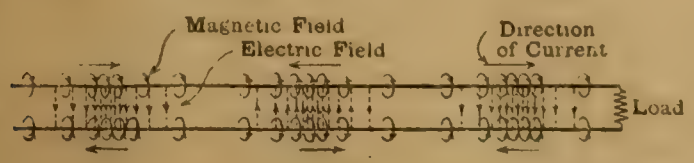


FIG. 4.

of H, is a maximum at any moment the P.D., and therefore also the value of E, will be a maximum at the same moment (fig. 4). The rate of energy transmission in watts per square centimetre is given at every point, at every moment, by the formula $10/4\pi \cdot H E$.

If the non-inductive load be replaced by a choking coil of negligible resistance, or by a condenser with negligible losses, the voltage and current vectors will be 90° out of phase, not only at the end but all along the line. This is easily proved, because the voltage drop is at right angles to the current vector and the capacity current is at right angles to the voltage vector at every point. The current in the line at any moment is a maximum when the P.D. is zero, and *vice versa*, so that we have alternately a storage of magnetic energy and a storage of electrical energy, but no resultant transmission of energy. In this case we have stationary waves on the line.

Returning now to the case of the non-inductive load, the velocity of the wave along the line is easily found from fig. 3. The inductive drop per centimetre is ωLi; for a length l the drop is ωLil, and this is set off around the circumference of the circle described by the vector e. If we take such a length along the line that $\omega Lil = 2\pi e$, we arrive at a point where the phase is the same as at the end; this value of l is therefore the wave-length λ.

Hence, $\lambda = 2\pi e/\omega Li = 2\pi/\omega\sqrt{KL} = 1/(\sim \sqrt{KL})$.

and the velocity of the wave

$$= \lambda \cdot \sim = 1/\sqrt{KL}.$$

Substituting the values of K and L, we have—

$$\frac{1}{\sqrt{b/4\pi d \cdot 4\pi d/b \cdot 1/(9 \times 10^{20})}} = 3 \times 10^{10} \text{ cm. per second.}$$

Hence, the electromagnetic wave travels along the line with the velocity of light.

We have seen that the ratio e/i is constant all along the line and equal to $\sqrt{L/K}$; therefore, $L i^2/2 = K e^2/2$, that is, the total energy in each cubic centimetre of the dielectric space is at every moment equally divided between the magnetic and the electric fields. The total energy in 1 cm. of the line is $K e_{in}^2$, where e_{in} is the instantaneous value of the P.D., and the average value of the energy per centimetre is $K e^2$, where e is the R.M.S. value of the P.D. This energy is being transferred with the velocity $v = 1/\sqrt{KL}$, and the amount of energy arriving at the far end in a second will be—

$$K e^2 \times 1/\sqrt{KL} = e^2 \times \sqrt{K/L} = e^2/R \text{ joules.}$$

The electromagnetic waves in the space between the two strips are of the simplest possible type, viz., plane waves. If the two strips are made several hundred miles wide and several hundred feet apart, and if the lower strip is replaced by the earth, no essential change is made in the nature of the waves; it is simply a matter of scale. We should then have sweeping over the surface of the earth plane electromagnetic waves. In many problems connected with radio-telegraphy it has been assumed for the sake of simplicity that the waves employed are of this type.* It may be objected that, in the case of radio-telegraphy, we have not a transmission free from loss with a non-inductive load of a certain definite value at the far end. In the theory of the propagation of telephone currents it is a well-known and easily proved fact that for a long line in which the energy is dissipated before it arrives at the far end, where it might otherwise be reflected, the apparent impedance of the line is equal to $\sqrt{I/Y}$, where $I = R + j\omega L$ is the impedance of unit length of the line and $Y = G + j\omega K$ is the admittance of unit length (G is the reciprocal of the insulation resistance, $j = \sqrt{-1}$ and $\omega = 2\pi \sim$). If R and G are small compared with ωL and ωK, the apparent impedance of the line will be simply $\sqrt{L/K}$, and the current at the sending end will be in phase with the applied P.D. so that the line appears to be non-inductive. This will also be true if $R/L = G/K$, which is the condition for Oliver Heaviside's distortionless transmission line. In the case of radio-telegraphy the damping is small, especially over the sea, and we make little error in assuming that the current and P.D., or, as we must say if we refer to the space between the conductors and not to the conductors themselves, the magnetic and electric fields are in phase.

We can, however, approach much more closely to the actual radio-telegraphic waves by assuming that the two parallel strip conductors radiate from the alternator in all directions. The upper strip now becomes an upper disk and the lower strip a lower disk, or merely the earth, while the alternator is imagined to be connected between the centres of the disks. All round the edges of the disks, which we imagine to be of enormous diameter, we can assume a non-inductive load of the correct value to be uniformly distributed, or, more in accordance with facts, the resistance of the lower disk (the earth) may be assumed to dissipate the radiated energy so that none ever reaches the limits of the disks. The transmission will, however, be no longer perfectly distortionless, unless we assume that the leakage bears the necessary relation to the resistance, but this is a point of minor importance.

The magnetic flux will be distributed concentrically around the generator in alternate belts in opposite directions, there being no flux except between the disks. Passing outwards from the centre of the disk one would pass through successive belts of current flowing alternately radially outwards and radially inwards. At every point in either disk there is an alternating radial current.

The radiation of energy is in this case strictly cylindrical, but is otherwise identical with the radiation from a "wireless" antenna. The electric and magnetic fields in the neighbourhood of the lower disk are identical in their nature with those near the earth, but the variation with the distance from the generator is different.

This want of agreement is entirely removed by making the height of the upper disk above the lower vary directly as the distance from the centre, or, in other words, by replacing the upper disk by an inverted cone, as shown in fig. 5. The alternator is connected between the apex of the cone and the point of the earth

* Zenneck, *Annalen der Physik*, 1907, Vol. XXIII, p. 846.

almost in contact with it. This supposititious arrangement not only gives a radiation of electromagnetic waves almost identical with that of wireless telegraphy, but at the same time lends itself to very simple calculation. Contrary to the case of the two parallel disks, the inductance per radial centimetre of this new

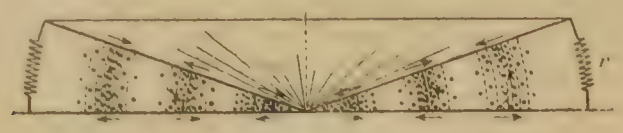


Fig. 5.

multi-directional transmission line is constant—*i.e.*, independent of the distance from the origin—as is also the capacity per centimetre. In this respect the inverted cone arrangement is similar to the ordinary telephone line or the two flat strips already considered, and leads to the same simple formulæ and the same vector diagrams.

To calculate the inductance per radial centimetre we have to find the flux per radial centimetre when unit current flows steadily outwards in the cone and returns radially to the centre of the lower

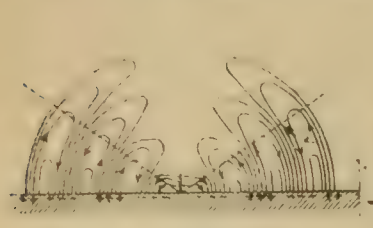


Fig. 6

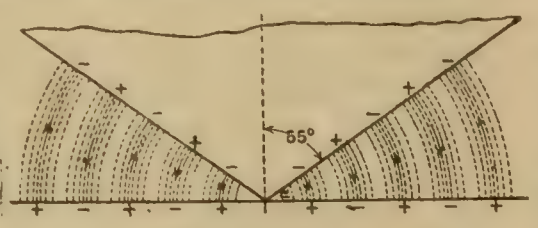


Fig. 7

disk. Let a be the angle between the cone and the lower disk, x the distance from the centre and d the distance between the cone and the earth, measured along the circular arc, then $d = a\,x$. The length of the magnetic path is $2\pi x$, and the flux per radial centimetre for unit current is $4\pi d/2\pi x = 2\,a$, and the inductance per centimetre is, therefore, $2\,a\,.\,10^{-9}$ henry. The capacity per radial centimetre is obviously that of a plate condenser with plates of area $2\,\pi\,x$, separated a distance d, which is $2\pi x/4\pi d = 1/2a$ absolute units, or $1/(2\,a \times 900{,}000)$ mfd.

Hence, apart from damping, the current and the P.D. will vary from point to point exactly as in an ordinary telephone line with these values of inductance and capacity per unit length. The strength of the electric field E at any point is found by dividing the P.D. at the point by the distance between the cone and earth, which varies as the distance from the generator. Now we have already proved that, apart from damping, the P.D. has the same amplitude all along the line, hence the strength of the electric field E will vary inversely as the distance from the centre. Again, since the length of the magnetic path varies directly as the distance from the centre, the magnetic field strength H must vary inversely as the distance. This agrees with the results obtained for the radiation of electromagnetic waves from a Hertzian oscillator or antenna. It is seen, therefore, that, taking the earth as the lower disk and replacing the upper atmosphere by the perfectly conducting inverted cone, a system of electromagnetic waves is generated and propagated, and these waves are identical in their nature and properties—at least, in the neighbourhood of the earth—with those electromagnetic waves employed in radio-telegraphy, and vary in intensity from point to point on the earth's surface in exactly the same way. This radiation cannot be called cylindrical, but is essentially spherical, the wave fronts being approximately portions of spheres.

Although this supposititious arrangement gives the correct values of E and H near the surface of the earth, this cannot be so for the upper atmosphere, where, instead of ending normally on an upper conical surface, the electric field forms loops as shown in fig. 6.

Calculation of the Angle a between the Conical Surface and the Earth.

If one is merely considering the question from a qualitative point of view, the slope of the upper conical surface is immaterial. To make quantitative calculations, however, the angle must be so chosen that the total amount of energy in the advancing wave bears the same relation to the values of H and E near the earth's surface as it does in the actual radio-telegraphic wave. The correct value of this angle is easily calculated. On the assumption of a perfectly conducting flat earth, the strength of the electric and magnetic fields at the earth's surface due to a vertical aerial is given by the following equation*—

$$\text{E} = \text{H} = 2\,i_{max.}/10\,.\,\frac{\cos\,(\omega\,t - \omega\,x/v)}{x}.$$

where $i_{max.}$ is the maximum aerial current in amperes, $\omega = 2\,\pi \sim$, x = distance from aerial in centimetres, and v = velocity of light in centimetres per second.

Therefore, $\text{E}_{max.} = \text{H}_{max.} = i_{max.}/5\,x$ C.G.S. units, or, $\text{E}_{max.} = i_{max.}/5\,x \times 300 = 60\,i_{max}/x$ volts per centimetre. Again, the total power radiated from a vertical aerial is $0{\cdot}61\,\text{I}^2/v$ ergs per second,† where I is the amplitude of the antenna current in electrostatic units. Putting the current in amperes and $v = 3 \times 10^{10}$, we have—

$$\frac{0{\cdot}61 \times i^2_{max.} \times 9 \times 10^{18}}{3 \times 10^{10}} \text{ ergs per second}$$
$$= 18{\cdot}3\,i^2_{max.} \text{ watts},$$
$$= 36{\cdot}6\,i^2_{\text{R.M.S.}} \text{ watts}.$$

* Abraham, "Theorie der Elektricität," Vol. II, p. 300.
† Abraham, *loc. cit.*, p. 304.

Now in the supposititious case of the inverted cone and the perfectly conducting lower disk, the amplitude of the total radial alternating current is the same at all distances from the centre, and the length of the magnetic path is $2\,\pi\,x$. The strength of the magnetic field at a distance x will therefore be—

$$\text{H}_{max.} = \frac{4\,\pi/10\,.\,i_{max.}}{2\,\pi\,x} = i_{max.}/5\,x,$$

and the electric field

$$\text{E} = \text{P.D.}/d = \frac{i\,\sqrt{\text{L}/\text{K}}}{a\,x} = \frac{i}{a\,x}\sqrt{\frac{2\,a\,10^{-9}}{1/2\,a\,.\,1/(9 \times 10^{11})}}$$
$$= i/a\,x\,.\,\sqrt{3{,}600\,a^2}$$

and $\text{E}_{max.} = 60/x\,.\,i_{max.}$ volts per centimetre. (Note.—$\text{H}_{max.} = \text{E}_{max}$ if the latter is expressed in electrostatic units.)

Now the apparent resistance of our transmission line is $\sqrt{\text{L}/\text{K}}$, and the power supplied to it by the alternator, and, therefore, transmitted along it is $i^2_{\text{R.M.S.}}\,\sqrt{\text{L}/\text{K}} = i^2_{\text{R.M.S.}} \times 60\,a$ watts. In the case of the actual aerial the power radiated is $36{\cdot}6\,i^2_{\text{R.M.S.}}$ watts. Hence, for the radiated power to be the same in each case, we must have

$$60\,a = 36{\cdot}6, \text{ or } a = 0{\cdot}61 = 35°.$$

This angle can be found in another way without considering the apparent resistance of the transmission line. We have seen that by Poynting's theorem the power transmitted across a square centimetre is equal to $10/4\,\pi\,.\,\text{HE}$ watts. The maximum power per square centimetre will, therefore, be $10/4\,\pi\,.\,i_{max.}/5\,x\,.\,60\,i_{max.}/x = 30\,i^2_{max.}/\pi\,x^2$ watts, and this will be the radiation at any point at the moment when H and E have their maximum values at that point. Since both H and E vary according to a sine law, the average rate at which energy is transmitted across each square centimetre is equal to half the maximum, viz., $30\,i^2_{\text{R.M.S.}}/\pi\,x^2$ watts. The total radiation is

$$30\,i^2_{\text{R.M.S.}}/\pi\,x^2 \times 2\,\pi\,x \times a\,x = i^2_{\text{R.M.S.}} \times 60\,a \text{ watts},$$

as found by the other method.

Hence, if the arrangement of inverted cone and lower disk is to give a correct representation of the actual radio-telegraphic waves, as regards both H and E and the total radiated energy, the angle a cannot be such a small angle as in fig 5, but must be exactly 35°, as shown in fig. 7.

It will be evident from the foregoing, and especially from fig. 4, that the vertical electric field is a maximum at any point at the same moment that the magnetic field at the same point is a maximum. The writer has found that there is a prevalent idea

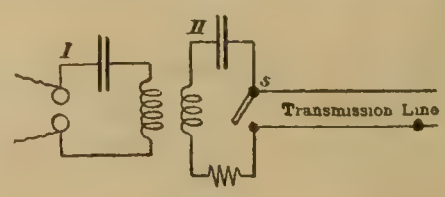


Fig. 8.

that the successive bands of vertical electric flux sweeping out from the antenna with the velocity of light *alternate* with bands of magnetic flux. This is not so; the electric and magnetic fields occupy the same space at the same moment, and the successive bands are separated by spaces in which both H and E fall simultaneously to zero. This is only true, however, if we avoid the immediate neighbourhood of the antenna. The current in the antenna, and therefore its magnetic field, are zero at the moment when the P.D., and therefore also the electric field, are approximately at a maximum. It is important to notice, however, that if the current and P.D. were exactly 90° out of phase, the antenna oscillation would be wattless, and there could be no radiation of energy. The radiation has a similar effect to the introduction of an additional resistance in the antenna, and constitutes the useful load on whatever may be used to maintain the oscillation. In the immediate neighbourhood of the aerial there are powerful magnetic and electric fields, which are nearly 90° out of phase, and which produce, for the most part, an oscillation, as distinct from a transmission of energy. It is only the components of H and E that are in phase which can cause a transmission of energy, and the other components are negligible beyond a certain distance from the antenna.

If there were no radiation the antenna could be represented by an equivalent inductance, capacity and resistance forming a closed oscillatory circuit, as in fig. 8, where I is the spark-gap circuit and II the equivalent aerial circuit. In fig. 8 a new cause of damping can be introduced into circuit II by opening the switch s, viz., a transmission line, which, if infinitely long and free from losses, acts exactly as an additional non-inductive resistance in the circuit. Here it is evident that a part of the oscillating energy is now transmitted away along the line and that in this line current and P.D. are in phase.

The same is true in a sound wave. Our sending antenna is here replaced by an organ pipe in which we have stationary waves, with a stationary distribution of pressure at one moment, succeeded after a quarter of a cycle by an equal pressure distribution of velocity. The maximum velocity occurs at points a quarter of a wave-length away from the points of maximum pressure. When sound waves travel through space, however, the conditions are very different; the compressional waves are in phase with the velocity waves, that is to say, the air particles which have the maximum compression or maximum rarefaction at a given moment are those which are moving with the greatest velocity (*see* Poynting and Thomson's "Sound," p. 13).

As we have already said, there is a prevalent idea that the electric and magnetic fields succeed one another alternately; the fourth chapter of Prof. Fleming's "Elementary Manual of Radio-telegraphy," which is devoted to a study of electromagnetic waves, is permeated through and through with this fallacy, which is even supported by mathematical treatment by giving incorrect solutions for the differential equations.

[Note.—The statements here criticised occur in the first edition of the "Elementary Manual." On the receipt of an advance proof of the paper, Prof. Fleming wrote to the author pointing out that the error had been discovered and corrected in a second edition published three years ago. The author must therefore apologise to Prof. Fleming for having done him the obvious injustice of criticising statements which he himself had already corrected. Had the author known of this later edition, this part of the paper would have been very much modified.]

Returning now to the electromagnetic waves travelling over the earth's surface, we have seen that the calculated strength of the electric field near the surface is $60\,i/x$ volts per cm., where i is the current in the sending antenna. This field is normal to the surface—*i.e.*, it is a vertical field. These results are confirmed by experiment if the distance from the sending antenna is not too great. The distance at which marked discrepancies appear depends on the wave-length employed, and especially on the nature of the earth's surface. These discrepancies are to be expected because we have made three assumptions :—

1. That the earth is a perfect conductor, whereas dry soil might be better described as a poor insulator.
2. That the earth is flat.
3. That the atmosphere is a perfect and uniform dielectric at all heights.

A large amount of mathematical work has been devoted to the effect of the resistance and specific inductive capacity of the earth's crust, and also to the effect of curvature. The nature and effect of the upper layers of our atmosphere is the subject of a great deal of speculation at the present time, but all these questions call for systematic research on a large scale. Their discussion would go beyond the scope of this paper.

Exposure Tests of Copper, Commercial Aluminium, and Duralumin.

By Ernest Wilson.

(*Section G. Abstract.*)

These are a continuation of tests upon the influence of exposure in London on the electrical conductivity of light aluminium alloys, reports of which have been made from time to time to the British Association. Each specimen is in the form of wire 0·126 in. diameter and 70 ft. long; and the figures obtained after two years' exposure are :—

	Percentage increase of electrical resistance taken on value in 1911 at 15° C.
High conductivity copper	2·0
Commercial aluminium	4·4
Duralumin	8·2

Duralumin is a copper-manganese-magnesium alloy of high tensile strength, and exposure has apparently made it more brittle.

Practical Standards for Use in Electrical Measurements.

Report of the Committee : Lord Rayleigh (*Chairman*), Dr. R. T. Glazebrook (*Secretary*).

(*Section A. Abstract.*)

The republication of the Reports of the Committee from 1862 to 1870, and from 1881 to 1912, is now complete. The volume consists of about 800 pages, with several plates, and is published by the Cambridge University Press on behalf of the Association.

In 1861 the first work to be undertaken by the Committee was the realisation of the absolute unit of resistance. In 1882, 1883, 1888, 1894, and again in 1897, other measurements were made by members of the Committee, and in this their last Report they are pleased to be able to announce a further development. The new Lorenz apparatus at the National Physical Laboratory is now complete, and measurements of resistance can be made by means of it with an uncertainty of not more than a few parts in 100,000. During the present year a large number of such measurements have been made, and the results obtained are now being prepared for publication.

A satisfactory feature of the machine is that it can be used at all times for absolute measurements, and the plans adopted for the redetermination of the dimensions of the coils ensure an accuracy in the future as great as that obtained in the recent measurements. The nominal values of the resistances measured are 0·001, 0·002 and 0·01 ohm. As an instance of the care taken, it may be mentioned that the dimensions of the coils have been measured with a current flowing through them, and the radius of a disk 53 cm. in diameter has been determined within 0·01 mm. when running at 1,200 r.p.m. Electrical methods of setting the coils parallel and coaxial with the shaft proved to be more sensitive than the usual methods, and a Wheatstone bridge with a condenser in one arm proved to be the most sensitive indicator of constancy of speed. This instrument, together with the Ayrton-Jones current balance, enables the fundamental electrical units to be realised with an accuracy sufficient for all present purposes. It is hoped to rewind the coils of the current balance and leave them uncovered with paraffin wax so that their dimensions may be determined at any time.

The Committee are pleased to report that the original rotating-coil apparatus, designed by Lord Kelvin in 1861, is in good condition, and steps are being taken for its inclusion in the science collection of the Victoria and Albert Museum, South Kensington. Some rough measurements of resistance were made by the apparatus in the spring of this year, and the coils used by Lord Rayleigh in 1882 were also experimented with. An account of the apparatus is given in the Secretary's "Kelvin" Lecture to the Institution of Electrical Engineers.

A statement on international comparisons of resistances and standard cells was included in last year's Report and sufficiently indicates the arrangements that have been made for the maintenance of constant electrical standards in the future. The Committee regard these arrangements as satisfactory. They do not ask for reappointment.

On the Minimum Quantity of Light Discoverable by means of Selenium.

By E. E. Fournier d'Albe, D.Sc

(*Section A. Abstract.*)

The paper dealt with the behaviour of selenium under very faint illuminations. The changes in conductivity resemble phenomena of ionisation and recombination, inasmuch as the light-action curve satisfies the equation $dK/dt = I - C K^2$, where I is the illumination, C the coefficient of recovery on recombination, and K the additional conductivity imparted to selenium by the action of light. The initial light-action is a linear function of the time, so that the action observable in a given time is proportional to the "exposure" if the latter is short. The final additional conductivity is proportional to the square root of the illumination. This offers a means of discovering very faint illuminations. A current of the order of 10^{-9} ampere is obtainable by the unaided illumination produced by Venus, and it should be possible to discover invisible stars by means of a sensitive galvanometer without any optical aid. Attempts to do this were described, and the bearing of the results on the theory of quanta was discussed.

(Some new applications of the properties of selenium were demonstrated at the University Buildings.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Kemco" Fan Electric Lighting Dynamo for Motor-Cars.

Among the many small dynamos for motor-car electric-lighting purposes recently introduced in America, probably the most novel is that known as the "Kemco," lately put on the market by the Kouyounijian Electric and Manufacturing Co., of Cleveland, O., U.S.A. One of the difficulties in connection with the problem, especially in the case of old cars is that of finding a convenient location for the dynamo, so that it can be easily driven. It has remained for the Kouyounijian Co. to discover the fact that a generator could be built up as the hub of the fan which now forms a standard part of the engine-cooling system; by this means not only is no more additional space about the engine taken up, but an additional drive is unnecessary, the belt that operates the

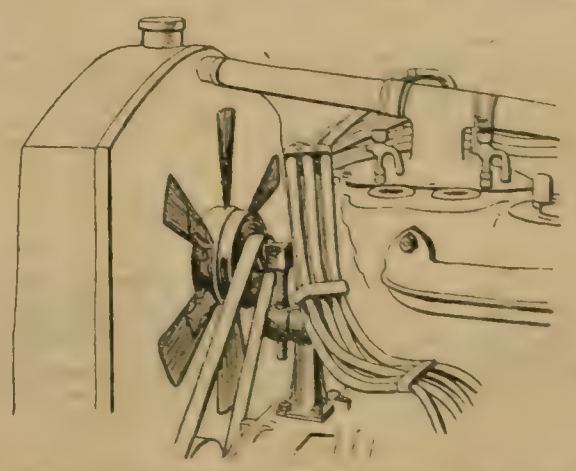


Fig. 1.—The "Kemco" Combined Radiator Fan and Dynamo.

fan, also driving the electric generator. As the illustration (fig. 1) shows, excepting that the fan has a somewhat larger hub than usual, the combined fan and dynamo outwardly differs but little from the usual fan, while it is claimed that as the inner end of the fan blades is of little use, the reduction of the fan blade area by the enlarged hub—which forms the casing of the generator—represents practically no loss of efficiency so far as the fan draught is concerned.

Constructionally, the dynamo differs from standard practice in that the field remains fixed in the centre while the armature

rotates round it, this arrangement being claimed to result not only in better cooling, but the more certain retention of the windings owing to the centrifugal force tending to force the windings into instead of out of their slots. A battery of accumulators is, as usual, employed in connection with the generator, the latter being arranged so as to charge the same at all engine speeds between 400 and 1,200 R.P.M. The regulation of the machine is automatically accomplished by magnetic leakage gaps incorporated within it. An ammeter mounted on the dashboard of the car forms part of the equipment; in the same base as the ammeter is a cut-out, to which the main wiring from the dynamo is connected. Two head lights, two side lamps, a tail lamp and a dashboard lamp are installed.

One special advantage of driving both dynamo and fan by one belt is that the ammeter affords the driver a ready indication as to the operation of the belt, a slipping belt, and the consequent imperfect cooling action of the fan on the radiator, being immediately indicated by the needle of the ammeter.

Dowsing Heating and Cooking Apparatus.

THE DOWSING RADIANT HEAT CO., LTD., of 105, Great Portland Street, London, W., have issued a new season's list of the above apparatus, in which department of the industry, by reason of their very lengthy experience, they are, of course, in the front rank of specialists. In the course of the seventy and more pages they illustrate and give prices and brief particulars of the Dowsing

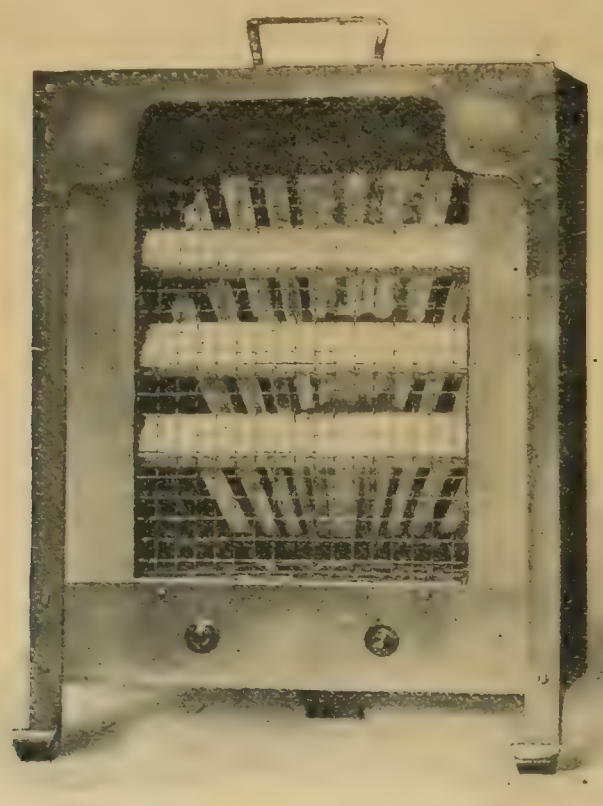


FIG. 2.—DOWSING HOT BAR RADIATOR.

luminous radiators, the Dowsing-Huntley convectors, radio-convectors and hot-bar radiators, also the Bastian red-glow radiators, as well as a variety of cooking apparatus. In the luminous radiator pages there are a number of new designs. Attention may be directed to the firm's new hot-bar radiators, which are made in various designs. These are fitted with a special form of reflector giving a ruby illumination, having the appearance of a glowing coal fire. This reflector also acts as baffle plate and flue,

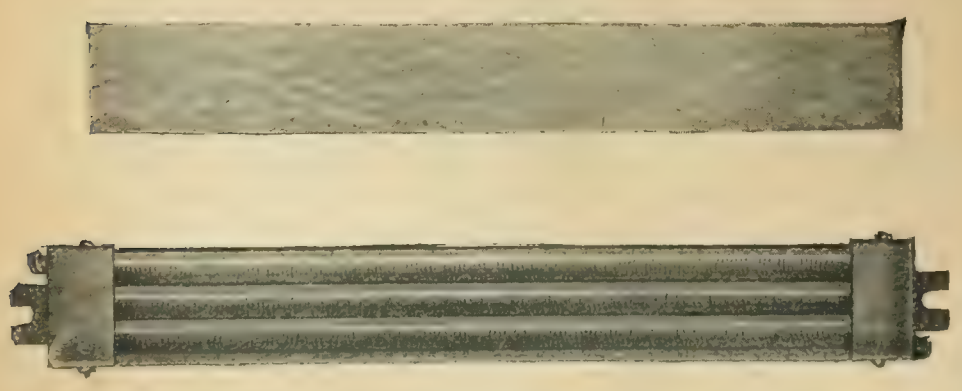


FIG. 3.—DOWSING HOT BAR.

which projects the current of heated air into the apartment. The hot-bars themselves (see fig. 3) are stated to be very durable, strongly constructed and easily replaceable. The whole of the radiator is so arranged that by the turning on of a button the radiator can be opened for cleaning or renewing the elements. These hot-bar radiators (fig. 2) are made by the firm with or without quartz coverings. When the quartz cover is used a considerable amount of protection is afforded and water spilled on the heating surface has no effect. The elements are made to take 500 watts, and to run in parallel so that each element may be switched on or off to reduce the heat produced in the radiator at will. The heating element can easily be replaced and the heat resistance wires can be refitted at a very small cost. With the Dowsing-Huntley patent system of double back, a large volume of air is heated and passed through the radiator per hour. Each radiator has accessible terminals, and is made with a movable back for easy inspection, &c.

A typical example of the firm's electric kettles is shown in fig. 4. These kettles are of new and improved designs, and fitted with special heating elements. The combined toaster grill and hot



FIG. 4.—A DOWSING KETTLE.

plate in fig. 5 is also fitted with the new hot bars. The Dowsing Co. have had considerable experience with these electric grillers at their Medical Institution in London, where they cook by electricity for more than 60 persons daily. With grilling it has been found that there is a danger to the elements by the meat being sometimes forced against them, or by the chef's fork causing a short-circuit. These points have received special attention in the Dowsing grillers.

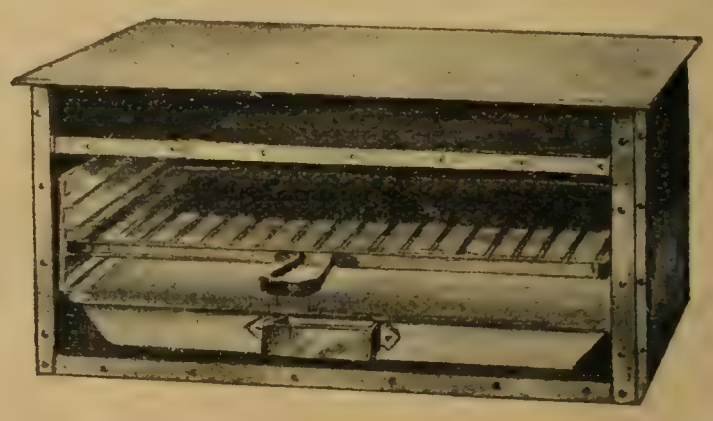


FIG. 5.—COMBINED TOASTER, GRILL AND HOT PLATE.

From among other articles listed, we may single out for mention a breakfast toaster and dish warmer combined. This has a hot plate on which plates and dishes may be kept warm, and the lower portion is fitted with two toast racks to allow toast to be made on the table.

B.T.H. Automobile Switches.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, Upper Thames Street, E.C., have placed on the market a series of automobile switches of neat design and lasting construction, which are made in two types, for surface and flush fixing respectively, and in two finishes, polished brass and nickel. The switch is of the



FIG. 6.—SURFACE TYPE.



FIG. 7.—FLUSH TYPE.

single-pole type, but two, three or four switches can be mounted side by side on one plate, so that any desired switching combination can be arranged. Surface type B.T.H. automobile switches (fig. 6) have the ordinary tumbler movement, while the flush switches (fig. 7) can be had either with tumbler or push-button movement. There is also a flush locking switch which is operated by means of a key.

The Flarion Lamp.

MESSRS. SCHOLEY & CO., LTD., of 151, Queen Victoria Street, London, E.C., claim for the Flarion arc lamp, which they have put upon the market, extreme simplicity of design and strength of construction. It is made at present in two sizes—10 and 18-hour—and is equally well adapted for alternating and direct current.

In this lamp (fig. 8) the vertical plunger solenoid cores are provided with extensions which, while allowing comparatively free movement, give sufficient natural air-cushion effect to eliminate all hammering and pumping.

The feed mechanism consists of a simple three-wheel train steadied by a rotary air fan and ending in a substantial chain drum, from which is suspended the weighted carbon carrier. The high-

speed wheel consists of a smooth edge brake-wheel released or held by a clutch operated directly from the rocking arm. No escapement bars, toothed clutches, or ratchets are used, and by this means another very prolific source of breakdown is removed. The brake is positive and exceedingly delicate, so much so that it is no uncommon thing for the carbons to feed with half a revolution of the brake wheel, while a two-volt arc regulation can be assured. One strong centre chain supports the carbon carriers, and this is raised when trimming, by a button neatly housed and running in a slot in one of the outer frame rods. The striking gear is supported well above the furnace, and the carbon guides consist of metal straps clamping mica plates, thus doing away with the possibility of cracked insulating pieces. The blow-magnet is particularly well designed, and together with the economiser has received special attention. Experience has shown that without a



Fig. 8.—The Flarion Lamp.

properly-constructed arc chamber or economiser, and a well fanned-out arc, the carbons will burn unevenly and consume too fast, sometimes giving only 7 hours' life out of 10-hour carbons.

In the Flarion lamp all brass parts are heavily plated to withstand fume action, and the cases are scientifically ventilated and trebly enamelled.

Adjustment of the electro-magnetic control is made by means of a set weight on the rocking arm; it is entirely free from springs or any other form of variable tension adjustment which sooner or later is sure to land an arc lamp user in difficulties.

The "Eye" Electric Motor Lamp.

An extremely interesting form of electric motor-car lamp has recently been brought out in France. It is known as the "Eye" orbicular lantern, and is the design of M. Cannevel, of 14, Rue

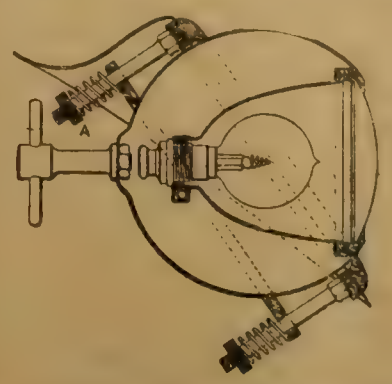


Fig. 9.—The "Eye" Electric Motor Lamp Section.

Reval, Levallois-Perret, near Paris. The lamp is of the type designed to be embodied in the bodywork of the car, the feature being that it can, at the will of the driver, be turned in any direction, the socket being so arranged that it can be swept over an arc of 80° from left to right, and up and down. The lamp is held in any position by two small clamps, which are removable from the inside, and can be adjusted instantaneously, so as to illuminate sign-posts at the side of the road, mile-stones, and even the motor in front. The entire lamp can also be pulled right out of the socket and used to light the underside of the dashboard under the footboard, and as a general "trouble lamp." A slight loosening of the milled nuts A (fig. 9) permits of turning the eyeball by means of the handle in any desired direction.

Willans Rotary Air-Pumps.

Messrs. Willans & Robinson, Ltd. of Victoria Works, Rugby, have undertaken the manufacture of the Müller-Jesse patent rotary air pumps, which are in extended use on the Continent,

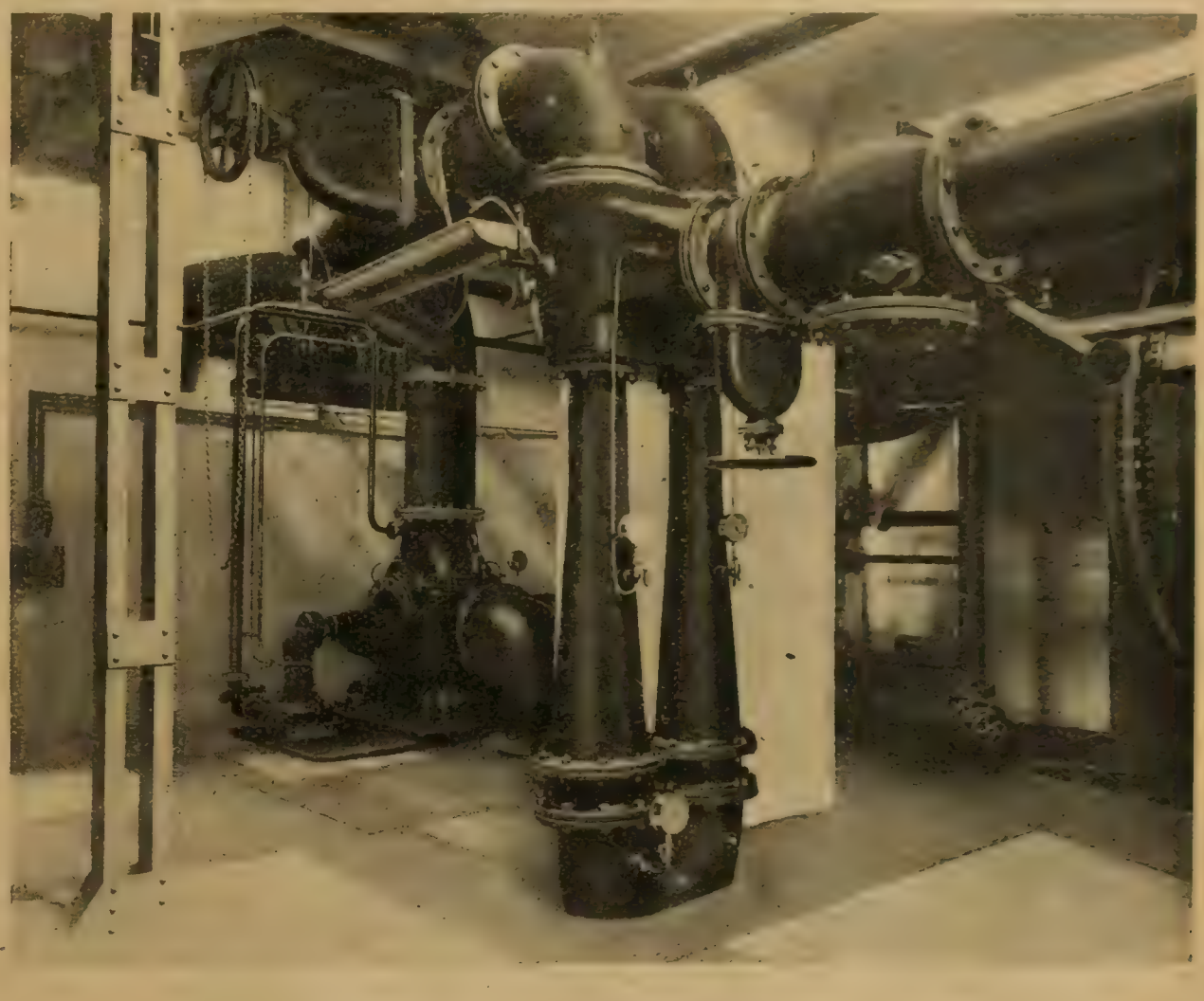


Fig. 10.—Willans 4,000-kw. Surface Condensing Plant.

and they have already secured orders for a plant of 8,500 kw. for the Sheffield Corporation, as well as 5,000 kw. for the Pinkston power station of the Glasgow Corporation Tramways, and 25,800 kw. for the L. & S.-W. Railway Co. The standard 4,000-kw. plant is illustrated in fig. 10 herewith.

The system is operated in two ways, called respectively the "Shunt" and "Series" systems. In either case, the air is extracted from the condenser by means of an ejector, the condensed steam being removed by a separate centrifugal pump from

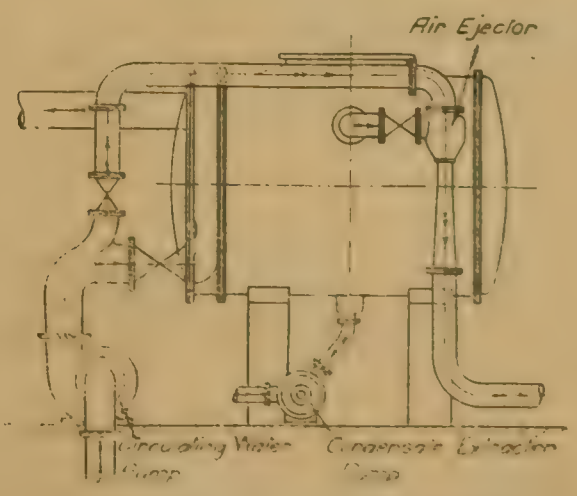


Fig. 11.—Willans Rotary Air-pump System—"Shunt" Arrangement.

the bottom of the condenser. In the shunt system, a portion of the circulating water is used to supply the ejector, while in the series system the whole of the circulating water is passed through the ejector, the choice depending upon other circumstances, but in neither case is a greater quantity of cooling water required than where other kinds of air pump are employed. The system is very simple, and it is claimed that it involves the minimum power consumption, without requiring a separate air pump or water tanks. Fig. 11 shows diagrammatically the lay-out of the "shunt" system.

New B.T.H. Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., have recently placed on the market the Radial Wave Reflector, which can be used with any form of street lighting bracket, post or cable suspension equipment. With

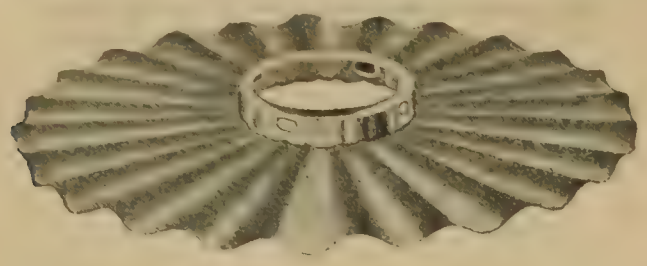


Fig. 12.—B.T.H. Radial Wave Reflector.

ordinary reflectors a common defect is that they give a high intensity of light immediately under the lamps, which intensity decreases very rapidly until, midway between two posts, the illumination is quite inadequate. The B.T.H. Radial Wave Reflector, fig. 12, has been designed to overcome this difficulty, and its peculiar



Fig. 13.—Complete Radial Wave Reflector Unit with Suspension Pulleys.

construction enables it to project a much higher candle-power between the horizontal and an angle of 30° below the horizontal than the ordinary concave reflector. The reflector is made of stamped fluted steel with a reflecting surface of white vitreous enamel, and is painted green outside. It is provided with a heavy glazed porcelain hood, and is fitted with an Edison screw holder.

Electric Heat Carpets.

The Schniewindt Electric Co., of 40 and 41, Staniforth Street, Birmingham, have sent us illustrated information respecting their "Stangerotherm" electric carpets for industrial and general domestic service, with a list of useful sizes ranging from 12 in. × 12 in. to 42 in. × 60 in., and a statement of approximate consumption in watts for three heats. Prices are also tabulated. It is claimed that heating from the floor is far better than that from radiators, as it does not leave the feet cold. The heat from the elements, of course, first warms the carpet. Abundant heat can be transmitted to the room without raising the temperature of the carpet beyond a comfortable warmth. The elements are liberally rated preventing the possibility of overheating. The Stangerotherm carpet is fitted with a small regulating switch by means



Fig. 14.—Electric Heat Carpet.

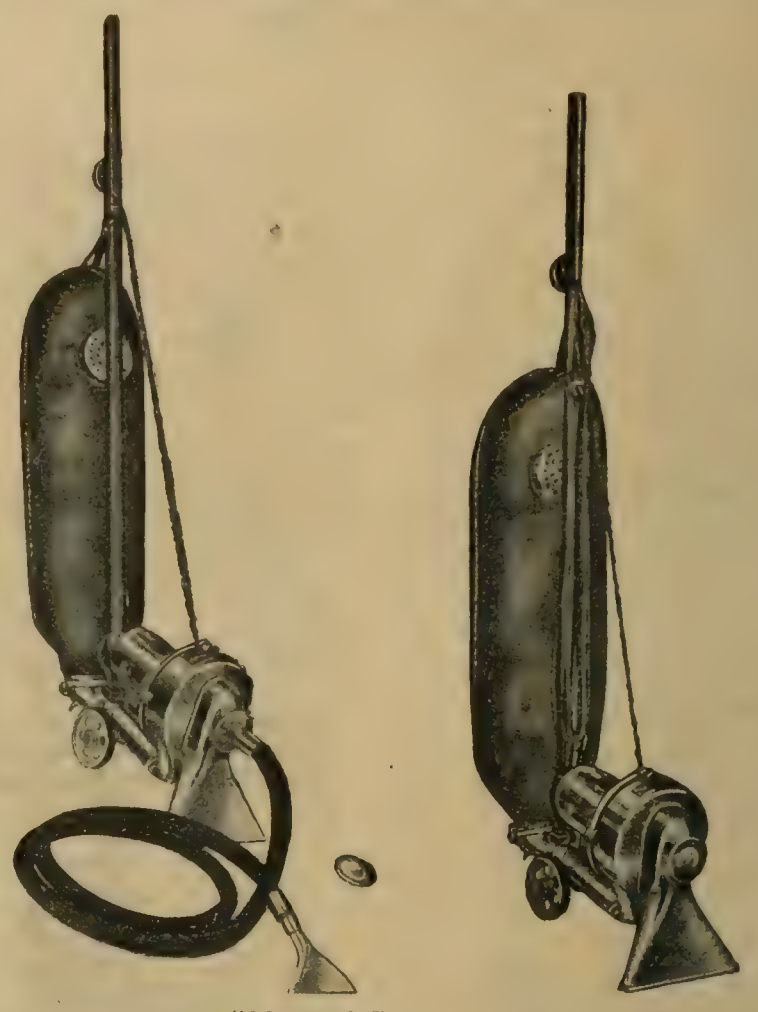
of which three different degrees of warmth may be secured. The heating elements, which are entirely separate from the carpet itself, are enclosed in watertight insulating envelopes, which are placed between the carpet proper, and a waterproof underlay fitted to the carpet and opened at one end to insert the element. Small elements can be fitted to any carpet at any spot required, such as near a desk, work-table, piano and so on. It is claimed that the energy consumption is very low owing to the low degree of warmth to which the elements have to be treated. For three positions of the regulating switch it is as follows :—1st position, 720 watts per sq. yd. ; 2nd position, 360 watts per sq. yd. ; 3rd position, 180 watts per sq. yd.

The "Grei" Semi-Diesel Engine.

The Barlaw Engineering Co., Ltd., of 100c, Queen Victoria Street, E.C., are introducing the "Grei" semi-Diesel oil engine, which works on the two-cycle principle, and burns either crude oil or petroleum. The engine is very sensitively governed and well balanced, and is provided with forced lubrication. It is suitable for driving dynamos for country house installations and similar purposes.

New Model "Magic" Cleaner.

As the result of experience with the earlier machines during the past three years, "Magic Appliances," Ltd., of 6, Farringdon Avenue, E.C., have brought out a new model of the "Magic" suction cleaner, in which many improvements have been embodied. Every part of the machine has been subjected to the most careful scrutiny and exhaustive experiment, with a view to producing a machine which shall be as nearly perfect as possible, combining reliability with efficiency and economy. A much more powerful motor has been employed, fitted with ball-bearings, and capable of standing a considerable overload. We have seen one of these motors, and it is really a little gem. The mode of attaching the hose for



Figs. 15 and 16.—"Magic" Cleaner, with and without Hose attached.

cleaning walls, &c., has also been greatly improved. Instead of clipping it under the nozzle of the cleaner, it is now connected to the front of the nozzle in a line with the centre of the fan, by means of a cone-shaped fitting (fig. 17), which completely prevents leakage and loss of suction, besides providing a direct path from the hose straight into the fan.

A patent antiseptic device is attached to the bag, containing a sponge saturated with "Florox," a germicidal fluid, which gives to the air of the room a pleasant odour. Hooks are provided for neatly coiling up the flexible when not in use, and the handle is linked to the machine by a chain which can be instantly adjusted

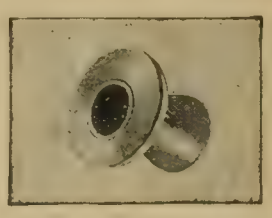


Fig. 17.—Hose Connector Cap.

in length. The motor bearings are provided with small Stauffer lubricators, which, however, rarely need be touched, and the brushes are of a most simple design. Owing to the extreme variety of voltages and frequencies in use in this country, a very large stock of cleaners has to be carried ; some 500 are stocked in London for A.C. and D.C. The machines are made throughout at the company's works near Birmingham, and are tested during manufacture, on completion, and again before dispatch from the London warehouse, and are intended to be placed in the hands of any ordinary domestic without special instructions, being as far as possible foolproof.

Novel Window Sign.

The Electrical Co., Ltd., of 122-124, Charing Cross Road, W.C., have placed on the market a novel shop-window sign for high-class advertising, embodying an entirely new and original idea especially suitable for display after closing time. It is composed of ½-in. plate glass, upon which any inscription, trade mark, &c., can be painted and renewed as desired. The novelty is that this inscription is illuminated from an invisible source, and can be hung at any convenient spot in the window like a picture. It is made in two sizes, and the plate glass is mounted in a bronze frame, with covers and holders for the Aegma drawn-wire lamps of tubular shape which are employed for illuminating it.

Engineer's Handy Drill.

Every engineer of experience will appreciate the value of a drill that will enable him to drill out broken set-screws, pins, &c., in places where an ordinary ratchet drill cannot be used without dismantling much of the engine, pump, &c. The drill shown may be

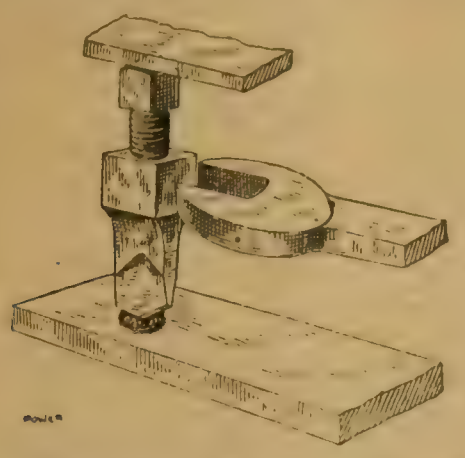


Fig. 18.—A Home-made Drill for Narrow Places.

made at the plant, and by having a few of different diameters and lengths on hand, many emergency repairs may be quickly made that would otherwise necessitate much time and labour.—*Power.*

New High-Frequency Generator for Wireless Work.

A new high-frequency generator, lately described by Dr. Riccardo Moretti in *L'Elettricista*, is arranged as illustrated diagrammatically in fig. 19. The generator is a modification of the Duddell singing arc, but is distinguished from the latter and from Poulsen's generator, by the fact that continuous wave trains are not obtained from Moretti's apparatus.

The direct current arc is operated in series with a suitable ballast resistance, and is shunted by a capacity and inductance as shown. The positive arc electrode is hollow, and is traversed by a continuous stream of water (or other cooling liquid). The water cools the electrode, and on entering the arc, it is dissociated by the combined effect of heat and electrolysis, and an extremely rapid series of

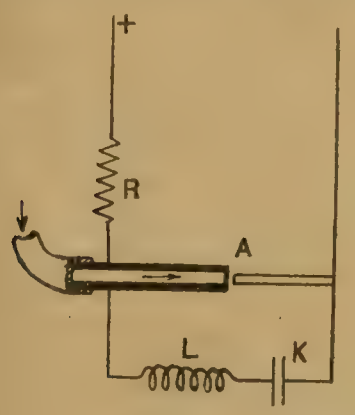


Fig. 19.—Diagram of Generator.

explosions occurs in the arc, thus setting up energy surges, the frequency of which is said to be about 100 kcy. per second. These discharges in the arc circuit set up oscillations in the circuit KL of frequency $F = 1/T = 1/2\pi\sqrt{LK}$. The frequency of the arc discharges is generally considerably lower than the natural frequency of the oscillating shunt circuit KL, so that damped wave trains are obtained—more or less closely following one another according to the frequency of the arc discharge.

Hydrogen enclosure of the arc is not required. Using this generator, an hydraulic microphone and the usual arrangement of aerial, Moretti claims to have achieved satisfactory wireless telephonic communication from Centocelle (Rome) to Tripoli.

Superlux Glassware.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., after a considerable amount of experimenting have brought out a new glassware, designed and manufactured on a scientific basis, which they have named "Superlux." This is a pure white glassware of exceptional reflecting and diffusing qualities, and the company claims that it has an absorption factor of only about 5 per cent. over the effective angle of illumination. It is manufactured in a variety of forms and sizes for use with lamps of every candle-power, and is applicable to all existing systems of lighting, such as direct, indirect or diffuse. The inner or reflecting surface is of a dull, unpolished nature, which is produced in the manufacturing processes; the outer surface has a subdued polish which, combined with its pure whiteness and texture, produces a pleasing effect. It can easily be adapted to existing installations.

Lectures.—Mr. A. C. Huckstepp, principal of the Forward Publicity Committee, began a course of classes in "Advertising and Salesmanship" at the Birmingham Y.M.C.A., on Wednesday evening.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Charge Engineer's Complaint.

It is to be hoped that the following little article may have some effect in preventing some of the younger fellows in central stations from trying to get on, trying to get a charge engineer's job.

Recently a charge engineer in a generating station, three-phase, D.C., and traction, resigned. At this particular time the three engineers were respectively, a B.Sc. (Vict.), a Faraday House man, and another University graduate.

In place of the man who resigned, an engine driver in the station was appointed "shift," permanently, not *pro tem.* The vacancy was not advertised.

This will serve to show what our chief electrical engineers think of the man who has obtained excellent technical education combined with thorough works training, and it also shows many young fellows engaged in power station work the utter uselessness of trying earnestly to improve their positions so long as such appointments are made.

At this station it has been customary for some years to take pupils, the expenses of the pupil being about £100 per year, and it was usually stated on one's articles that such pupils would be given reasonable preference over other applicants for a vacancy, when one occurred, provided, of course, that the pupil had made himself proficient. The writer is a past pupil who has made himself very proficient in power station work by reason of mechanical work, pupilage, insight into work of other concerns, and technical education, the total cost of which would come to some hundreds of pounds, yet an engineman, pure and simple, is given the post of charge engineer, before a single other fellow even hears of there having been a vacancy.

This serves to show that decently trained men are not required in power stations, and the sooner it is recognised the better; it shows up the premium pupil game very clearly.

James Fredericks.

Apparatus on Hire.

In reply to Mr. H. S. Ingleby's criticism of the article on this subject I should like to make a few comments.

It has not been my experience that a corporation can buy motors at a considerably lower price than other traders. As a matter of fact, the company from whom the Govan Corporation purchased the majority of their motors gave them no better terms than they gave any engineering firm in the neighbourhood.

Mr. Ingleby (I am sure, unintentionally) misrepresents me when he says that I advocate running a hiring department at a loss. He cites the fact that after all charges in connection with the Govan hiring department had been paid there was only a small credit balance, which is correct, but he, perhaps, overlooked the fact that in addition to the sinking fund, a depreciation fund equal to an average of 6·08 per cent. per annum was formed, and this was certainly more than was necessary for safety.

He says that no charge was made for supervision, and in this, no doubt, my statement that nothing was allowed for the mains superintendent's time misled him, and I ought, perhaps, to have been more explicit on the point. The motor attendant was a first-class wireman who had been through the armature winding shops of one of the principal electrical firms in the country and needed very little supervision, and, consequently, the amount of time the mains superintendent gave to the work was very small, but the motor attendant's time was all fully allocated. It should be noted also that I was not holding up the Govan undertaking as a model, and under the heading of rental charges, I gave what I consider to be sufficient to cover every charge. In this, I allowed 3·28 per cent. for establishment charges and capital charges on stock motors, which, I think, is quite sufficient. The other items, sinking fund (depreciation in the case of a company) and repairs, would be the same for either corporation or company,

and 3·5 per cent. is sufficient for interest for a corporation, but I quite agree is *not* sufficient return for a company trading to make its profit out of hiring, so that I think the matter boils down to whether a corporation should undertake a trading concern, such as an electric supply or not, and this question I am not prepared to argue!

I do not think that the local traders had any complaint to make against the Govan electricity department, and our relations with them were always very friendly, including those with a firm that hired out small motors.

If there is a company in the district who will hire out motors of all sizes, there is no necessity for a corporation to hire, but there are relatively few of such companies, and where there are none, the supply authority, be it company or corporation, should undertake the work itself.

With regard to reliability, &c., my remarks hold good whether the hiring authority is corporation or company, and I had not the slightest intention of reflecting upon hiring done by a company, as Mr. Ingleby seems to think. In the case of the Govan Corporation, the motor attendant was a fully qualified and very excellent workman, who was paid the standard rate of wages, and, in my opinion, such a man should always be employed.

With regard to the stock of motors being small, I can assure Mr. Ingleby that it was quite sufficient, and that we never had any trouble from breakdown on that account. As I pointed out, our practice was to obtain our motors as much as possible from one firm, and with that arrangement, if you have eight sizes in stock and a good assortment of pulleys, you can do a good deal. I should, perhaps, have emphasised more that, given first-class motors and efficient inspection, the spare motor problem largely disappears, and with this I think Mr. Ingleby will agree.

I should be interested to know if Mr. Ingleby, with his experience at Leeds, takes exception to the article regarded simply as detailing a hiring scheme, disregarding the paragraphs relating to municipal ownership.

T. C. Parsons.

Exeter, *September* 19*th*, 1913.

"Continuity."

If the graceful rebuke meted out by yourselves to your correspondent under the above title in this week's issue does not close your columns to this subject matter, permit me to express my opinion that the £5 and "Tosh" will not part company.

It is, indeed, regrettable that our friend fails to comprehend the poetical language and the inner meaning of the impressive close of Sir Oliver Lodge's eloquent address. He has yet to learn that money will not bring a man into tune with the Infinite, neither will it furnish the "evidence" he requires to prove "statements and assertions."

When one reads that the President's pronouncements were given as the result of over 30 years' research, surely it must be admitted that no man has a right to dispute the conclusions before studying the evidence, especially when the pronouncements do not travel beyond the boundaries of the researches.

Difficulties and confusions arise from the general disposition to assign limits, where there are no limits. Your correspondent will have to pass the boundary line of the physical before his perceptive faculties are attuned to more subtle influences. Happily, there are many who consider the Presidential address an excellent augury for the expansion of science.

H. E. Yerbury.

September 20*th*, 1913.

Permit me—a reader of the Electrical Review since 1876—to associate myself with your protest against the sentiments of your correspondent with the self-bestowed name "Tosh" who, in your current issue, criticises Sir Oliver Lodge's recent Birmingham discourse, and your own leading article (September 12th) dealing with the same.

It is a pity that your favourable reception of Sir Oliver's weighty and courageous utterances should, by your correspondent, be made the occasion for words not only crude and ill-mannered, but calculated also to stab the religious convictions of thousands of your readers.

"Tosh" and hectoring fellows of his class—overweening in cheek and exaggerated sense of their own importance and numbers—ever seek with negative dogmatism, and futile abuse of anything beyond their own restricted vision, to disturb by sheer vulgar noise the serenity of fellow men who are believers in God and the happy future awaiting all who, according to their lights, do their duty in this life.

Even from the commonplace point of view of existing conditions the conduct of "Tosh" has its ludicrous aspect, for he appears to be ignorant of the fact that even in our own restricted English electrical world, many of the foremost men therein are convinced Christians: men predominating, too, among the writers of the most up-to-date electrical literature. As a pledge of *bona fides*, I append to this letter, for the eye of you personally, Mr. Editor, a list of some of these men, as well as further corroborative details relating to other statements in this communication. Even with my own very restricted personal knowledge regarding the intimate convictions of others, I can point to "Believers" among past Presidents and other eminent men in the I.E.E.; apart, too, from Lord Kelvin, who, by his famous profession of Faith uttered in the Sheldonian Theatre at Oxford, proved his mettle. All these men believe in the reality of the unseen world, and of many facts in the spiritual order at present beyond their ken. Yet are they any the less keen in the pursuit of science? . . . .

All this, Sir, may "sound to" your correspondent "like Tosh," but does he still think that this word is applicable to beliefs which have energised the lives of Damien among the lepers, Dolling in the East End, Stanton in the back streets of Holborn, Booth among the outcast and Spurgeon in much earnest work?

E. Raymond-Barker.

London, *September* 21*st*, 1913.

[We have ventured to abbreviate our correspondent's remarks, and close this discussion for two reasons: first, because we do not think it a suitable matter for extended treatment in the columns of a technical journal, and, secondly, because experience tells us that if we give our correspondents the reins, there will be no room for anything else in the journal.—Eds. E.R.]

With your permission I will quote a few extracts from Carlyle's "Sartor Resartus," which, I think, will sufficiently explain the passage in Sir Oliver Lodge's address, which your correspondent "Tosh" regards as unintelligible; and incidentally, perhaps, earn that £5 for the I.E.E. Benevolent Fund!

Nature, with its thousandfold production and destruction (is) . . . . what the Earth-Spirit in *Faust* names it, *the living visible Garment of God*:

. . . . . I walk and work, above, beneath
Work and weave in endless motion!
Birth and Death,
An infinite ocean;
A seizing and giving
The fire of living:
'Tis thus at the roaring Loom of Time I ply,
And weave for God the Garment thou seest Him by.

Of twenty millions that have read and spouted this thunder-speech of the *Erdgeist*, are there yet twenty units of us that have learned the meaning thereof? . . . .

The thing Visible . . . what is it but a Garment, a Clothing of the higher, celestial Invisible? . . .

It is written, the Heavens and the Earth shall fade away like a Vesture; which, indeed, they are: the Time-Vesture of the Eternal.

William Watson embodies the same idea in a little poem entitled "The Questioner":—

I asked of Heaven and Earth and Sea,
Saying: "O wondrous Trinity,
Deign to make answer unto me,
And tell me truly what ye be."
. . . .
And they made answer: "Verily,
The robe around His form are we. . . .

Musicus.

Lightning Conductors at St. Paul's Cathedral.

The description given in the Review of September 5th is rather *ex parte*, and conveys the impression that the installation which was carried out by the cathedral staff to

my specification in 1900 was left incomplete. The authorities would not permit new conductors to be carried down the outside walls, so they were rearranged in the ducts, and were so interconnected with the new cables on the roof that they formed a "modified bird cage" protection.

Cable conductors have the advantage of durability, which tape does not possess, and those at St. Paul's, when I last tested them, were in perfect electrical condition; the contractor would have given better value had he not made a change to tape. Both on the Continent and in the United States lightning rods are, as a rule, of solid rod or cable, the use of tape is very limited, as the "neat job," which pleases the architect, of running out and in over the projections of the building has long been condemned by scientific Committees in many countries, as well as by the Lightning Research Committee (1905 Report) and Phœnix Insurance 1910 Rules.

Pieces of the original iron rods, said to have been designed by Franklin, also samples of the copper conductors, can be seen in the Science Section of the South Kensington Museum. A specimen of modern copper tape, deteriorated so as to be almost a non-conductor after about ten years' exposure, is also exhibited.

Killingworth Hedges, C.E., M.I.E.E.

St. Stephen's Club, S.W.

Greatest New York.

On page 422, "The New York Edison Co.," total area of more than "25,000 sq. miles"—bit of a stretch isn't it, even for a Yankee? Perhaps you can confirm it?

V.

The "Hand" of an Armature.

However "eminently desirable" it may be to obtain uniformity in the use of the names right-hand, left-hand, progressive, retrogressive, as applied to armature windings, it is very unlikely that such a uniformity ever will be reached, for the reason that the suggestions of Mr. MacCallum, as supported by certain text-books, differ from the existing standard practice of several leading manufacturers in this country. The existence of specifications, drawings, records, &c., which assume the use of this standard practice, makes it practically out of the question that manufacturers would change their present methods.

All that can be done, unfortunately, is simply to make a note of the fact that this nomenclature varies, so that one will not be led astray when the names are encountered with a different meaning to that to which one has been accustomed.

G. Moores.

Stockport, *September 20th*, 1913.

[Our correspondent tells us that there is a "standard practice," but that the nomenclature varies—statements which are rather inconsistent. Surely it is eminently desirable that uniformity of nomenclature should be achieved by some means or other, whether Mr. MacCallum's suggested system or another be adopted. From the last paragraph of Mr. Moore's letter it appears that at present chaos reigns in this respect. The matter might appropriately be taken up by the Electrotechnical Commission.—Eds. Elec. Rev.]

Electric Train Lighting in Switzerland.

The following facts *re* above may be of interest:—Electric lighting has been universal on all broad-gauge railways for many years. Narrow-gauge lines, other than electric, also use it almost exclusively, the exceptions being a few small lines where *oil lamps* are still in use.

Electric lighting was in universal use on the broad-gauge lines long before the State began, in 1903, to buy up the companies. The latter, therefore, bore the whole expense of equipment. Moreover, the electric lighting of trains was universal long before the introduction of the train-lighting dynamo. It entailed the use of interchangeable accumulator cases fixed under the carriages. The latter system is still in use on part of the older rolling-stock.

D. A. Stewart Sandeman, C.E. (Laus.).

Lausanne, *September 21st*, 1913.

The Metalite Meeting.

I have to-day returned to London after a holiday and notice a letter from a shareholder of "Metalite." I shall have pleasure, with your permission, in answering the questions raised during next week.

In the meantime you are at liberty to publish my address.

F. Harrison.

14, Dickenson Road,
Crouch Hill, London, N.
September 23rd, 1913.

LEGAL.

Colliery Electricians' Duties.

Sheriff Shennan, at Hamiltion, has given his opinion on the objections to the relevancy in the summary complaint against James McNeil, colliery electrician, Wishaw, superintendent of the electrical plant at Dalzell and Broomside Colliery, Motherwell, who is charged, along with Robert Wilson Dron, mining engineer, Bearsden, and James Dalgleish, manager of Dalzell and Broomside Colliery, with having, between March 15th and April 16th last, contravened the Coal Mines Act by failing to take certain precautions in connection with the colliery plant. Certain objections to the complaint against Messrs. Dron and Dalgleish were reserved pending the prosecutor amending the complaint. Of the eight charges against Mr. McNeil, it was held that seven were irrelevant in respect that in these Mr. McNeil was accused of "failing" to have certain things done or supplied in connection with the electrical plant, whereas the rules clearly defined the electrician's duties as being those of examination and testing, and also keeping a log book. Sheriff Shennan stated that, in his opinion, this objection to the relevancy fails to be sustained. Before a breach of duty can be charged the prosecutor must be able to point to the section of the Act, or the special rule or rules which impose the duty. He failed to find any duties specially imposed on the electrician except those contained in sub-heads (*c*) and (*d*) of Special Rule 14, viz.:—(I) The thorough examination of all apparatus as often as may be necessary to prevent danger; and (II) the examination and testing of new apparatus and of apparatus re-erected; and (*d*) the keeping of a log book. His Lordship did not find what he might call executive duties imposed on the electrician. It seemed to his Lordship that the scheme of the rules was to put the electrician in the position of technical adviser, and the results of his examination and inspection being entered in the log book, it then became the manager's duty to see that the necessary work was carried out. To the remaining charges against Messrs. Dron and Dalgleish, and the eighth charge against Mr. McNeil, viz., of failing to make a thorough examination of the electrical plant, a plea of not guilty was tendered, and the trial was fixed for the 26th inst.

Lead.—Messrs. James Forster & Co., of 141, Fenchurch Street, E.C., in their lead report dated September 20th, state: "Closing prices last week were £19 12s. 6d. September, £19 15s. October, and £19 7s. 6d. November. Monday's market opened firm, with a rise of about 10s. a ton on the day for September lead, this prompt selling at £19 17s. 6d. to £20 5s., and has remained strong throughout the week, closing at £20 15s. for September, £20 7s. 6d. for October, £19 17s. 6d. for November, and £19 10s. for December. The demand has been large, particularly for export, for which heavy sales have been made to Europe and the East, and home consumers, who are not at all well supplied, have also bought freely. For September/October, for which months we believe there is a considerable 'short' account open, the prospects are anything but inviting for 'bears.' We anticipate higher prices for all positions this year, with continued scarcity of early lead. English lead, £21."

Electric Elevators in the Transvaal.—According to the *African World* there are now 139 elevators at work in buildings in the Transvaal, of which 128 are in Johannesburg; 134 are of the electric type, while four are hydraulic power and one steam driven. A departmental report states that in the types of machinery installed in the new elevators a great improvement is noticed, due to the employment of firms of repute.

ELECTRIC VEHICLES.

We have received the following interesting communication, to which we refer in our leading columns :—

At the annual general meeting of the Incorporated Municipal Electrical Association held in June last, the following resolution was passed unanimously :—

"That a Committee be appointed by the Council to consider and adopt such measures as may be found desirable to further the use of the electric battery vehicle. That such Committee be empowered to co-opt representatives of other institutions, company-owned electric supply undertakings, manufacturers and others directly interested in this matter."

The Committee referred to has been appointed, and at the first meeting the President of the Incorporated Municipal Electrical Association—Mr. R. A. Chattock, city electrical engineer of Birmingham—was elected chairman, and it was also decided that, in addition to the seven members of the Municipal Electrical Association forming the present Committee, the following additional members should be co-opted, representing—

Company-owned electric supply undertakings in the London area	2
Ditto in the provinces	1
Manufacturers of electric storage batteries ...	2
Manufacturers of electric (battery) vehicles ...	3
The Royal Automobile Club	1
The Automobile Association and Motor Union ...	1

As Messrs. Edmundsons' Electricity Corporation appear to be interested in the greater number of the company-owned electric supply undertakings in the provinces, the Committee consider that the present requirements of the case are met by asking Messrs. Edmundsons to nominate one of their technical staff to serve on the Committee as representative of the provincial companies.

It is proposed that the scope of the Committee's work shall, at the outset, cover the following :—

1. To get into communication with electric supply authorities throughout the United Kingdom, and to impress upon them the desirability of taking energetic steps to encourage the use of the electric vehicle by :—

(*a*) Agreeing to supply electric energy for charging purposes at a reasonable price.

(*b*) Calling meetings of the motor-car traders and hotel proprietors in their districts in order to induce them to provide charging facilities.

(*c*) At the outset, giving assistance to motor-car traders when the latter may be confronted with difficulties in connection with electric vehicles.

(*d*) Advertising the whereabouts of charging stations at all main road entrances to each town.

(*e*) Impressing upon municipal bodies and others employing means of transport in their respective areas, the advantages attending the use of the electric vehicle.

(*f*) Distributing information and literature among likely users. (The Committee have in view the hope of being able to compile and supply literary matter for this purpose.)

(*g*) Providing charging outfits on hire.

2. (*a*) To decide upon the best arrangements to recommend for charging.

(*b*) To decide upon the most suitable sizes of a line of charging outfits :—(1) For D.C. systems ; (2) for A.C. systems ; which, in order to eventually reduce cost of manufacture, could be recommended as standard sizes.

(*c*) To secure, as far as possible, simplicity, clearness and uniformity in battery charging instructions.

3. To consider the issue of rules for the proper use and maintenance of electric vehicles.

4. To consider and make recommendations for the standarisation of the technical details connected with the design of electric vehicles :—

(*a*) Standard ratings for motors.

(*b*) Standard voltages.

(*c*) Standard ratings for commercial vehicles (carrying capacity and speeds).

(*d*) Wiring details.

(*e*) Standard charging terminals.

(*f*) Standard battery units.

(*g*) Electric lighting on electric vehicles, &c.

5. To approach the insurance companies with a view to inducing them to quote specially favourable rates for insuring electric vehicles in consequence of the reduced fire risk, &c.

6. To arrange, if possible, for periodical parades and exhibitions of electric vehicles.

7. To collate useful information in regard to electric vehicles and to publish same from time to time.

8. To take up with the authorities concerned the question of the rating of electric vehicles for taxation purposes.

9. To arrange for the issue of maps with charging stations indicated, together with list of the latter and tariffs.

10. To consider any other matters connected with the electric vehicle.

In regard to the constitution of the Committee, there does not appear to be any society or institution in this country representing the manufacturers of electric storage batteries which could be asked to nominate representatives to serve on the Committee, and the same remarks apply in the case of manufacturers of electric vehicles. It is proposed, therefore, to ask firms dealing respectively in batteries and electric battery vehicles to meet and choose representatives to serve upon the Committee. In order that such meetings may be convened at an early date, I should be glad if the firms interested would communicate with me as soon as possible. It is, of course, understood that where the manufactory is situate abroad, the properly-accredited agents in this country are referred to in the term "firm" mentioned above.

The Committee desire me to say that they will, at all times, be glad to receive and consider any suggestions which may assist in this "forward" movement connected with the use of the electric vehicle. Any communications should be addressed to the undersigned.

F. Ayton,

Hon. Secretary of the Electric Vehicle Committee of the Incorporated Municipal Electrical Association.

Chief Engineer and Manager, Corporation Electric Supply and Tramways Departments, Ipswich.

BUSINESS NOTES.

A Blow to the German Export Trade.—The German Home Tax on lighting materials is proving a serious handicap to the German export trade, more particularly that to the United States and Canada. In both of these countries for some time past the Customs Authorities have added this tax to the value of German exports in calculating the import duties, the effect of which is to increase the net selling price of German goods by from 30 to 50 per cent., and to practically shut the German goods out of those markets. The value of the lost trade is placed at at least £150,000. Representations by the German Government to the Governments of Canada and the United States have failed to secure an amelioration. An evil side to the question is that other countries may be led to adopt similar methods, when the blow to the German export trade will be incalculable. Failing the revocation of the tax by the Imperial Government, the only alternative before the German electrical material industry will be to transfer their works abroad, when the Fatherland will presumably lose much more than the £1,650,000 which the tax now brings in. The Union for the Defence of the Economic Interests of the German Electrotechnical Industry, and the Vereinigung der Glühlampfabrikanten, are taking active steps in this matter, and have presented a petition to the Reichstag urgently pressing for the repeal of the tax.

The Edison Battery.—The Edison Storage Battery Co., of Orange, N.J., U.S.A., has just brought out a new type of the well-known Edison accumulator. The new type or size is known as A5 and has a rated capacity of 187½ ampere-hours ; it is designed for use on pleasure cars, light delivery vans, industrial and luggage trucks and similar work.

Fire.—The drying sheds at the timber mills of Messrs. Beecroft & Wightman, of Hull, were gutted by fire on 19th inst., but it is understood that arrangements have been made for business operations to continue as usual.

Coating Metals with Lead.—Lead, Ltd., of 1 and 2, Old Pye Street, Westminster, has acquired from Mr. Sherard Cowper-Coles the sole right for the coating of iron and steel with lead by an electrolytic process. Lead by this process can be economically deposited up to the thickness of $\frac{1}{8}$th of an inch. A plant has been erected in London for the coating of sash bars for window frames and for metallic glazing for roofs. Brass, copper and other metals can also be coated with lead, and the process is suitable for protecting the lining of pipes, tubes and chemical vessels for containing and conveying corrosive liquors, as well as for the coating of earthenware and wood, and the protection of ornamental ironwork.

Lundberg Switching Competition.—We understand that a very satisfactory number of papers from candidates in the United Kingdom has been submitted in connection with the above ; and the results of the competition will be published in our "Advertisement Columns" in the first week of November. Papers from the Colonies and abroad are not due in till February 2nd next.

Trade in Germany.—It is stated on behalf of the Bergmann Electricity Works that the course of business in recent months has been normal, the turnover being about on the level of last year. Large transactions are somewhat more scarce, but compensation is obtained from the partially more active business in the so-called merchant products. In particular, the departments for machinery, installation material and cables are satisfactory, but the company has refrained from financing works since the Bergmann Electrical Enterprises Co. restricted itself to the completion of old transactions.

The Glow Lamp Industry in Austria.—On the course of business in the glow lamp industry in Austria, the *Elektrotechniker* remarks that that branch is among the few which have been unaffected by the Balkan war. Demand, especially for metal-filament lamps, was fairly active. In the mass, as the technical methods of producing the metal-filament lamp are perfected, the domain of utility of the carbon lamp will be restricted. The chief users of the latter are those manufacturing industries where the lamps are exposed to strong vibrations, such

as mills, mines, &c. Elsewhere the metal-filament lamp is ever gaining new ground. The price, which, for the most used kinds, a year ago was about 3 kronen, has come down to between 1 and 1·40 k. It has lately become possible to make the high candle-power filament lamp economically and this renders a competition with the arc lamp possible. Austria-Hungary's present output of these lamps, which totals between 18,000,000 and 20,000,000 a year, far exceeds the consumptive powers of the Monarchy which amounts to only about half of this quantity. The export business, which embraces all quarters of the earth, shapes itself satisfactorily. But in many export markets the competition of Germany is being more and more felt. The carbon lamp Cartel, in which German, Austro-Hungarian and Dutch firms are represented, expires in May next year, and it seems little likely that there will be a renewal of the same. That is to say, most manufacturers are of the opinion, that with the altered circumstances in the glow lamp industry, free competition will prove itself to be the better policy.

Water Softeners.—Messrs. Lassen & Hjort, of 52, Queen Victoria Street, London, E.C., have sent us a lengthy list of firms and undertakings which are at present installing their automatic water softeners, orders having been received from them during the past few weeks. The list includes three further plants for the Government for Woolwich Arsenal; seven plants for Messrs. Babcock & Wilcox, Ltd., who have exclusively adopted the L. & H. softener and supply it under licence; and installations for important colliery owners, iron companies, paper mills, rubber companies, laundries, &c., the Royal Exchange, London, and the Rochdale and Wakefield Electricity Works. The Lassen-Hjort softener is an automatic device giving direct positive measurement of both hard water and chemicals in separate adjustable quantities; and it is claimed that by means of this apparatus it is possible to treat any water or effluent with any reagent in rigidly proportionate quantities which can be varied at will and regulated with precision. This water purifying plant has been installed by the British Admiralty at Portsmouth and Hong-Kong, by the French War Office at Rochefort Arsenal, by the Japanese Admiralty at Kobe Dockyard, and by the Italian Admiralty at Castellamare.

Lamp Test.—At South Shields, recently, three large shops adjoining each other were completely gutted by fire. The stocks were particularly inflammable, consisting of millinery, furniture, boots, &c., and the fire was so fierce that the wiring in all the shops was completely destroyed, but the Osrams in the outside fittings were not damaged. The heat caused the opal globes to burst, and molten lead from the roof fell upon one of the fittings; later a blazing sun blind crashed on top of it, but the lamps withstood successfully the severe tests of fire and water.

Bankruptcy Proceedings.—Jack Francis Barnes, electrical and mechanical engineer, picture house proprietor, &c., Oldbury, Worcester, and Cradley Heath, Stafford.—Mr. Registrar Walker held a sitting at the Law Courts, West Bromwich, on September 19th, for the public examination of the above debtor. In reply to the Assistant Official Receiver, the debtor said that in 1895 he commenced the business of cinematograph entertaining at the Victoria Pier and the Empire, Blackpool. Since then he had run cinema entertainments in nearly every city and large town in England, Scotland and Wales. About 14 years ago he settled at Walthamstow, London, and worked his business as an electrical engineer from there. For about eight years whilst in London he ran cinema shows, principally at music halls in London and the provinces. When he left London, six years ago, and went to Smethwick, he was in debt to the extent of £400 to £500, all of which he was able to pay off within 12 months. He was engaged at the Aston and Smethwick Theatres for about 5½ years, and during that time he supplied films and electrical apparatus in the district. In August, 1909, he joined Mr. Richard Nightingale, of the West Bromwich Theatre Royal, and they took premises at Cradley Heath for a picture house. Reference was made to other picture palace ventures. Bankrupt attributed his failure to keen competition in the cinematograph business, and loss on picture houses, and at the date of the receiving order 17 judgments had been entered against him. In seven cases committal orders had been obtained. He admitted that he had possessed a motor-car which he took in payment of a debt, and which he subsequently sold for about £37. His wife now had a motor-car, which she purchased out of her own private income, she having been left altogether three fortunes, and the furniture also belonged to her. He denied that he had been extravagant. His deficiency was £423. The debtor was allowed to pass.

Frederick Thomas Johnson (described as Frederick Johnson in the petition), electrical engineer, 60, Eltisley Avenue, Newnham, Cambridge. The public examination of this debtor was fixed to take place at the Guildhall, Cambridge, last week, before Mr. Registrar Eaden, but was adjourned.

Joseph Swainson, an electrical contractor, 22, Booth Street, Manchester, and 10, Wilton Road, Chorlton-cum-Hardy.—This matter came before Mr. Registrar Atkinson, at the Manchester Bankruptcy Court on 19th inst., when the debtor was publicly examined as to the causes of his insolvency. The statement of affairs showed a deficiency of £1,044 upon unsecured liabilities estimated at £1,371, and he alleged that his failure was due to losses on contracts, bad trade, special allowances to book debtors to obtain cash, bad debts (£300 in the last 12 months), and increased cost of material after the accepting of contracts. In answer to the Official Receiver (Mr. J. Grant Gibson), the debtor confessed that he was unable to explain how a surplus capital of £418 18s. shown in a balance-sheet prepared by his accountant as on January 31st last, had been converted in so short a time to the deficiency shown in his statement of affairs. The Official Receiver suggested that as a matter of fact the debtor had been living in a fool's paradise. Debtor replied that he had relied on the balance-sheet prepared by his accountant. The Official Receiver pointed out that the accountant could only prepare a balance-sheet from information supplied to him by the debtor. The examination was closed.

Francis Hastings Medhurst (deceased.—Trustee (F. W. Pixley and F. S. Salaman) release dates from August 18th.

Alfred Wilson Hughes, 49, Queen Victoria Street, E.C., manufacturer of ebonite and electrical insulators.—The first meeting of creditors was held on Monday at the London Bankruptcy Court under a receiving order. Mr. W. P. Bowyer, Official Receiver, reported that since 1893 the debtor had been interested in a number of patents relating to incandescent gas, the maturing of whisky, a non-flammable celluloid, a patent varnish and electrical insulators. In January last he purchased at the price of £3,500 the machinery and patents for a substance called "Pluton," a substitute for ebonite. He paid a deposit of £500, and agreed to pay the balance of £3,000 on the assignment by the vendors to him of the whole of the patents. It subsequently transpired that the vendors did not hold the patents absolutely, and that Mr. A. R. Muller, the inventor, who held one-half interest in the patents and machinery, declined to execute the assignment, there being a debt due to him by the vendors. For that reason the assignment to the debtor had not yet been completed. He had expended over £3,000 in erecting plant and machinery at the factory at Walthamstow, where the business was now being carried on. He had received an offer for the business of £8,000 cash and £10,000 in shares of a proposed company, and also an offer for the purchase of the Canadian and American rights when the assignment was completed. His present difficulties were brought about through lack of sufficient capital to carry through the various businesses in which he had been interested, and in connection with which he had borrowed money on bills. No statement of affairs had been filed, but the debtor roughly estimated his liabilities at between £5,000 and £10,000 and his assets at £30,000. He consequently did not admit insolvency, being of opinion that if the assets were realised to advantage they would produce sufficient to pay off all the debts and provide a large surplus for himself. They included the plant, machinery and stock of ebonite insulators at Walthamstow, £3,000; cash, £500, deposit on the purchase of the patents; and a one-half interest in the Pluton Co., £20,000. The meeting was adjourned for a month with a view to a proposal being formulated and submitted to the creditors.

E. J. Crosier, engineer and merchant, Newcastle-on-Tyne.—October 9th is the last day for receipt of proofs for dividend by Mr. J. A. Gardner, the trustee, 145, Pilgrim Street, Newcastle-on-Tyne.

Trade Announcements.—From 29th inst., all correspondence for Messrs. Turner & Burger should be addressed to 149, Farringdon Road, London, E.C., where they have taken larger offices and warehouses.

In our last issue we recorded the registration of a new company formed for the purpose of dealing effectively with the question of the letting out of electric motors on hire, about which there was some discussion before the Leeds City Council last year. This new company, The Electric Motor and Stove-Hiring Co., Ltd., hopes to take a very active part in popularising the use of electricity for power and domestic purposes, and the motors supplied are made entirely in Leeds.

Messrs. Irwin & Jones, engineers and agents, of 5, London Wall Buildings, London Wall, E.C., are moving to larger premises to-day, and their address in future will be London House, New London Street, E.C. Their new telephone number is 1449 Ave; telegraphic address, Irwijos Fen, London.

Liquidation.—Electric Ignition Co., Ltd.—A meet- will be held at 131, Edmund Street, Birmingham, on October 28th, to hear an account of the winding up of the liquidator, Mr. R. A. Felton.

For Sale.—The goodwill, stock-in-trade, patents, &c., of the XL Electric Co., Ltd., is to be sold by tender, pursuant to the order of the Court, of July 29th. See our advertisement pages to-day for particulars.

Lamp Contracts.—The Edison & Swan United Electric Light Co., Ltd., have recently secured orders for Royal Ediswan lamps from the British Admiralty, the General Post Office, British L.M. Ericsson Manufacturing Co., and the United River Plate Telephone Co., Ltd.

Annual Outing.—The employés of the electrical department of Messrs. J. Stone & Co., Ltd., of Deptford, went for their annual outing on Saturday, 12th inst., by brakes to Downe, where, before tea, a football match was played; after a ramble, a programme of music and song was rendered at the Queen's Head Hotel.

Tungsten Lamp Price Reductions.—On Monday last a general reduction was made in the prices of metallic-filament lamps. The General Electric Co. inform us that this has been made possible by further technical progress in connection with drawn-wire filaments, combined with the increased output of the Hammersmith Osram Lamp Works. The reduction amounts to 4d. on the list prices of most of the smaller sizes of lamps, and 6d. to 1s. on the larger sizes. The front cover of the new Osram price list bears a striking picture showing effectively how the exertion of powerful muscles fails to break the filaments of the Osram lamp. A card gives a list of 12 actions commenced by the Osram Lamp Works, Ltd., on the score of infringement, as well as of three actions

in which judgment has been given in their favour, and one in which an interim injunction has been granted.

Messrs. Siemens Bros. Dynamo Works, Ltd., announce a similar series of reductions in the prices of their Wotan drawn-wire lamps, which apply also retrospectively to stocks held unsold by retailers on September 22nd, provided they had been bought direct from the makers, and that notice was given on or before yesterday. A corresponding reduction has been made in connection with certain types of tantalum lamps, amounting to 3d. in each case, and a special price list has been issued containing the particulars regarding both lamps. Price lists will be over-printed for trade customers on request.

The Electrical Co., Ltd., also send us their list of prices reduced in accordance with the foregoing statements, applying to the Aegma drawn-wire lamps, other makers of tungsten lamps, and tantalum lamps.

We understand that the prices of the Mazda lamps have been reduced by the British Thomson-Houston Co., Ltd., as well as the lamps made by the Edison & Swan United Co. (from whom, as we go to press, a price list showing the reductions, comes to hand), and other makers. Details are given in our advertisement pages to-day.

Competition in Wire Lamps in Germany.—The trade contest in wire lamps in Germany is now very keen. It prevails both among the small firms themselves and between the small firms and the large firms, as well as between the three largest producers. Indeed, although the latter have participated since 1911 in the combined German-American patented process for the production of drawn wire, or its method of application, the patent agreement has not led to the conclusion of a formal price syndicate. The present depression in prices dates back to last April, when the list prices of the leading firms were reduced by about 30 per cent., but, on the other hand, the discounts to retailers were reduced by 10 per cent. The fall in prices has not been fully equalised by an increased turnover and improvements in manufacturing, so that the profits earned per lamp have largely declined in those cases where profits have been realised, whilst in instances where losses have been incurred, these have become greater. The small lamp factories mostly use the squirted filament, but where this practice does not prevail, legal proceedings are in progress in regard to the process used. In any case, it is only possible to secure the continuance of the sales of the less durable lamps to contractors, by offering them larger profits on the business done, and the under-selling which thereby results forces the large producers to adopt a similar attitude. It is considered that the prospects of forming a syndicate for wire lamps, similar to that which exists for carbon-filament lamps, are not very favourable, owing to the wide divergence of the interests of the individual makers.

Catalogues and Lists.—The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Catalogue No. 248 is an abridged issue (32 pp.) of their catalogue of switchgear and fuseboards, containing illustrated descriptions and prices of an extensive range of distribution boards, switch and fuseboards, main switches, ironclad switches, &c., for domestic and industrial purposes. In addition to the boards for ordinary standard requirements, special designs to comply with the latest Home Office Regulations are also included. A second publication (No. 249), of 12 pages, particularises prices and gives illustrations of a new range of reflectors—"Superlux"—for which the firm are wholesale trade distributors. These reflectors are manufactured in four types, scientifically designed, adapted for various classes of installation. For example, pure white glassware is described as particularly suitable for domestic, shop and office use; other classes are: vitreous enamelled steel reflectors, aluminium reflectors, and glass mirror reflectors. In addition to the purely direct reflector of the concentrating and distributing type, globes, hemispheres, and reflectors of the inverted type are manufactured, and the range is complete for all standard sizes of metal-filament lamps.

Messrs. Willans & Robinson, Ltd., Rugby.—Pamphlet No. 4 contains a description of the Willans rotary air-pump system (Muller-Josse patent) to which reference is made in our "New Devices" section to-day.

Messrs. Hann & Ingle, 13, Albert Place, Bridge Street, Manchester.—Folder card giving brief notes concerning, and prices of, the "Adaptable" earthing and continuity clip.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—New folder (envelope series No. 4,043), 12 pages, entitled "Industrial Motor Applications," giving small half-tone views showing bakery machinery, blouse making, woodworking, laundry, flour mill, and other industrial premises that have been electrified, and giving brief information respecting each class of application.

Messrs. Ronald Trist & Co., Ltd., 4, Lloyd's Avenue, London, E.C.—40-page pamphlet containing excellent illustrations in colour, together with description, of their "Thermofeed" regulator, the patents for which are being worked in nine other countries besides Great Britain, and a considerable trade has been already established. We understand that as a result of severe trials, clients throughout this country have placed orders for 20, and in some cases 50, machines—one for each boiler. A coloured folder clearly shows the construction and details of the regulator.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, near Manchester.—Eight-page pamphlet (No. 51) giving illustrated information respecting their "Cyclone" electric blower and exhauster, electric fan, "Cyclone" motor, and the "Sirius" oxy-acetylene welding and cutting plant.

The Power Plant Co., Ltd., West Drayton, Middlesex.—16-page list (No. 8) containing illustrated description and prices of their electric hand-drilling, tapping and reamering machines.

Messrs. De Rusett Bros, 4, Page Street, Westminster, S.W.—Illustrated price leaflet of direct-coupled electric lighting sets, paraffin and petrol respectively, also direct-coupled motor pumping sets.

The British Anti-Vibration and Noise Co., Ltd., 5, Lloyd's Avenue, London, E.C.—Illustrated circular respecting their patent isolating devices and materials for preventing transmission of noise and vibration with motors, motor-generators and other electrical and general machinery. The firm have at present in hand the isolation of Diesel engines amounting to 3,000 B.H.P., with "Bavanite" iron-framed cork foundation plates.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—New list of machines for continuous current, of which considerable stocks up to 8½ KW. are kept at the company's Birmingham works. The catalogue deals also with motor-generators for cinematograph purposes, &c., and vertical motors. Quotations will also be given for D.C. generators up to 1,000 KW., of which examples are illustrated in the list. The motors can all be supplied either semi-enclosed, enclosed ventilated, or totally enclosed, with ring lubrication and specially prepared Brush bearing. All four-pole machines are of the interpole type, and each part is standardised, so as to be rapidly replaceable. The machines are of the latest design, in accordance with the specification issued by the British Engineering Standards Committee. Copies of the list can be had on application to the motor department.

Messrs. Woolnough, Lang, Ltd., St. Stephen's Engineering Works, Norwich (temporary London offices, 133, Finchley Road, N.W.).—Price list of semi-enclosed and totally-enclosed continuous current dynamos and motors of from $\frac{1}{10}$ to 14 H P; prices of a special large type of machine, from 15 to 60 H.P., are also quoted.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—Sixteen-page pamphlet, entitled "Have Electric Motors been applied to my Trade?" It contains a lengthy list of names of firms, classified as to different trades, who have adopted motor-driving in Huddersfield and district. Messrs. Brook have themselves fixed all these motors. The number and H.P. of motors, and the purposes to which they are put, are indicated in a number of cases. The firm have specialised in making electric motors suitable for textile machinery, and for that class of work they have sent motors to all parts of England, and even abroad where the competition for this class of motor is very keen. In one case in this country they have placed 73 motors, giving a total of 1,400 H.P.; a number of competitors were invited to send motors to run different types of machines, and it is stated that the motor most suitable for the work was selected irrespective of price.

The Jandus Arc Lamp and Electric Co., Ltd., Hartham Road, Holloway, London, N.—Copy of the 29th edition of their catalogue of Jandus arc lamps. By thumb index reference is facilitated to the various sections which contain very full information, together with half-tone illustrations, line diagrams of interiors, and prices, relating to the following:—Regenerative lamps, special regenerative lamps, ordinary enclosed lamps, resistances, chokers and transformers, cut-outs, carbons, globes and spare parts, photo-printing lamps, colour-matching lamps ("Dalite") with list of users, the Jandus patent winch, and a list of places where the Jandus regenerative lamps are in service for street, industrial, theatre and other lighting.

Messrs. Electrical Installations, Ltd., 27 and 28, Martin's Lane, Cannon Street, London, E.C.—Attractive 28-page booklet, entitled "Electrical Service," containing brief notes relating to the usefulness, &c., of electricity in the home, the country house, the office, the factory, and the retail shop. Notes on the upkeep of installations, and particulars of the firm's "Maintenance department" are included.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A collection of a number of the firm's latest illustrated pamphlets. They deal with overload protection, telephone cable dividing boxes, Merz-Price protective gear, explosion-proof oil switches, sheet-steel panels up to 3,000 volts, plug boxes, enclosed H.T. tubular fuses, flat-back switchgear, ironclad switchgear (draw-out type), and armoured switchgear.

The Adams British Oil Co., Ltd., Plough Bridge, Deptford, London, S.E.—Leaflets concerning their "Velos" motor-car oil and motor lubricants.

The Radium Electric Co., 82, Hatton Garden, London, E.C.—Thirty-two-page illustrated catalogue, with full tabulated particulars as to prices, weights, measurements, &c., of various "Inventa" electric heating and cooking apparatus. Technical details and descriptive information lead on to particulars of electric laundry irons, electric iron for hat makers, flat-iron stand, hot plates (small and large), table heaters, nickel-plated electric geyser, bed warmers, foot warmers, and an electric poultice for supplying warmth uniformly to a part of the body.

Train-Lighting Systems.—Referring to our description of the Vickers system in a recent issue, Messrs. A. P. Lundberg and Sons point out that in main-line trains it is essential to provide means for dimming the lights in any compartment when it is desired to sleep, or when a compartment is unoccupied; and it is also essential to leave the turning on or off of the current to the guard, to prevent any waste during daylight, and the total extinction of light in any compartment during the night. The lamps in a compartment may number two or more, according to the ideas of those responsible, the lamps being well separated to secure good diffusion; and Messrs. Lundberg have designed series-parallel

switches for either 2, 3, 4, or 5 lamps. These switches put the lamps in parallel for full light and in series for dim light, but they have no off position, the turning off or on of the current being effected by a main switch in the guard's van. They have also a switch which will give two degrees of dim light when three lamps are in use, and one or two special arrangements.

Book Notices.—"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 7. September, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 9. September, 1913. New York: The Institute. Price $1.00.

"*Journal* of the Franklin Institute" CLXXVI, No. 3. September, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"New Calorimetric Resistance Thermometers." By H. C. Dickinson and E. F. Mueller. "Note on Cold-Junction Connections for Thermocouples." By P. D. Foote. 1913. Washington: Government Printing Office.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 28. August-October, 1913. Paris: Gauthier-Villars. Price 5 fr.

"Elasta" Lamp Tests.—Messrs. Pope's Electric Lamp Co, Ltd., of Willesden, inform us that a number of metal-filament lamps of their "Elasta" wire type, taken at random from stock, were recently tested by an important Corporation. The lamps were burnt for a period of 2,512 hours, at the end of which time all were intact, and giving an average C.P. of 41·79 British, with an average consumption of 1·5 watts per British C.P., showing a very satisfactory maintenance of candle-power and low rate of consumption. Messrs. Pope also inform us that they have contracts from the Admiralty, H.M. Office of Works, and many large Corporations for the supply of "Elasta" wire lamps, which are now being widely used by supply companies and Corporations for street lighting purposes.

Canada.—It is reported from St. John's, Quebec, that the Hart Accumulator Co., Ltd., of Stratford, London, has decided to establish accumulator manufacturing works in that city, with the view of supplying the Canadian demand.

LIGHTING and POWER NOTES.

Acton.—The U.D.C., on the advice of the clerk, has decided to procure a certificate from a qualified electrical engineer as to the condition of the electric service at the public baths.

Airdrie.—An exhibition of electrical appliances for domestic and business uses promoted by the Coatbridge and Airdrie Electric Supply Co., Ltd., was largely patronised. The appliances were the manufactures of the Carron Co.

Atherton.—Following upon the discovery of a fault on the high-tension cable in Tyldesley Road, which led to the cutting-off of the supply to the Hindsford section, it has been decided to erect two section pillars on this length of main, so that if a fault occurs in future the mains can be split up, and better facilities afforded for localising the trouble.

Australia.—The Albury (N.S.W.) Municipal Council has accepted the offer of the Commonwealth Bank to advance £10,500 for an electric lighting and power scheme. The loan has been made at 1½ per cent., repayable by annual instalments of £645.

In the South Australian Legislative Assembly the Premier, Mr. A. H. Peake, promised to appoint a Royal Commission to consider the municipalisation or nationalisation of the electric light and gas services.—*Australian Mining Standard.*

Aylesbury.—The U.D.C. has appointed Messrs. Kincaid, Waller, Manville & Dawson as consulting engineers in connection with the proposed electric light and power undertaking.

Bacup.—On Wednesday, Mr. H. R. Hooper conducted an L.G.B. inquiry into an application of the Corporation for sanction to borrow £1,800 for a high-tension main, in accordance with the recommendation of the Electricity and Tramways Committee.

Bolton.—Mr. Alfred Pilling, elective auditor, in his report just published, says the net profit in the electricity department amounts only to £1,615, and permits of a contribution to rates of £1,500, as against £3,250 in the previous year. The very heavy capital outlay on the new station now in course of erection will, for a little time, adversely affect the accounts, as the interest charges will be increased. The Committee will have an anxious period during this time of extension, and would probably much prefer, as a matter of financial prudence, to be relieved of any call for rate relief. Practically one-third of the original capital outlay has been redeemed altogether. "In my view," adds Mr. Pilling, "the electricity department could not properly spare this year the £1,500 granted in aid of rates, nor, indeed, any contribution."

Calverley.—Several new electricity mains are to be laid in the Calverley district by the Electrical Distribution of Yorkshire, Ltd.

Canada.—The city of Charlottetown, Prince Edward Island (the smallest of the Canadian provinces) is going in for municipally-owned lighting service. With this end in view the Council is at present negotiating with the Electric Light and Power Co., which controls the light and power in the city, for its purchase by the city.

A correspondent writes:—"The Ontario Hydro-Electric Commission are well-intentioned and earnest in their efforts to give the people of Ontario cheap power from the great source of Niagara. So far only the manufacturers of a few of the larger towns get this advantage. The Government has spent thus far between five and seven million dollars on the hydro-electric plant transmission lines, &c., while only the towns of London, Hamilton, Toronto, Windsor and a few smaller towns benefit. All the rest of the provinces get no benefit at all. It is found that the small manufacturing towns in Ontario not served by the Hydro-Electric cannot compete with the towns that are so served, and that they are losing their manufactures and 25 to 50 per cent. of their population as a result. It is an unfortunate position for the province to be placed in. The town of London shows a profit of $40,000 in the operation of its hydro-electric plant, and is taking steps to make a big reduction in the price of energy to city consumers. This is another case of a successfully-operated municipal plant."

"Ottawa will make a further reduction in its price for lighting this coming year. Notwithstanding the big reduction made in the price of energy to consumers last year, there will be a good profit on the year's operations, and to meet increased demands 1,500 H.P. has been obtained by the city. The city is now beginning to make preparations for supplying extra current for cooking instead of the use of gas as is now general in the warmer months. Gas costs in Ottawa $1·00 per 1,000 cb. ft. This is 30 per cent. dearer than in Toronto, and the city has under consideration the starting of a municipal gas plant. Mayor Ellis, the father and the chief manager of the electric plant, proposes to use the electric current instead of gas, and announces that they can easily compete with gas at $1, even now. He proposes to supply consumers with electric cooking apparatus on low monthy instalments and supply the energy at a price that will make cooking in Ottawa by electricity cheaper than gas. This will be a splendid move, and Ottawa will be the first city in Canada to make cooking by electricity general, instead of by gas as now obtains."

Chester.—The construction of the new hydro-electric works of the Chester Corporation on the site of the old Dee Mills is now completed, and the machinery has been tested with satisfactory results. The formal opening of the works will take place in the course of a few weeks.

Cleethorpes.—A number of the better working-class houses are being wired for supply as they are built, and shilling-in-the-slot meters are being installed. The Council has decided in these cases to supply the first lamps to the houses free of charge.

Dover.—The T.C. has decided to have the E.L. installed at Barton Road schools in place of gas.

Dromore (County Down).—The new electric lighting scheme has just been most successfully inaugurated in this town. It may be remembered that the Board of Works refused to sanction a loan for the purpose, so the scheme was carried out by a private company.

Erith.—The U.D.C. on September 15th discussed a recommendation by the Electricity Committee that the Council should again provide sundry electrical fittings for consumers, some of which, it was asserted, it was impossible to obtain locally. Councillor Mathers moved that it be referred back to the Committee to see if it was not possible for local traders to supply the necessary articles. Mr. Palmer, in seconding, said that the local traders had been negligent in not providing the appliances required, but they should be given another chance to do so, as the Council did not want to recommence competition with them. Mr. Ling observed that if they supplied lamps he did not see why they should not supply other electrical appliances. It was explained that often a little switch was required by a consumer, and could not be obtained from local tradesmen for two days, whereas the Council's men could put the matter right in about two minutes. Another difficulty was that often consumers did not know what they wanted themselves, and the men in the shops could not always advise them, and all this tended to make the public think that the electric light was hardly worth having. On a division, the matter was referred back to the Committee.

Godstone (Surrey).—Owing to the heavy cost of gas (over £300 per annum), the B. of G. has appointed a committee to consider the desirability of adopting another form of lighting at the Workhouse.

Greenock.—Mr. F. S. Grogan has been giving demonstrations and lectures on electric cooking at the Town Hall, from Wednesday until to-day inclusive, under the auspices of the Corporation electricity department.

Helsby (Cheshire).—The Parochial Committee has decided to apply to the L.G.B. for sanction to borrow £1,000 for sewer extensions and conversion to electrical power at the water and sewage works.

Heston-Isleworth.—At last week's meeting of Brentford Union Board of Guardians, a letter was read from the electrical engineer to the Heston and Isleworth U.D.C., respecting the proposed lighting of the Workhouse buildings with electricity. He suggested the lighting of the board-room first; that would cost for installation £28, and the rest of the premises £108. It was recommended that the Board take the supply on the telephone system, and a quotation was given at £27 17s. per annum for 1,700 units. The clerk said the present cost of gas lighting for the board-room was £11 12s. 6d. Dr. Williams pointed out that many Boards of Guardians generated their own electricity, at a cost of about ½d. per unit, and he did not see why they could not do the same. Several other members objecting to the high price quoted, the Board referred the matter to the Engineering Committee.

Heywood.—The Bury T.C. recently decided to enter into an agreement with the Heywood Corporation for a supply of energy in bulk to Heywood, but the Lancashire Electric Power Co. has refused to give its consent to the agreement. The Town Clerk last week reported to the Bury Electricity Committee that in accordance with the instructions of the Council he had made application to the B. of T. for an order dispensing with the company's consent.

India.—SIMLA.—The engineer in charge of the electricity department of the Simla Municipality has been instructed to submit detailed proposals, with estimates, for the extension of the electrical power house plant, sub-station equipment and mains. —*Indian Engineering.*

Leyton.—Last week Mr. P. M. Crosthwaite held a L.G.B. inquiry into the application of the U.D.C. for a loan of £5,600 for electricity purposes– services and mains. There was no opposition.

Littleborough.—The price of energy for lighting purposes is to be reduced from 5d. to 4½d. from October 1st.

At a special meeting of the D.C. last week plans and estimates for extensions of cables and other work amounting to £2,000 were approved. It was decided to increase the amount to £4,000 to provide for future mains and service cables and additional transformers, and to apply for sanction to borrow this sum. Mr. Hawtayne, consulting engineer, was instructed to proceed at once with the laying of the four-core cable from Victoria Street to Joseph Street.

London.—BATTERSEA.—Electricity mains are to be extended in various parts of the borough at a cost of £298. At the last meeting of the Borough Council the Law and General Purposes Committee submitted a report upon the arbitration proceedings instituted by the Board of Trade to settle the differences between the Council and the London Electric Supply Co., Ltd., as to the route, &c., which should be taken by the company in laying their mains through the borough. At an early stage of the hearing, the Committee stated, the question was raised by the company as to whether the Council was bound by the terminal boundary points already settled with the adjoining boroughs, and would, therefore, have to submit an alternative route between those points. The engineer of the company also stated that the company had revised their proposals, and desired to lay four pipes only instead of eight, and were prepared also to put them vertically where necessary or advisable. At a later stage the Council's engineer suggested that an adjournment should be made for consultation between himself and the borough surveyor and the electrical engineer. As a result of this consultation, a proposal was tentatively agreed to for submission to the Council for approval, and the arbitration was then adjourned until September 30th, in order that the decision of the Council might be obtained. The proposal mentioned is (1) that the Council agree to a certain route starting along the north side of York Road, to the eastern end of the borough; and (2) the company to pay the cost of trial holes made by the Council, the other costs of the Council in connection with the arbitration, and the Arbitrator's costs. Under the circumstances the Committee recommended the Council to agree to the route suggested on the terms referred to.

HAMMERSMITH.—The Council has agreed to an application from Messrs. J. Lyons & Co., Ltd., for the supply of electricity to their premises, 2, Hammersmith Road, for a period of five years at 1d. per unit.

Mains are to be extended to Aldensley Road at a cost of £177.

Long Eaton.—The U.D.C. has received from the L.G.B. sanction to loans of £4,407 for generating plant, £2,701 for a boiler and economiser, and £2,741 for extensions to the electricity works buildings.

Luton.—The L.G.B. has sanctioned the borrowing of the following amounts for the purposes of the undertaking:—£8,800, repayable in 25 years, for new buildings; £24,000, repayable in 15 years, for new plant, and £5,000, repayable in 25 years, for mains

Macroom (Co. Cork).—At a meeting of the Urban Council, the chairman, Mr. John O'Shea, drew attention to the unsatisfactory public lighting of the town by electricity. For two or three weeks past the lighting had been practically useless. It would be well, however, that the private consumers should know that a new engine was being laid down with a view to supplying the town with a good and reliable service. The clerk said that Mr. Smith proposed to expend £1,000 in improving the electric lighting of the town, and in providing improved and reliable plant for the purpose. The chairman said that the engine was ordered, and would soon be erected. They would not, therefore, be any longer dependent on the water power as they were at present, and they would in the future have better lighting.

Manchester.—The electrical workers employed by the local contractors have decided to give a month's notice unless their demand for an advance of 1d. per hour is granted.

LEVENSHULME.—St. Peter's new schools are to be lighted by electricity.

Market Weighton.—Mr. C. H. Best and Mr. Charles Pullan, of Bradford, propose forming a company with a capital of £2,000 for the purpose of supplying electric current for lighting and power at Market Weighton, where gas is 5s. per 1,000 cb. ft., and, with this end in view, have persuaded the Market Weighton and Arras Parish Council to meet them to discuss matters.

Mexborough.—Last week the E.L. Committee spent five hours in investigating complaints presented by the electrical engineer (Mr. John Senior) against a wireman jointer named Harold Kemp. The matter was referred to the Council meeting held the following evening, when the Council sat with closed doors until midnight and heard the statements of both parties concerned and other witnesses. At the end of the consideration a very sharp division of opinion was indicated, the voting being seven to six, and, as two members of the Council were absent, it is probable that the matter will be further discussed.

Middlesbrough.—A report on the system of charging for electricity was submitted to the Gas and Electricity Committee by the electrical engineer, Mr. H. M. Taylor. He favoured separate charges for lighting, and for cooking, heating and power. He did not think the system based on the rateable value could be worked satisfactorily. He favoured a charge of 1d. per unit for heating purposes only. The Committee, after discussion, decided to reduce the charge per unit for domestic purposes from 2d. to 1d.

Morley.—The annual financial statement of the Corporation electricity department shows that though there is a deficit of £619 on the year's working, this is £164 better than the previous year. The revenue showed an increase of £401, and, together with sundry receipts, amounted to £3,476. The expenditure amounted to £2,152. There was a gross profit of £1,325 on the year's working, but a deficit was caused by the payment of £839 interest on loans, and £1,105 to the sinking fund. The number of units generated at the station was 242,637, of which 41,394 were supplied for the public lamps, and 138,692 were sold to private consumers by meter at 6d. per unit.

Newport (Mon.).—Mains are to be extended to Friars Road and Brynglas Road, at a cost of £328.

New Zealand.—We read in the *Australian Mining Standard* that a wiring scheme is proposed by the Christchurch (N.Z.) City Council, and is embodied in the Christchurch Electrical Supply Empowering Bill, which passed its second reading at the end of July. The Bill is to authorise the Council to expend £30,000 in the form of loans to ratepayers who desire to have electrical installations in their dwellings. The Council has already been authorised by the ratepayers to borrow £120,000 for carrying out the Lake Coleridge scheme for the generation of electrical energy, and desires to obtain the sanction of Parliament to apply a small portion of that loan to encourage ratepayers to use their own power by advancing the amounts necessary to procure its installation, the money so advanced to be repaid in five years. It was stated by Mr. T. W. Davey, when moving the second reading in the House of Representatives, that whereas gas companies were in the habit of monopolising gas fitting, the City Council had no intention of monopolising electrical installation work, and the opposition which contractors in Auckland and Wellington had shown to the Bill was based on an entire misapprehension of its purpose and scope. "If the contractors," he said, "only knew on which side their bread was buttered, they would support the Bill, because it ensured that when their contract was completed they would get their cheque from the Council."

Nuneaton.—The T.C. has resolved to have 25 existing gas lamps converted to electric lamps.

Portsmouth.—The E.L. Committee is extending its mains in a number of streets.

Preston.—Mr. Gibbs, electrical engineer, in a report to the Guardians upon the disposal of the large engines for generating electricity at Fulwood Workhouse, stated that the maximum current the Board was ever likely to require at any time was 250 amperes, which would include the charging current of the battery. He recommended the installation of another engine and dynamo of 250 amperes capacity, together with the retention of the present small engine. This would allow the Board to dispose of the two big engines, which would leave a balance in the Guardians' favour, after payments for alterations in the foundations. The Board deferred consideration of the matter.

The Corporation Estate Committee has consented to the R.D.C. carrying an overhead wire on poles, about 20 ft. high, across the Ribble and Holme—until the new bridge is completed, when it will be laid underground—for the purpose of obtaining electric power to pump the sewage of Middleforth.

Rawtenstall (Lancs.).—At a meeting of the T.C. on September 18th, Councillor Parkinson asked for consideration to be given to the question of lighting the whole of the roads in the

borough by electricity. Councillor Trickett replied that the matter would be considered in due course.

The Lighting Committee has given instructions to the electrical engineer and tramways engineer and the lighting superintendent with regard to the lighting by electricity of Bury Road and of Hall Carr Road.

Rochester.—By arrangement with the T.C. the E.L. Co. is making an experiment in lighting the High Street with electricity by means of four 100-c.p. lamps suspended from wires fixed to the tramway poles.

Rothesay.—The scheme drawn up by Mr. J. A. Robertson, of Greenock, for an electric light and power scheme and refuse destructor was considered last week by the Rothesay T.C., and after three hours' discussion was adjourned for further consideration. Mr. Robertson says that by adopting a destructor there would be a saving as compared with the present method of refuse disposal.

Salford.—Annual Accounts.—The borough treasurer's report states that the electricity department was not able to show a profit after £4,618 had been paid to the depreciation and renewals fund. This was £7,000 worse than the previous year's trading. There was an increase in the cost of generation, distribution, &c., including replacement of machinery after the disastrous fire, of £17,160. In respect of the fire, £11,330 was received from insurance companies. The tramways department showed a net surplus of £22,000, which was £4,000 better than the previous year. There was an increase in traffic receipts of £6,403, whilst several other factors contributed to the improved position of the undertaking. On the other hand, the traffic and general expenses increased by £7,312, and £2,240 was expended on covered tops for bogie cars.

South Africa.—Cape Town.—The City Council has decided to lay additional cables from the Dock Road power station to the Molteno power station. The estimated cost of these cables is £5,000. Tappings from the cables will be carried to the Mount Nelson Hotel, and they will also be used eventually in connection with the Table Mountain Railway, and the anticipated bulk supply to the United Tobacco Factories.

Worcester (Cape Province).—The Municipal Council has decided to entrust a scheme for the supply of electric light and power to Mr. Thomas Stewart, engineer, Cape Town. The arrangement is that an electrical engineer, whose name and qualifications must first be approved by the Council, shall work in conjunction with Mr. Stewart. The prime movers in the installation will most probably be water turbines.

Southampton.—A L.G.B. inquiry is to be held into the Council's application to borrow £16,720 for the electricity undertaking, and £4,400 for a refuse destructor.

Steyning (Sussex).—Mr. C. B. Oxley, of St. John's, Fletcher's Croft, Steyning, has announced his intention to apply to the B. of T. for a prov. order for electric light at Steyning, Bramber and Upper Beeding.

Stirling.—At a meeting of the Corporation a further letter was read from Mr. G. Balfour, of Messrs. Balfour, Beatty and Co., London, regarding his proposals for the electrification of the tramways. Mr. Balfour wrote that he assumed that the particulars of his scheme which were of the greatest importance at the present moment were those relating to his proposal to acquire Stirling burgh electricity undertaking. He said he was prepared to pay £28,642 to cover the unredeemed debt on the undertaking, an additional sum of £2,250 to refund the Council the difference in accumulated debit balances, accumulated up to the year 1908, and the credit balances carried to reserve since that date; and, in addition, a sum in cash of £2,000, making a total of £32,892. Mr Balfour said he appreciated the objections of the Council to holding the cash amount of the unredeemed debt on the undertaking as an investment until redemption became due under the existing arrangement, and he had, therefore, added to the amount of unredeemed debt the cash amounts totalling £4,250. He also promised a reduction in the charges for energy. As far as he could calculate on the figures at his disposal, the aggregate value of all reductions would amount to between £800 and £900 per annum. Mr. Balfour also stated that the costs incidental to the transfer would be borne by him. The letter was remitted to the Tramways Committee to report.

Swansea.—Annual Accounts.—The accounts of the electricity department issued by Mr. Prusmann, the electrical engineer, show that the capital expenditure is £190,272, of which £43,379 has been repaid. The revenue amounts to £29,112, an increase of 1·73 per cent. Total costs were £16,588, and the gross profit £12,537, while the net profit on the year's working was £2,133. The total units sold were 3,127,229, or 15·17 per 32-watt lamp. The average price obtained was 2·16d. Works costs were £12,257, or ·94d. per unit sold, an increase of 9·04 per cent. Management expenses, salaries, &c., totalled £16,588, or 1·273d. per unit sold.

Tadcaster.—The electric power cable in Lock Lane is to be extended to the new sewage works.

Tonge (near Bolton).—The new Sunday school for St. Chad's, in Belvoir Street, will be lighted by electricity.

Tunbridge Wells.—Thirty-five gas lamps in the town are to be converted from gas to electricity. The B. of T. has forwarded a formal order permitting the Corporation to supply energy to several places outside the borough boundary. The question of applying for a provisional order extending the area of supply is under consideration.

Tyldesley.—To celebrate the inauguration of the electric supply to Tyldesley, the Lancashire Electric Power Co. entertained 40 guests representative of various local bodies at dinner on September 18th. Mr. F. Isherwood said the local Electric Lighting Order was obtained in 1902, and in 1904 the Council was advised to take a supply of electricity from an outside source. Later the order was transferred to the Lancashire Electric Power Co., under an agreement which gave the local authority power to take it over again at the end of 7, 14, 21 or 28 years. Regarding the matter as a business proposition, he thought that the Council had acted wisely.

Warrington.—A scheme of extensions in connection with the electricity undertaking, involving an expenditure of £16,000, has been considered and approved by the Electricity and Tramways Committee. The extensions are rendered necessary owing to the ever-increasing demand for power. The proposal includes the provision of a 2,000-kw. turbo-alternator and a water-tube boiler of about 4,500 sq. ft. heating surface.

Witney.—The new plant at the generating station is completed and ready for preliminary running and tests by the makers.

TRAMWAY and RAILWAY NOTES.

Australia.—Mr. Justice Burnside recently delivered the award of the West Australian Arbitration Court in the dispute between the Kalgoorlie Electric Tramways, Ltd., and its employés. The award fixes the minimum wage of drivers at 11s. a day, 48 hours to constitute a week's work, but the company may employ drivers and conductors 54 hours per week, exclusive of Sunday, at ordinary rates. After nine hours in one day, or 54 hours in a week, overtime is to be paid at the rate of time and a quarter. Sunday work is to be paid at time and a half, but if the company is compelled, by agreement with the municipal councils, to maintain a Sunday service, the ordinary rate is to prevail. Drivers and conductors are to be granted seven days' holiday annually on full pay. —*Australian Mining Standard.*

Sydney (N.S.W.).—From the report of the Chief Commissioner on the working of the tramways for the year ended June 30th, it appears that during the year tramway extensions totalling 12 miles 14 chains were opened for traffic, making the line mileage 207¾, while a number of new lines are under construction and further extensions are contemplated. Good progress has been made with the erection of the new tramway power house at White Bay, Balmain, and a portion of the plant has been erected on permanent foundations, and is now under steam. The total staff employed in connection with railways and tramways on June 30th numbered 41,322, as compared with 37,605 in the previous year, an increase of 3,717.—*Financier.*

Argentina.—In 1905 the City Council granted a concession to Messrs. Varela & Cuneo for an electric tramway in the Federal capital to join up with one to the Tigre. The concession was transferred to the Buenos Ayres City and Suburban Tramways Co., which was connected with the Buenos Ayres Port and City Tramways Co. As the period allowed by the contract has expired, and the work has not been commenced, the Mayor has imposed a fine of $1,000.

The San Juan Legislature has approved a Bill granting a concession to Mr. Eugenio Vargas for the construction of electric tramways in that city.—*Review of the River Plate.*

Belfast.—At the fortnightly meeting of the Tramways Committee on Monday, the surcharge of the bonus paid to the employés was reported, and the members concerned decided to appeal to the Local Government Board to have the surcharge—which amounts to over £2,000—rescinded. The National Amalgamated Union of Labour asked to have the wages of the employés increased by ½d. per hour in lieu of the surcharged bonus. The matter was deferred.

Bolton.—In his annual report, Mr. A. Pilling, electric auditor, says the traffic revenue has increased in a remarkable manner. With the same average number of cars in use per day as in the previous year, the receipts have increased by £3,994. The department has a disposable profit of £16,436, an increase of £6,584.

Canada.—Nelson, B.C.—It is officially announced that arrangements are about completed for ordering four electric locomotives at an approximate cost of $75,000 each, to be used on the Castlegar to Rossland line of the Canadian Pacific Railway, which is to be electrified shortly. Already the West Kootenay Power and Light Co. has made arrangements to increase the capacity of its power plant at Bonnington Falls, and the necessary machinery is being ordered; 9,000 h.p. is being added to the plant. The completion of the electrification of this route is expected to overcome the difficulties now experienced on the heavy grades on the Rossland hill, and a material reduction will be made in the time of the run from Castlegar to Rossland.—*Canadian Engineer.*

Chadderton.—The U.D.C. has instructed its Parliamentary agents to seek powers on its behalf for the running of motor-omnibuses in the district.

Croydon.—The B.C., on Monday, upon the recommendation of the Tramways Committee, passed a resolution urging the Government speedily to legislate upon the lines of the recommendations of the Motor Traffic Select Committee, owing to the dangerous and congested state of the streets of Croydon, the serious accidents and loss of life, through the influx of motor-'buses. Five persons have been killed in the streets of Croydon this year by these vehicles, but none by tramcars.

Dearne Valley.—The Urban District Councils of Bolton, Wath, Thurnscoe and Wombwell, in the Dearne Valley of Yorkshire, have decided to promote a Bill in Parliament granting the Councils power to undertake a tramway scheme for the linking-up of the various districts under their control.

Edinburgh. — A number of proposals for tramway extension are before the Council's Tramway Committee. At last week's meeting, it was moved that the Committee consider the advisability of promoting a provisional order for the extension of the tramways to Redford Barracks and the Dreghorn district. The proposal is to extend the Colinton Road tramways, so as to form a circular route linking up the City Fever Hospital and the poorhouse with Morningside. The burgh engineer was instructed to prepare a plan of the proposed route. The town clerk was asked to bring a previous report regarding extensions beyond the city bounds up-to-date, while a sub-Committee was instructed to consult with the tramway company on the subject of extension to Corstorphine.

Glasgow.—The T.C., after negotiation, has arranged with the Caledonian Railway Co. in connection with expenses incurred by the re-erection of bridges at certain points to carry the tramway lines over the railway system. The work, it appeared from the Corporation minutes, was largely departmental, three T.C. departments and the company being involved, while the amount rendered against the latter was £5,207. The Corporation Committee in charge has decided to accept the offer of the company of £3,000 in full settlement of the accounts, the sum to be allocated as follows—viz., £251 to the gas department, £406 to the electricity department and the balance of £2,343 to the tramways department.

Leith. — The T.C. Tramways Committee is asking for a conference with Edinburgh Town Council, regarding the proposed extension of Leith tramways eastwards from Seafield terminus.

Manchester.—On Tuesday a deputation of tramway workers waited on the Workmen's Committee of the Manchester Corporation and pressed a claim for an extra day's holiday in consideration of the exceptional nature of their employment. It will be remembered that the Tramways Committee conceded the men's claim for seven days' holiday per annum with pay, instead of six days as at present, but the Workmen's Committee rejected the application but consented to receive a deputation. The Committee has now decided to recommend the Council, having regard to the exceptional circumstances under which they are employed, to give tramcar drivers, guards and trolley boys the extra day's holiday per annum, with pay.

Newcastle.—The question of extending the tramways to Benton has been under discussion by the City Tramways Committee and the Benton D.C. A further consultation may be held at an early date.

Northampton.—The B. of T. has sanctioned the extension of the Corporation tramways to Far Cotton. The scheme has been delayed for the widening of the South Bridge, which has now been completed, and the metals on this part of the road have already been laid.

Preston.—The Corporation Tramways Committee has had before it an application signed by drivers and conductors, asking it again to consider the advisability of covering in the ends of cars. The Committee has deferred consideration, and instructed the engineer to report after inspection of the Leeds cars. It has accepted the tender of Leyland Motors, Ltd., for the supply of a motor tower wagon for the sum of £735.

Rochdale.—Recently the Corporation tramway employés sent in a demand for higher wages and improved working conditions, and certain concessions were granted by the Tramways Committee, which will cost £350 a year. The men were not altogether satisfied, and, as a result of a further demand, the Committee has agreed to pay time and a quarter to all the men after working 11 hours, and also consented to their reaching the maximum rate of pay in four years, instead of five.

South Africa.—The *Financier* quotes the Mayor of Durban as stating, while referring with satisfaction to the deferred decision of the Council with regard to a proposed important extension, that recent developments in connection with road traction appeared to him to indicate that the days of the tramway track were numbered, and that motor and electric 'buses would ere long supplant the tramcar equipment.

Southport.—Annual Accounts.—The report of the Borough Treasurer (Mr. Lloyd) shows that the Tramways Committee had an income of £17,314 ; working expenses were £12,492, and the gross profit £4,821. £5,224 was received from the Tramways Co. for the lines leased to them, but after charges for interest, sinking fund, and depreciation had been made, there was a deficit on the year's working of £1,651, this bringing the adverse balance on tramways account from £5,200, at which it stood on March 31st, 1912, to £6,852 on March 31st, 1913. The capital account of the Tramways Committee now stands at £196,179. The debt extinguished totals £83,260, and there was £13,238 credited to renewals fund, whilst the sinking fund available totalled £5,266. The Electricity Committee had a net profit of £1,363.

Tottenham.—The District Council is urging the Metropolitan Electric Tramways Co. to remove the centre poles on their system in the district.

West Ham.—The B. of T. has agreed to the Council's proposal to increase the maximum speed limits on the tramways.

TELEGRAPH and TELEPHONE NOTES.

Amateur Wireless.—The Postmaster-General has requested all the police authorities of Great Britain to assist in the prevention of unofficial and unauthorised wireless telegraphy, especially with portable wireless apparatus.

Berlin-Rome Telephone.—The trans-Alpine telephone from Berlin to Rome, *via* Berne and Milan, is approaching completion. This international line, which passes through the Simplon Tunnel, is the longest on the Continent as a "through" line between capitals. In several sections it passes over Swiss mountains, and precautions have been taken to prevent avalanches sweeping it away in winter. Most of the cost is guaranteed by Germany and Italy.—*Standard.*

Canada.—The Department of Marine and Fisheries is going to erect a wireless telegraph station near Fort Henry for the purpose of forming a connecting link between Montreal on the east and Toronto on the west, in a chain of stations reaching across Canada from Labrador to Vancouver.

Isle of Man.—Thanks to the intervention of the Lieutenant-Governor, the cessation of the telephone service at Douglas threatened by the Post Office has been averted, and the authorities are making arrangements to continue the service to the notified subscribers.

Morocco.—The Committee for Foreign Affairs of the French Chamber of Deputies recommends an expenditure for postal, telegraph and telephone services of £428,000.—*Board of Trade Journal.*

Postal Servants.—The Post Office has issued a statement in reply to the resolutions passed at local meetings of the postal employés condemning the Holt Committee's report, showing that, in addition to the advantages of security of tenure, prospect of a pension, holidays (on full pay), &c., the postal service compares favourably with similar outside employments in point of wages. Telegraphists in the large provincial towns will receive 44s. a week after 10 years' service, with a maximum of 58s. ; in the smallest towns 39s. and 42s., for 45 hours' work, representing in each case a rise of 2s. a week in the maximum wages. Very considerable concessions have been made to the engineering classes, the number of established employés being increased by 35 per cent. and the hours of duty in minor grades being reduced from 50½ to 48 a week. Unestablished skilled workmen will receive increases up to 2s. 6d. a week and labourers up to 2s. 9d. The net cost of the Committee's recommendations will exceed a million sterling per annum.

The National Joint Committee of the Postal Organisation, by way of rejoinder, states that the extra expenditure named will not be reached for at least 10 years, and that most of the London employés get little or no increase.

Train Control. — A wireless train-control system, invented by Prof. C. Wirth, of Nuremberg, has been successfully tested on the Bavarian State Railway Lines, in the presence of British railway officials.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

March 18th, 1914.—Tenders are invited by the Postmaster-General for the supply, delivery, and erection of automatic telephone switchboards, with associated equipment, at the Epping, Ryde, Hunter's Hill, Drummoyne, Wahroonga, Paddington and Waverley exchanges, New South Wales. — *Australian Mining Standard.*

Sydney.—October 15th. For the P.M.G. ; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

October 14th.—For the P.M.G. A common-battery multiple switchboard.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

October 15th.—20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" September 19th.

Melbourne.—October 1st. Lead-covered cable, for the City Council. See "Official Notices" September 19th.

October 7th.—Six 60-K.V.A. and one 30-K.V.A. single-phase transformers, for the City Council. See "Official Notices" Sept. 19th.

October 7th.—33,300 carbon-filament lamps, for the City Council. See "Official Notices" September 19th.

October 8th.—City Council. Lead-covered cable. See "Official Notices" to-day.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" to-day.

Brisbane.—November 19th. For the P.M.G. Wire, bronze, 100 lb. per mile. See "Official Notices" to-day.

Belgium.—October 4th. The Fonderie Royale de Canons in Liége (80, Quai Saint Leonard) is inviting tenders for a quantity of electric cables for the forts in the Liége and Namur districts.

October 11th.—The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine) are inviting tenders for a quantity of electric cable.

January 2nd, 1914.—Tenders are invited for the supply and erection of an iron bridge, with mechanical and electrical fittings complete. Guarantee deposit after acceptance, 10,000 fr. Cahier des Charges No. 104 (80 centimes) and drawings (1·60 fr.), on application to the Musée Commercial, 15, Rue des Augustines, Brussels.

Canada.—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

Dundee.—September 29th. (1) Construction of tramways in Blackness Road, and (2) supply of 170 tons of steel tramway rails and of manganese steel points and crossings and steel tie bars. Specifications from Mr. J. Thomson, city engineer. Deposit £2 2s. (returnable).

France.—October 15th and 18th. The French State Railway authorities (Bureaux du Service Electrique, 2me Division) in Paris (43, Rue de Rome) are inviting tenders until October 15th for four cables for three-phase current, 15,000 volts, 25 periods, of a section of 3 × 150 sq. mm., to connect the Moulineaux generating station in Paris on the one hand with the Viroflay sub-station, and on the other with the Porchefontaine sub-station. The same authorities are also inviting tenders until October 18th for two high-tension three-phase cables between the Moulineaux station and the Vaugirard-Marchandises sub-station.

Paris.—October 2nd. Supply of insulators and galvanised iron wire for the postal and telegraph service in Senegal, in two lots. Particulars, Ministère des Colonies, Paris.

Germany.—October 11th. The Bremen Railway Construction Office, in Bremen, is inviting tenders for two 30-cwt. electrically-operated cranes.

Holland.—October 1st. The municipal authorities of Leeuwarden are inviting tenders for a quantity of electric cables for the electricity supply service in the town.

Ilkley.—October 6th. (Sec. 1) Prime-movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" September 12th.

Keighley.—October 1st. 6,600-volt 3-phase A.C. transmission line (two miles) for the Corporation. See "Official Notices" September 19th.

Leicester.—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" September 5th.

October 7th.—Car repairing shops for the Corporation tramway department. Mr. E. G. Mawbey, borough engineer (returnable deposit of £2).

London.—Bermondsey.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

Hammersmith.—Tenders are to be invited by the Electricity Committee for clearing away ashes and clinker during 12 months; and for the supply of a mechanical stoker and hard dry coal.

Middleton.—October 6th. Steam coal, for a year, for the Corporation electricity works. Mr. S. Pauls, electrical engineer.

New Zealand.—October 31st. Telephone instruments and accessories for Lake Coleridge power scheme. Specification may be seen at Board of Trade (C.I. Dept.) in London.

November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire, for two years. Specifications from Electrical Engineer, Dunedin.

December 11th.—Switchboard and accessories for Wellington Corporation E.L. Dept. Specification may be seen at Board of Trade (C.I. Dept.) in London.

Tenders are also invited for the supply of two A.C. pressure regulators for 3,000 and 400 volts. British manufacturers can obtain particulars at the B. of T. Commercial Intelligence Department.

Rochdale.—October 13th. Mechanical filtration work, including turbine or water motor, &c.; also electric lighting plant. Specifications, &c., from Mr. F. H. Brunt, engineer and manager, Waterworks Office, Lord Street. Deposit £3 3s.

Salford.—September 29th. Compound air compressor, for the electricity department. Specifications, &c., from Borough Electrical Engineer, Frederick Road, Pendleton.

September 29th.—Rotary converters for the Corporation. See "Official Notices" September 19th.

Saxmundham (Suffolk).—October 2nd. Sewerage and sewage disposal works, with pumping and electrical plant, dynamos, motors, cables, switches, &c., for the R.D.C. Mr. P. F. Mackenzie Richards, engineer, 53, Victoria Street, Westminster, London. (Returnable deposit of £5 5s.)

South Africa.—Johannesburg.—November 24th. Electric light fittings for the Town Hall and Municipal Buildings. See "Official Notices" to-day.

South Shields.—October 15th. Corporation. One 2,000-KW. turbine, direct coupled to two three-phase generators in tandem, together with condensing plant, rotary converters, transformers and switchgear, &c. See "Official Notices" to-day.

October 25th.—Corporation. Five or ten top-covered tramcars complete. See "Official Notices" to-day.

Spain.—The municipal authorities of Pozoblanco (province of Cordoba) have just invited tenders for the concession for the electric lighting of the town during a period of six years.

Walthamstow.—October 8th. L.T. feeder cable for the Electricity Department. See "Official Notices" September 19th.

Warrington.—October 14th. Corporation. (1) Low-tension cable; (2) low-tension feeder panel. See "Official Notices" to-day.

Worthing.—September 29th. Corporation. Diesel engine and D.C. generator. See "Official Notices" September 12th.

CLOSED.

Australia.—The contract for main steam pipes and valves for power house, Canberra, Federal Territory, has been placed with Stewarts & Lloyds (Australia), Ltd., at £374.—*Australian Mining Standard.*

New South Wales.—P.M.G.—
Copper binders, zincs, &c.—I.-R., G.-P. & T. Works Co.
Copper tapes, tinned copper wire, &c.—B.I. & Helsby Cables, Ltd.
Copper wire.—R. Johnson, Clapham & Morris.
Tinned copper wire.—Noyes Bros.
Outside distributing wire.—W. T. Henley's T. Works Co.
2,500 cells.—R. J. Connolly.
10,000 connectors.—British G.E. Co., Ltd.
20,000 battery leads, 40,000 zincs, suspenders, &c.—Lawrence & Hanson Electrical Co.
50,000 porous pots, 20,000 tubes.—I.-R., G.-P. & T. Works Co.
Insulating tapes.—W. G. Watson & Co.
Australasian Record.

P.M.G.—
60,000 jointing sleeves.—Theodore Zwicker & Co.

Public Works Department.—
Electric passenger elevator (£1,415), and electric goods elevator (£800) for Parcels Post Office, Sydney.—Standard Waygood Elevator Co., Ltd.
Tenders.

Queensland.—P.M.G.—
Copper binders.—I.-R., G.-P. & T. Works Co.
Jointing sleeves.—Brabant & Co.
Jointing sleeves.—Theodore Zwicker & Co.
Copper wire (349 tons); bronze wire (122 tons).—G. Wills & Co., Ltd.
Five nauts of submarine telegraph cable, £141 per naut.—Siemens Bros. Dynamo Works.
Paper-insulated lead-covered cable.—Western Electric Co.
Paper-insulated lead-covered cable.—Noyes Bros.
Eight tons galvanised steel wire.—Johnson, Clapham & Morris.
22,000 glazed earthenware conduits.—Brunswick Brick, Tile and Pottery Works Proprietary.
7,000 carporous pots.—British General Electric Co., Ltd.
4,000 Callaud battery zincs.—Lawrence & Hanson Electrical Co.
1,000 Leclanché zincs.—I.-R., G.-P. & T. Works Co.
Tenders.

Victoria.—Public Works Department.—
30 electric radiators for use in various Government buildings.—Sutherland and Ashman, £118.
Tenders.

Austria.—The Austrian Siemens-Schuckert Co., of Vienna, has secured a contract from the municipal authorities of Koplitz, Bohemia, for the establishment of a central electric lighting station in the town.

Belfast.—The B.C. Tramways and Electricity Committee has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable, and that of the British Thomson-Houston Co., Ltd., for switchgear.

Belgium.—The Belgian State Railway authorities in Brussels have just placed an order with the Ateliers de Construction et d'Estampage d'Awans, of Awans-Bierset, for a 25-ton electrically-operated travelling crane for the railway workshops at Malines.

Cardiff.—The E.L. and Tramways Committee met last week to receive some 50 tenders for plant, including a turbine alternator, a rotary converter and boiler-house accessories for the Roath power station. The Committee instructed Mr. Ellis (the manager) to tabulate them and report at a meeting called for to-day (Friday).

Cape Town.—The Council has placed an order with the British Westinghouse Co. for a 300-KW. rotary converter, with transformers and switch panel, for £1,033. The total cost of switchgear and delivery and erection of plant is estimated at £1,400.

Epsom.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for 400 yards of cable, at £133, and for 1,400 yards, at £355.

Faversham.—The T.C. has accepted the tender of the Campbell Gas Engine Co., Ltd., for an exhausting scoop for the engine at the electricity works.

Germany.—Messrs. Windhoff & Co., of the Rheinen Maschinenfabrik, at Rheine, Westphalia, have submitted the lowest tender (£932) for the supply and erection of an electrically-operated locomotive turn-table, 65 ft. dia., for the Prussian State Railway authorities at Stettin.

Glasgow.—The T.C. Committee on Tramways Works and Stores has recommended acceptance of the following offers :—

Section pillar switches.—B.I. and Helsby Cables, Ltd.
Telephone switchboard for head office.—J. Macmillan & Co.
Westinghouse commutators.—P. R. Jackson & Co., Ltd.
Valves for Pinkston power station.—Dewrance & Co.; Hopkinson & Co.
Copper bonds.—R. R. Todd.
Lamps.—Lux Lamp Co., Ltd.

The Electricity Committee on Works has recommended that the following offers should be accepted :—

British Westinghouse Co., Ltd.—Two sets of 500-KW. size, at £2,573.
Siemens Bros. Dynamo Works, Ltd.—Two sets of 250-KW. size, at £1,787.

These offers were in each case the lowest.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Electric cable.—Hooper's Telegraph and India-Rubber Works, Ltd.; Johnson & Phillips.

CROWN AGENTS FOR THE COLONIES.

Train lighting cells.—Chloride Electrical Storage Co., Ltd.
Spiral joints, &c.—Siemens Bros. & Co., Ltd.
Telegraph poles.—Bullers, Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Accumulators.—Hart Accumulator Co.
Cells.—Siemens Bros. & Co.
Insulators.—Taylor, Tunnicliffe & Co.; Bullers, Ltd.
Lamps.—General Electric Co.
Projectors.—Siemens Bros. Dynamo Works Co.
Telegraph apparatus.—Elliott Bros.

POST OFFICE.

Telephonic apparatus.—Automatic Telephone Co,. Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co , Ltd.
Electric light cable.—Hooper's Telegraph and India-Rubber Works, Ltd.
Telephonic cable.—Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co , Ltd.; Western Electric Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Solder.—British Insulated and Helsby Cables, Ltd.
Rod zincs.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric passenger lift, Dublin G.P.O.—A. & P. Steven.
Telephonic exchange equipment, Manchester City Exchange and Birmingham Victoria Exchange.—Western Electric Co., Ltd.; ditto, Smethwick P.O..—British L.M. Ericsson Manufacturing Co., Ltd.

Keighley.—The contract for the transformer, switchgear, three-phase motors, from ½ to 40 H.P., wiring, &c., in connection with the electrification of the Eastwood Bottoms Mill of Messrs. Ira Ickringill & Co., Ltd., has been placed with the "Schorch" Electrical Co.

Long Eaton.—The U.D.C. has accepted the tender of Messrs. Perks & Son, Ltd., at £3,003, for carrying out work at the electricity station.

Luton.—The tender of Messrs. S. H. Heywood & Co., Ltd., has been accepted by the T.C., at £725 10s., for the supply and erection of an electrically-driven 15-ton travelling crane.

Newport (Mon.).—The Tudor Accumulator Co. are to be asked to weld 300 tramway rail joints, at 27s. 6d. if carried out during the daytime, and at 35s. if done at night.

Rochdale.—Messrs. Turner Bros., Ltd., have placed an order with the "Schorch" Electrical Co., Ltd., for about 300 "Schorch" motors for their various departments, to replace mechanical shaft driving.

London.—HACKNEY.—The Electricity Committee has reported giving the following results of tenders received :—

HIGH-TENSION RING MAIN CONDUITS.

Foote & Milne, Ltd. .. .. .. (recommended)	£16,019
William Griffiths, Ltd.	20,773
Dick, Kerr & Co., Ltd.	22,835

SUB-STATION PLANT.

General Electric Co. (with Westinghouse transformers)	£6,991
do. (with Brush transformers)	6,691
Brit. Westinghouse Electric and Manufacturing Co.	7,006
Siemens Bros. Dynamo Works, Ltd., (with Siemens transformers)	7,051
do. do.	6,931
British Thomson-Houston, Co. (with Brush transformers) ..	7,159
do. (with Westinghouse transformers)	7,555
do. (with Brit. Elec. Co.'s transformers)	7,793
do. (with Brush transformers and step starting) ..	6,999
do. (with Westinghouse transformers and step starting	7,395
do. (with Brit. Elec. Co 's trans. and step starting ..	7,658
Bruce Peebles, Ltd. (with La Cour converters) (recommended)	8,166
Vickers, Ltd. (Brush transformers)	8,189
Electric Construction Co. (motor generators)	8,436

The whole of the tenderers quote for rotary converters excepting Messrs. Bruce Peebles, Ltd., who quote for La Cour motor converter. In regard to these tenders the Committee says :—

The difficulty in adjudicating upon the tenders for this section is that of coming to a proper decision as to which class of machine is the most suitable for the purpose. The choice is a most controversial matter among engineers. Users of rotaries pin their faith to rotaries, and the same remark applies to users of the La Cour machine. The engineer has done all he can to obtain the experience of those who are running both types of machine, and we find that, at any rate in East London, opinion seems to favour the La Cour machine; but over the country generally there is no very definite bias in either direction—the one class of machine appears to be generally as satisfactory as the other. There is no doubt that the efficiency of the La Cour machine is slightly less than that of the rotary, which is a point in favour of the rotary, in addition to the advantage of lower first cost. These are undoubtedly two strong points in favour of the rotary, but there the advantages appear to end. In favour of the La Cour machines we have machines running at 500 R.P.M. instead of 750 R.P.M. which tends towards securing the quiet running we so much desire in our sub-stations, also less space is occupied, and possibly these machines are more stable during troublous times with the mains. In view of the fact that the La Cour machines are used at Poplar, Stepney and Stoke Newington and that there is a possibility in the not far distant future that East London Boroughs will be linked up, we think it desirable that our plant should as far as possible match that of our neighbours, and in all the circumstances, we feel that the Council will be better advised to adopt the La Cour type of machine. We therefore recommend that the tender of Messrs. Bruce Peebles, Ltd., amounting to £8,166, be accepted for the motor converters of the La Cour type.

SUB-STATION SWITCHGEAR AND CONNECTIONS.

Johnson & Phillips, Ltd. .. .. (recommended)	£4,748
General Electric Co , Ltd.	5,187
Electric Construction Co., Ltd.	5,632
A. Reyrolle & Co., Ltd.	5,759
Siemens Bros. Dynamo Works, Ltd.	5,778
British Thomson-Houston Co , Ltd.	5,909
Brit. Westinghouse Elec. and Manufacturing Co., Ltd. ..	6,212
Ferranti, Ltd.	6,832
Switchgear & Cowans, Ltd.	5,985

After stating that these have been by far the most difficult tenders to come to a decision upon, the Committee gives reasons for the statement and recommends that the tender of Messrs. Johnson & Phillips, £4,748, with extras amounting to £942, making a total of £5,691, be accepted.

HAND-OPERATED TRAVELLING CRANES.

Herbert Morris, Ltd. (standard design) (recommended)	£389
do. (as specified)	437
Holt & Willets	445
Chatteris Engineering Works Co., Ltd.	623
John Smith (Keighley), Ltd.	669

COMPARISON OF TENDERS WITH ESTIMATES.

		Tender.	Estimate.
Ring main conduits ..	Foote & Milne	£16,019	£13,814
Sub-station plant ..	Bruce Peebles, Ltd. ..	8,166	9,450
Switchgear	Johnson & Phillips ..	5,691	5,985
Travelling cranes ..	H. Morris & Co., Ltd. ..	389	472
	Totals	£30,265	£29,721

HAMMERSMITH.—The B.C. Electricity Committee recommends the acceptance of the tender of Messrs. Langdon-Davies & Co., Ltd., at £63, for supply of one each 2, 3 and 9-H.P. motors which will be let out on hire to Messrs. W. A. S. Benson & Co. The other tenderers were :—Siemens, £84; Harding Churton, £86; British Westinghouse, £135.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., for the electrical equipment of the sewerage works, at £498.

Swindon.—The following tenders have been accepted for the electricity works :—

Cooling tower.—Davenport Engineering Co., £685.
Water-softening plant.—Kennicott Water Softener Co., £558.
15-in. flanged cast-iron piping.—Sheepbridge Coal and Iron Co.

FORTHCOMING EVENTS.

Municipal Tramways Association.—September 26th. At Sheffield. Annual Conference. Business meeting, and excursions.

Salford Technical and Engineering Association.—Saturday, October 4th. At the Royal Technical Institute. At 7 p.m. Lecture on "Automobile Construction," by J. A. Mackie, B. Eng.

Institute of Marine Engineers.—Monday, October 6th. At the Institute, Romford Road, E. At 8 p.m. Paper on "Fuel Gas Analysis and its Advantages," by A. E. Jones.

NOTES.

Institution and Lecture Notes.—Junior Institution of Engineers.—The winter programme of the 33rd session of this Institution has been prepared.

The weekly informal discussion evenings will be recommenced on Friday, October 3rd, when Mr. W. A. Tookey, M.I.Mech.E. (Vice-Chairman), will lecture upon the subject of "Gas Engine Testing," at the offices of the Institution, 39, Victoria Street, Westminster, S.W.

A special popular lecture will be given by Mr. F. H. Taylor, A.M.I.E.E., A.M.Inst.M.E., on "Light—Ancient and Modern," at the Willesden Polytechnic on Wednesday, October 1st, at 8 p.m. Tickets may be had on application at the office of the Polytechnic, Priory Park Road, Kilburn, N.W.

New Wireless Society.—The inaugural meeting of the Wireless Society of London was held in the City of Westminster Schools, on Tuesday evening, the 23rd inst., the chair being taken by Mr. F. Hope-Jones, M.I.E.E., whose election was confirmed, together with the Committee, as follows:—H. F. Brand, M.A., B.Sc., Leslie McMichael, W. J. Shaw, V. W. Delves Broughton, W. J. Fry, E. W. Kitchen, A.M.Inst.C.E., Dr. F. C. Knight, L. F. Fogarty, and R. H. Klein (secretary). About 60 members were present. The objects of the Society were fully explained and its policy was discussed. The Committee was authorised to negotiate for the acquisition of club rooms in Hatton Garden and their equipment with a large aerial and suitable instruments. A letter from Sir A. F. King, K.C.B., on behalf of the Postmaster-General, was read at the meeting, welcoming the formation of such a Society, and indicating that certificates of its Advisory Committee would be accepted by him as qualifications for the granting of licences. Other letters were read from influential supporters, and it was announced that Dr. Silvanus P. Thompson, F.R.S., had consented to become one of the vice-presidents.

Appointments Vacant.—Educated men, with practical knowledge of cars and lorries, for Mechanical Transport Section of the Army Service Corps. See our advertisement pages this week.

Educational.—The Polytechnic, Regent Street. The new session opens on Monday, September 29th; courses are provided in electricity and magnetism, electrical engineering, telegraphy and telephony, under the direction of Mr. W. Hibbert.

Visit to M.S. "Tynemount."—An interesting visit was afforded on Saturday afternoon, the 13th inst., to about 30 members of the Newcastle Local Section, due to the kindness of Messrs. Swan, Hunter & Wigham Richardson, Ltd., who invited them to inspect the electrically-propelled vessel, the M.S. *Tynemount*. An opportunity was also given of inspecting the yard, and one of the new machine and erecting shops, which are fitted with the latest improvements in shop equipment.

The visitors were conducted round by Messrs. Thorne, Tweedy and Morgan, of the above firm's staff, and Mr. Taylor, the chief engineer of the boat. Tea was kindly provided by the firm later, terminating an instructive and enjoyable visit, which gave an insight into one of the latest applications of electrical engineering.

The following are a few particulars regarding this boat, which has been built to the order of the Montreal Transport Co. for service in the Canadian lakes and canals, where numerous locks have to be passed through, necessitating frequent and rapid starting and stopping and control; it is claimed that these qualities are obtained best by the electrical system adopted and fitted by Messrs. Mavor & Coulson, and described in a paper recently read before the Institution of Naval Architects.

Particulars of Vessel.—Length, 256 ft.; breadth, 42½ ft.; tonnage, 2,400; speed, 9 knots; single propeller, direct-coupled to three-phase squirrel-cage motor, speed 78 R.P.M., with two stator windings, connected to two generators, each of 235 K.V.A., 500 volts, driven by two Diesel engines, each of 300 H.P., four-cycle, six cylinders, 400 R.P.M.

One of the generators has eight poles, and is normally connected to one section of the motor-stator, wound for 40 poles. The other generator with six poles is normally connected to the other motor-stator section, wound for 30 poles. This condition gives a speed of 78 R.P.M. If the eight-pole generator is coupled to the 40-pole stator-winding a speed of about 58 R.P.M. is obtained, which will give full load to one coupled set. If either generator set is connected to its respective motor stator winding alone, about half-speed is obtained. The auxiliaries on the boat are steam-driven, steam being furnished by two donkey boilers fired with oil fuel.

Mr. Mavor dealt with the equipment of this boat first in his paper before the British Association at Portsmouth (Electrical Review, September 22nd, 1911), and again before the same body at Dundee, when he described the modified plans which were finally adopted (Electrical Review, September 20th, 1912). Drawings were reproduced in our pages showing the complete lay-out of the plant.

Fire Brigade Tournament.—The Osram Lamp Works Fire Brigade competed at the Annual Tournament of the London Private Fire Brigades' Association, winning the Second Prize for four men wet drill, and Third Prize for three men ditto. They also won the Geelong Challenge Shield. For the Championship of the Association they were placed third, their total time being 277⅕ seconds, against 270⅘ seconds by the winners. Twenty-three Brigades competed.

Aisgill Disaster.—On Friday last, at Kirkby Stephen, at the inquest on the victims of the Aisgill collision, the jury returned a verdict that the deaths were caused accidentally and by misadventure, with riders to the effect that great blame attached to the locomotive inspector at Carlisle for refusing to provide a pilot engine for the first train, and to the rear guard of that train for failing to protect it with detonators, while there were extenuating circumstances in the case of the driver and the fireman of the second train. A jury at Leeds, on a similar inquest, exonerated the railway officials concerned from criminal responsibility. On Tuesday, however, at the conclusion of an inquest at Carlisle in connection with the death, in hospital, of Sir A. P. Douglas, the jury returned a verdict of manslaughter against the driver of the second train, S. Caudell, who will, therefore, be tried at the next assizes. The driver admitted that the safety of the public ought to have been his first consideration, whereas he passed the signals without looking at them, because he was occupied with the boiler feed, the water being low. The Deputy-Coroner characterised this as an astounding admission, and we cannot understand how the other two juries arrived at their extraordinary verdicts in view of the facts before them.

The Municipal Tramways Conference.—On Wednesday morning the twelth annual Conference of the Municipal Tramways Association was opened at Sheffield, where in the Town Hall, the Lord Mayor, Alderman S. Osborn, cordially welcomed the members and delegates, at the same time paying a tribute to the services rendered to the city both by the present general manager, Mr. Fearnley, who is the president of the Conference, and by his predecessor, Mr. A. L. C. Fell. A vote of thanks to the Lord Mayor having been proposed by Alderman Miles, of Bolton, and seconded by Mr. Fell, Mr. Fearnley took charge of the proceedings.

Mr. Fearnley then read his Presidential Address, which constitutes a useful *résumé* of tramway progress during the past year, and naturally refers to the motor-'bus, in so far as it has to be considered in connection with future developments. Reading between the lines, we gather that the Sheffield Tramways Committee and its manager are rather favourably impressed with the work done by the ten Daimler 'buses which have been in use since last February. Some of these vehicles operate on very hilly roads, but the fares charged are in marked contrast to the cheap rides given on the tramways. Mr. Fearnley comes to the conclusion that the use of the 'bus now depends more on the road than on the vehicle, and suggests that in view of the permanent way which will shortly require renewing, there is an opportunity for some authority to convert a tramway route for 'bus working and compare results, the construction of a good road surface being one requirement.

Alderman Flint's paper on the "Advantages and Disadvantages of Platform Fare Collection," which followed, briefly describes with illustrations the ticket and fare system adopted on the Leicester Corporation Tramways. It might have been entitled "Punch, brothers, punch with care," but although the title scarcely indicates the contents of the paper, a lengthy discussion followed, mainly on the merits of the PAYE system.

While the Leicester and Aberdeen representatives, who were the only ones having actual experience of the system, were quite in favour of it, a good many other speakers were sceptical as to its supposed merits, especially under the conditions existing on British tramways. In this connection, Mr. McElroy pointed out that the PAYE system had been developed in America, where the universal fare facilitated its use; it had yet to be thoroughly tried in this country.

Councillor Fenton's paper on "The Maintenance of Paving on Tramway Track as affected by Sec. 28 of the Tramways Act, 1870" resulted in considerable discussion in the afternoon. Consideration of this subject generally results in some difficulty in discriminating, as regards proposed taxation, between the motor-'bus and other vehicles. Bailie Alston, Glasgow, ingeniously suggested that it was quite right to discriminate between a vehicle which earned its income on the streets (similarly to a tramway car) and one which merely transported goods over roads.

Generally the heavy repairs due to weighty motor vehicles using the tracks are compelling the Association to take the matter up in fairness to the tramway undertakings; in this action they are at one with the Tramways and Light Railways Association, who were represented by Mr. Harry England and Mr. H. M. Sayers.

Thursday's paper, by Mr. J. B. Hamilton, on "Urban Passenger Transport," aroused a great deal of interest. Although the author shows on paper that the motor-'bus cannot profitably compete with the electric tramway, presumably under provincial conditions, this is a maxim which all good tramway managers are supposed to subscribe to. The spectacle of Mr. Hamilton solemnly proving that 'bus costs cannot be under 10d. per mile, and will inevitably increase, when brother managers are experimenting right and left and buying still more 'buses, is rather humorous.

During the stay of the Association, the Corporation is providing with a liberal hand for the amusement of many of its visitors; as the electrical Press were not amongst the favoured ones, we are unable to refer at length to this feature of the Conference.

Accident.—Peebles.—At an inquiry regarding the death of an engineman in the employment of the Peebles Hotel Hydropathic Co., Ltd., who was caught by a belt while starting the gas engine which drives the dynamo, a witness stated that he understood it was the intention of the company to put in new plant altogether outside the building, as the noise of the engine annoyed the people in the hydro.

Railway Signals and Mercury Vapour Lamps.—In view of the very wide publicity that has been given to the fact that engine drivers on the Great Northern Railway became perplexed at night by the appearance of a green light over the distant signals on approaching Peterborough, which was afterwards discovered to be due to a mercury vapour lamp used for advertising purposes on the Peterborough Kinema, the Westinghouse Cooper Hewitt Co., Ltd., point out that confusion of this kind can be very readily overcome by using a special globe or special reflectors that have been devised and largely adopted with these lamps for railway work. With this globe the appearance of the lamp from a distance is altered, although the characteristic quality of the mercury vapour light as light "to see by" is maintained.

Electric Garage.—A feature of the electrical vehicle section of the Electrical Exhibition, which is to be held in New York, from October 15th to 25th next, will be a motor garage, fitted out with all the apparatus and equipment requisite for the care and charging of electric vehicles.

Fatality.—It is reported that on Wednesday an electrical engineer named Carpenter was killed by electric shock at the Sittingbourne paper mills.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the T.C. meeting at Whitehaven, on 10th inst., the Mayor and others made complimentary remarks with respect to the qualifications and abilities exhibited by MR. SANKEY during his holding the position of electrical engineer.

Mr. E. W. L. NICOL, assistant station superintendent under Mr. Herbert A. Fleet to the Yorkshire Electric Power Co., has been appointed fuel expert to an important London organisation, at a commencing salary of £300.

At East Grinstead (Sussex), on Monday, the marriage took place of MR. EDWIN DADSWELL, of the Keighley (Yorks.) Corporation electricity staff, and Miss Doris Foster, fourth daughter of the late Mr. Foster, Hazelden, East Grinstead.

On the occasion of his marriage to Miss Nancy Adams, daughter of Mr. S. H. Adams, of Fulford (Yorks.), MR. H. D. LEATHER has been presented with a silver dish by the management and staff of the Minehead Electric Supply Co., Ltd.

MR. W. H. JOHNS, of Saltley, Birmingham, has been appointed gas and electrical engineer to the Malvern U.D.C.

MR. T. W. DAVIES, for 4½ years station superintendent at the Corporation electricity works at Wrexham, who has resigned, has been presented by the staff and employés with a clock and silver-mounted walking stick, with a silver-mounted umbrella for his wife.

MR. JOHN R. DAVISON, of the staff of the Poplar electricity works, and formerly of H.M. Dockyard, Devonport, has been appointed shift engineer at the Stuart Street generating station, Manchester.

The Rhondda U.D.C. has appointed MR. JAMES BOWMAN as engineering clerk-of-works to supervise the erection of its refuse destructor and electric generating works.

MR. R. W. WILLIS has resigned his appointment as assistant electrical and mechanical engineer at the Swindon Council's electricity works. The vacancy is not to be filled for the present owing to an amendment having been passed in the Council, on the motion of a gentleman who said that personally he did not consider that a small concern like the electricity department ought to carry two engineers. At present each Committee had its own officials—there was no organisation and no cohesion. "What they required was an engineer able to guide and supervise the different departments. There were too many assistant engineers." The passing of the amendment by 17 votes to 14 was followed by expressions of regret. One speaker said that the amendment had not been understood, and another that it was equivalent to charging the Electricity Committee with spending money unnecessarily.

MR. F. V. BROWNE, of the Rochdale Corporation electrical staff, and late of Norwich, has secured an appointment under the Great Central Railway as substation attendant at Immingham Docks.

Tramway Officials.—The Tramways Committee of West Ham Town Council proposes to grant MR. F. EGGINGTON, principal assistant in charge of the tramways department, a gratuity of £20 for extra services rendered since the resignation of the tramways manager (Mr. H. E. Blain), whose duties he had taken up until the new manager took over the position on August 18th last.

The staff and employés of the Bradford City tramways have presented an oak bureau and bookcase to MR. T. B. MOSELEY, on his marriage. Mr. Moseley also received a barometer from the Bradford City Tramways Military Band.

The Brighton T.C. has increased the salary of MR. W. N. BROOKS, tramway traffic superintendent, from £3 to £3 5s. per week.

General.—On the occasion of his marriage, MR. J. P. STRANGE has been presented with a chiming clock by the staff of the Electric Installation Co., of Tunbridge Wells.

The West Ham Testing Laboratory has acquired the business of fuel analysts hitherto conducted by Messrs. Greenwood & Wells, 16, York Place, Baker Street, W.

MR. E. H. LAMB, demonstrator and scientific adviser to Messrs. W. H. Allen, Son & Co., Ltd., electrical and general engineers, of the Queen's Engineering Works, Bedford, who is leaving after 10 years with the firm, has been presented by the directors with a library of 28 volumes of engineering and other works, and by the staff, pupils and apprentices with a barometer, cigarette case and silver rose bowl.

We are informed that, by arrangement with the directors of Messrs. Siemens Bros. Dynamo Works, Ltd., MR. E. P. BARFIELD will sever his connection with the Dalston Lamp Works at the end of the present month. He will, therefore, take up his new appointment as general commercial manager with the Edison & Swan United Electric Light Co., Ltd., early next month.

Obituary.—SIGNOR CALISSANO, Italian Minister of Posts and Telegraphs, died suddenly on Sunday afternoon.

Will.—MR. J. S. JEANS, whose death was announced some weeks ago, left £42,218 net personalty.

CITY NOTES.

Crompton & Co., Ltd.

THE statutory meeting of the shareholders of this company was held on Monday, at Salisbury House, London Wall, E.C., Mr. C. F. Tufnell presiding.

The CHAIRMAN said that the meeting was called in order to comply with the requirements of the Companies' Act. Although no formal business had to be transacted, they would doubtless like to hear something from him as to the present position of the company. It would be observed from the report that the whole of the preference shares offered had been allotted, and he was particularly pleased to state that the reconstruction of the company—although involving a considerable amount of work—had been carried through without any interruption whatever of the company's business. At the last meeting of the old company, in June, he was able to inform the shareholders that the new company — which was to take over the business as from April 1st — would start at that date with a considerable increase of orders in hand, as compared with the value of work in hand on the same date in the previous year. He was glad to be able to state that the orders received since that date showed a satisfactory increase on the orders for the corresponding periods of the previous three years. They had made some changes in the staff at the headquarters and at the works. Mr. Edwin Reeves—for many years secretary of the old company, and who acted also as joint manager during the last 18 months of the old company's existence—had been appointed managing director and secretary, and all of them who knew Mr. Reeves and his loyal work in the past would, he felt sure, allow that no better appointment could have been made. The directors had also appointed Mr. Thos. Britten—a gentleman with the highest credentials, and in whom they had every confidence—as works manager at Chelmsford. The reconstruction offered them an opportunity, of which they were taking advantage, to introduce certain changes into the business, which they were confident would have a marked effect on the earning power of the company. It was, perhaps, not advisable for him to go into details, but the shareholders could rest assured that whatever they did they would bear in mind that they had inherited from the old company a reputation which attached to the name of Crompton for good work and straightforward dealing, and they were determined to uphold that good name. As the company had really only been in existence three months, it was too early to talk about the profits they were making, but he trusted the shareholders would be satisfied when they saw the balance-sheet of the first year's working, which they hoped to present when they next met them. As most of them were shareholders in the old company, they might like to hear something about the last year's working of that company. At the meeting of the old shareholders on June 19th he stated that they hoped the results of the year's working, to March 31st (the accounts for which were not then completed), would show a profit sufficient to pay debenture interest. As a matter of fact, the results were better than this. After paying depreciation on the usual scale, debenture interest, interest on bank loans, and other charges against revenue account, there was a balance in hand of some £800. He did not know whether the shareholders were altogether aware of the scope of the company's business. In the first place, at their works at Chelmsford, they turned out dynamos, alternators, motors of various sizes for direct and alternating current, arc lamps of many descriptions, projectors or searchlights for naval, military and other purposes, and he might say that the British Admiralty was one of their biggest customers for this class of work, and their field service projectors gave a good account of themselves at Adrianople during the late war. They also did a large business in ceiling fans, particularly for the East. Their electrical measuring instruments were well known, and the output was steadily going up. They had a high reputation for the finish of their switchboards and switchgear. They also took on contracts to manufacture, supply and erect electric cranes, capstans, winches and various work of this description. They also did a big business

in the electrical equipment of factories and the supply and erection of electrical plant for collieries and mines, at home and abroad. They carried out the complete equipment of lighting stations, including the laying of mains, at home and abroad, and, at the present moment, they were busy on various town lighting jobs of this description. His object in giving this information to the shareholders was that he wanted them to help the company by trying to influence business in their direction. They were a new company, and they "meant business," as the expression went. Their determination was to earn dividends at the earliest possible moment, and they wished to look upon the shareholders as their best friends and customers.

Replying to questions, the CHAIRMAN said it was the intention of the board to apply for a Stock Exchange quotation for the new ordinary and preference shares at the earliest possible moment. The £20,985 representing the reserve fund of the old company had gone into the assets of the new company which at present had no reserve fund.

MR. GIBSON said that as an old shareholder of Crompton's he would like to express his great satisfaction at the way in which the reconstruction had been carried through. They were particularly indebted to Mr. Reeves, who, he was glad to see, had been appointed managing director and secretary. The board had had a very anxious time, and he was sure it was the wish of the shareholders to thank them for their work.

The vote was carried with acclamation, and the CHAIRMAN, in acknowledging the same, said he fully endorsed all that Mr. Gibson had said with regard to the great services which Mr. Reeves had rendered in carrying through the reconstruction.

United Electric Car Co., Ltd.

MR. R. B. BARNINGHAM presided at the annual general meeting at Preston, on the 17th inst., and said that the past year's working was not so satisfactory as that of the previous year. The net profit on that occasion was the best since 1907, viz., £15,267. The past year had certainly not been a boom year in the demand for tramcars, and, in the circumstances, the directors considered the net profits of £10,809 satisfactory. Such had been their anxiety to obtain orders that they had often to take work at prices which, although showing a small margin of profit did not really cover the extra prices of materials. The keen competition had mainly affected them for foreign work, and had come chiefly from American and Continental firms. The order books and prospects were slightly better than 12 months ago. They should take the earliest opportunity to build up their general reserve to provide for the loss in the realisation of the Hadley and Trafford Park works. The report was adopted, and it was decided to pay a dividend of 5 per cent. on the ordinary shares and to carry forward £1,558. Messrs. R. H. Prestwich (Manchester) and J. Kerr were re-elected directors.

Official Announcements re Companies.—Unless cause is shown to the contrary, the following companies will be struck off the register within three months :—

Anglo-French Turbines, Ltd.
British Electro-Metallurgical Products Co., Ltd.
British Rubber Regenerating Co., Ltd.
Engineering Digest Publishing Syndicate, Ltd.
Heat, Light and Power Syndicate, Ltd.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List :—

Minaes Geraes Electric Light and Tramways Co. (Companhia de Electricidade e Viacao Urbana de Minas Geraes).—£120,000 5 per cent. first mortgage bonds, Nos. A1 to 1,000 of £20 and B1 to 1,000 of £100 each.

International Light and Power Co.—A dividend of 1½ per cent. (being at the rate of 6 per cent. per annum), less income-tax, upon the preference shares, is announced for the quarter ending September 30th.

South America.—The directors of the Compania de Tramways Electricos del Sud, in their report for the year ended June 30th, state that net profits, including $28,864 brought forward from the preceding year, amounted to $231,843, which was distributed as follows :— Reserve funds, $14,208 ; directors, $18,268 ; 6 per cent. dividend, $179,910 ; forward, $19,457. Reserve and renewal funds amount to $337,292. Gross receipts for the year were $1,127,603, an increase of $52,411 ; expenditure was $834,681, an increase of $50,330. The number of passengers carried was 8,040,835, as compared with 7,507,976. There was a decrease of 292,063 in the kilometres run, though the cost of electrical energy showed an increase of $27,756. During the year $1,000,000 in new shares were issued, which were taken up by French capitalists at par.—*Review of the River Plate.*

Marconi's Wireless Telegraph Co., Ltd.—The following dividends will be payable on and after October 1st, 1913 :— On the 7 per cent. cumulative participating preference shares, a final dividend for the year 1912 of 10 per cent. ; an interim dividend for the year 1913 of 7 per cent. On the ordinary shares a final dividend for the year 1912 of 10 per cent.

Kalgoorlie Electric Power and Lighting Co.—A dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ending September 30th is announced.

British Westinghouse Electric and Manufacturing Co., Ltd.

At an extraordinary general meeting which will be held at Hamilton House, Victoria Embankment, London, E.C., to-day (Friday), the following and a number of [illegible] resolutions will be considered :—

"That the capital of the company be reduced from £1,875,000 (divided into 500,000 preference shares of £1 each and 75,000 ordinary shares of £5 each, all fully paid) to £1,150,000 (divided into 500,000 preference shares of £2 each and 75,000 ordinary shares of £2 each), and that such reduction be effected by cancelling paid-up capital which has been lost or is unrepresented by available assets, to the extent of £1 per share on each of the preference shares and to the extent of £3 per share on each of the ordinary shares, and by reducing each preference share to a share of £2 and each ordinary share to a share of £2."

In their circular calling the meeting, the directors say :—"The shareholders are aware from the remarks of the chairman at recent meetings that it has been in contemplation for some time past to make a further reduction in the capital of the company. Proposals would have been placed before the shareholders before this but for the fact that the questions between the company and the Underground Electric Railways Co., of London, were still unsettled, and your directors were desirous of knowing exactly what the outcome of the proceedings would be before formulating the necessary plan. Those proceedings having now reached a final solution, your directors are of opinion that in the interests of the company it is not desirable to delay the matter any longer. The directors recommend that a reduction in the capital of the company to the extent of £725,000 be made. Of this amount £225,000 would be devoted to writing down patents and goodwill to £150,000. The balance of £500,000, together with the balance at the credit of profit and loss account on December 31st, 1912, on the accounts of which year the reduction of capital will be based, would be devoted to the depreciation of buildings, plant, machinery and investments, the writing off of the expenses of the issue of the prior lien debentures, and the loss sustained in connection with the Underground Electric Railways Co. of London, which has been £52,050. To meet this reduction in the capital assets of the company they recommend that the share capital be reduced by writing off £1 per share from the 500,000 preference shares and £3 per share from the 75,000 ordinary shares. In order to maintain the same relative position of the two classes of shares as it stood at the incorporation of the company, it is proposed that the rate of dividend be increased as follows :—

"On the preference shares from 10 per cent. to 15 per cent., and on the ordinary shares from 12 per cent. to 30 per cent. ; the division of any surplus profit between the two classes of shareholders remaining as at present—viz., one-fourth thereof among the preference and three-fourths among the ordinary shares.

"The result would be that before division of surplus profits, the preference shares would be entitled to the same amount of preferential dividend—viz., 6s. per share, and the ordinary shares to the same amount of dividend—viz., 12s. per share, as they were respectively entitled to at the date of the incorporation of the company. In other words, the 500,000 preference shares will be entitled to participate in each year in the profits up to £150,000 before any distribution is made among the ordinary shareholders. In the event of liquidation the rights of the two classes of shares remain as at present, so that the preference shares shall first receive £5 per share before any distribution is made to the ordinary shares. The voting power now enjoyed by the respective classes will not be affected. The board strongly recommends the adoption of these proposals in the interests of shareholders themselves. If the reduction is approved, the resumption and maintenance of the payment of dividends will be much facilitated."

Callender's Share and Investment Trust, Ltd.

MR. T. O. CALLENDER (chairman) presided, on September 18th, at the first annual meeting of the above company. The proceedings were purely formal, and the following report (to which brief reference was made last week) was adopted on the motion of the chairman. The earnings in respect of interest and dividends on investments from May 10th, 1912, the date on which the company commenced business, to August 31st, 1913, amounted to £14,720. A further amount of about £1,400 will become due in respect of dividends on ordinary shares, which there is every reason to believe will be punctually paid, but as these dividends have not yet been declared, no credit has been taken for this sum in the accounts now submitted. After paying all working expenses and writing off £1,007 in respect of preliminary expenses and cost of issue of debenture stock, the gross profit amounted to £19,227. From this has to be deducted interest on debenture stock and calls paid in advance, £7,022, leaving an available balance of £12,205. It is proposed to pay a dividend at the rate of 5 per cent., less income-tax, whereof an interim dividend of 2½ per cent., less income-tax, was paid on May 8th, 1913. This will absorb £8,270 ; redemption fund, amount deposited with debenture stock trustees, being first annual payment, £1,800, leaving to be carried forward £2,135. During the year advances have been made to Callender's Cable and Construction Co., Ltd., and the balance now due in respect thereof is £102,000. The interest on these advances has been paid up to date. The total cost of the formation of the company and the issue of the debenture stock was £7,673. Of this £1,007 has been written off as above, and it is proposed to write off the remainder, £6,666, by nine annual instalments of £741.

STOCKS AND SHARES.

Tuesday Evening.

The principal feature in the Stock Exchange markets since our last notes appeared has been the dropping, and the raising of the fear that there might be a general strike on all the railways. Although the markets professed that they did not expect the threat would materialise, precautionary measures were taken against the possibility of such a thing; and as soon as the pressure was withdrawn, prices bounded up sharply. This, of course, was particularly the case in the Home Railway list, but Traction shares of most kinds were affected, and our catalogues show a fair number of improvements on the week, these improvements in some cases simply replacing the losses sustained just previously.

The demand for Electric Lighting shares has come to something of a halt. Speculation, what little there is of it in so sober-minded a market, looks to the price of City of London shares for its inspiration. If City "Lights" are quiet, it may be taken for granted that there will be nothing interesting amongst the rest; the Cities for the past few days have been sticking round about 17. Reference was made last week to the strength of County Ordinary; the price gained 25s., and at one time buyers came along at 12½. They were supplied without a great deal of difficulty, however, and the price thereupon fell back to 11⅞, thus showing a fall of 12s. 6d. on the week. The Preference lost their previous 5s. gain. Amongst the others, Kensington and Knightsbridge Ordinary hardened to 7¾, at which price the yield is exactly 5 per cent. on the money, taking the last dividends as the basis. Westminsters are better at 9¼. There is a quiet demand for Metropolitans, but the only change in the company's stocks is a rise of a point in the Second Debenture. Other shares are steady, without quotable alterations.

Amongst Home Railways, Metropolitans have recovered their previous fall of 1½, and Districts at 34½ are ¼ higher. The principal activity in this group has occurred in the Underground Electric issues. The £10 shares fell to 3⅝, rallying on Tuesday to 4, and so showing a 5s. rise on the week. The 1s. shares remained about half-a-sovereign, varying between 9s. 9d. and 10s. 9d. as the outside prices. Buyers came in for the Income bonds at 90, and as soon as the sentiment changed, the price promptly hardened to 91½. British Electric Tractions are better. Central London Guaranteed Assented Ordinary stock eased off to 80. Metropolitan Electric Trams 4½ per cent. Debenture fell 2 to 84, while the pre-ordinary list tends to droop a little here and there.

The reconstruction proposals put forward by the British Westinghouse Company resulted in a rise of 1/16 in the Company's Preference shares. The scheme is regarded favourably on the whole by the market; and though it is open to criticism in certain directions, it is considered to be a fair attempt to deal with the difficult situation that has arisen by reason of the past misfortunes of the concern. Modifications may be suggested at the meeting, which is to be held on the Friday in this week. British Aluminium Ordinary are also harder; and of the Cable shares, Callenders rose ¼ to 11¾. The Willans & Robinson's shares have been removed from the lists for the time being, and the price of the 4 per cent. Debenture stock at 57½ shows a nominal rise of 1. Electric Construction Preference shares are better. Aron Preference have fallen back.

The Telegraph group is very steady. It is difficult to account for the continued dulness of Anglo-American Telegraph stocks, and the market explanation—namely, that there has been some pressure to sell on behalf of deceased estates—is not an entirely satisfying one to those who have watched the decline that has been going on so steadily for the past few weeks. The Preferred has now got back to 106. Probably the real reason for the depression is the vague fear that if the United States Government takes active steps against the trusts in that country, the merger which took over the Anglo-American Co. may have to be dissolved. The Deferred stock remains at 23¼.

Of the Eastern securities, Eastern Ordinary is ½ up at 129. Eastern Extension Debenture is a similar amount to the good at 93½, and Globe Preference rose ⅛ to 12⅜. The Company has declared its usual quarterly dividend. Indo-Europeans continue to advance, and West India and Panama shares are steady. Mackay Common fell 3 points, although the Preference at 69½ is 1½ better. Chile Telephone shares are a little lower. National Telephone Deferred holds its advance at 7⅞. The rise in Marconis was checked by profit-taking sales as the end of the account approached. After touching 4¼, the price of the parent shares receded to 3⅞, this having its natural effect upon the Preference shares and upon the issues of the subsidiaries.

The Latin-Canadian group presents a few points of special interest, but the market for the various companies' bonds is becoming restricted in its supply of stock, and prices are therefore hardening. Mexico Tramways First Bonds, Rio Bonds of both kinds, and Sao Paulo Tramway Debentures are better to the extent of ¼ to a point. Mexico Tramways shares eased off to 98½ in sympathy with a drop in Brazilian Tractions. The latter had been run up to 99, and the Preferred to 101½, but from these prices there were slight reactions that took the quotations back to 98 and 100 respectively, the Common showing ½ rise on the week. There is quiet buying going on of various foreign tramway shares, Singapores, for instance, being in demand this week at 5s. Lisbon Electrics are flat, both Ordinary and Preference falling. Electrical Development of Ontario bonds put on 1½ to 93. Monterey bonds at 74 are 1½ lower. The British Columbia issues show small rises.

Keen interest follows the course of raw rubber, and of the market in the shares. Both had a relapse after hardening up a little, the improvement being brought about by a proposal to establish a central selling agency which might be able to regulate the price of the raw material. To this suggestion a good deal of support has been promised; but not all the people most interested see eye to eye over the matter, and unless there is practical unanimity, it is difficult to understand how the market can derive much benefit from this protective influence. At Manaos, one of the ports from which Brazil rubber is exported, trade is reported to have come practically to a standstill in consequence of the crisis in the rubber trade.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, September 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£24	5s. inc.
a Lead, Nitrate	„	£30	..
a „ White Sugar	„	£27 10	£1 10s. inc.
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only) ..	„	7½d.	..
a Shellac	per cwt.	100/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c „ Tube (brazed)	„	10½d.	⅜d. dec.
c „ „ (solid drawn) ..	„	9½d.	..
c „ Wire, basis	„	8½d.	..
c Copper Tubes (brazed)	„	1/-	..
c „ „ (solid drawn) ..	„	11⅜d.	..
g „ Bars (best selected) ..	per ton	£91	£5 inc.
g „ Sheet	„	£91	£5 inc.
g „ Rod	„	£91	£5 inc.
d „ (Electrolytic) Bars ..	„	£78 10	£1 15s. inc.
d „ „ Sheets ..	„	£96 10	£1 15s. inc.
d „ „ Rods ..	„	£84	£1 15s. inc.
d „ „ H.C. Wire	per lb.	10⅜d.	⅛d. inc.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	..
h India-rubber, Para fine	„	3/8	..
j Iron Pig (Cleveland warrants) ..	per ton	54/9	..
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£21	2/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	8/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£194 to £195	£2 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals ..	per ton	£50 to £228	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Globe Telegraph and Trust, Co.—The directors have declared an interim dividend of 2s. per share on the ordinary shares for the past quarter.

Stothert & Pitt, Ltd.—A financial daily states that a dividend of 10 per cent., free of income-tax, on the ordinary shares for the year is announced, £2,000 is placed to reserve, and £2,100 carried forward.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 23rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10⅛	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅞	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅞	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	— ½	4 9 0
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	10	6	5†	11⅝ — 12⅛	— ⅝	4 19 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	— ½	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	89 — 91	+1	4 19 0
Hove	5	9	..	7⅞ — 8⅛	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 8	+ ½	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	3	2½	..	1½ — 1⅝	..	4 7 9
Do. 5 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 5
Metropolitan	5	4	4†	8⅜ — 8⅞	..	5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	+1	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10⅜	..	5 11 7
Oxford	5	7	6†	5⅞ — 6⅛	..	5 9 10
St. James' and Pall Mall, Ord.	5	10	10†	8⅞ — 9⅛	..	5 8 1
Do. 7 % Pref.	5	7	7	6⅞ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅞ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 5/32	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 2⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10†	9 — 9½	+ ½	5 5 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	..	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7†	113 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	5/8 — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	+1½	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3½ — 5/8	..	Nil
Do. 6 % Pref.	1	6	..	5/8 — 1/16	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅛ — 1¼	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5		103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4	66 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	97½ —102½	..	6 16 7
Do. 5 % 1st Mort. Gold Bds.	..	5	5	91 — 93	..	5 7 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	78 — 80	..	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	72 — 76	—1½	6 11 7
Montreal, Lt., H. and Power ..	$100	9	10†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	5½	6†	140 —144	..	8 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	100⅛ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	3/4 — 7/8	..	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	98 — 95	—1	5 5 8
American Telep. & Teleg., Cap.	$100	8	8	134 —136	..	5 17 8
Do. Collat. Trust	$1000	4	4	91 — 93	+1	4 6 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105½ —106½	— ½	5 12 8
Do. Def.	Do.	30/-	..	28 — 23½	..	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	—11/16	5 5 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81½ — 83½	..	4 15 10
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 12 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127½ —130½	+ ½	5 7 3
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 6
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	93 — 95	+1	4 4 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	95	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅛ — 12⅝	+ ⅛	4 15 1
Great Northern Telegraph ..	10	20	6†	30½ — 32½	..	6 3 1
Indo-European Telegraph ..	25	10	..	57 — 59	+1	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	—3	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	+1½	5 12 8
Marconi's Wireless Telegraph	1	20	..	3⅞ — 4	— ⅛	5 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	3½ — 3⅝	—1/16	5 0 9
Monte Video Telephone, Ord. ..	1	6	6	1 5/16 — 1 7/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99⅜ —100⅝	— ⅛	4 9 4
Oriental Telep. and Elec. ..	1	10	..	1 13/16 — 1 15/16	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9⅜ — 10½	..	9 17 6
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅞	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9⅜	..	6 6 4
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Cert

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 23rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	8 3/16 — 8 5/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	+ 3/4	..
Do. Do. Deferred	100	..	..	4½ — 5	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb.	100	5	5	94 — 97	+ ½	5 8 1
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	8	8	78 — 75	.	4 0 0
Do. Gtd. Assented	100	..	4	79 — 81	—1	4 18 9
Do. Pref.	100	4	4	77 — 79	..	5 1 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 8
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	5	6†	1 7/32 — 1 9/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 1/16	— 1/16	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 1/8	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	74 — 79	..	5 13 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Metropolitan Railway Consol.	100	1⅞	1½†	47 — 47½	+ 1½	3 10 3
Do. Surplus Lands	100	2⅜	2¾†	59 — 61	..	4 10 2
Do. 8½ % Deb.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	77 — 79	—1	4 8 7
Do. 8½ % Con. Pref.	100	8½	8½	77 — 79	..	4 8 7
Metropolitan District Ord.	100	Nil	..	34¼ — 34¾	+ ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 .
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 8½ % Gtd.	100	8½	8½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	—2	5 4 8
Do. 5 % Deb.	100	5	5	89 — 92	..	5 8 8
Potteries, Ord.	1	3½	..	3/32 — 13/32	..	..
Do. 5 % Pref.	1	0	5	0 — 1/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 86	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	3/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3 7/8 — 4 1/8	+ 1/4	Nil
Do. "A"	1/-	..	..	7/32 — 9/32	— 1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	109 —111	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	91 — 92	+1½	6 10 5
Yorkshire (West Riding), Ord.	5	Nil	..	1/8 — 3/8	..	..
Do. 6 % Pref.	5	3	1½†	3 3/8 — 3 7/8	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/8 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ - 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	5	6†	97⅛ — 98⅛	+1⅛	6 1 10
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ - 7⅜	..	5 5 0
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	126 —129	+1	6 4 0
Do. Pref. Ord.	100	6	6	113 —116	..	5 8 5
Do. 5 % Pref.	100	5	5	103 —106	+ ½	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4¼ % Con. Deb.	100	4¼	4¼	94 — 96	+ ½	4 8 7
Calcutta Trams, Ord.	5	7½	..	5½ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1⅛ — 1 3/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5 5/16 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	..	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	.	..	13/32 — 17/32	..	..
Do. Pref.	1	4 2/5 d.	6	29/32 — 1 1/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1½	— 3/32	4 16 0
Do. 5 % Pref.	1	6	6	1 5/16 — 1 3/16	— 1/16	5 1 1
Do. 5 % Deb.	100	5	5	91 — 96	.	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7†	7	97½ — 99½	— 1	7 0 8
Do. Gen. Con. 5 % Bonds	..	5	5	91 — 93	+ ½	5 7 6
Do. 6 % Bonds	100	6	6	93½ — 95½	..	6 5 8
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 — 6½	..	7 18 10
Do. 6 % Pref.	5	6	6	4⅜ — 6⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102½ —103½	+ ¼	4 16 10
Do. 5 % Mort. Bonds	100	5	5	97 — 98	+ ½	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	£500	5	5	102½ — 104½	+ ½	4 15 8
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½ xd	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	— 1/16	7 18 4
Babcock & Wilcox	1	16	..	3 1/16 — 3 3/16	..	5 0 5
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	31/32 — 1 1/32	— 1/32	..
Do. 6 % Cum. Pref.	1	5	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	..	5 5 3
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 8
B I. & Helsby Cables	5	10	..	8½ — 8¾	..	5 14 3
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾	..	4 14 0
British Westinghouse, Pref.	8	Nil	..	1/16 — 1/8	+ 1/16	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —8/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	..	11 — 11¾	+ ¼	6 7 8
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	8¾ — 8⅞	..	5 3 2
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	31/32 — 35/32	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1¾	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	5	..	1 — 1¼	..	8 0 0
Do. Pref.	2	7	7	1⅞ — 2⅛	+ 1/16	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	6	6	9½ — 10½	..	6 14 8
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	12⅜ — 13¾	..	5 9 1
Do. Pref.	10	8	8	9⅜ — 10⅜	..	4 18 9
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson	100	4	4	55 — 60	+1	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1913.

The electrical exports for August, which are summarised below, show a return approximately to the June level, the figure for July having been abnormally inflated by a large export of telegraph cable; the total exports amounted to £434,226, compared with £660,363 for July. The imports at £216,301 are almost exactly the same as in July, £216,908; and the re-exports have fallen to the exceptionally low value of £17,654, compared with £34,462 in July.

Allowing for the absence of the big telegraphic item, the most noticeable falling off in the exports is still found under the heading of telegraphic cable and apparatus, being in the neighbourhood of £30,000; the telephone section, on the other hand, shows an increase, but batteries are down, and there is a heavy drop in electrically-driven machinery. With these exceptions there is no great difference between the returns for the two months. The imports table, however, shows variations in all the items, although the total is practically unchanged. In particular, glow lamps, electrical goods and electrically-driven machinery have fallen off, while batteries, machinery and meters show substantial gains. Our best customers for the month were again India and New South Wales, with Argentina, Canada and Brazil well to the fore.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,343	611	95	...	2,786	327	5,120	256	...	21	65	313	10,937
Germany	1,425	4,527	35	...	594	27	1,414	71	196	49	29	274	8,641
Netherlands, Java and Dutch Indies ...	480	1,414	74	...	35	98	1,486	...	8	51	119	559	4,324
Belgium	601	364	149	...	78	9	3,630	121	2	...	1,295	365	6,614
France	629	...	3,353	...	...	...	2,819	259	151	...	21	1,023	8,255
Portugal	526	119	...	22	...	119	325	...	7	4	120	90	1,330
Spain, Canary Isles and Spanish N. Africa...	840	656	109	...	563	39	4,987	...	183	...	205	110	7,692
Switzerland, Italy and Austria-Hungary ...	336	40	345	...	22	5	12 250	...	155	148	45	4,272	17,618
Greece, Roumania and Turkey	187	3,089	148	54	56	8	218	...	25	...	1,527	4,008	9,317
Channel Isles, Gibraltar, Malta and Cyprus...	45	50	4	30	...	11	141	...	...	...	96	633	1,010
U.S.A., Philippines and Cuba	957	...	38	33	...	97	4,085	...	...	...	74	699	5,981
Canada and Newfoundland	1,596	4,498	690	996	84	2,053	7,112	280	661	12	4,888	5,191	28,058
British West Indies and British Guiana ...	17	...	98	61	15	63	730	14	33	...	77	19	1,127
Mexico and Central America	90	...	...	...	...	...	964	...	...	...	...	...	1,054
Peru and Uruguay	692	878	99	325	23	...	856	89	35	35	226	2,541	5,799
Chile	757	769	376	74	192	245	2,776	110	744	22	155	7,635	13,855
Brazil	1,071	1,642	1,097	224	...	906	8,867	697	415	24	201	12,690	27,834
Argentina	4,389	9,246	1,271	207	60	624	7,185	1,979	946	177	9,416	669	36,167
Colombia, Venezuela, Ecuador and Bolivia...	184	104	19	182	...	13	1,662	...	918	...	229	...	3,311
Egypt, Tunis and Morocco	1,682	12	192	11	...	...	660	600	35	22	362	487	4,063
British West Africa	12	596	108	14	...	...	501	...	121	...	42	175	1,569
Rhodesia, O.R.C. and Transvaal	2,039	1,880	463	917	...	165	2,450	44	294	28	12	128	8,420
Cape of Good Hope	2,271	2,664	328	399	...	303	2,363	17	2,092	58	160	3,982	14,637
Natal	881	3,053	434	226	151	3	3,984	83	240	...	29	4,106	13,190
Zanzibar, Brit. E. Africa, Mauritius & Aden	368	69	189	206	...	50	148	16	...	...	8	103	1,157
Azores, Madeira and Portuguese Africa ...	288	1,067	1,023	74	...	114	1,353	31	4	13	99	292	4,358
French African Colonies and Madagascar ...	54	...	...	...	...	...	...	...	...	...	...	132	186
China and Siam	1,441	1,833	104	522	...	956	3,793	93	105	32	2,199	167	11,225
Japan and Korea	238	856	834	32	...	559	16,825	33	1,418	54	...	960	21,809
India	3,586	7,975	2,298	1,277	139	1,465	19,876	4,746	1,870	238	3,437	1,485	48,392
Ceylon	388	102	213	47	70	76	76	201	43	...	170	300	1,686
Straits Settlements, Fed. Malay States and Sarawak	289	2,198	521	161	...	119	2,664	19	72	5	340	4,664	11,052
Hong Kong	212	1,027	126	247	...	...	928	19	31	18	44	1,250	3,902
West Australia	213	1,637	36	402	...	553	330	24	360	10	26	711	4,302
South Australia	276	1,042	280	213	...	1	680	...	6	...	39	573	3,110
Victoria	1,449	7 680	1,563	1,291	837	899	2,699	337	1,223	15	1,154	147	19,294
New South Wales	1,040	10,339	760	2,155	281	1,653	11,994	310	456	14	8,929	2,995	40,926
Queensland	237	90	250	92	40	556	1,108	594	24	...	30	...	3,031
Tasmania	83	25	65	...	...	...	649	...	...	...	1,454	...	2,276
New Zealand and Fiji Islands	1,022	2,701	974	1,078	115	4,578	412	75	245	80	3,756	1,681	16,717
Total, £	34,234	74,850	18,761	11,572	6,141	16,684	140,111	11,118	13,118	1,130	41,078	65,429	434,226

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	2	...	...	12	...	...	6,004	75	509	6	5,426	12,034
Germany	84	31,898	1,545	6,046	10,364	5,691	46,264	14	3,824	8,331	8,501	122,562
Holland	...	5	...	350	653	...	109	...	6	...	...	1,123
Belgium	1,005	2,423	59	174	...	...	3,711	...	926	570	11,817	20,685
France	233	300	274	987	177	474	321	...	659	4,008	530	7,963
Switzerland	313	1,101	26	8	...	167	1,440	...	...	89	235	3,379
Italy	...	3,036	...	...	6	...	...	...	...	...	159	3,201
Austria-Hungary	13	160	...	105	130	...	...	...	323	1,265	33	2,029
United States	5,442	75	624	...	10	1,902	15,624	14,991	697	548	2,682	42,595
Total, £	7,092	38,998	2,528	7,682	11,340	8,234	73,473	15,080	6,944	14,817	29,383	215,571

Additional imports: Spain, carbons £550; Canada, telegraph and telephone apparatus £65, electrical goods £20, electrical machinery £95.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	9,677	529	...	1,203	449	...	4,784	...	250	197	565	17,654

TOTAL EXPORTS: £434,226. TOTAL RE-EXPORTS: £17,654. TOTAL IMPORTS: £216,301.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

APPARATUS ON HIRE.

By T. C. PARSONS.

(*Concluded from page* 476.)

Account Forms.—The form of accounts for this purpose got out by the writer for the Govan Corporation was that of a triplicate book. The Electricity Department made out and issued the accounts; a copy of the account was retained in the book, and a copy was sent to the burgh treasurer or accountant who received the money. There was also an alphabetical index in the book, so that any account could be quickly found for reference. This system worked well, and samples of the three leaves are appended.

No.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

HELEN STREET,
GOVAN, ... 191

Messrs. .....

.....

Dr. to THE PROVOST, MAGISTRATES AND COUNCILLORS OF THE BURGH OF GOVAN.

To Rent now due for Motors and Slide Rails as under:—
For Quarter ending .....

			£	s.	d.
Motor of	H.P. at £	per annum .. Corp. No.			
Do.	H.P. at £	do.			
Do.	H.P. at £	do.			
Do.	H.P. at £	do.			
Do.	H.P. at £	do.			
Sets Slide Rails,	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
		TOTAL .. .. .. £			

NOTE.—Any inquiry in connection with this Account shou'd be made to the BURGH ELECTRICAL ENGINEER, Electricity Works, Helen Street, within seven days, after which date no question as to the accuracy of same can be entertained.

PAYMENT is requested to be made within ten days to
JOHN RANKIN, Collector, Municipal Buildings, Summertown Road, Govan.

Office open from 9.30 a.m. to 4.30 p.m. Closed on Saturdays at 1 p.m.

Please present this Account when Payment is made.

No.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

HELEN STREET,
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Do.	H.P. at £	do.			
Do.	H.P. at £	do.			
Do.	H.P. at £	do.			
Sets Slide Rails	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
Do.	at £	do.			
		TOTAL .. .. .. £			

The Treasurer will please note that the above Account has been delivered.

When the accounts were made out at each quarter, the total amount of each invoice was copied into a ledger and sent up to the treasurer for him to enter the date of payment. The ruling used is given at the bottom of the page.

One double page served for the complete year, the hirer's name and address being in the two centre columns for easy reference to both pages. The account number is the one printed on the top right-hand corner of the triplicate form.

ELECTRIC HEATING.

Whilst electric heating is exceedingly useful for occasional use and for special cases, it cannot, at the present price of current, be put forward as a commercial competitor to the coal fire. To attempt to do so will only bring discredit on electric heating; and if consumers are persuaded to install hired radiators with the idea that they are going to be an economical solution of the domestic fire question, the result will be bad for the hiring department.

It must be remembered, in the first place, that by far the largest proportion of the population must have heat at the lowest cash cost, and convenience cannot possibly enter into their calculations; this will be clearly brought home to everyone when it is remembered that 89 per cent. of the population do not pay direct income-tax, and that therefore their incomes are under £160 per annum.

Electricity has so many other uses, in which it is superior to all competitors, that it is a pity prospective consumers should be misled as to the cost of heating and induced to put in heating appliances, to find in the end that it is a failure on the score of expense.

In order to establish a comparison between the two ways of heating, tests were made in an office of 3,537 cb. ft. and in a private room of 2,831 cb. ft., the results of which were as follows:—

It was considered that the results would be of no value without a record of the temperatures both outside the window and inside the room.

The office had two outside walls, one facing north-west with three windows, each 6 ft. × 3 ft., and the other facing north-east, with no windows. It was heated first by a well fire and then by a 3-unit Bastian heater. Three thermometers were hung up, one at each end and one in the middle of the room, and one was put outside the window. Temperature readings were taken every hour, and the coal and electricity were measured for several days. During the coal-heating tests the weather was considerably colder than during the electric-heating tests:—

HEATING BY COAL FIRE.

Date, 1911.	Average outside temperature. °F.	Average rise of temperature in room. °F.	Coal.	Cost per day at 20s. per ton.
Feb. 1	27	24·1	49 lb.	5·24d.
,, 2	31·8	23·1	52 ,,	5·56d.
,, 3	31·2	18·8	44 ,,	4·71d.
,, 4	39·4	14·0	27 ,,	2·89d. (Saturday)
,, 6	44	11·5	40 ,,	4·28d.
,, 7	46·3	12·5	34 ,,	3·64d.
,, 8	41·1	16·2	33 ,,	3·53d.
,, 9	43	14·0	34 ,,	3·64d.
,, 10	41·9	16·9	34 ,,	3·64d.
76 hours	38·4	16·8	347 lb.	37·13d.

Ruling of Motor Ledger.—

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

MOTOR RENTS.

For period ending						For period ending						Name.	Address.	For period ending						For period ending						
No. of Account.	Date of issue.	Amounts. Due.	Amounts. Paid.	Date of payment.	Arrears.	No. of Account.	Date of issue.	Amounts. Due.	Amounts. Paid.	Date of payment.	Arrears.			No. of Account.	Date of issue.	Amounts. Due.	Amounts. Paid.	Date of payment.	Arrears.	No. of Account.	Date of issue.	Amounts. Due.	Amounts. Paid.	Date of payment.	Arrears, May 15th.	Remarks.

The fire was lit at 7.30 a.m. and the temperature readings were taken from 8.30 a.m. to 5.30 p.m. The total number of hours for the period was 76, but, of course, the fire was not right out at 5.30 p.m. The variation of temperature in different parts of the room was very slight, the maximum being 5° F., on February 1st, and the minimum 1° F., on February 9th.

Maximum Variation.—February 1st, 1911.

Time.		Reading on thermometer. 1.	2.	3.	Outside.
10.45 a.m.	...	48·5	51·5	46·5	28
12 30 p.m.	...	49·5	50	50·5	28
2.30 p.m.	...	52	53·5	54·5	27
4 p.m.	...	52·5	57	52	26
5.15 p.m.	...	54	55	54	26

Minimum Variation.—February 9th, 1911.

Time.		Readings on thermometer. 1.	2.	3.	Outside.
8.30 a.m.	...	52	52	51	44
10.50 a.m.	...	56	57	57	44
12.30 p.m.	...	59	60	58	43
2.45 p.m.	...	57·5	59	61·5	42
5.15 p.m.	...	58·5	59	58	42

In estimating the efficiency of a coal fire, one point is frequently lost sight of, viz., the heat which is given to the brickwork and radiated out again into the room.

In the office in question, the temperature was taken at the entrance to the chimney, sufficiently high up to ensure that the gases had been mixed with the air drawn in from the room, and was found to be 650° F., and at the same time readings at the chimney pot showed 195° F., the difference being 455° F., and the heat represented by this difference of temperature must have been absorbed by the brickwork and a fair proportion radiated out into the room. In the case of a house where the fireplace is in an inside wall, all the heat absorbed by the brickwork in this way is given out into the house.

After these tests a 12-ampere Bastian radiator was installed, and for five days temperature readings were taken in the same way, the results being given below :—

Heating by Electricity.

Date.	Average temperature outside.	Average rise inside.	Units.	Cost at 1d per unit.
Feb. 21 ...	50·3	7	21	1s. 9d.
,, 22 ...	39·6	16·3	28	2s. 4d.
,, 23 ...	45·3	12·6	29	2s. 5d.
,, 24 ...	45·9	9·8	26	2s. 2d.
,, 25 ...	44	13·0	11	11d. (Sat.)
40 hours	45·02	11·7	115	9s. 7d.

The radiator was on for 23 days from 8.30 a.m. to 5.30 p.m. and for four days from 8.30 a.m. to 12.30 p.m., a total of 223 hours, and during that time 600 units were consumed, an average of 2·69 units per hour.

Since the radiator was first installed the fire has not been lit, and all the heating has been done electrically, and from February 21st, 1911, to November 7th, 1912, 5,708 units were taken, the temperature of the room being usually kept between 55° and 60° F. This practically represents the heating for one and a half seasons, and the cost at 1d. per unit would have been £23 14s. or £15 16s. per annum for one fair-sized room.

The variation of the temperature in different parts of the room was about the same as with coal heating, the maximum being 5·5° F.

Electric Heating.

Maximum Variation on February 22nd, 1911.

Time.		Reading of thermometer. 1.	2.	3.	Outside.
8 30	...	56	51	50·5	42
9.45	...	55	55·5	54·5	40
12.45	...	57	56·5	56·5	41
2.45	...	57	57	57	34
5.15	...	58·5	58·5	58·5	41

Maximum Variation on February 24th, 1911.

Time.		Readings of thermometer. 1.	2.	3.	Outside
8.30	...	50	47	47·5	40 5
9.45	...	54	53	52	42
11.0	...	55	52	52	39
2.40	...	58·5	57·5	57	46
3.50	...	59·5	59·5	58·5	60
4.45	...	61	62	60·5	51
5.25	...	59	57·5	58·5	43

The results in the living room, which were taken in exactly the same way, were—

Coal Firing.

Average temperature rise	13·8° F.
Coal burnt	61 lb.
Total hours	28·5
Cost at 20s. per ton	6·53d.

Electric Heating.

Average temperature rise	9·5 F.
Energy consumed	112·5 units.
Total time	81·6 hours.
Cost at 1d. per unit	9s. 4½d.

Taking the total, the results are—

Office.

347 lb. coal gave an average rise of 16·8° F. for 76 hours.
112 units ,, ,, ,, 11·7° F. ,, 40 ,,

Assuming a direct proportion, there would be required 128 lb. coal to give the same amount of heat for the same time as 115 units, or one unit equals 1·11 lb. coal. Taking the price of coal at 20s. per ton, electricity in order to compete must sell at ·119d. per unit.

Living Room.

61 lb. of coal gave an average rise of 13·8° F. for 28·5 hours.
112·5 units ,, ,, ,, 9·6° F. ,, 81·6 ,,

and assuming a direct proportion, there would be required 121 lb. coal to give an average rise of 9·6° F. for 81·6 hours, so that 121 lb. coal can be taken as equal to 112·5 units, or one unit equals 1·075 lb. coal, and assuming coal at 20s. per ton, electricity to compete must sell at ·115d. per unit. The efficiency of coal heating is often stated as being as low as 10 per cent., but these figures would point to a considerably higher value.

Taking the case of the first room, 115 × 3,428 = 394,220 B.TH.U. = heating value of electricity used, and it has been shown that 128 lb. coal has the same effective heating value, so that 394,220 ÷ 128 = 3,097 = effective B.TH.U. per lb. of coal. There were actually about 15,000 B.TH.U. per lb. of this coal, so that the efficiency is about 20·5 per cent.

The amount of ventilation will obviously affect the number of units taken to heat up a room, and in all the experiments in the private office one window was open six inches at the top. The area of the windows was 54 sq. ft., and of the walls 745 sq. ft., and if the formula for the KW. required to heat a room—

$$\text{KW.} = \frac{(30\,A + 8\,B + n\,c)\,20{\cdot}4 \times t}{3{,}600 \times 1{,}000}$$ be applied,

where A = sq. ft. of window surface,
B = ,, wall surface,
C = cubic contents of room,
t = temperature rise,
n = number of times air changed per hour,

then it would appear that the number of times the air was changed per hour averaged ten.

The writer is aware that this is considerably in excess of the number of changes of air per hour necessary for health, but the difficulty of regulating this is great and will depend also on the number of people in the room, and it is better to err on the side of changing the air too frequently than not to change it often enough.

Even supposing that the air was only changed three times per hour. the energy consumed would be 1·206 units per hour, against a coal cost of ·34d. per hour, so that to reduce the electrical cost to the same price, energy would have to be sold at ·282d. per unit, and this is assuming that the coal cost remained the same with three changes of air per hour as it was with ten changes, and of course it would really be lower.

The writer considered that it would be of interest to obtain figures from heating by gas fires, and observations were taken for a week in an office heated by the latest and most efficient type of gas fire.

The area of the windows was 107 sq. ft., of the walls 1,613 sq. ft., and the cubic contents of the room 8,325 cb. ft.

Readings were taken in the same way for a week of 47 hours. The average temperature rise was 11·7° F., with a consumption of 2,240 cb. ft. of gas. It was merely

a coincidence that the temperature rise was exactly the same as in the case of the electrically-heated office.

The following is a tabulation of the readings obtained :—

Date.	Average outside temperature.	Average inside temperature.	Average rise of temperature.	Cubic feet of gas.	Cost at 2s. per 1,000.
Feb. 12 ...	48·1	57·44	9·34	440	10 56d.
„ 13 ...	44·97	57·12	12·15	350	8·4d.
„ 14 ...	43·8	55·27	11·47	410	9·84d.
„ 15 ...	43·3	54·9	11·6	220	5·28d. (Sat.)
„ 17 ...	40·54	53·3	12·76	480	11·52d.
„ 18 ...	40·18	53·1	12·92	340	8·16d.
47 hrs. ...	43·48	55·18	11·7	2,240	53·76d.

The total gas consumed for one complete heating season, from October 5th, 1912, to April 29th, 1913, was 66,500 cb. ft., which at 2s. per 1,000 = £6 13s.

In the previous year the coal cost was £4 4s. 2d., but this included the period of the coal strike, and the fair comparison is with the year before that, when 4 tons 18 cwts. cost £3 13s. 7½d., so that comparing gas at 2s. with coal at 20s., gas costs 1·37 times the price of coal, and the relative cost of heating by the three systems would be :—

Coal, at 20s. per ton, equal to 1.
Gas, at 2s. per 1,000 cb. ft., equal to 1·37.
Electricity, at 1d. per unit, equal to 8·4.

These figures demonstrate the hopelessness of attempting to oust the domestic fire by electricity, even at the low rate of ½d. per unit, but for occasional uses and in special cases it is excellent, and would be far more used if radiators were let out on hire at reasonable rates. One particularly suitable place is an hotel bedroom, where it is usual to charge 1s. for a fire. If a radiator were fixed with a shilling slot meter, it would pay both the hotel proprietor and the guests who wish for a fire for a short time.

Rental.—There are so many different patterns of heaters that a definite price cannot be fixed for all, but as a general principle it may be taken that the life of radiators built up of sheet iron can be taken at 10 years, those built up of sheet copper at 12 years, and those built up of cast metal at 15 years. The renewals will vary according to the type of heating element, and must be allowed for in each separate class : in the lamp radiators, to be safe, a renewal of half the lamps per annum, and in the convector and Bastian heaters the renewal of all the elements in four years.

Taking the sinking fund as improved at 3 per cent., and the interest at 3·5 per cent., these charges will be :—

For 10 years' life, 12·223 per cent. of the first cost ;
„ 12 „ 10·546 „ „ „
„ 15 „ 8·876 „ „ „

The following list then gives the cost, rental and upkeep of the different types of radiators, based on these principles. It should be remembered, however, that the prices given for the radiators are simply the ordinary trade terms for a single radiator, and that very much better terms would be obtained if a contract for a large number were entered into, so that the cost, rental and upkeep would therefore be *lower* in actual practice than the figures given.

Type.	First cost.	Estimated life.	Rate % for sinking fund.	Interest and sinking fund.	Renewa's.	Rent per ann.
Cheap 2-lamp radiator ...	20/–	10 yrs.	8·723	29·3d.	30d.	5/–
4-lamp ditto.	25/–	10 „	8·723	36·7d.	60d.	8/–
Better class 2-lamp radiator	65/–	10 „	8·723	103d.	30d.	11/–
4-lamp ditto.	77/–	10 „	8·723	113d.	60d.	14/6
F-type Bastian heater ...	48/–	15 „	5·376	51·12d.	46d.	8/–
C.I. convector, 1,000 watts	55/–	15 „	5·376	58d.	33d.	8/–
1,500 watts ditto.... ...	62/6	15 „	5·376	66d.	49·5d.	10/–
Sheet copper, 1,500 watts	76/6	12 „	7·046	97·5d.	49·5d.	12/6
„ „ 2,000 watts	92/–	12 „	7·046	116·5d.	66d.	16/–
„ „ 2,500 watts	103/6	12 „	7·046	131d.	82·5d.	18/–

The procedure would be much the same as in the case of the motors on hire. There would be a difference in the application form and in the valuation book, to suit the different apparatus. There would be no necessity to send an inspector round to examine, unless the hirer sent to say that something was wrong.

Wiring.—The wiring in connection with the radiators should not be done free nor included in the rental for the apparatus, and if done at all should be paid for out of revenue and charged up to the hirer.

Building contractors when putting up new properties should be urged to install plugs in the different rooms, so that a radiator can be put in at any time.

Wiring contractors also should be circularised as to the necessity of putting in wires of sufficient size to take electric heating and cooking apparatus which is certain to come later on. The present tendency, especially in tenements, is to cut down the copper to the lowest in order to give a cheap price, but this policy will prevent the adoption of electric heating and cooking, because people will not go to the bother and expense of putting in special wires, particularly where the house is not their own.

AIR FILTER PLANTS FOR ELECTRIC GENERATORS.

The subject of air filtration in connection with the cooling of electric generators has been prominent of late ; the following description of modern type of air filter plant which has been developed by Messrs. Balcke and Co., Ltd., of Westminster, S.W., may therefore be of interest. Its construction is shown diagrammatically in figs. 1-3. It consists of a wooden frame, stretching apparatus, pocket frames and pockets. The wooden framework is made of the very best selected pitch-pine, of very strong section, free from all defects, and securely connected by mortised and tenoned joints, cleats and bolts. The whole of the woodwork, both of the framework and the other parts of the filter, is treated with linseed oil. If specially called for it can be impregnated under pressure with fireproof composition, after, in the first instance, the sap in the wood has been removed by vacuum. The filter is thereby rendered absolutely fireproof, right through every fibre of the wood.

The stretching apparatus for each section of the filter consists of two horizontal bars, each of which is tightened by two screws (10), between which and the bars is interposed a spring (12), so that any slackening or tightening of the cloth due to atmospheric influences can be automatically taken up. The pocket frames are hooked into an elastic steel wire rope (8), so that any inequalities in the depth of the pockets are automatically adjusted. The main timbers of the pocket frames (2) are made of best selected pitch-pine ; the thin sections of best fir. They carry at one end the tightening frame (1), and for the easy removal of the pockets a handle (3). The pockets are made of best cotton cloth, and can be impregnated with fireproof solution. They are bound at the pure-air opening with a strong linen tape, with elastic cord for fixing the pocket to the tightening frame (1). It will be seen from the drawings that the cord forming the end of the pocket is pressed into a groove on the outer rim of the tightening frame, and rests against the partition frame (4), between each two individual pockets, while, at the same time, the pocket frame can move independently of the tightening frame, so that immediately a pocket is placed into position and fixed to the elastic wire, an air-tight joint is made between the tightening frame and the partition frame (4), the friction at the joint relieving any tension on the cord of the pocket edging, and making it thereby impossible for this to be drawn out of its position in the groove.

The erection of the filter is exceedingly simple, and after the fitting-up of the frame and stretching apparatus, the pockets with their respective pocket frames are simply inserted in the opening, hooked into the wire ropes and stretched evenly by tightening the four bolts (10). The replacing of the pockets is equally simple, and after slackening the four bolts referred to, they can be immediately unhooked from the frame and withdrawn from the pure-air space. It is also possible, after having withdrawn two or three pockets from the pure air space, to remove the remaining pockets with their respective frames from the impure-air space.

A wet air filter has also been designed by Messrs. Balcke to meet the demand for a type of plant which does not use cloth as the filtering medium (see fig. 4). The filter casing is of galvanised sheet steel, the lower portion forming a water tank and the upper portion the filter proper, each being pro-

vided with facings for the water inlet and outlet connections. The air inlet is closed with wire netted doors, which could, if required, be replaced by louvred doors. Immediately behind the same a system of sprayers is arranged, which breaks up

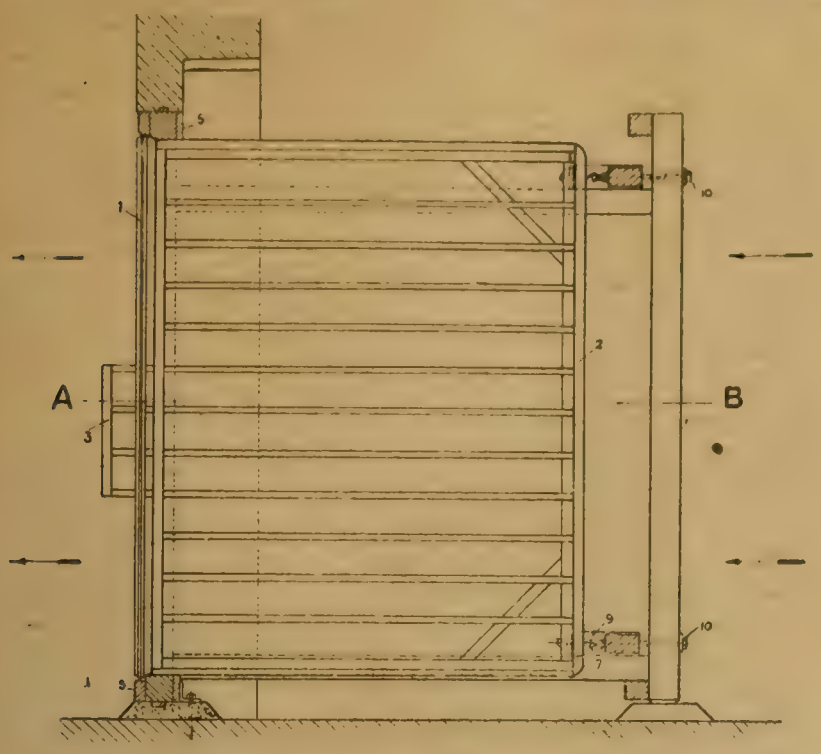


Fig. 1.—Balcke Air-Filter.—Section on B C, Fig. 2.

the water into a fine spray, thoroughly atomising it. The air is thereby brought into intimate contact with the water, so that the impurities are thoroughly moistened, and either fall by gravity into the tank, or are separated from the air by the baffle plates. The atomised spray is thrown in the

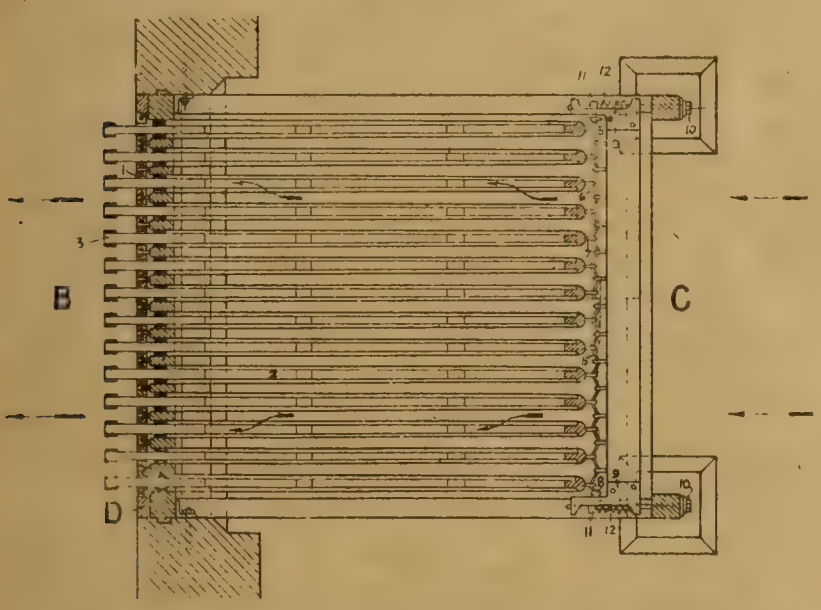


Fig 2.—Section of Air-Filter, on A B, Fig. 1.

direction of the air flow, so that instead of offering resistance to the air as in the case of filters where the direction of the spray is opposed to the air flow, it will assist the flow of the air, thereby reducing the labour thrown on the fan and generator.

The nozzles are made of gun metal, and are of such construction that they cannot easily choke; the piping of the sprayers is all galvanised. As the spraying system is only a

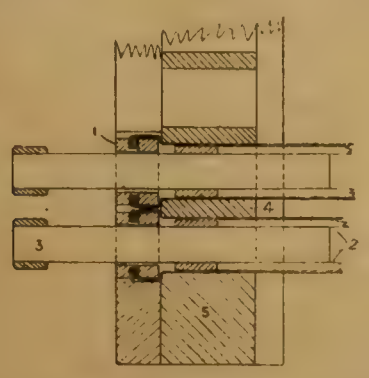


Fig. 3.—Detail at Corner D, Fig. 2.

few inches away from the air inlet, it can be attended to without entering the filter, by opening the doors while the filter is in operation. The same water is used over and over again, being circulated by means of a belt or motor-driven centrifugal pump, which will generally be placed in close proximity to the filter. The pump is designed to deliver the water to the nozzles at the correct pressure to obtain the most efficient spraying.

To dry the air thoroughly and retain any impurities carried by the spray, a system of baffle plates is arranged at the air outlet of the filter. These consist of galvanised sheet metal strips, arranged at an angle to the longitudinal centre line of the filter, alternate rows being inclined in opposite directions. Each baffle is provided with an upright channel at the outlet edge, into which the particles of moisture and impurities are thrown and drain to the bottom of the filter, preventing any deposit being carried through from one row of baffles to the next. Although the baffles are placed at close intervals, they offer practically no resistance to the air. At the upper end of the spraying system, a few special nozzles are arranged to throw water on to the top of the

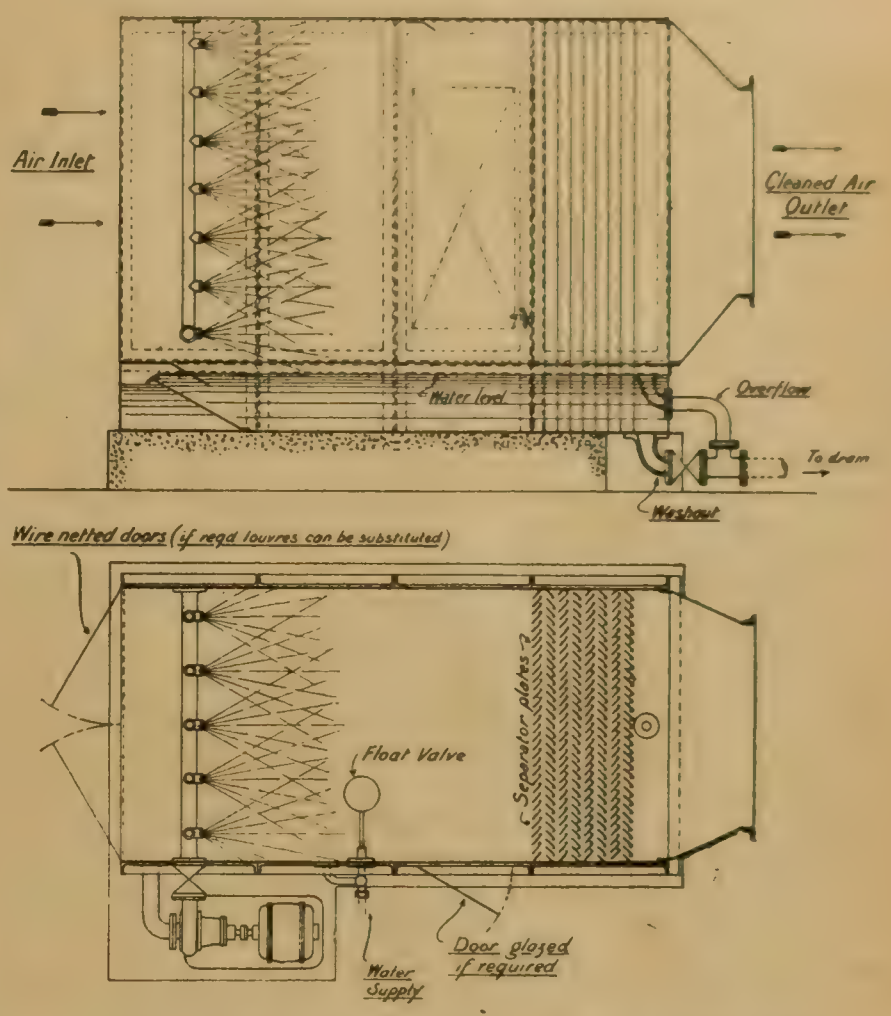


Fig. 4.—Elevation and Plan of Wet Air-Filter.

first row of baffles to assist in washing down any impurities retained. The air outlet end of the filter is provided with a conical cover, to which the air duct is connected. In the side of the casing an inspection door is provided, which can be glazed if required.

The tank at the air outlet end of the filter is provided with a large wash-out connection and overflow, with suitable valves leading into one common drain pipe, as at this end most of the impurities will settle. The pump suction is arranged at the opposite (the air inlet) end, separated from the main tank by a sloping partition protected with a removable cover. The flow of water towards this suction is exceedingly slow, so that all the impurities, with the exception of the most minute, will settle in the bottom of the tank without getting to the suction chamber. The tank is provided with a make-up water ball cock and separate connection for quickly filling the tank after the same has been washed out, from the same source. A further connection is made from this make-up water pipe to the inlet end of the filter, to which a short piece of hose pipe can be connected to wash out the tank when it is being periodically cleaned.

Commercial Development in Canada.—We have received from a Canadian correspondent a copy of the "Electric Service Magazine," which is issued monthly by the Toronto Electric Light Co., and is distributed gratis to all their consumers. The magazine gives illustrations relating to the company's plant, brief articles and notes forcibly driving home the advantages of electricity in every walk of life, examples of handsome fittings in the Bank of Toronto, &c. It is a bright little paper, and likely to interest the layman in the possibilities of electricity supply.

WATER STERILISATION BY ULTRA-VIOLET RAYS.

In a paper recently read before the Société International des Electriciens, M. de Recklinghausen gives some interesting particulars of an improved mercury vapour lamp arrangement for use in sterilising large quantities of water, such as the whole water supply to a town.

The first experiments were carried out with quartz mercury vapour lamps of the Westinghouse Cooper Hewitt Co.'s make. The lamp was inserted in a separate chamber provided with rock crystal windows (fig. 1), so as to avoid



Fig. 1.—Section of Sterilising Chamber.

actual contact between the lamp vessel and the water. In this way the comparatively high lamp temperature essential for the economical production of the ultra-violet rays was maintained. The water to be treated is subjected to a preliminary partial filtration to remove matter in suspension and render it as transparent as possible, and it then passes in front of the lamp chamber and is subjected to the action of the rays.

Experiments with apparatus of this form extending over two years proved that at an expenditure of 25 to 30 watt-hours per cubic metre of water practical sterilisation was attained. Bacteriological examination showed that the number of germs had been reduced to 10 per cubic centimetre (after 15 days' culture) and in many cases even to zero. The colon bacilli, which are sometimes found in unpurified water, were entirely absent after the sterilisation. When the water was at all discoloured, it was found necessary to reduce the rate of flow past the lamp to obtain equally good bacteriological results.

On the whole, these early experiments were satisfactory, but showed that a large number of such lamps would be

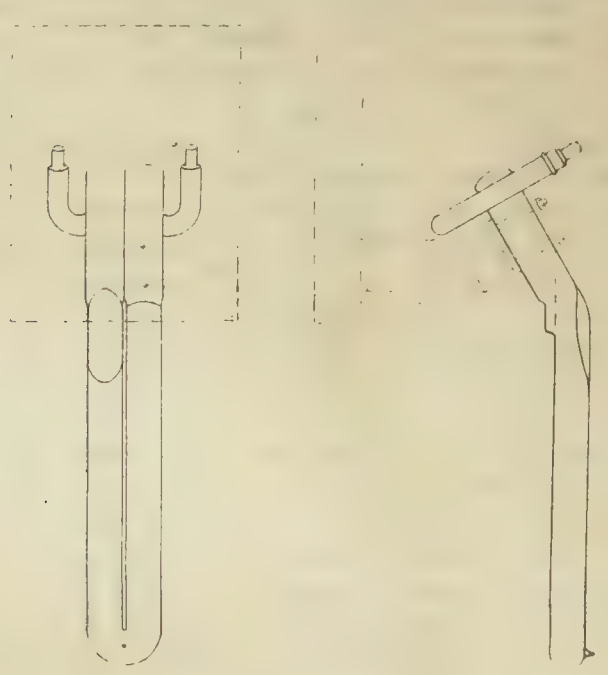


Fig. 2.—Improved Form of Lamp.

necessary to deal with any public water supply. Consequently the construction of a more powerful form of apparatus was decided upon.

With the original shape of lamp and protecting chamber only some 60 per cent. of the light actually reaches the water, and in order to reduce this loss the form of lamp was changed to that shown in fig. 2. It consists of a U-tube of quartz with the two branches quite close together, the length of each branch being $6\frac{1}{2}$ in. in the lamp suitable for a 500-volt 3-ampere supply. In this way the two electrodes are brought together at one end and are cooled by a single radiator, whilst the luminous portion of the lamp is free to be inserted into an external quartz tube of comparatively small diameter projecting into the water chamber.

Such a lamp, though connected to a 500-volt circuit, has about 375 volts across the actual electrodes and gives some 8,000 c.p. measured at right angles to the length of the lamp.

Comparing this lamp with the older 110-volt lamp as regards its effect on the colon bacillus (the typical bacillus in polluted water) it was found that the same degree of sterilisation could be obtained with it about 60 times as quickly. Compared with the 110-volt 8-ampere lamp, the effect was about 50 times as great and compared with the 220-volt $3\frac{1}{2}$-ampere lamp about 11 times as great.

The arrangement of the lamp in the water-flow chamber is shown in fig. 3. When two lamps are required, a single straight quartz tube running right across the chamber is used with a lamp inserted at each end of it.

The lamps are ignited by tipping them as usual, but, in order to avoid the use of an unnecessarily wide outer quartz tube, this tipping is done after withdrawing the lamp (on its stand) towards the back. When alight the lamp is

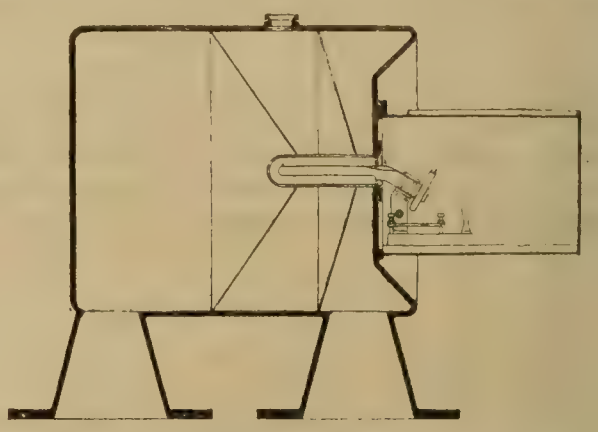


Fig. 3.—Section of Improved Apparatus.

returned into its working position in the chamber. The operator is protected from the effects of the ultra-violet rays by a cover containing an inspection window. Baffle plates are provided, as shown, in the water chamber to ensure a thorough stirring of the water whilst under the action of the rays.

An electromagnetic relay, operated by the lamp current, is arranged to cut off the flow of water should the lamp become extinguished at any time accidentally. Also, when several lamps are used in parallel, the circuit is so arranged that if one lamp becomes extinguished accidentally, the rest are immediately cut off automatically.

Such a plant as the above, provided with two 500-volt, three-ampere lamps, was tested with from 1,600 to 2,000 cubic metres (350,000 to 440,000 gallons) a day of ordinary river water which had been roughly filtered, but which still retained a marked yellowish tinge. The resulting water contained from 0 to 9 germs at most per cubic centimetre (average 2·5 germs), whilst originally there were between 56 and 655 germs per cubic centimetre.

An important question in connection with such plants is the length of life that may be expected. The new U-shaped lamps have been only recently introduced, but the experience gained with the first installations has shown that no appreciable falling-off in ultra-violet rays occurs at least up to 1,300 hours of work, and there seems to be no reason why their life should not extend to 3,000 hours or more, as with the ordinary quartz lamps. In the laboratory at the Sorbonne some lamps tested after 7,000 hours' use have shown only from 10 per cent. to 15 per cent. reduction in ultra-violet rays.

Insulated Wires in Germany.—The manufacturers of insulated wires in Germany, exclusive of telephone and telegraph wires, formed a price association a year ago. It is now intended to establish a sales bureau in the form of a company, which, whilst allowing a suitable profit to the trade, will undertake sales on common account for Germany. The level of prices, it is stated, has not undergone any change.

TRADE STATISTICS OF SWEDEN.

The following figures show the imports of electrical and similar goods into Sweden during the year 1911, and are taken from the official statistics which have recently been issued; the figures for 1910 are given for purposes of comparison, and notes of any increases or decreases have been added. The predominance of German trade in nearly all branches will be noticeable.

	1910. Kronor.	1911. Kronor.	Inc. or dec. Kronor.
Electric Meters.—			
From Germany	611,000	692,000	+ 81,000
„ Great Britain ...	71,000	68,000	— 3,000
„ Other countries ...	2,000	7,000	+ 5,000
Total ...	684,000	767,000	+ 83,000
Electric Incandescent Lamps.—			
From Germany	642,000	929,000	+ 287,000
„ Great Britain ...	1,000	—	— 1,000
„ Switzerland ...	7,000	—	— 7,000
„ Austria-Hungary ...	29,000	20,000	— 9,000
„ Holland	7,000	91,000	+ 84,000
„ Other countries ...	9,000	16,000	+ 7,000
Total ...	695,000	1,056,000	+ 361,000
Dynamos and parts thereof.—			
From Germany	184,000	162,000	— 22,000
„ Great Britain ...	4,000	—	— 4,000
„ Switzerland ...	81,000	23,000	— 58,000
„ France	12,000	—	— 12,000
„ Other countries ...	7,000	16,000	+ 9,000
Total ...	288,000	201,000	— 87,000
Electric motors and parts thereof.—			
From Germany	447,000	468,000	+ 21,000
„ Great Britain ...	7,000	12,000	+ 5,000
„ Switzerland ...	12,000	—	— 12,000
„ France	—	11,000	+ 11,000
„ United States ...	22,000	19,000	— 3,000
„ Other countries ...	28,000	34,000	+ 6,000
Total ...	516,000	544,000	+ 28,000
Transformers and parts thereof.—			
From Germany	235,000	242,000	+ 7,000
„ Great Britain ...	2,000	—	— 2,000
„ Switzerland ...	22,000	16,000	— 6,000
„ Other countries ...	1,000	6,000	+ 5,000
Total ...	260,000	264,000	+ 4,000
Telephone apparatus.—			
From Germany	6,000		—
„ Great Britain ...	1,000	No details.	—
„ Other countries ...	2,000		—
Total ...	9,000	7,000	— 2,000
Telegraph apparatus.—			
From Denmark	3,000		—
„ Germany	2,000	No details.	—
„ Great Britain ...	2,000		—
Total ...	7,000	11,000	+ 4,000
Turbines.—			
From Norway	17,000	—	— 17,000
„ Germany	1,000	33,000	+ 32,000
„ Great Britain ...	3,000	7,000	+ 4,000
Total ...	21,000	40,000	+ 19,000
Accumulators.—			
From Germany	497,000	796,000	+ 299,000
„ Great Britain ...	6,000	27,000	+ 21,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	504,000	825,000	+ 321,000
Rheostats.—			
From Germany	689,000	799,000	+ 110,000
„ Great Britain ...	19,000	—	— 19,000
„ Switzerland ...	69,000	24,000	— 45,000
„ Denmark	—	40,000	+ 40,000
„ Other countries ...	16,000	18,000	+ 2,000
Total ...	793,000	881,000	+ 88,000
Elevators.—			
From Germany	44,000	19,000	— 25,000
„ Great Britain ...	5,000	—	— 5,000
„ Other countries ...	2,000	18,000	+ 16,000
Total ...	51,000	37,000	— 14,000
Cranes.—			
From Germany	38,000	255,000	+ 217,000
„ Great Britain ...	85,000	109,000	+ 24,000
„ United States ...	91,000	—	— 91,000
„ Other countries ...	25,000	93,000	+ 68,000
Total ...	239,000	457,000	+ 218,000
Copper wire, twisted, and cable not insulated.—			
From Germany	137,000	79,000	— 58,000
„ Other countries ...	—	5,000	+ 5,000
Total ...	137,000	84,000	— 53,000
Copper wire covered with textiles.—			
From Germany	7,000	11,000	+ 4,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	8,000	13,000	+ 5,000
Copper wire covered with rubber.—			
From Germany	2,000	No details.	—
„ Other countries ...	1,000		—
Total ...	3,000	3,000	—
Electric cables covered with lead.—			
From Germany	3,078,000	5,215,000	+ 2,137,000
„ Holland	63,000	49,000	— 14,000
„ Great Britain ...	281,000	267,000	— 14,000
„ Other countries ...	2,000	5,000	+ 3,000
Total ...	3,424,000	5,536,000	+ 2,112,000
Copper wire otherwise insulated.—			
From Germany	279,000	320,000	+ 41,000
„ Great Britain ...	21,000	21,000	—
„ Other countries ...	9,000	1,000	— 8,000
Total ...	309,000	342,000	+ 33,000
Other electric cable.—			
From Germany	326,000	404,000	+ 78,000
„ Great Britain ...	10,000	29,000	+ 19,000
„ Other countries ...	1,000	1,000	—
Total ...	337,000	434,000	+ 97,000
Steam turbines.—			
From Germany	114,000	154,000	+ 40,000
„ Great Britain ...	18,000	—	— 18,000
„ Switzerland ...	29,000	—	— 29,000
„ Other countries ...	—	9,000	+ 9,000
Total ...	161,000	163,000	+ 2,000
Steam boilers.—			
From Germany	36,000	68,000	+ 32,000
„ Great Britain ...	230,000	26,000	— 204,000
„ Other countries ...	7,000	16,000	+ 9,000
Total ...	273,000	110,000	— 163,000

Krone = 1s. 1⅓d.

The Anglo-American Exposition, 1914.—A great demonstration of what the progress of the world owes to Anglo-Saxon invention and industry will take place at the White City next year, in the shape of an Anglo-American Exhibition. The inception of the scheme is due to the American Society in London, and the actual work was inaugurated at a meeting at the Mansion House. The support which the Exposition has received since the meeting, exceeds even that for the Franco-British Exhibition of 1908. The Duke of Connaught has consented to be patron, and the Duke of Teck, president of the Exposition, whilst Lord Curzon, the Earl of Derby, Lord Rothschild, Lord Strathcona, Lord Weardale, the Lord Mayor of London, Sir Archibald Geikie, the Right Hon. Sir William Mather, and Sir Edward Poynter, have accepted positions as vice-presidents of the Exposition.

The Executive Committee includes the Earl of Kintore, chairman; Lord Blyth, chairman of the Organising Committee; the Hon. Sir John A. Cockburn, Lord Rotherham, the Hon. Arthur Stanley, and most of the vice-presidents.

The United States Government has promised its cordial co-operation and support, and two of the principal buildings and one-half of the Fine Arts Palace have been set aside for the U.S. Government exhibits.

A strong American Committee has been formed, as well as an American Executive Committee, and a Local Executive Committee in each of the important cities, all of which are working with enthusiasm to make the Anglo-American Exposition surpass all previous exhibitions held in London. The profits will be devoted to objects of national utility and importance in the United Kingdom and the United States.

A REMOTE-READING HYGROMETER.

[BY OUR BERLIN CORRESPONDENT.]

A determination of the moisture of air is of the highest importance in the storage rooms of slaughter-houses, in granaries and storehouses, in the malt-floors of breweries and malt factories, in the workshops of spinning mills and in hothouses, in fact, wherever goods are produced or kept, the quality of which is influenced

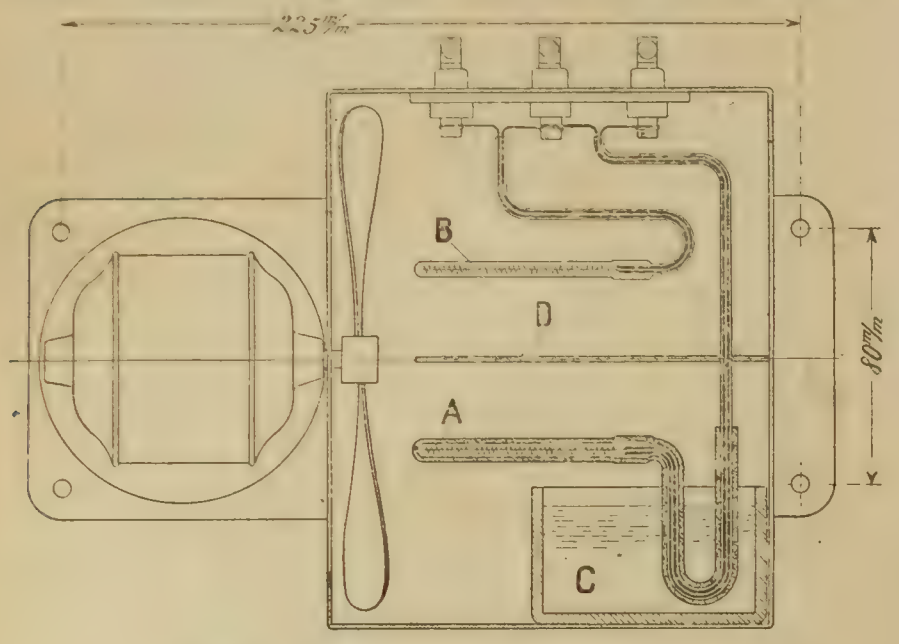


Fig. 1.—Details of Hygrometer.

by the variable degree of atmospheric moisture. It is especially desirable to be able to transmit moisture readings to remote points of a given building or set of buildings. Where there are ozone or ventilation plants in operation—in schools, banking houses, offices or dwelling rooms—the provision of moisture remote-gauges is likewise a most desirable feature.

A reliable remote-reading hygrometer has recently been designed on a system suggested by Mr. Constanz Schmitz, by Messrs. Siemens Bros. This is based mainly on the aspiration psychrometer principle, the only scientific method of moisture determination. The mercury thermometer of the ordinary apparatus is replaced by quartz glass resistance thermometers, which have been for some years used with satisfactory results for remote readings of temperature, their small dimensions, reliable insulation, even when damp, &c., being especially valuable in this connection.

Two such quartz glass resistance thermometers are arranged in a tube-shaped casing at the place where the moisture in the air is to be checked (fig. 1). Thermometer A is coated with a porous sleeve, drawing up distilled water from a vessel C. The other resistance

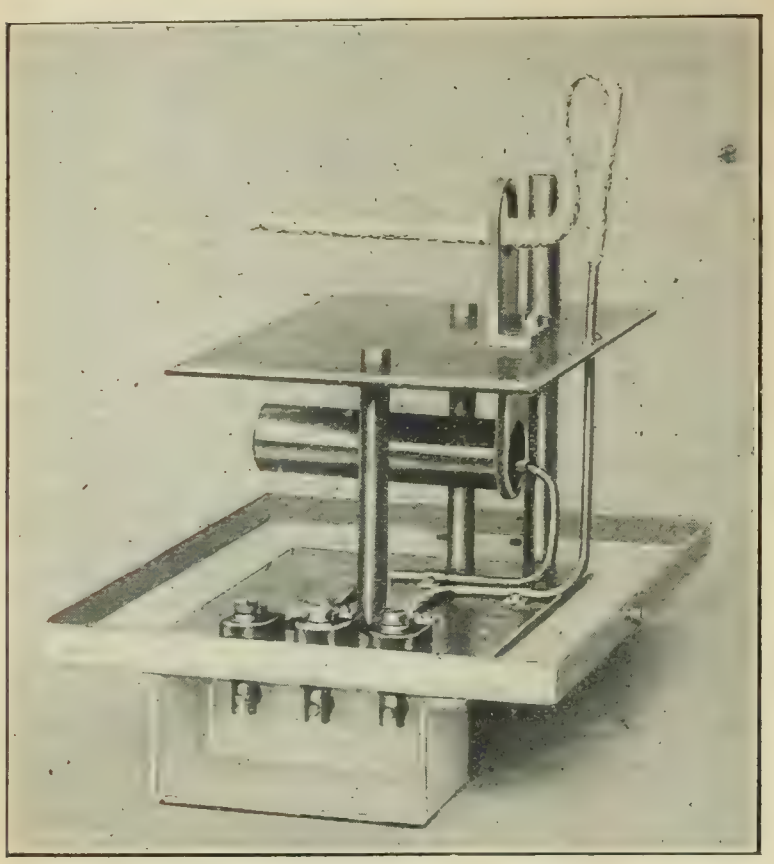


Fig. 2.—Complete Hygrometer (Inverted).

thermometer B is separated from the former by a diaphragm D, and is what is called the "dry" thermometer. As the air, the moisture of which is to be determined, passes through the casing enclosing the two thermometers, evaporation on the "moist" thermometer will produce a difference of temperature between this and the "dry" thermometer. The relation between moisture on the one hand, and temperature and temperature difference on the other, has been accurately ascertained and is embodied in Jelinek's psychrometer tables. As, however, the figures given in these tables are only true in the case of air velocities of 1 m. as a minimum, a ventilating fan should be provided in the case of slower air motion, to drive the air past the thermometers at the proper velocity. Psychrometer readings leaving this factor out of account are liable to show considerable errors. Provision has been made in this remote hygrometer for the fan motor to be thrown on and off simultaneously with the thermometers by a single manipulation, eliminating any risk of mistake, so as to avoid any waste of current.

For temperature remote-readings there are used Messrs. Siemens Bros.' temperature remote-gauges (fig. 3) fitted with a milli-voltmeter of precision and a key switch with automatic key stopping and disengaging device, a pressure key being provided for each set of "dry" and "moist" thermometers. Temperatures are read directly from the temperature scale, after inserting the thermometers, by pressing down the key (possibly starting at the same time the fan motor). In reading the "moist" thermometer temperature the operator should wait a few minutes until the index has adjusted itself to the lowest point of the scale corresponding to the actual circulation of air. The psychrometric difference of temperature having been ascertained from the two readings, the corresponding degree of moisture is derived from the table supplied with each apparatus. Measurements are further simplified in case the temperature of the "dry" thermometer only fluctuates between narrow limits. In this case, the temperature of the second thermometer being left out of account, the second determination simply

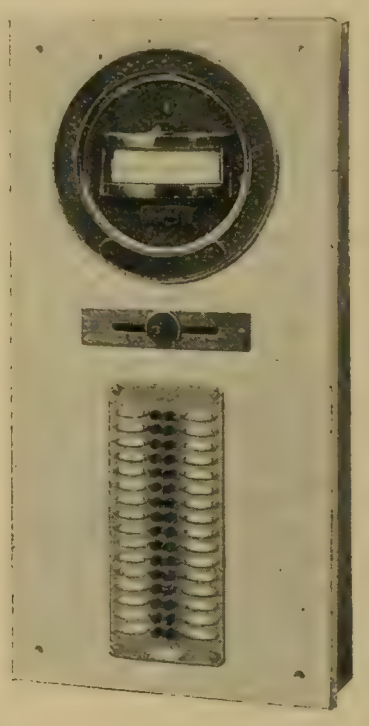


Fig. 3.—Remote Indicating Apparatus.

consists of reading the temperature difference, directly and without any calculation, from the second milli-voltmeter scale, which is graduated in degrees of temperature, or possibly in degrees of moisture for a given temperature. In this case the normal temperatures and temperature limits should be accurately given.

Three lines are required for each pair of thermometers, to connect the remote gauge with the resistance thermometers. A 4-volt accumulator is preferably used as the source of measuring current—the fan motor being connected up to the lighting mains by means of two further lines, across the remote-gauge switch. Recording remote hygrometers are designed on the same system.

The "dry" thermometer of the remote-reading hygrometer does away with the need of any special thermometer for determining the room temperature.

ELECTRICITY IN AGRICULTURE.

The following communication has been received by the Westinghouse Cooper Hewitt Co., Ltd., from Miss E. C. Dudgeon, of Lincluden House, Dumfries, regarding her experimental work on the acceleration of plant growth under mercury vapour lamps:—

Seeds germinated several days, and in some cases weeks, before those sown and grown under precisely similar conditions in a control house, as the following table will show :—

	Experimental house.	*Control house*
French beans	13 days	21 days
Carrots	11 „	26 „
Cauliflower	6 „	26 „
Maize	8 „	57 „
Lettuce	6 „	12 „
Maple peas	6 „	16 „
Vegetable peas (filbasket) ...	7 „	16 „
Oats	7 „	12 „
Barley	7 „	12 „
Wheat	8 „	16 „

Several other seeds, foreign ones, such as China and Syrian beans, Soya beans, were experimented with for germination with similar results.

The quality of seedlings was remarkably good they being sturdy of stem and strong in leaf.

The temperature of the greenhouse was kept low, the following being the averages for three months :—

	Experimental house.	*Control house.*
January ...	Day 58° night 46°	Day 59° night 48°
February ...	Day 60° night 46°	Day 67° night 50°
March ...	Day 73° night 47°	Day 78° night 50°

The control house is situated in a position where it gets slightly more sun than the experimental house, and this caused the rather higher temperature on the average.

The earth temperature was taken at intervals, during the time the lamp was on, *after sunset* in both houses, and showed no perceptible difference.

All plants responded satisfactorily to the light treatment ; besides seeds, geraniums, roses, carnations and heliotrope were placed in the house and showed a marked increase in foliage and flowers of good size, colour and shape. The rose tree "Belle Lyonnaise," which had flowered all the previous summer and autumn, was pruned in November as bare as a vine. In two weeks it showed leaf, in six weeks buds, and it has continued to bloom ever since.

Strawberries flowered abundantly, and the fruit ripened very well. It was proved that there was an increase in the crop of 25 per cent.

The plants are placed on a staging about 4 ft. from the lamps ; the radiation extended over the whole house (20 ft. long) which was tested by photographic printing paper exposed after sunset. The best results were those obtained within 8 ft. radius of the lamp ; as the radiation became less the growth was less, as could very soon be seen by a casual glance over the staging.

The lamp was put on about an hour *before* sunset, and kept on for about 4½ hours.

The general inference from the experiment is that if carried out on a large scale it would be a source of great profit to the market gardener. A considerable amount of *heating* is saved ; the seedlings require practically no hardening-off before being planted in the open. I put out about a dozen cauliflowers in March, protected the first night by a glass shade ; the next two nights a mat was thrown over them, and after that nothing. They were exposed to frost, but their growth is in no way retarded, and they look remarkably strong plants.

Beans and peas are now ready for use, those in the control house being much later ; pods in the control house formed but quite two weeks behind experimental. I failed altogether with lettuces in the control house ; they apparently required more heat. Also French beans. Both did well in the experimental house ; in fact, the lettuces were very fine.

The expense of the lamp is not much ; a practical electrical engineer worked out for me that the consumption would be rather less than one-fifth of a KW.

Prof. Priestley, of the Bristol University, very kindly made the analysis of the plants for me, and the following is a quotation from a lecture delivered by him in London on April 3rd regarding my experiment :—

"The light seems to have been extraordinarily efficacious, producing accelerated germination, increased growth, greater depth of colour, and, more important still, no signs of the lanky, unnatural extension of plant usually associated with forcing. Rather, the plants exposed to the radiation seem to have grown, if anything, more sturdy than the control plants. . . . . A structural examination of the experimental and control plants carried out by means of a microscope fully confirms Miss Dudgeon's statements both as to the depth of colour and greater sturdiness of the treated plants."

POINTS IN SHOP LIGHTING.

The conditions which determine the success or failure of shop lighting involve a considerable number of interesting features which have to be carefully examined before complete satisfaction can be obtained. It may, therefore, be of interest to refer briefly to some leading ideas on the subject which were ably explained some little time ago by Mr. E. L. Elliott in the columns of our esteemed American contemporary, *Illuminating Engineer*.

The useful points brought out in that contribution may be briefly summarised as follows :—The intensity will vary with the class of goods, and dark-coloured merchandise, such as men's clothing, requires twice the amount of light necessary for white goods or light-coloured fabrics ; a margin of from two to five candles covers the difference. If an illumination of five ft.-candles is provided for dark goods, it will be better to reduce the density in the room devoted to lighter-coloured goods. Tapestries, wall-papers, and the like, are usually displayed in a vertical plane of a non-reflecting quality. Floor coverings, furniture, and such commodities are also usually dark in colour and non-reflecting ; excessive intensity is to be avoided, as the buyer afterwards seeing the goods in ordinary daylight, may believe that he has been deceived.

As regards the colour value of the light, a wide margin is possible, as such light sources as carbon-filament lamps, Nernst lamps, &c., give warm tones, while unshaded arcs and partly-enclosed arcs give a cold or hard tone ; neutral light may be obtained from metallic or luminous arcs, flame arc lamps with special carbons, and the new types of metallic-filament electric lamps. In no case is a cold or hard light preferable to a neutral or warm one, but in shops selling hardware, groceries, &c., cold lights may be acceptable. Some shops dealing in coloured fabrics of delicate shades and tints, must be very careful as to the light they adopt, as tints that would produce harmonious combination by daylight, may very readily give a discordant effect by ordinary artificial light. The colour of light sources may be modified between certain limits by reflection, and by transmission through transparent or translucent media. In some cases the loss necessary to produce neutral light is so great as to render the process impracticable. Light sources which have a preponderance of blue and violet, such as the arc lamp, may be slightly modified to give a neutral tone by using an opalescent glass of the right density and composition. The colour of light can be modified by reflection from a dense surface, but this is far less efficient than by transmission.

The situation of lamps will generally be a compromise between the structural conditions and considerations of light distribution. Thus, a large ceiling divided into panels involves the placing of units symmetrically with regard to the structure, as ceilings are usually very light in colour, and a surface will thus reflect 50 to 60 per cent. of the light falling on it ; this affords a strong inducement for placing the light units high up. Where show-cases or shelving with glass doors are used, care should be taken to place the lights high enough to avoid reflection in the glass.

Shop illumination is first and foremost utilitarian, but it is almost an absolute necessity to make the illumination as decorative as possible in order to make the shop attractive. There are many cases in which special lighting for special effects should be installed ; for example, in show-cases in the interior of a shop the same principle should be applied as to a shop window—the question of using concealed lights should be considered. The provision of Linolite or similar lamps in the interior of show-cases gives a very high-class effect. In some of the most modern American stores special rooms have been fitted up, equipped with both gas and electric lamps for the purpose of showing how coloured fabrics will appear both in gas light and electric light ; these are intended for use during the day as well as the evening, and are especially useful for displaying millinery and dress goods.

The first cost of the installation should not be the preponderating consideration, as, compared with the cost of the building itself, as well as with other fixtures of the shop, it bulks very small in the total bill, while cutting down lighting in a show window entails a perpetual loss in results. The only debatable question is that of the purely decorative features, and these should very properly be charged to the advertising account, and not to the lighting bill. The electric arc appears to afford the cheapest form of electric lighting, but, as pointed out above, the conditions of the shop may preclude the use of that lamp when compared with decorative glow-lamp lighting.

It should be remembered that the lighting installation must be kept in first-class order, both for the sake of reasonable economy and of satisfactory results. It is a sad fact that merchants who have their windows washed daily leave the glow-lamps untouched for a year at a time, whereas regular and systematic inspection of all accessible parts, and renewal of all defective portions, is an absolute necessity. It is hoped that these remarks may be of value to electrical engineers who are troubled with complaints as to their lighting by shop consumers who have not devoted sufficient attention to the details of their installations.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The regulations as to the costs to be included in the estimation of 25 per cent. British labour for goods exported to New Zealand in order to gain the advantage of the British preferential tariff, have recently been revised. In estimating the amount of British labour involved in the preparation of goods, it is now permissible to include costs incurred in the packing of foreign-made goods, in, for instance, cartons or other containers. The certificate of origin for goods shipped to New Zealand, for which it is desired to secure the benefit of the preferential rates of duty, has been revised accordingly.

SOUTHERN NIGERIA.—Merchants have recently raised a point in connection with the through booking of goods *viâ* Southern Nigeria to Northern Nigeria, relative to an alleged statement that railway freight to Kano from Southern Nigeria to Northern Nigeria is to be included in the value of goods for duty purposes. According to the *Nigerian Customs and Trade Journal*, the Customs authorities have stated that there is no such provision in the law, and that the value on which duty is assessed is the fair market value of the goods as sold in the country from which the goods are exported. In preparing invoices for Customs purposes, merchants are required to show separately cost of packing, freight, insurance, &c., but duty is not assessed on them.

CHILE.—The Chilean Government has decided that the surtax of 5 per cent. on all goods dutiable at the rates of 5 per cent., 15 per cent., 25 per cent., 35 per cent. or 60 per cent., which was recently imposed on goods for a period of three years from April 15th, 1912, is to be levied for a further 18 months after the expiration of that period.

COLOMBIA.—A Bill has been laid before the Colombian Parliament proposing certain alterations in the tariff; the following are the proposed new rates on certain electrical and similar goods:—

	Dollars per kg.
Electrical apparatus:—Porcelain, wood, or glassware, with, or without, parts of metal	·02
Electrical accessories not separately specified ...	·04
Insulators of glass or porcelain	·01
Insulators of caoutchouc	·03
Measuring apparatus	·02
Apparatus not separately mentioned	·04
Telephone and telegraph apparatus	·02
Electroliers, &c....	·25
Globes for incandescent lights	·05
Wire or cables protected with rubber, tar, &c. ...	·01
Dynamos, motors, transformers, rheostats	·01
Lamps for outside lighting	·02
Ventilators	·10
Wire of copper, &c.	·20
Bars of zinc	·02
Insulating materials	·02
Electro-medical apparatus and batteries	·25
Accumulators and plates	·02
Jars for batteries	·02
Tramway cars and wagons	free
Rails	free
Transmission gear	·01
Pumps and turbines	·01
Fuel oil	·01
Iron posts for electrical transmission work	·01

WEST INDIES.—With reference to recent information relating to the certificate of origin requirements of the West Indies resulting from the inauguration of preferential treatment for British goods, it is now noted that certain West Indian Governments have decided to alter their regulations regarding signatures and attestation of signatures on certificates. New regulations provide that in the case of goods shipped direct from this country certificates of origin need only be verified by the signature of the exporter or his duly authorised representative. Certificates of origin for goods for which preferential treatment is desired, and which are not shipped direct, in order to be valid, must be attested to in British countries before a collector or other principal officer of Customs, notary public or other official authorised to administer oaths, and in other countries before a British Consul, and such attested certificates must bear the autograph signature of the authority issuing the same, together with the seal of office, if any. No certificate of origin shall be valid after the expiration of six months from the date of its issue.

As it is possible that goods may occasionally reach this Colony before the arrival of the certificates of origin relating to the same, the Customs authority may authorise the delivery of such goods at the preferential rates of duty on the security of a deposit equal in amount to the difference in duty between the preferential and general rates. Deposits will be forfeited at the end of 15 days after the expiration of the time allowed by the Customs authority for the production of the certificate of origin, which time may not be less than one month, nor more than six months, from the date of the importation of the goods. When goods accompanied by certificates of origin are not in uniformity with the descriptions borne on the certificates, by reason of discrepancies as regards the marks or numbers of the packages, or the kind, quantity or value of the goods, they are not to be entitled to preference unless the Customs authority at the port of destination is satisfied as to the origin of the goods, and that the differences are solely due to error. Goods certified for entry as goods entitled to preference will not be entitled to such preference unless they be packed separately from other goods. The packages, however, may be enclosed with other goods, provided the certificate of origin is endorsed accordingly. Goods will not be entitled to preference if they are set out in Customs bills of entry in which other goods are also set out.

The forms of certificates of origin for goods shipped direct, and for goods not shipped direct, have been made to vary slightly in accordance with the above regulations.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,216. "Unspillable electric accumulator cells." W. Thomson. September 8th.

20,230. "Electric lighting and starting of motor road vehicles and other motor-driven bodies." C. E. Simms. September 8th.

20,269. "Telegraphic systems employing the Morse code." W. S. Steljes. September 8th.

20,278. "Electric welding of metals having different melting points." G. Gnuchtel. September 8th.

20,284. "Trolley poles." C. C. Wallace and C. A. Macey. September 8th. (Complete.)

20,288. "Pedal-driven electric generators for use in connection with projection apparatus." Soc. Internationale de Lumiere Froide (Procedes Dussaud). (Convention date, September 7th, 1912, France.) September 8th. (Complete.)

20,300. "Method of packing the joints of metal vapour alternating-current rectifiers and other vacuum apparatus." E. Hartmann. (Convention date, September 21st, 1912, Germany.) September 8th. (Complete.)

20,311. "Automatic transmitters for telegraph signals." Creed, Bille and Co., Ltd., and A. L. Pailthorpe. September 8th.

20,318. "Railway electric signals." E. O. Evans and J. B. Saunders and Co., Ltd. September 9th. (Complete.)

20,335. "Polarised cut-in and -out switch for battery charging." W. A. Stevens. September 9th.

20,346. "Devices for utilising short pieces of carbon in bioscope arc lamps." W. B. Robinson. September 9th.

20,361. "Sparking plugs." O. Freiberg and O. Petzsche. September 9th. (Complete.)

20,371. "Electric furnaces." C. A. Keller. September 9th. (Complete.)

20,438. "System of electric lighting." Van Raden & Co., Ltd., and M. Metz. September 10th.

20,482. "Devices for producing discharges in Röntgen ray tubes." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) September 10th. (Complete.)

20,495. "Electric lighting for railway carriages." G. Inrig, A. Braid and G. J. Mills. September 10th.

20,500. "Vapour electric apparatus." E. E. Darmois and M. A. E. Leblanc. (Addition to 11,870/12.) September 10th.

20,521. "Rotary interrupters or contact-breakers and similar devices for use in connection with wireless telegraphy and like installations and for analogous purposes." A. B. Williams and W. A. Solomon. September 11th.

20,526. "Continuous-ringing electric bell for railway signal at danger." N. A. Rihoy. September 11th.

20,534. "Suspenders for electric cables." P. Huntington. September 11th.

20,545. "Apparatus for automatically controlling the direction in which current can be supplied to electric circuits." W. H. Dammond. September 11th.

20,549. "Microphones." J. Hecht and N. Carlton. September 11th.

20,552. "Electric water heater of the geyser type." E. Welch. September 11th.

20,554. "Electric switches, terminals, and the like." F. Westwood. September 11th.

20,577. "Electric strip light reflectors." J. P. Child. September 11th.

20,588. "Electric generators and starters for internal-combustion engines, especially those of motor road vehicles." W. H. Scott. September 11th.

20,591. "Power control system for automatic switches." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) September 11th. (Complete.)

20,654. "Galvanometers or the like." Cambridge Scientific Instrument Co., Ltd., and W. H. Apthorpe. September 12th.

20,663. "Incandescent filament lamps." J. R. Quain. September 12th.

20,683. "Means of suspending electric supply fittings, terminating, anchoring, insulating, and protecting flexible wires used in connection therewith." B. Deakin. September 13th.

20 703. "Boiling base for a steam cooker which is heated by electricity." E. Welch. September 13th.

20,704. "Electric kettle." E. Welch. September 13th.

20,709. "Apparatus for electrically igniting miners' safety lamps." V. E. Joyce and Spagnoletti, Ltd. September 13th.

20,719. "Apparatus for controlling motors, and especially the motors for working guns." R. H. S. Bacon and R. Redpath. September 13th.

20,725. "Holders for incandescent electric lamps." E. Dobson. September 13th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Arc Lamps. E. C. R. Marks. (Deutsche Beck-Bogenlampen Ges.) 12,592. May 28th. (Convention date not granted.)

Apparatus for the Production of Electric Power for Use in Connection with Wireless Telegraphy or Wireless Telephony on Aeroplanes and Waterplanes. C. Grahame White and H. Fothergill. 16,492. July 22nd.

Electricity Meters. S. H. Holden and Chamberlain & Hookham, Ltd. 19,118. August 21st.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,251. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,252. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,254. August 22nd.

Electrically-wound Clocks. N. Friedman and I. Friedman. 19,429. August 24th.

1913.

Apparatus for the Production of Alkali Metals by the Molten Electrolysis of Alkali Compounds. G. W. Johnson. (Deutsche Gold and Silber-Scheide-Anstalt vorm. Rössler.) 1,933. January 23rd.

Electrical Condensers of the Variable Type. A. E. Watkins. 2,238. January 28th.

Method of Making Sheets, Rods, Wires, Filaments and the Like of Tungsten and Molybdenum or Alloys thereof. Westinghouse Metallfaden Glühlampenfabrik Ges. 3,162. February 6th. (February 9th, 1912.)

Refillable Electric Fuses. J. G. Clemens and Monarch Refillable Fuse Co. 3,573. February 11th.

Distance-operated Mechanisms and Signals on Electric Supply Systems. H. W. Handcock, A. H. Dykes and W. Duddell. 6,772. March 18th. (Addition to No. 6,716 of 1912.)

Electric Clock Control. Allgemeine Elektricitäts Ges. 6,934. March 20th. (March 22nd, 1912.)

Electrical Heating Bodies Composed of Non-metallic Resistance Materials. Geb. Siemens & Co. 7,932. April 4th. (April 11th, 1912.)

Flexible Electric Conductors. Western Electric Co. (Western Electric Co.) 10,164. April 30th.

Handles for Hand Lamps and other Articles. S. Stern and British Ever-Ready Electrical Co. 10,597. May 5th. (Divided application on No. 19,318 of 1912, August 23rd.)

Electrical Control Clocks for Trunk-line Switchboards. Aktiebolaget L. M. Ericsson & Co. 11,658. May 19th. (May 21st, 1912.)

Machines for Making Electric Incandescent Lamps. Allgemeine Elektricitäts Ges. 14,433. June 23rd. (June 21st, 1912.)

Control of Series-connected Electric Consuming Devices. R. Franz. 15,502. July 4th. (July 4th, 1912.)

Method of, and Means for, the Production of Alternating, Pulsating or Variable Electric Currents. W. Dubilier. 16,917. July 23rd. (Divided application on No. 14,015 of 1912, June 15th.)

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TEMPERATURE LIMITS.

ELSEWHERE in this issue we give the limiting values for the observable temperatures for different insulating materials employed in the manufacture of modern electrical machinery, as adopted by the International Electrotechnical Commission at its recent meeting held in Berlin. Certain leading features are also referred to which go to show the commercial importance of the work which the I.E.C. is now engaged upon, and for which, to a large extent, it was originally founded. As our esteemed contemporary, the *Electrical World*, rightly observed some time ago, it is reasonable to assume that since the I.E.C. is an international body which arrives at its decisions by a process of international discussion in Committee work and debate, each Nation's successive editions of standardisation rules will certainly converge towards the consensus of opinion as expressed by the I.E.C., with the ultimate aim of the creation of a single set of rules.

This very desirable object can, however, only be attained through the process of time, and should not in any way be forced. Indeed, in international matters it is almost an axiom that to attempt to force a vote upon a point not yet ripe for discussion is highly detrimental to the best interests of those concerned. The Commission, preferring that its decisions should be practically unanimous, has deferred the question of the value to be fixed for the maximum ambient temperature in the hope that a satisfactory solution may be found in the near future, which will be confirmed at the San Francisco meeting two years hence.

With so much goodwill at its disposal and such readiness to defer to the considered opinion of the majority, a striking characteristic of all its debates, we may safely leave to the Commission this problem, the solution of which will mean so much to the electrical industry generally. It should especially affect export business, where simplicity is so necessary to avoid those unfortunate misunderstandings which do much to retard commercial progress and interfere with good feeling between the producer and his clients.

The values now adopted internationally for the highest observable temperatures for different classes of insulating materials are standardised for continuous operation. While, doubtless, recognising that, strictly speaking, the life of insulating material is a function of both time and temperature, commercial expediency has evidently led the Commission to recommend such temperatures as are in accordance with durability when continuously sustained, and which must never be exceeded. The introduction of the time element, notwithstanding its importance, would certainly not be consistent with the simplicity so essential to commercial standardisation, and this is, no doubt, the reason it has been avoided. The object of a standard rating is not only to assist the maker, but also to protect the non-technical purchaser and enable him easily and with confidence to compare tenders received from various countries, even though their own national rules may still differ in their methods of rating.

Experience in Great Britain has proved that standardisation on broad lines has been of great commercial assistance to the industry adopting it. We feel sure, therefore, that

when a definite international basis is established whereby the capacity of any electrical machine may be ascertained correctly, it will have a decided influence on the progress of the whole of the electrical industry.

Rubber.

The market for crude rubber has again justified all the scepticism which has been expressed as to its having reached a thoroughly safe level of values, for within the past fortnight or so a fresh bout of weakness has been seen, with considerable flatness in the share markets. The attempts which have been made to hold up the Para market seem likely to have no more successful an issue than those put forward on previous occasions, and the mere fact that Para is held at a big premium over plantation is adduced as evidence of the unsoundness of the conditions affecting the former. One thing is certain, however, and that is that at present prices the collection of wild rubber will cease not only in Brazil, but also in the Congo and elsewhere. This cannot but have a highly important effect in the long run upon the position of rubber generally, for, with the greatly extended consumption going on, it is hardly likely that the plantations will supply the world's needs at current prices. This may sooner or later involve a rise in values to a level at which wild rubber can again come into force as a market factor. But the immediate price prospect is not very encouraging for the holders of shares in plantation rubber companies, and it seems as if consumers would be able, for a long time to come, to obtain their supplies on easy terms.

The scheme that was propounded some time ago, whereby a certain amount of the output of the plantations should be earmarked for the use of manufacturers at a very low figure compared with that then ruling, provided that the rubber so purchased was used solely for experimental purposes in connection with the discovery of new uses, has fallen through, but in its place quite a new scheme has been launched, and with some prospect of success, although it is stated that one important group of companies will not fall into line. This is a proposal for forming a selling agency to handle the entire output of the plantations in the middle East. The scheme was put forward by the Malacca Plantations, and is now under the consideration of the trade.

The suggestion that the producing companies should pool their output, and that it should be handled by a central organisation, has good points in it, but it is to be hoped, in the best interests of the trade, that such a concern will not make the mistake of attempting to hold up the market by the manipulation of supplies, for if it does, then the last state of the plantation rubber industry will probably be worse than the first. The present position of the trade in Brazil is due, in some measure, to the foolish attempts made to hold up prices in the face of economic disadvantages, and an effort to regulate the plantation trade by means akin to manipulation must fail in the end. For this reason the less the interference with the natural course of events the better.

Probably the central organisation will take cognisance of a number of matters apart from the actual selling of the rubber produced by the constituent companies, in which event it is not unreasonable to look for some regulation of the planting up of new areas. The ultimate extension of production is beyond the wit of man to forecast, but if the raising of prices is the main object of the central concern, then the extension of planted areas on the part of the constituent companies becomes a matter of vital importance. Already quite a number of the plantation companies have decided to cut down severely their programme of new planting; the outlook for prices is at the present time anything but satisfactory, and with rubber not far off the 2s. a lb. mark, the greatest caution should be used in developing productions.

The burning questions to-day, with most companies, are how and in what way costs can be kept down. The rubber trade of the Amazon Valley is now passing through a severe crisis. The Ministry has decided to ask Congress for authority to reduce the export duty on rubber by half, and to endeavour to secure from the Amazon navigation companies a reduction in freights. Sundry other measures of relief are in contemplation, but with business at the rubber towns at a standstill, there are troublous times in store.

Municipal Secrecy in Agreements.

It is well known that the large electrical firms in Germany are constantly endeavouring to acquire control of municipal or communal electricity works either by purchase, leasing, or by the formation of companies in which they are interested jointly with these local authorities. In this connection, the Association of Special Electrical Works (Vereinigung Elektrotechnischer Spezial Fabriken), which appears to avail itself of every opportunity of directing attention to the monopolistic endeavours of the large firms, claims to have discovered a fresh ground for complaint against the latter. It is stated, for instance, that when approaching local authorities with offers to take over their supply works, the large firms make it a condition that the strictest secrecy shall be observed in the matter.

Although publicity in such affairs is highly desirable in that country as in others, the object of seeking to keep the proposals secret is doubtless to minimise any opposition which might arise to the negotiation of the transactions in contemplation. But the Association further alleges that in order to secure the maintenance of secrecy it is arranged, where offers develop into actual schemes, that the draft agreements shall be withheld from the municipal or communal councillors as long as possible. If this is the case, it would be of interest to learn who are the parties to the negotiations on behalf of the town or commune. Yet the Association states that the draft agreement at Saarbrucken in 1912 was laid before the municipal councillors only on the day when a decision was arrived at, and then only in abstract form, whilst at Rostock in May of the present year the councillors received no information of the draft agreement for a lease before the meeting of the Council, when a verbal report was made.

Whatever secrecy may be possible in the preliminary stages, doubts certainly arise as to the possibility of withholding draft agreements from the members of the local authorities, who, as a body, are the contracting parties on the one side, until the final day of decision. Indeed, we should be reluctant to attach credence to the two cases mentioned, in view of the publicity which has taken place in other instances of transfer or leasing of works. If the Association has not been hoaxed in the matter, the situation set forth reveals an extraordinary state of affairs in connection with the management of some municipal supply works in Germany.

The Tramway Conference.

Judging by the proceedings at the Tramway Conference which was held last week at Sheffield, the problems which confront tramway men remain very much the same as a year ago, at the time of the previous Conference.

Any survey of the position must differentiate between London and the provinces. In the former the alternatives appear to be an immediate readjustment of the financial burdens of the tramways, or a continuance of dwindling surpluses—the severity of an indirectly subsidised motor-'bus competition being the main factor in this state of affairs.

After all, any argument which would seek to saddle the tramway with an undue proportion of road maintenance, because it diverts traffic elsewhere, causing increased wear in other directions, must apply with equal force to a stream of motor-'buses, which equally tends to monopolise the two sides of the road, *unless it uses the tramway track.*

It cannot be doubted that a more equitable distribution of road maintenance is urgently needed, and that it can be most easily achieved by relieving the tramways of at least a portion of the present ridiculously unfair charges for this purpose.

In the provinces, the motor-'bus appears only as an ally of the tramways, but the question of road maintenance is nevertheless a matter for consideration, owing to the increasing number of heavy industrial vehicles which use the tramway tracks in the ordinary way.

All tramway men appear to be convinced of the necessity of taking some action, and it only remains to be settled what shall be done.

THE BRITISH ASSOCIATION.—III.

In our last issue we printed an abstract of the paper read in Section G on "Electromagnetic Waves," by Prof. G. W. O. Howe. This was followed by a paper on "Atmospheric Refraction," by Dr. W. H. Eccles, and a further contribution was read by Prof. Marchant, on "The Effect of Atmospheric Conditions on the Strength of Wireless Signals at Liverpool."

All three papers were discussed together, Prof. Fleming opening the discussion. He said that an old conception of the ether was now being taken away, and they were asked instead to adopt the quantum theory of radiation. There was a great deal to learn about "wireless" waves, and although it was generally admitted that the state of the atmosphere had some effect on the signals, it was difficult to reconcile that with the fact that in London, with antennæ only 35 ft. high, and with houses all round, signals were received from Paris without any difficulty. The question was whether the radiation passed entirely outside the earth. He suggested that a society should be formed to embrace all "wireless" experimenters, with the special object of comparing all experiments made, so as to arrive at the facts. He also suggested that at all wireless stations instruments should be fixed to register the strength of the signals under all conditions.

Prof. Nicholson said the difference between the strength of day and night signals must be due to the state of the atmosphere, and showed that the signals passed over, and not through, the earth.

Mr. Rivers-Moore referred to the large number of enthusiastic amateurs engaged in "wireless" experiments, and said he felt sure most of them would be only too happy to co-operate. He referred to the Wilson high-tension discharge apparatus, which was demonstrated in another room. It is claimed that a ½-kw. set is effective up to 200 statute miles.

Prof. Wilson agreed that there was a lack of data. He said that he had proved at King's College that the air was ionised by sunlight, and described the apparatus used by him, which proved that conductivity was increased by the ultra-violet rays.

At the conclusion of the discussion Dr. Eccles announced, as secretary of the Radio-Electric Committee, that a complete scheme was being drawn up for the co-operation of "wireless" investigators.

On the same day Prof. E. Wilson's paper on "Exposure Tests (for oxidation) of Copper, Aluminium and Duralumin," of which we printed an abstract in our last issue, was read and discussed.

A further paper was contributed by Mr. W. R. Cooper, on "Short Heat Tests of Electrical Machines," in which methods were described by which 6-hour runs of electrical machinery might be dispensed with.

Prof. Marchant, referring to temperature curves, said he always found them rather flattened at the commencement of the run, which he attributed to internal heating-up of the metal.

Mr. Mordey said he did not look forward to the possibility of shortening tests, and he thought they were none too long now, as there was not only the electrical heating, but the question of bearings and general running, which required a reasonable length of test before plant was taken out of the maker's works. Questions of balance were not sufficiently considered even now. The average resistance was useless as a guide. What was required was to know which was the hottest part of the machine.

Domestic Electric Cooking and Heating—Results of One Year's Working.

By Prof. J. T. Morris, M.I.E.E.

(*Section G. Abstract.*)

During the last five years great strides have been made in the construction of the electric cooker, and it may now be confidently asserted that there are makes which are thoroughly reliable.

An important question is, What will the weekly consumption of energy be? If a householder can get an idea of the number of units which would be used, then, knowing the tariff for electric cooking in the district, he can form an approximate estimate as to the weekly cost of electric cooking in his case.

It is the object of this paper, since but few figures of the kind are readily available, to give a definite answer to this question in one particular case, where the daily consumption has been recorded throughout a period of one year. Experience has clearly brought out the following facts:—

1. Those who have tried electric cooking know that joints of meat and steak are cooked better by electricity than by other means, and it is also true that a shorter period of training is required in order to be able to do so.

2. The heavy work in the kitchen is largely reduced, owing to the fact that there is far less coal to be handled, and there is no kitchen range to be cleaned and polished every morning.

3. The certainty that if the same time is given for the same operation exactly the same result will be produced.

4. The convenience and cleanliness and the avoidance of an unhealthily hot atmosphere in the kitchen.

It must be allowed that a difficulty is experienced in the supply of hot water in large quantities, such as for washing up and for baths, where either the electric cooker or the ordinary gas cooker is used. Although special arrangements are obtainable which will deal with these large quantities, the author still has to be convinced that any of them can compete with coke or anthracite slow-combustion stoves, on the score of cost at least.

I believe that, at any rate as far as large blocks of flats are concerned, a central boiler kept permanently fired, will be used for supplying hot water continuously to all of the flats in the block, so that it can be obtained as easily as cold water. (I am informed that this is now being done in certain large blocks of flats.) However, as far as the independent householder is concerned, at least he must have some arrangement for obtaining hot water.

In the present instance the arrangements used for cooking were a Jackson (Marylebone) electric cooker, having three hot plates, two for boiling and one of lower heat for simmering purposes, one grill and a fair-sized oven, the approximate measurements being: height 38 in., width 30 in., depth 24 in. The Board of Trade units when each of the hot plates, &c., were in use individually for one hour, and the cost per hour at ½d. per unit, are given in the following table:—

Hot plates	No. 1.			No. 2.			No. 3.		
	Low.	Med.	High.	Low.	Med.	High.	Low.	Med.	High.
Units used in 1 hour	0·36	0·67	1·34	0·36	0·70	1·39	0·24	0·48	0·94
Cost per hour in pence at ½d. per unit ...	0·18	0·33	0·67	0·18	0·35	0·70	0·12	0·24	0·47

	Grill.	Oven. One-third.	Oven. Two-thirds	Oven. 1/3+2/3rds.
Units used in 1 hour ...	1·34	1·06	2·11	3·17
Cost per hour in pence at ½d. per unit ...	0·67	0·53	1·05	1·58

The hot-water supply was obtained by means of a coke boiler, manufactured by the Carron Co. (O-sho boiler), pattern Y.A. It stands 32 in. high and is 14 in. wide by 14 in. deep. Its smoke flue is 5 in. in diameter. As it is not large it is set in a recess, and it gives very little trouble. It requires lighting in the morning, and stoking two or three times a day with coke, and it will burn practically any kind of rubbish. This is a matter which should not be lost sight of, for if all coal fires are done away with in a house difficulties arise with regard to disposing of certain forms of rubbish.

Another matter which requires attention is the proper heating of the kitchen. Of course, under ordinary circumstances, it is oppressively hot in the summer with a coal range. When electric cooking is used, then the kitchen is a much more healthy place, and the extra warmth which is required in winter can be obtained from the coke boiler by leaving its doors open, though naturally it is not then so efficient as far as heating water is concerned.

The table on next page gives the units used each day for five or six persons for a period of 10 months. It will be seen that, neglecting exceptional cases, this quantity varies from 5 to 15 units, depending on the quantity of cooking required. The "record" consumption which occurred on December 16th was due, as might be guessed, to the Christmas pudding. The average daily consumption over the whole period is 9·75 units, which, at ½d. per unit, amounts to 4·87d. per day.

Over the same period of 10 months the quantity of coke used was 6 chaldrons, costing £4 11s., which, taking into account the wood needed to light the fire each morning, comes out at 4d. per day. Hence the running costs for electrical energy to the cooker and for the supply of hot water for all household purposes amounts to 8·87d. per day—that is, less than 9d. per day.

The figures were obtained in a flat having six rooms, a kitchen and a bathroom, and represent the consumption for a household of five persons.

It should be noted that in one room a coal fire was used for part of the period, and therefore the figures for heating are smaller than they would otherwise have been. Further, it should be remarked that there are no gas pipes in the flat. The maximum weekly consumption for heating is 129 units, and this was due to visitors.

With reference to the lighting the maximum weekly consumption will be seen to be 6·5 units, which at a halfpenny per unit comes out at 3¼d. per week. It is interesting to note that this amount is insignificant in comparison with the amount due to the

annual charge, but it should be remembered that this annual charge covers all uses of electricity, though based on the maximum possible *lighting* load.

Table of Daily Consumption in Board of Trade Units for Cooking during the period of September 29th, 1912, to July 26th, 1913.

Week ending	October, 1912.				November.					December.			
	5	12	19	26	2	9	16	23	30	7	14	21	28
Sunday ...	6	4	7	5	5	5	6	6	8	5	5	5	6
Monday ...	5	6	9	9	5	8	8	8	5	7	21	36	7
Tuesday ...	12	11	14	13	9	11	11	13	12	14	6	17	10
Wednesday ...	11	11	11	6	11	14	13	6	9	7	6	10	13
Thursday ...	9	7	8	9	9	7	8	17	12	9	8	11	5
Friday	15	6	13	10	11	8	12	13	6	8	7	7	3
Saturday ...	14	12	14	12	12	12	14	12	11	12	13	13	6
Weekly total ...	72	57	76	64	62	65	72	75	63	62	66	99	50

Week ending ...	January, 1913.				February.				March.				
	4	11	18	25	1	8	15	22	1	8	15	22	29
Sunday	5	6	6	7	7	5	6	12	7	6	6	9	8
Monday	5	6	8	13	6	6	5	6	4	10	8	8	7
Tuesday	4	12	13	13	9	6	8	11	13	13	10	11	10
Wednesday ...	5	8	9	12	10	9	7	6	8	10	8	8	12
Thursday ...	9	8	9	6	11	12	10	10	10	8	14	14	7
Friday	7	13	11	9	12	10	5	10	12	8	10	9	14
Saturday ...	13	12	14	17	17	12	6	12	11	14	10	15	13
Weekly total ...	48	65	70	77	72	60	47	67	65	69	66	74	71

Week ending ...	April, 1913				May.					June.				July.			
	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26
Sunday	6	8	7	8	7	12	13	10	14	8	8	5	8	8	4	5	5
Monday	11	7	9	6	14	10	8	8	10	10	9	6	8	7	4	4	13
Tuesday	12	11	10	10	11	15	9	13	12	10	11	6	15	8	7	11	8
Wednesday	12	12	7	6	15	14	13	13	14	11	10	2	9	9	13	6	7
Thursday	10	11	15	10	12	10	11	15	11	9	11	10	14	8	10	9	9
Friday	7	16	6	7	10	11	14	13	10	10	11	11	13	7	8	9	10
Saturday	11	18	11	15	16	12	13	14	15	14	9	10	10	9	11	12	10
Weekly total ...	69	83	65	62	85	84	81	86	86	72	68	50	78	56	57	56	62

The individual charges which go to make up the total expenditure throughout the year from July 27th, 1912, to July 26th, 1913, on cooking, heating and lighting, are given below :—

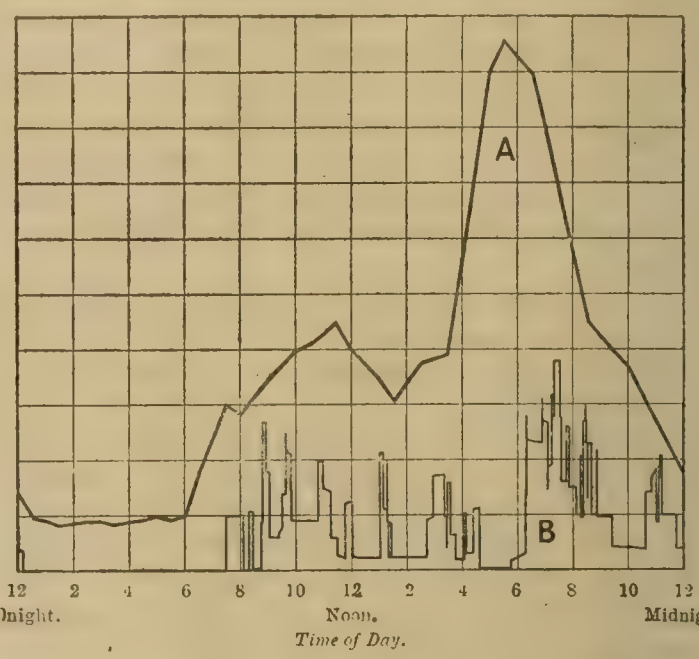
Annual "Telephone" charge	£6	10 8
Hire of cooker at 15s. per quarter ...	3	0 0
Cooking : 2,934 units at ½d.	6	2 3
Heating : 2,068 ,, ,, ...	4	6 2
Lighting : 200 ,, ,, ...	0	8 4
	£20	7 5
Coke and wood	4	11 0
	£24	18 5

Since coming to Birmingham I have seen Mr. R. A. Chattock and obtained from him the corresponding figures for this city. He tells me that they do not let out cookers on hire, but have a three years' purchase system by which consumers can buy cookers from the Corporation. Again, Mr. Chattock has no charge corresponding to the "Telephone" charge at Marylebone. The annual cost for the same flat at Birmingham would be :—

One-third purchase of cooker	£6	0 0
Cooking : 2,934 units at 1d.	12	4 6
Heating : 2,068 ,, ,, 1d.	8	12 4
Lighting : 200 ,, ,, 2·85d.	2	7 6
	£29	4 4
Coke and wood	4	11 0
	£33	15 4

In comparing this method of heating and cooking with methods in which coal is used, it must be borne in mind that a saving of from £25 to £30 has been made in the cost of domestic service, and therefore on the above tariff it is an indisputable fact that a considerable gain has been made on the score of economy, cleanliness and independence.

A typical load curve is given in the figure of the total current taken for all electrical purposes in the flat on Monday, January 20th, 1913. On the same diagram, through the kindness of Mr. A. H. Seabrook, I am able to show the station load curve for the same day, though to a very different scale. These curves are placed on the same chart with the object of showing that this cooking, heating and lighting load does not reach its maximum at the same time as that at which the peak load of the generating station occurs.



CURVES COMPARING GENERATING STATION LOAD (CURVE A) WITH SHAPE OF COOKING, HEATING AND LIGHTING LOAD DUE TO ONE CONSUMER (CURVE B).

Monday, January 20th, 1913. Fair day. Temp. 45° F.

Experience gained with this electric cooker has suggested the following as some of the directions in which improvements would be specially welcome :—

1. At present a rather serious obstacle in the way of reheating dishes—a common every-day need in most households—is the relatively long time taken in bringing the oven to the working temperature, and consequently the disproportionately large expenditure of energy to effect a comparatively trifling result.

2. The time taken to boil a pint of water, especially the first one in the morning when the cooker is quite cold, might be shortened with considerable advantage.

Weekly Consumption in Board of Trade Units for Cooking, Heating and Lighting during the period from September 29th, 1912, to July 27th, 1913.

Week ending...	October, 1912.				November.					December.				January, 1913.			
	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26
Cooking	72	56	75	65	62	66	72	77	61	62	64	100	50	48	65	71	77
Heating	51	31	50	50	31	46	90	45	55	82	42	37	31	45	74	84	68
Lighting	4	3·5	3·5	4·5	5	5·5	5	5·5	5·5	5·5	6·5	5·5	5	6	6·2	6	6·5

Week ending ...	February.				March.					April.				May.			
	2	9	16	23	2	9	16	23	30	6	13	20	27	4	11	18	25
Cooking	71	62	50	63	65	68	68	72	72	70	84	64	61	89	84	79	90
Heating	80	63	58	60	49	50	61	92	94	96	129	79	48	30	55	55	32
Lighting	6·5	6	5·5	4	5	6	5	4	4	4	6	5·1	4·1	4·5	4·5	4·2	3·5

Week ending ...	June.				July.				Weekly average.	
	1	8	15	22	29	6	13	20	27	
Cooking	80	73	66	52	78	55	56	56	63	68·2 ... ... Cooking.
Heating	1	4	3	2	2	1	5	4	3	48·1 ... ... Heating.
Lighting	3·2	3·4	3·1	2·4	3·2	3·3	3·1	3·1	3·3	4·6 ... ... Lighting.

3. Cooking utensils, however perfectly flat-bottomed they may be when first supplied, appear, with ordinary wear and tear, too soon to lose this quality, so necessary for economy both in time and energy used.

That these matters are receiving attention at the hands of some designers of electric cookers will be gathered from the following information which the author has received, on the best authority, since the first draft of this paper had been made. The latest form of electric cooker, of which about a dozen are in use at the present time, have the ovens arranged so that the direct radiation from the heater is not shielded in any way, with the result that the time taken for raising the oven to the working temperature has been reduced to about one-half of what it was in the older patterns.

Further, that in a week or two a red-hot plate will be put upon the market which halves the time necessary for raising cold water up to the boiling point, avoids the necessity for special utensils, and is robust, for cold water can be poured upon it with impunity.

It may fairly be claimed, as to safety in use, that of the three most common methods of cooking food the electric cooker is, when properly installed, by far the safest. For instance, there is no chimney to get on fire, nor is there danger from stray cinders, or of explosions, unpleasant fumes or of "firing back."

There is also, as already referred to, the great advantage of perfect cleanliness in use. Saucepans, for instance, can never become sooty outside. This fact alone saves a not inconsiderable amount of labour. Then, too, the walls and ceiling of the kitchen remain much longer clean. When to these two advantages of safety and cleanliness is added that of absolute reliability, it is obvious that electric cooking is an ideal method for use in an ordinary household.

Discussion.

Prof. Kapp, in inviting discussion, said the author had not mentioned the saving electric cookers effected in the butcher's bill.

Prof. Fleming said the greatest trouble he had found in the regular use of electric cookers was the variable and irregular life of the heating elements. When these failed it was not easy to replace them, as makers had not adopted rigid interchangeability in manufacture. He thought detachable hot plates a good feature in electric cooking apparatus. The author's figures of cost depended on the ½d. units. He had used electric cooking for three years at 1½d. per unit, at which price it was economical to heat water. At ½d. per unit he knew the cost of electric cooking was within that for coal and gas cooking. As a rough guide to this consumption in a kitchen, he found that one unit per day per person, plus a unit or two for the cooker, was about the average.

After a few remarks by others on the Birmingham figures, the author briefly replied.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Apparatus on Hire.

I have been much interested in the series of articles by Mr. T. C. Parsons on the above that have been appearing during the past few weeks.

In last week's number Mr. Parsons describes a card that is used to keep track of the motors that are installed on hire and hire-purchase. I would suggest that the cards could be made much more useful if more information were put upon them. Motor makers do not use the same size brush for many machines, and as the principal trouble with modern motors is a worn brush, a journey may be saved if full information *re* the brushes is put upon the card. A frequent trouble is a blown fuse through bad starting, and if different types of fuses, cartridge, "Zed" or open, are used, it is worth while to have the information handy, so that the right sort can be sent, in the event of a 'phone call. Mr. Parsons mentions that he does the usual trick of "swapping" armatures when necessary; it is advisable to keep track of the maker's numbers of the armatures as well as of the frames in this event. The card enclosed is one that I devised whilst responsible for the department of a contracting firm that had many hundred motors out upon hire and hire-purchase, as well as ordinary installations, and I would suggest that any card should contain all this information. In the case of shaped brushes, the profile may be registered by inking the brush on a rubber stamp pad, and stamping the back of the card, at the same time registering the dimensions and length in millimetres.

In this week's issue, Mr. Parsons gives some figures *re* costs of room heating that are not of much service to the makers of radiant heaters. It would be very interesting to know if Mr. Parsons or any other engineer has made any similar careful practical tests comparing radiant heaters and convectors. I believe that it is acknowledged that convectors are the cheaper in running cost, and can compare better with coal or gas.

The formula quoted by Mr. Parsons

$$\text{KW.} = \frac{(30\,A + 8\,B + nC)\,20{\cdot}4 \times 1}{3{,}600 \times 1{,}000}$$

was originally published by me in a convector maker's catalogue, and I am afraid that it cannot be used for radiant heaters. It is based on the assumption that the walls derive their heat from the air in the room, and that they are at the same, or a little less, temperature than the air. Each square foot of window dissipates approximately 30 units per deg. F, and each square foot of wall surface, on the average, eight units. The formula works out pretty consistently in the case of big halls and rooms heated by convectors, but, where

Installed at .....

.....

..... B.H.P. ..... r.p.m. ..... Volts ..... Frequency

Maker .....

Frame* ..... Armature* .....

Brushes No. ..... Size .....

Pulley Diam. ..... Face .....

Driving .....

.....

Fuses ..... Supply Co. .....

Installed .....

the walls and floors, &c., are at a higher temperature than the air, as is the case when radiant heaters are employed, they naturally dissipate more heat than is indicated in this formula. I presume that radiant heat advocates will agree to this, and admit that this is why their heaters are of 3-KW. capacity or thereabouts.

G. H. Elliott.

London, W., *September 27th*, 1913.

In reply to Mr. T. C. Parsons's letter of September 19th, I may say at once that so far as the scheme he details relates purely to the hiring-out of motors, and apart from all question of municipal ownership, very few traders or manufacturers would take exception to it, especially in view of the facts now made clear, namely, that fair prices were given for motors and that a qualified and fully-paid attendant was employed to carry out the inspections.

By far the most serious objection, however, is generally in connection with the sales effected by many of these so-called municipal hiring departments, and it will be noted, taking the figures for Govan, that apparently out of 146 motors purchased by the undertaking, no fewer than 42 were sold direct to the consumers. In the only other case for which figures are given, namely, No. 6 on the list, it appears that whereas in 1912, 70 motors, representing 670 H.P., were out on hire, 308 motors, representing 2,552 H.P., had been sold outright to consumers. It would seem that where so large a proportion of the motors are being sold it is somewhat misleading to take average figures and treat these as if they referred to hiring alone. Apparently maintenance and repairs would be discontinued as soon as a sale had been effected, and many motors would be sold before they had been running sufficiently long to need much in the way of repairs; in fact, no doubt very often the motors would be sold within the period for which they were guaranteed by the makers.

Returning to the question of the injury done by direct sales, the writer has it on the best possible authority that in one city the consumers, at any rate a short time ago, could buy their motors from the Corporation at prices, roughly 10 per cent. below those at which the largest contractors in the city could buy motors of the same make. The motors, it may be said, were foreign ones, so that here the whole

matter resolved itself into a case of "dumping" pure and simple, and on a very large scale. It was really against abuse of this kind that my letter was chiefly directed.

In conclusion, with regard to the whole question of the letting out of motors on hire by municipalities, from the writer's experience it is always easy to convince anyone that electric motors are much the cheapest and most convenient form of power to install. The real trouble nowadays is in connection with the price to be paid per unit, and if Corporations wish to give something away, they should give it here, where it would be most appreciated. A consumer can usually obtain a motor on hire from a private firm if he wishes to do so; but when this is not the case, then, and then only, is there any justification for a Corporation taking up this work.

Electric Motor and Stove Hiring Co., Ltd.
H. S. Ingleby, *Secretary.*

Leeds, *September 29th*, 1913.

A Charge Engineer's Complaint.

I was rather amused at the letter in your last week's issue from a charge engineer indignant at the idea of an engine driver being made a shift engineer, but I think that it should serve rather as a warning to college men *not* to go in for central station work, as it must be admitted that non-college men, and even the raw material, can be trained to make very good station attendants. Nowadays, with reliable generating plant, highly-trained men may not be necessary, and possibly complaints like Mr. Fredericks's will fall back on the chief engineers responsible. It should be remembered that many chiefs are depending on their shift engineers and station supers. for their low works costs, the manager taking all the credit. But Councils and others are becoming better acquainted with the state of affairs, and the days of the overpaid manager may also be numbered.

I am an engineer's traveller, and have been through a great many stations and conversed with station supers., who complain about the manager taking credit for their work. The station of the future could be run with a good accountant as manager, the reports to Councils, &c., and questions of charges, being merely a good accountant's work. A manager such as this, with a good station super. and mains engineer under him, are all the hands necessary for a station up to 3,000 or 4,000 kw.; when extensions become necessary, give the vast army of consulting engineers a chance to carry them out and give them something to do; so young men, with fine college training, eschew station work and be consulting engineers.

Converter.

Permit me to comment upon Mr. James Fredericks's letter, under the heading "A Charge Engineer's Complaint," printed in the issue of September 26th.

He complains that an engine driver pure and simple has been appointed charge engineer. If it be true that the man had only sufficient abilities for a driver, he ought not to have been appointed to the higher position. But the fact that the chief gave him the post seems to show that he had qualifications which he did not make known to everybody, thus making the appointment look unfair. I would like to point out that enginemen's duties in certain stations comprise electrical and mechanical jobs, testing, and even switchboard attendance. An engineman who has had experience in the shops or erecting, previous to several years in the central station, as well as a certificate for a College course of engineering, has an equal right with any B.Sc. or University man in competing for a higher position in the central station. I do not agree with Mr. Fredericks in preventing an ambitious engineman or other young fellow from getting on.

Hundreds of pounds spent on training for a position in a central station is sheer waste, when electrical courses can be had now so reasonably. Engineers should be good practical all-round men, those who have worked up through several stations, from the boiler house upwards; and this is found in a good ambitious engineman with technical training.

Ambitious.

Your correspondent, James Fredericks, in your last issue complains that an engine driver has been promoted to shift engineer and has as colleagues a Faraday House man and a University graduate; presumably this refers to the recent appointment at the Burton-on-Trent Electricity Works. I beg to congratulate the engine driver.

Recently, a shift engineer informed me that he had resigned his position as "shift" to take up an appointment at another station as "fitter-driver" at about 30 per cent. increase in wages; this engineer had a good technical training and was (in the generally accepted meaning of the word) "qualified."

Compare the supply authorities of Coventry and Hammersmith, capacity of both stations between 9,000 and 10,000 kw. The charge engineers at Hammersmith are paid £200 per year, at Coventry anything from £85 to £117 per year.

These cases show clearly the chaotic state of employment in electrical stations. The Universities, Faraday House, Technical Colleges, Polytechnics and Correspondence Schools are all turning out hundreds of highly technically-trained men every year, whose only prospect is a mere pittance as charge engineer, while we see carpenters, bricklayers, &c., who have not had the opportunity of technical education obtaining a wage which only a minority of the technically-trained men can expect to equal as a maximum in the best-paid stations.

To remedy this miserable state of affairs, the technical man in electrical stations must have recourse to organisation, the only remedy.

I am very pleased to state that a fair proportion of station men in the United Kingdom have realised this fact, but there are others who consider it beneath their dignity to join any organisation that proposes to demand better conditions, and do not consider it beneath their dignity to work for a mere pittance and depend on someone else to keep them from starvation.

A certain class of chief engineer fosters the "beneath their dignity" idea. One can quite understand that a chief engineer would not be exactly comfortable in a well-organised station where the wages were low and the Electricity Committee refused to consider an increase.

There is another point that has prevented progress in the past. I refer to the bickerings and petty jealousies that are the rule, and not the exception amongst employés of electrical stations, and must seriously call to account all those who are responsible for this state of affairs, because if they do not sink their petty differences and suspicion of the other man, and uphold a spirit of mutual help, they can never hope to better their conditions financially or otherwise.

In conclusion, I must emphatically point out that the main cause of the miserable conditions in electrical stations cannot be blamed to premium pupils, chief engineers, electricity committees, or company directors, but to the employé who remains outside his organisation.

W. J. Ebben,
Hon. Secretary, A.E.(S.)E.

Stratford, *September 30th*, 1913.

Birds and Railway Accidents.

While waiting at a wayside station the other day, I observed some pigeons sitting on a wire leading from a signal cabin to a route of telegraph poles. When the birds flew away together, the upward bound which they gave at the commencement of their flight caused the wire on which they had been sitting to swing into contact with some of the telegraph lines. I was curious to know what effect in the signal cabin would be caused thereby. On inquiring I found that a stray current had entered the apparatus there, and that a false indication had been produced, giving the signalman authority to send a second train into a section which was already occupied. Pursuing my inquiries, I was astonished to learn that many railway instruments are liable to similar interference.

Traveller.

Municipal Tramways Conference.

In your current issue you make the following remark regarding Mr. Hamilton's paper, on "Urban Passenger Transport." "The spectacle of Mr. Hamilton solemnly proving that 'bus costs cannot be under 10d. per mile, and will inevitably increase, when brother managers are experimenting right and left and buying still more 'buses, is rather humorous." As a constant reader of your journal this appears to me a very unfair comment.

None of the "brother managers" to whom you refer operate 'buses at less than 10d. per mile, and, personally, I do not think anyone (with the possible exception of Mr. Fearnley) operates municipal 'buses at so low a figure as this. The figures given for Keighley, Halifax and Eastbourne are 16d., 12·7d. and 14·39d. per mile respectively.

Mr. Hamilton's figures were not challenged at Sheffield. Even Mr. Worby Beaumont had nothing to say on Mr. Hamilton's calculation for 27 towns in Great Britain (with over 150,000 inhabitants each) where municipal tramways are operated.

The author of the paper stated that instead of those towns getting, as at present, a profit in receipts and other services to the towns of £1,642,356, there would be a loss of £2,556,441, if, on the present available figures, tramways were superseded by motor-'buses.

Turning to your remark again, however, I see no reason why a large municipality should not experiment with motor-'buses even if they cost 1s. per mile to operate, if the chief object of the experiment is to test the traffic possibilities of a particular suburb before incurring heavy capital expenditure for tramway track.

Urban passenger transport of the future will be a question of the survival of the fittest, and Mr. Hamilton has proved conclusively that the fittest form at present is by means of a steel wheel on a steel rail, and that if the municipalities have the best interests of their ratepayers at heart, the tramway must be used in preference to the motor-'bus, on account of the lower operating costs, to say nothing of the much greater street dangers involved by the use of the motor-'bus.

L. C. F. Bellamy,
Borough Electrical Engineer and Tramways Manager.

Ilkeston, *September 29th*, 1913.

[Mr. Bellamy takes the remark in our brief report too seriously; as a constant reader of our pages, he must be aware that our views are quite in accord with those which he outlines. We have always held that while the motor-'bus is useful to tramway managers for experimental purposes, and as a feeder to the tramways, it cannot deal with heavy traffic in fair competition with the latter. We had no intention of ridiculing Mr. Hamilton's paper, and regret that the remark was made, though the situation still appears to us to possess a humorous aspect.—Eds. Elec. Rev.]

The "Hand" of an Armature.

Your correspondent, Mr. Moores, says that it is unlikely that uniformity will ever be reached in the nomenclature relating to the "hand" of an armature, and gives as his reason that my suggestions differ from the existing standard practice of several leading manufacturers in this country. His next sentence leads one to believe that the standard practice referred to is not a question of nomenclature at all, but of actual windings. I am well aware that some firms build their armatures right-handed and some left-handed, and I have not set out to persuade every manufacturer to build armatures of the same hand. In my article I have given what I believe to be a practical definition of right and left-handing applicable to all drum armatures, and have pointed out where the two hands differ. The classification appears to me to be a natural one, and I think it is likely to be followed. This, however, as you suggest, is a matter for the Electrotechnical Commission. I have yet to find the text-books that "support my suggestions," as Mr. Moores kindly puts it, and I would be grateful if he can enlighten me.

Humphry MacCallum.

Chelmsford, *September 29th*, 1913.

Electric Vehicles.

In your leading article on the above subject last week, you seem to lay the whole onus of the development of electric vehicles on the central station engineer, and perhaps it would be interesting to you to hear my experience in attempting to get some information on the subject.

I may say that at the present time I am running some 20 vehicles for the transportation of goods and passengers, a considerable portion of their work consisting of journeys under 20 miles. I am also running a power station plant which is turning out current at about ·25d. per unit, and was under the impression that I was in an exceptionally sound position to take up electric vehicles.

On May 30th this year I made a preliminary inquiry of a firm selling vehicles in this country as to whether they had any 4 or 5-ton vehicles yet running, and received their reply on June 10th to the effect that they had not such heavy types running in this country, but in a few days they were giving a demonstration in this town with a ½-ton vehicle, and would be pleased to bring this car down to our works. I then replied on June 11th to the effect that I should be interested to see the half-tonner when down here, and should like to have full details with cost of running, &c., of a five-tonner, and to arrange, if possible, a trial of such a vehicle under actual working conditions, the cost of which we were prepared to pay.

I also obtained a quotation for a small battery set to run on one of our petrol lorries, so as to judge how they would stand our local roads, which are exceptionally bad. This was obtained, order placed and battery received, and has since been working. I have since twice written them for details of the five-tonner, and also when the half-tonner would be down here, but so far without result. My object in writing this is to show you that the station engineer can never get a vehicle load unless the manufacturers pursue a more business-like method of putting their vehicles before prospective customers.

Chief Engineer.

[Our correspondent's experience is unfortunate; apparently he dealt with only one firm, which had not sufficiently developed its organisation to supply his needs. We have reliable and independent information which indicates that, now that the central-station engineers are moving in the direction of providing charging facilities, manufacturers are taking steps to do their part.—Eds. Elec. Rev.]

Safety of the Diesel Engine.

I read a paragraph in the Electrical Review last week, referring to the accident at Bray, due to the bursting of the blast bottle, previously filled with oxygen, of a Diesel engine. Being one of those who regard this type of engine, relative to other prime movers, somewhat in the same way as electric light *versus* gas, and wishing to see it dealt with in the fairest way, I should like to ask whether it cannot be definitely stated that if oxygen had not been used no accident would have occurred.

I do not go so far as to advocate that a non-return valve on the blast-pipe is unnecessary, but certainly think that a far more necessary appliance would be a relief valve on each cylinder. This would allow abnormal pressures to escape, but more especially it would provide for the escape of water when starting up, should an excessive quantity have leaked into the cylinder from the cooling water jacket whilst the engine was shut down.

P. F. R.

[A lengthy abstract of the Home Office Report on this matter appears elsewhere in this issue.—Eds. Elec. Rev.]

A.E.(S.)E.

As one who was present at the last general meeting, I was exceedingly surprised at the large number of members of the Electrical Trade Union who had congregated for the specific purpose of informing the central-station men of the extent of their beastly "Snobbishness." As I understood the A.E.(S.)E. was formed for this so-called "Snob" class, I

sincerely hope they will maintain the distinction. I feel confident after conversation with several central-station men that many meetings of this description will see the downfall of a promising Association.

Snob.

Metalite, Ltd.—We have received from Mr. F. Harrison, of 14, Dickenson Road, Crouch Hill, London, N., a somewhat lengthy letter replying to the questions put by "A Northern Shareholder" in our issue of September 19th. We regret, however, that owing to the demands upon our space, and to the limited interest of a number of the points covered, we are unable to publish the communication. We would suggest that those who desire further information should get into touch with Mr. Harrison.—Eds. Elec. Rev.

THE EXPLOSION AT BRAY U.D.C. ELECTRICITY WORKS.

The following is an abstract of the report of Mr. G. S. Taylor, H.M. Inspector of Factories, on the circumstances attending the explosion which occurred at the electricity generating station of the Urban District Council of Bray, Ireland, on July 10th, 1912 :—

This explosion caused the destruction of a steel storage vessel for compressed air used in connection with a Diesel oil engine, resulted in the death of Christopher Coates, the head fitter at the station, and caused such injuries to Mr. W. J. Sowter, the chief engineer, that both legs had to be amputated. Mr. McDonnell, the assistant engineer, also sustained extensive burns and other injuries to his face.

The engine at Bray was constructed by Messrs. Mirrlees, Bickerton & Day, Ltd.; it had a single cylinder 12 in. diameter, worked on a four-stroke cycle, developed about 50 H.P., and was first started in March, 1910. Compressed air for fuel ignition and starting purposes was obtained from a two-stage air compressor driven directly from the main engine shaft. An inter-cooler was provided for cooling the air between the two stages of compression, and the air passed through another cooler after the final compression. From this after-cooler the compressed air, at a pressure approaching 900 lb. per sq. in., passed through a $\frac{1}{2}$-in. copper pipe into the blast air vessel. Compressed air from the blast vessel was conveyed to the fuel valve by a blast injection pipe of solid drawn copper $\frac{1}{2}$-in. diameter, $\frac{1}{4}$-in. bore and about 16 ft. in length. The blast air vessel consisted of a lap-welded mild steel cylinder 3 ft. in length, 8 in. external diameter and $\frac{13}{32}$ in. in thickness; circular plugs $1\frac{3}{8}$ in. in thickness were welded into the ends, the upper plug having a hole communicating with the entrances to the valves in the steel "head." The "head" was fitted with a spring-loaded safety valve $\frac{3}{16}$-in. diameter set to blow off at a pressure of 1,050 lb. per sq. in. A $\frac{3}{8}$-in. copper pipe with an open and bevelled end extended almost to the bottom of the blast vessel; this pipe acted as a drain for any condensed water, and also conveyed the compressed air to the starting air vessels. There were two such vessels of mild steel with a longitudinal lap-weld and welded ends, of the following dimensions :—Length, 6 ft.; external diameter, $14\frac{3}{4}$ in.; thickness, $\frac{3}{4}$ in. They were fitted with steel "heads" connected by a T-piece, the vertical branch of which communicated with the starting valve on the engine cylinder. The interiors of these three air vessels had been coated with a bituminous composition to prevent corrosion.

On Sunday morning, July 7th, the Diesel engine was stopped by the engine attendant, and about 6 p.m. on the same day, when the station was visited by Mr. McDonnell, the assistant engineer, the attendant drew his attention to the loss of air from the three air vessels. At this time the gauges indicated a zero pressure in the reserve starting air vessel, and pressures of 350 lb. per sq. in. in the other starting vessel and in the blast vessel. On Monday, July 8th, the Diesel engine was overhauled, the fuel, exhaust and air valves were taken out, reground and replaced; the atomiser was cleaned, and the clearances on the valves were set by Mr. McDonnell. It was impossible to start the engine with an air pressure of only 350 lb. per sq. in. in the blast vessel, as this would be insufficient to inject the fuel oil into the cylinder. It was impracticable to use the Diesel alternator as a motor, and thus drive the engine and compressor until the necessary air pressure had been obtained in the blast vessel. In the absence of an auxiliary compressor, the pressure in the blast vessel had to be raised by other external means. A printed copy of instructions, supplied by the makers of the engine, contained the following statement :—

"If by any mishap the air is lost and no compressor is available, or if the engine cannot be run by external means so as to charge the receivers by its own air compressor, then these may be charged with carbonic acid gas or oxygen from the cylinders containing these gases, as used for many purposes."

As compressed oxygen had been so used without accident when the air pressure was lost in the previous February, a cylinder of compressed oxygen was ordered by Mr. Sowter from a firm of Dublin chemists, which was delivered at the factory on the morning of Wednesday, July 10th. Oxygen cylinders are usually charged with gas at a pressure of 1,800 lb. per sq. in. Shortly after its arrival the oxygen cylinder was coupled to the compressor connection of the blast vessel and the pressure was raised to 800 lb. per sq. in. The supply of oxygen was temporarily stopped and the valve opened between the blast vessel and the starting vessel; compressed air and oxygen thus passed over into the latter vessel, but the pressure in this was only slightly raised above 350 lb. per sq. in., as the pressure in the blast vessel fell from 800 lb. to 750 lb. per sq. in. The volume of the starting vessel was about nine times the volume of the blast vessel. The valve between the vessels was closed, and the oxygen again turned on to the blast vessel, until the pressure within was raised to 800 lb. per sq. in.; the oxygen cylinder was then removed and the high-pressure air delivery pipe from the compressor reconnected to the blast vessel.

The ordinary fuel (crude oil) was then emptied from the fuel pump, and from the engine fuel supply pipe, which was temporarily disconnected from the fuel valve. The fuel pump and pipe were then charged with ordinary lamp oil (kerosene), and when the fuel valve connection had been made, several strokes by hand were made with the pump, so that the atomiser in the fuel valve casing was charged with kerosene. The crude oil was then turned on from the supply tank, and the starting lever on the engine placed in the "starting" position. Mr. McDonnell stated that he then opened the valves in the following order: (1) Valve from blast vessel to fuel valve; (2) valve from compressor to blast vessel; (3) valve between blast vessel and pressure gauge; and (4) starting valve on starting air vessel. The engine began to move, and after the starting valve was fully opened, seemed to run quite satisfactorily. Mr. McDonnell therefore went to the engine platform and put the starting lever over from the "starting" to the "running" position. No firing stroke occurred, but air could be heard escaping from one of the valves with a hissing noise. The fitter Coates was at this moment standing on the far side of the engine, with his hand on the air intake pipe which is connected to the air valve on the engine cylinder. Coates made some remark apparently about the escape of air, but Mr. McDonnell did not hear this distinctly; Coates then moved to the other side of the engine, and at this instant an explosion occurred at the fuel valve on the cylinder, a blue flame was seen to travel along the blast pipe to the blast vessel, and the latter exploded with great violence. Mr. Sowter was standing on a concrete platform about 1 ft. 6 in. above the floor level close to the blast vessel which exploded, and was struck on the legs by flying metal. Probably the same fragment struck Coates, who was on the floor level, in the abdomen, causing his death within a few minutes. Mr. McDonnell was standing on the engine platform and sustained burns to his hands and face as a result of the fuel valve explosion. In addition to these personal injuries, the explosion and flying portions of the blast vessel caused considerable damage to the building and plant.

The upper part of the fuel valve cover was found on the platform near the engine cylinder; it showed no signs of having been violently projected, but was fractured across the webs below the spring box. The lower part of the cover was fractured on one side close to the gland and inside a stud hole. The top of the fuel valve casing which was outside the cylinder cover had a piece broken out on the same side as the fracture in the lower part of the casing cover. The fuel valve needle was in position in the casing and only slightly bent. The perforated washers forming the atomiser were in position around the needle, and had a slight carbonaceous deposit on them.

The air inlet and exhaust valves in the cylinder cover were both found to be leaky, and apparently at least one of these was in this condition prior to the explosion. Neither of the valves had been damaged, and the exhaust passage was coated with the usual sooty deposit.

The air starting valve was found in order, but it is not clear whether the hand lever was left in the "starting" or in the "running" position. Mr. McDonnell is certain that he put the lever into the "running" position, and thinks that he probably pulled it back involuntarily at the moment of the explosion in the fuel valve casing when he jumped from the engine platform. The engine cylinder cover was quite intact and the bolts showed no signs of injury. The blast injection pipe was burst in three places; the pipe had been opened up and flattened over lengths from 8 in. to 10 in., and the metal at the edges of these fractures was reduced to the thickness of a piece of paper. The interior of the pipe was coated with a more or less oily deposit.

The blast vessel was blown into eight fragments, and both the top and bottom plugs were completely separated from the cylindrical body of the vessel. The steel head with the valves remained attached to the top plug, and the holding-down studs had not been injured. The welding between the top plug and vessel was defective for about three-fourths of the circumference. The welding of the bottom plug was good, and the metal had been torn from the weld near the inside edge of the plug. The fragments of the body are of various shapes, and showed that the material at the longitudinal weld was practically as strong as the other parts. The fragments show signs of stretching, and as part of one piece had been bent double without indications of cracking, the steel appears to have been of good average quality and ductility. The interior surfaces of the fragments forming the centre of the vessel were blued, showing subjection to a high temperature, but the action of heat was less marked towards the ends of the vessel and on the plugs. No evidence of corrosion, either external or internal, was noticed, but the whole of the internal coating of anti-corrosive paint, with the exception of a slight trace, had been removed, probably by the explosion. There were indications that the valve had operated during the explosion, but a valve $\frac{3}{16}$ in. diameter would offer little relief for an explosive pressure. The internal pipe of the blast vessel had been burst in two pieces in a somewhat similar manner

to the blast pipe. The air compressor and air coolers were uninjured and in order.

Tests have not been made upon the material of the blast vessel, as there was no reason to doubt its suitability. Assuming this mild steel had an ultimate tensile stress of 30 tons per sq. in., and allowing 30 per cent. reduction in strength for the welding, a pressure of at least 5,320 lb. per sq. in. would be necessary to rupture the blast vessel.

Such pressure might be produced in a vessel containing a gaseous mixture: (1) by rise of temperature due to addition of heat from some external source; (2) by rise of temperature due to injection of a mass of highly heated gas; (3) by transmission of an explosive pressure wave from some connected vessel; or (4) by rise of temperature and increase in the gaseous contents due to ignition of some combustible material within.

Previous to the explosion, the blast vessel contained a mixture of pure oxygen and air in the proportion of about 3 vols. of oxygen to 2 vols. of air, equivalent to about 68 per cent. of oxygen. The gaseous mixture was at a pressure of 800 lb. per sq. in., and at a temperature of about 70° F. (the temperature of the engine house). In order to produce a pressure of over 5,000 lb. per sq. in., the gaseous mixture would have to be raised to a temperature approaching white heat. There is, however, no evidence of the proximity of any external source of heat which would produce such a temperature.

The second cause appears to be equally unlikely.

Dealing with the third possible cause, the blast vessel was connected to two sources from which an explosive wave might be propagated--viz., (1) the high-pressure air delivery pipe from the air compressor, and (2) the blast pipe from the fuel valve casing. An explosion originating in the pipe or in the compressor, which could produce sufficient pressure to burst the blast vessel, would have caused fractures in these parts. The absence of damage indicates that the explosion did not originate in them.

Any explosion in the engine cylinder which could transmit a wave of sufficient pressure to burst the blast vessel would, in all probability, have caused more damage to the cylinder and attached parts than was actually found.

The fragments of the blast vessel, especially those from near its central section, bore signs of local heating, and the bituminous lining appeared to have been burnt off. The fragments were not much reduced near the edges of the fractures, though there were indications that the material was sufficiently ductile to have shown, under a steadily increasing pressure, considerable thinning before fracture. It may, therefore, be concluded that an explosion occurred within the vessel, and developed with such rapidity that an instantaneous pressure was produced, causing a stress in the walls beyond the ultimate strength of the material. The fractures in the blast pipe and internal drain pipe indicated violent but localised explosions. There is evidence that these were preceded by an explosion, which was more or less localised in the fuel valve casing.

Under ordinary conditions of working, the blast vessel contains an oily emulsion in addition to compressed air. This emulsion is a mixture of water, from the moisture in atmospheric air, and traces of lubricating oil from the air compressor cylinder. Though much of the water and oil is removed by drains on the air coolers of the compressing plant, appreciable quantities of these pass over as vapours into the blast vessel and are there condensed. In the case of the engine at Bray, the oily emulsion was blown periodically from the blast vessel into the starting vessel, from which it was drained at intervals. In course of time the interior of the vessels becomes coated with oily matter. There is definite proof of oily deposits within blast vessels and similar compressed air cylinders. The blast vessel at Bray had been in use over two years, and the interior had never been scraped or otherwise cleaned. Many explosions and failures of air receivers, used in connection with compressed-air plant for mines, factories, and other works, have been traced to ignition of lubricating oil or vapour carried over into the receivers. The interior of the Bray blast vessel had been coated with bituminous composition which would also provide some amount of combustible matter. Moreover, since the engine had been standing for a few days previous to the explosion, it is improbable that any vapour of lubricating oil was present in the blast vessel, especially as the lubricating oil had a flash point between 425° and 450° F.

Some of the oily deposit probably was vaporised and ignited by injection of heated air or vapour into the blast vessel. It could enter the blast vessel by means of the blast or air injection pipe. Before the engine was started, this blast pipe would be filled by the blast vessel with a rich oxygen mixture which would be in contact with the kerosene in the fuel-valve casing. The flash point of ordinary kerosenes is between 70° and 90° F., and it is conceivable that kerosene vapour might have diffused into the oxygen mixture in the casing and blast-pipe. The kerosene, or its vapour, might have been ignited in several ways, but it is difficult to say what actually occurred. When the fuel-valve was opened, the kerosene in the casing may have been ignited by a flash back from the cylinder; a case is known in which this occurred with ordinary air injection, owing to the fuel-valve sticking up, and a considerable length of the blast-pipe was burst open. Again, kerosene would ignite at a lower temperature in compressed oxygen than in air, and it is possible that it might have been detonated in the oxygen mixture by the fuel-valve coming down on to its seat. Further, Sir Boverton Redwood has demonstrated that kerosene (F.P. 79° F.), if finely sprayed by pressure through a leaky rivet-hole, formed a mist which readily ignited at a temperature of 50° F. Therefore, if any obstruction was present in the fuel oil orifice in the valve casing, the mere spraying of kerosene into the oxygen mixture might have produced ignition.

Whatever the cause of ignition, and whether it originated from the cylinder or the fuel-valve casing, the evidence is clear that an explosion occurred in the casing. After the accident the blast-pipe showed on its interior surface traces of oil, possibly carried over from the blast vessel, or due to creeping of fuel oil along the pipe, or accidental injection in operating the fuel pump by hand. The explosion in the valve casing probably vaporised some kerosene which would propagate an ignition along the blast pipe and set up violent local explosions which burst the pipe, producing the effect observed of a flame travelling along the pipe. The flame would travel to the blast vessel, raise the temperature sufficiently to vaporise and ignite the oily deposit and the bituminous lining, which in the presence of excess of oxygen produced a violent explosion. The blast vessel probably contained some condensed water, and as water vapour would be present both in the vessel and piping, this may have accelerated the velocity of explosion and even added to its intensity. Dixon has shown that gaseous mixtures which cannot be exploded when perfectly dry, will do so readily when a trace of water vapour is introduced, and that the velocity of the explosion is enormously increased by the presence of water vapour. The fact that the oxygen mixture in the blast vessel and blast pipe was at a pressure of 800 lb. per sq. in. would not affect the propagation of an explosion from the valve casing, for Berthelot has shown that the velocity of transmission of explosions is independent of the pressure, the diameter of the tubes containing the explosive gaseous mixture, and also of the material composing the tubes.

There is no doubt that the presence of more than three times the normal amount of oxygen in the blast vessel added greatly to the violence of the explosion, and also facilitated the transmission of the explosion from the fuel valve, if it did not actually cause the initial explosion in the fuel valve casing. But it seems also clear that an explosion of the blast vessel would not have occurred if the walls of the vessel had been free from oily deposit. How far the anti-corrosive lining added to the effect it is impossible to say.

Cylinders of compressed air (pressure 1,800 lb. per sq. in.) can be obtained from the gas-compressing firms in London and some of the large provincial cities. Such cylinders have been utilised on several occasions for the purpose of recharging the air vessels of Diesel engines. But these facilities do not appear to be generally known, and so far as can be ascertained this method of recharging is not specifically mentioned in the instructions issued by any of the British or Continental makers of Diesel engines.

Compressed oxygen is not only unsuitable for recharging the air vessels of Diesel engines, but its use is obviously dangerous. Nevertheless, some firms of Diesel engine makers have issued instructions that compressed oxygen may be used for recharging purposes, as cylinders of this gas are easily obtainable.

As the result of inquiry it has been ascertained that at least two explosions of the blast vessels of Diesel engines have occurred on the Continent, owing to the use of compressed oxygen for recharging.

Many explosions and failures of air receivers connected with air-compressing plants have been recorded in the past, which have been traced to the presence of lubricating oil in these receivers. As the result of inquiry, it has also been found that similar explosions have occurred in the pipes and air vessels of Diesel engines. Mineral lubricating oils with high flash points should always be used in the cylinders of air compressors.

In addition to explosions from ignition of oil vapour, explosions of the high-pressure air cooler casings have occurred, and some of these have caused personal injuries. The compressed air, and possibly also the particles of solid matter which it contains, appear to exercise a scouring action on the interior of the pipes, especially in the neighbourhood of bends. After a time the pipes may be reduced in thickness to such an extent that they are unable to withstand the pressure of 650 to 900 lb. per sq. in. to which they are subjected, and therefore burst. An ordinary spring-loaded safety valve is quite inadequate to relieve the sudden pressure exerted, and other safeguards should be provided, *e.g.*, thin diaphragms of metal or other material which readily rupture with excessive pressure.

The inquiry leads to the following conclusions:—

1. The explosion of the blast vessel was caused by the ignition of an oily deposit on its interior.

2. Ignition was transmitted by a flame explosion from the fuel valve casing passing along the blast pipe, but there is no evidence to show whether this ignition originated in the fuel valve casing or was transmitted from the engine cylinder.

3. Ignition was facilitated, and the resultant explosions were intensified, by the large volume of compressed oxygen contained in the blast vessel and blast pipe.

4. This compressed oxygen had been used in the blast vessel in order to raise the pressure sufficiently to start the engine, and was so used in accordance with the printed instructions issued by the makers of the engines

5. Owing to the presence of deposits of lubricating oil carried over from the compressors, the same danger of ignition and explosion exists in blast vessels of Diesel engines as in the air receivers of air-compressing plants.

6. There are considerable practical difficulties which prevent the removal of all the lubricating oil vapour from compressed air before it enters the blast vessels, although entire removal is very desirable.

7. "Back fires" or explosions are sometimes transmitted from the cylinders of Diesel engines to the fuel valve casings and blast pipes; and ignitions, sometimes accompanied by explosions, occur in the high-pressure air delivery pipes of the compressors.

8. Loss of air pressure from the blast and starting air vessels of the Diesel engines occurs more frequently than the engine makers admit. This loss is often due to carelessness, but sometimes is due to the inexperience of the engine attendant.

Recommendations.—It is suggested that the observance of the following recommendations would tend to reduce the risk of explosions and accidents in connection with the running of Diesel oil engines.

1. Compressed oxygen, on account of its intense chemical affinity, and combustible gases like hydrogen, should not be used for the purpose of re-charging air vessels, and a warning to this effect should be issued by the makers of Diesel engines.

2. Definite instructions should be issued by the makers with regard to the adoption of safe methods for re-charging air vessels.

3. Only competent engineers, or experienced men under the direct supervision of a qualified engineer, should be employed as engine attendants on Diesel plants.

4. Traces of oil or oil vapours should be removed as far as practicable from the compressed air before it passes into the blast vessel.

5. Air vessels, especially blast vessels, should be cleaned and examined internally as far as practicable once every 12 months; they should also be tested hydraulically once in every four years, and the amount of expansion of the vessel under the test pressure should be carefully gauged.

6. Some device should be fitted for preventing the transmission of flame explosions along the compressed-air pipes.

An appendix gives particulars of 19 explosions in connection with Diesel oil engines, of which nine cases were due to the compressed air-pipes, and six to the blast injection pipe or the blast vessel exploding.

The complete report [cd. 6,964] can be had from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C., price 5d.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Redglo" Electric Fires.

Messrs. Redglo, Ltd., of Royal Liver Building, Liverpool, are supplying the "Redglo" electric fires in a number of interesting and attractive styles, and these are illustrated in the new catalogue that they have just issued. Several of the designs shown are specially suited for use as fire screens, the appearance being enhanced by the globe in the centre. Others are specially adapted for domestic use. It is claimed for the system that it gives a red-hot fire. The heating element is entirely covered in by a quartz dome with an area of 23 sq. in., and from the globular face the red rays of heat radiate.



Fig. 1.—"Redglo" Electric Fire.

Beneath this dome is disposed the actual heating medium or element, the alloy for which is warranted to withstand for very long periods the high temperature at which it is necessarily worked, even in the atmosphere which contains gases, which in time would prove detrimental to its life. In order to increase the life, the surrounding medium is arranged so that as far as possible it shall be neutral in its effect upon the alloy. The heater element is disposed upon a base which is also neutral in its effect upon the special alloy used, and at considerable extra expense this special alloy is used for all parts in proximity to the heat centre. Substantial leading-in pillars are formed of the same and carried right out and screwed into the terminals. The terminals and porcelain housings are of substantial design, roomy and far removed from the heating element and prevent the flexible wires getting overheated and breaking off short. The terminals are ample in design for 100 volts, and yet are suitably insulated and protected for use on 500 volts. The fires are wound for any pressure between 100 volts and 250 volts inclusive.



Fig. 2.—"Redglo" Fire with Adjustable Hob.

We illustrate herewith a couple of typical views of the "Redglo" radiators. Fig. 1 is the pattern No. 016 fire which is supplied in either polished brass or oxidised silver finish. In fig. 2 we show pattern No. 014 fire fitted with an adjustable hob for carrying a kettle, &c. The finish in this case is Georgian bronze and armour bright. Other examples appearing in the catalogue are finished in wrought-iron and antique copper, satin brass, antique brass, &c.

Night Bell Signal.

When commercial travellers and others arrived during the night at the Green Dragon Hotel, Hereford, they used, naturally enough, to pull the porter's night bell, but being unable to hear it ring in this official's bedroom, they were not sure whether their pulling tactics had been successful or otherwise. The consequence was that a series of noisy "ringings" was indulged in before the night porter could rise from his bed and get to the main entrance; moreover, other residents in the hotel thereby had their slumbers disturbed. So the ingenious proprietor had the word "Coming" painted in white letters on a red glass disk, which was fixed close beside the bell pull. Immediately behind this an electric light bulb was placed, the wires being carried direct to the night porter's bed room. Now, the moment a nocturnal visitor arrives and touches the bell, the night porter switches on the light which causes the word "Coming" to show up quite prominently—almost before the last tinkle of the bell has died away—and thus curbs the impatience of the newcomer.



Fig. 3.—Answering Signal for Night Bell.

Self-Contained House Service Unit with "Zed" Fuses.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, Westminster, have devised a new "Zed" house service in which the supply authorities' meter and fuses are mounted in a compact cast-iron case, provided at the bottom with terminals for connecting the supply and house mains respectively; all other connections are made permanently. This combination would not be possible in such a compact manner without the use of the latest pattern of "Zed" fuse fitting, in which all the metal parts are solid machined castings. For localities where utterly unskilled labour has to be employed for putting in house services, this self-contained unit should be invaluable, as it is practically impossible to make the connections wrongly. A further advantage is the saving of time in fixing, since only two screws are needed to support the iron case. The cast-iron box is provided with glazed "eyes" for inspecting the fuses and reading the meter. Space is allowed inside the case for storing several replacement fuse cartridges. The capacity of this particular box is

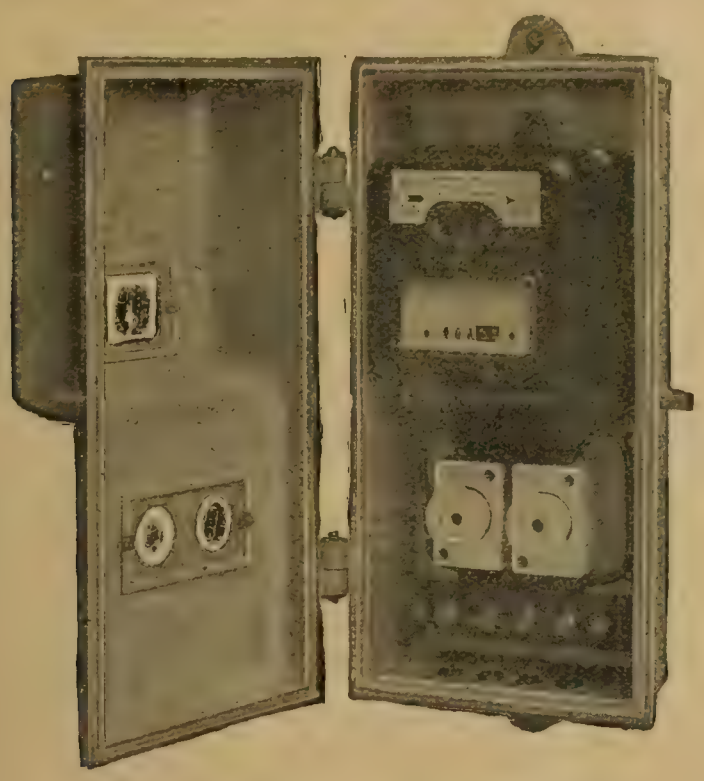


Fig. 4.—New "Zed" House Service Set.

from 2 to 50 amperes, up to 500 volts. Needless to say, the units can be supplied with or without the meter fitted.

The large number of supply authorities throughout the world who have standardised "Zed" fuses bears witness to the increased efficiency which they give in comparison with the bare-wire type of fuse. This increased efficiency shows itself in various ways; in very scattered areas it is often due to the possibility of allowing the consumer himself to replace the company's fuse when blown; in other cases, it is due to the more reliable protection of the mains and to the convenience of utilising unskilled labour to replace fuses quickly and with complete safety.

New Counterweight Fittings.

Messrs. J. M. Doughty & Sons, Ltd., of 214, St. John Street, Clerkenwell, have introduced the "Perfection" counterweight, in



Fig. 5.—"Perfection" One-piece Counterweight.

which the brass body is cast in one piece with the crutch for the pulley, making a most substantial piece of work. The strong cord guide is placed at the centre, as shown in fig. 5, and is screwed and brazed to the body: the guide and 2-in. pulley are designed to carry heavy C.M.A., or other flexible, comfortably. There is nothing loose, nothing that can possibly get out of order, and where reliability is of importance, nothing could be more suitable.

Another design, less expensive, is shown in fig. 6, the "Council



Fig. 6.—Ghost View of "Council" Counterweight.

counterweight (so called because used by the L.C.C.). In this case the body and cover are made of stout spinnings, which are held together by a bolt passing horizontally through both thicknesses of metal, and through the stem of the pulley fork, and secured by the wire guide. It is impossible for the counterweight to come to pieces, owing to the ingenious interlocking, completed by the flexible. Each of these devices can be filled to weigh 4½ lb.

Flexible Coupling.

The Standard Engineering Association, of 76, Gladsmuir Road, London, N., has introduced a flexible coupling which has many advantages in connection with the driving of or with electrical machinery. It consists essentially of packets or bundles of thin steel leaves secured in suitable holders, as shown in fig. 7. It will be noticed that in addition to the tangential flexibility due to the elasticity of the leaves, which operates equally well in either direction of rotation, radial motion and end-play are provided for by means of slots in the ends of the bundles, which also compensate for faults in alignment of the shafts, as shown in the illustrations. The leaves are held by pins fixed in cast-iron holders, which are housed in holes in the half-couplings and secured in place by spring rings which engage in grooves in the ends of the holders, so that it is a very simple matter to assemble

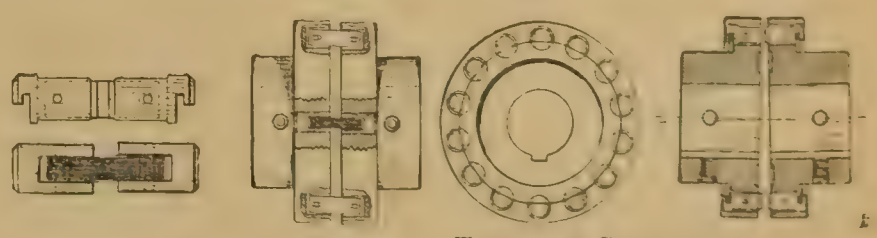


Fig. 7.—Details of Flexible Coupling.

or take apart the coupling; there are no projecting parts liable to catch in workmen's clothes.

The provision for end play enables the armatures of motors or generators to take up their position freely in the centre of the magnetic field, preventing pressure and friction on the bearings, and the use of large combined bedplates is not essential when these couplings are employed. For driving alternators with internal-combustion engines the coupling has special advantages, as it enables the machines to run in step without heavy circulating currents in spite of the slight irregularity of the speed of the engine; a similar advantage is gained in driving small lighting dynamos from oil engines, the fluctuation of voltage being eliminated. The couplings are made in all sizes up to 20 in. diameter.

Railway Battery Cars.—A new storage battery car and trailer, which are intended for the Munster district, have just been tested on the Berlin City railway. A speed of 40 miles per hour is reported to have been obtained over a length of 64 miles. The weight of the train without passengers is 84 tons, and accommodation is provided for 118 persons, whilst a separate compartment is available for mails and luggage.

E

BUSINESS NOTES.

Boving Contracts.—Among the principal orders received by Messrs. Boving & Co., Ltd., up to the end of August, are the following :—

Egyptian Government at Atbara.—One pump, 330 g.p.m., 181 ft. head.
McIlwraith, McEacharn for Penang.—One pump each, 1,670 g.p.m., 175 ft. head, and 2,300 g.p.m., 175 ft. head.
Breseis Tin Mining Co., Tasmania.—One pump, 1,200 g.p.m., 100 ft. head.
S. Pearson & Son, London.—One pump, 1,000 g.p.m., 65 ft. head (third repeat order); two pumps, 278 g.p.m., 30 ft. head.
Town of Ladybank.—One pump, 200 g.p.m., 75 ft. head.
Key Engineering Co., East Africa.—One pump each, 8,000 g.p.m., 20 ft. head, and 14,500 g.p.m., 64 ft. head.
Fairrie & Co., Liverpool.—One pump, 25,000 g.p.m., 370 ft. head.

The firm have also received orders from Messrs. Mitsui & Co. for a complete paper-making plant for Odomari, Japan; from the municipality of Cape Town for 500 lapwelded tubular steel poles, 35 ft. high; and from the township of Kopjes, South Africa, for 7 miles of steel piping of various diameters. Several small turbines, including :—

Rincon Mines, Mexico.—One turbine, 750 h.p., under 55 metres head.
Messrs. Malmquist, Tucuman, Argentina.—One turbine, 94 h.p., under 64 meters head.
Breseis Tin Mining Co., Tasmania.—One turbine, 70 b.h.p., under 350 ft. head.
Hydro-Electric Commission of Canada.—Two turbines, 750 h.p., under a head of 12 ft.

The two turbines for the last-mentioned body will be manufactured at the works recently established by the firm at Lindsay, Ontario,

There is a growing tendency on the part of British manufacturers to establish works in Canada. In some cases the majority of the parts of machines are imported, and only the heavy portions actually turned out in Canada, but in several instances works have been established for the entire manufacture. Messrs. Boving & Co., Ltd., have for the past six months been located at Lindsay, Ontario, where Boving and Co., of Canada, Ltd., have taken over the works of the Madison Williams Manufacturing Co., Ltd. The existing works are small, and only employ some 30 hands, but six acres of additional land have been purchased, and extensions will be proceeded with at the earliest possible moment. The company will be manufacturing water turbines, centrifugal pumps and pulp and paper-making machinery, and, no doubt, they will find a very wide market, as they have many good examples of their design to show in Canada, notably, water turbines supplied to Winnipeg City, the Calgary Power Co., the Ocean Falls Pulp Co., the Midland Construction Co., &c., and pumps supplied to Toronto City, Montreal Water and Power Co., the E.B. Eddy Co., Nipissing Mining Co., and many others. The Lindsay works are now engaged upon two turbines for the Hydro-Electric Commission at Wasdell Falls, each giving 750 h.p. under 12 ft. head in two wheels of 1,850 mm. diameter.

Bankruptcy Proceedings.—Woolf Barnett, electrician, 269, Mile End Road, London, E.—Receiving order made on a creditor's petition, September 22nd. First meeting, October 6th; public examination, November 12th; both at Carey Street.

Herbert William Wilson, consulting engineer, 28, Alder Road, West Derby.—Receiving order made September 24th on a creditor's petition.

John Dale Nixon (trading as J. D. Nixon & Co.), electrical and mechanical engineer, 65, Mill Street, Crewe.—The public examination of this debtor was held at the Court House, Edleston Road, Crewe, last week, before Mr. Registrar Speakman. According to the statement of affairs, the liabilities amounted to £1,292, and the deficiency was estimated at £1,115. The debtor attributed his failure to loss on contracts (£180), law costs paid in respect of action brought against him during the past 12 months for the recovery of the amount of trade goods supplied (£200), want of capital, and insufficient profit to meet general expenses. It appeared that the debtor had not been in business on his own account prior to March, 1910. There were 38 creditors, mostly for trade goods, amounting to £616, while there was a claim by a moneylender for £11 10s. In reply to the Official Receiver, the debtor said he had not been able to prepare the account and furnish the particulars asked for, and wanted more time. His books had been imperfectly kept, and he required the assistance of his book-keepers. The Registrar said he could get assistance, but it must be at his own expense. On the application of the Official Receiver, the examination was adjourned.

A Spanish Amalgamation.—As was mentioned some time ago, the ruinous competition between the electricity supply companies in Madrid has been terminated by the establishment of a community of interests between the companies. A similar state of rivalry has existed at Valencia, where four companies have been in keen contest with each other. The Canadian Pearson group, which is particularly active in Spain, has now put an end to this competition by taking over the assets and liabilities of three of the companies, which have thereby been converted into a uniform undertaking. The gas and electricity works of Lebon & Co. only remains outside the combined enterprise.

Strike in Russia.—It is reported that the Russian Allgemeine Elektrizitäts Gesellschaft, in consequence of a strike, has decided to entirely close down its works in Riga. The decision will affect 2,000 workmen.

The Argentine Republic.—The value of the electrical goods imported into the Argentine Republic during the six months ending with June last only amounted to £896,000, as compared with £972,000 in the corresponding half of 1912.

Fire Salvage.—After a large fire recently in an engineering works at Birmingham, the *débris* contained a considerable amount of iron, of such value as to warrant salvage operations. A 42-in. Witton-Kramer magnet, taking 5 kw., was therefore rigged up, and after the larger masses of metal had been removed, the rubbish was shovelled on the face of the magnet, which retained everything magnetic. When the face of the magnet became filled, a box was placed underneath and the current switched off, the magnetic "catch" falling into the box. Expectations were more than realised, and over 2 tons of metal, screws, &c., were salvaged, the bulk of which can be utilised.

New Aluminium Works.—A correspondent says that the British Aluminium Co. have completed negotiations for the acquisition of ground at Burntisland, Fife, and will proceed at once to erect a large manufactory and lay down electric plant, &c.

Catalogues and Lists.—The Phœnix Electric Heating Co., 17, Morwell Street, London, W.C.—Illustrated leaflet relating to their electric log fire radiators and giving prices of same.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Folder No. 729 illustrates a variety of designs of Aston luminous electric radiators (from two to six lamps), also a number of non-luminous types. Prices and code-words are clearly shown.

The Acme Motor and Traction Co., The Ham, Brentford, London, W.—Twenty-page stock list (No. 25) of dynamos, motors and fans, switches, and all kinds of electrical materials.

Mr. L. Herve, 90, Clerkenwell Road, London, E.C.—Revised catalogue containing 34 stout sheets illustrating a variety of turned and stamped metal parts for telegraph and other electrical and engineering work—terminals, battery fittings, nuts, set screws, studs, &c. Reduced prices are recorded, and a stock of increased variety is carried.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—"Book No. 2," of 80 pages, containing numerous illustrations—with brief descriptive matter and notes of prices and code-words—of a variety of telephones and telephonic apparatus for domestic, commercial, mining, and general purposes.

The Arc Lamp-Lowering Gear Co., Railway Appliance Works, Darlington.—New catalogue, containing specification of the firm's arc lamp lowering gear, winches and accessories. Prices and code-words are detailed in tabular form, and eight sheets are filled with illustrations of these specialities and street views showing their use.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Leaflet No. C513 gives an illustrated description of the Siemens bell signal indicator for use with mechanically-operated bells for mine shafts and haulage signalling gear.

The London Electric Warehouse Co., Manners Street, York Road, London, S.E.—Two net trade price lists relating to wires and cables; No. 101, 600-megohm grade cables; No. 102, 1,500 and 2,500-megohm grade cables.

Messrs. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.—Sixteen-page catalogue giving full particulars concerning Callender's cab tire sheathing. Sizes, code-words and prices are tabulated for several grades of single conductor, twin, three and four-core cables, also small flexible cord, single, twin, three and four-core.

The British Thomson-Houston Co., Ltd., Mazda House, London, E.C.—A copy of the "Lighting News," No. 2, has reached us. Its 16 small pages are occupied by a number of brief illustrated articles or notes concerning B.T.H. lighting specialities, their uses and economies. Electrical contractors, central station men and others who want numbers of the booklet for distribution should communicate with the company promptly.

Dissolutions and Liquidations.—Davis Electrical Co., Ltd.—Mr. H. Brougham, senior Official Receiver and liquidator, is applying to the B. of T. for his release in this matter. The total payments for fees, &c., have been £18 12s. 2d., and the receipts *nil*, leaving that amount due to the B. of T. The statement says :—"The public examination of H. E. Davis, the managing director of the company, was held on July 23rd, 1912, in connection with the matters referred to in paragraph 11 of the Official Receiver's observations,' dated April 12th, 1912. As the result of the examination certain creditors provided funds for the purpose of taking the opinion of counsel, which, it is reported, was to the effect that proceedings might lie against Davis, but that they were not advisable on behalf of the general body of creditors, though individual creditors might recover in certain cases. The assets disclosed in the statement of affairs were not equal in amount to the claims of the debenture-holders, and the Receiver states that there is no prospect of any surplus becoming available for the unsecured creditors."

The Electrical Wiring and Accessories Co., electrical, mechanical and general factors, Aberdare (also latterly trading as South Wales Accessories Co.).—Messrs. R. S. Belsten & T. O. Morgan, have dissolved partnership. Debts, &c., will be attended to by Mr. Morgan.

Brown & Parsons, Ltd., Leamington.—First and final dividend of 4s. 8d. in the £. Mr. C. T. Appleby, liquidator, 26, Corporation Street, Birmingham.

For Sale.—Mr. H. Butcher will on October 9th and 10th offer for sale, by auction in London, gas and electric fittings, illuminating devices, lathes, &c. See our advertisement pages to-day.

Electrical Publicity.—We have received from the City of London Electric Lighting Co., Ltd., several pieces of publicity literature. One is a 16-page pamphlet, on "Electric Light and How to Use It," with illustrations showing good and bad lighting compared; another particularises and shows electrical hot-water apparatus for the office.

Theatre Lighting.—At the London Opera House Osram drawn-wire lamps are installed, also in the whole of the auditorium; in fact, they form the principal illuminant throughout the theatre. Among leading provincial theatres, &c., that have lately adopted these lamps are the Theatre Royal, the Hippodrome and the Palace, at Oldham.

Depression in Austria.—According to a report from Vienna manufacturers of electrical cables in Austria and Hungary are just now passing through a period of depression, orders being extremely scarce.

Trade Announcements.—Mr. C. W. Webster, of Cecil House, Park Avenue, Bradford, sends us a couple of post-card photos showing the carbon works of the Compania Fabril de Carbones Electricos, of Barcelona, the sole sale concession for whose carbons in the United Kingdom and Colonies is held by him. The company have lately secured a repeat contract from the Glasgow Corporation for flame carbons for approximately 1,000,000 ft., and a repeat order for flame carbons from the Melbourne City Council, Australia, and we understand that many other large flame contracts are in hand for other corporations, municipalities, and arc lamp manufacturers. Owing to the continual increase of business, the firm are considerably extending their works. One of the cards shows a corner of the works where extensions are in progress. Besides manufacturing arc lamp carbons, the works make carbon electrodes and dynamo brushes. We have before us a Spanish catalogue of arc lamp carbons, but full particulars of the manufactures can be obtained from Mr. Webster.

To-morrow, Saturday, the Sterling Telephone and Electric Co., Ltd., are transferring their business from Upper Thames Street to more commodious premises at 210, 211 and 212, Tottenham Court Road, London, W., and all communications should be addressed there in future. Telephone number, Regent 4144 (five lines).

Messrs. André Citroen & Co., of 27, Queen Victoria Street, London, E.C., announce that the style of the firm has been changed to the Citroen Gear Co., Ltd.

Mr. H. Featherstone, electrical engineer, of Tunbridge Wells, has removed to new premises at 22, London Road.

The Edison & Swan United Electric Light Co., Ltd., are about to open premises at 10, Deansgate, Manchester, as showrooms.

The Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, London, W.C., have secured the sole selling rights in this country and the British Colonies for the machinery and apparatus manufactured by Messrs. Ateliers de Constructions Electriques, of Charleroi, at whose very extensive factories are made:—Large A.C. and D.C. motors and generators, traction motors, electric cranes, centrifugal pumps, haulage and winding gears, &c. The works being situated in the midst of the Belgian coal-fields, the firm have had a unique experience in the electrical equipment of collieries and steel works.

Messrs. J. T. Williams & Sons, engineers and machinery merchants, have removed to 37, Queen Victoria Street, E.C. Their telephone number is "City 3938."

LIGHTING and POWER NOTES.

Aberdeen.—Messrs. Hugh Imlay & Co., Ltd., envelope manufacturers, have recently installed electricity for lighting and power purposes in their works at Park Road, Aberdeen. The contract was carried out by Messrs. Claud Hamilton, Ltd. Energy is obtained from the Corporation supply, and the power is distributed to the different departments by means of various motors. "Osram" drawn-wire lamps are distributed throughout the works and warehouses.

The Lighting and Fires Committee have decided that the entire electric lamps and fittings meantime in the custody of the electricity department be transferred to the lighting department, and that in future all repairs be executed by the lighting department instead of by the electricity department.

Aberdeenshire.—The Committee in charge of the scheme for an installation of electric light in Aboyne has received an offer from Messrs. T. C. Smith & Co., electrical engineers, Aberdeen, acting on behalf of Mr. Duncan, of Tillycorthie, providing for the erection of the necessary generating machinery and laying of the mains. The Committee has to find a site. Current will be supplied at 6d. per unit for light, and at 4d. per unit for power. The cost is estimated at £6,000. The Town Council of Ballater has accepted a similar offer by Mr. Duncan.

Abingdon.—The local Electric Supply Co. has practically completed the buildings required for the plant, and has made a commencement with the laying of the underground cables.

Alderley Edge.—The Committee of the village institute has installed electric lights at various points round the bowling green, and many members are now to be seen playing the game long after darkness has set in.

Australia.—Camberwell (Vic.).—The Council has adopted the revised agreement with the Melbourne Electric Supply Co., Ltd., for lighting the streets of the town with electricity for a period of five years from November 1st next, at an annual cost of about £900. The present agreement with the gas company costs £969 per annum for 212 lamps, while the new agreement provides for 251 lamps, seven of which are arc lamps of 700 c.p.—*Commonwealth Engineer.*

Bacup.—On September 24th, Mr. H. R. Hooper conducted a L.G.B. inquiry into an application of the T.C. for permission to borrow £2,800, made up of £2,100 for H.T. mains, and £700 for sub-station equipment. The expenditure is necessitated by the increasing demand for current, especially in the Stacksteads portion of the borough.

The Balearic Islands.—A small central electric lighting station has lately been completed in the little town of Porreras. One is also being established in the town of Petra.

Barnstaple.—Subject to half the cost of the laying being repaid, the Council has decided to extend the mains to the premises of the South Molton Collar Factory, Mallet's Row.

Bedford.—Last week the Electricity and Street Lighting Committee reported that having considered a letter from the L.G.B., it had abandoned all intention of proceeding further with any installation of the Diesel oil engine plant, and had considered an alternative scheme for the installation of a 1,000-kw. mixed-pressure turbo-alternator with condenser, air filter, and accessories, and recommended that the electrical engineer be authorised to prepare drawings and specifications, and that tenders be invited. This was adopted by the Council.

Blackburn.—In connection with the forthcoming Tradesmen's Shopping Festival, the Electricity Committee has received permission to place electrical devices on the Town Hall and the markets. The Committee has decided to supply electricity for the illumination of the shops at 2d. per unit, and the Tramways Committee proposes to run two decorated and illuminated cars.

Bridlington.—The L.G.B. has sanctioned the borrowing of £1,500, repayable in 20 years, for mains, and £1,500, repayable in 15 years, for services.

Bristol.—The Bristol branch of the Electrical Trades Union having demanded an advance from 8d. to 9d. an hour under threat of a strike on September 27th, the electrical contractors concerned appointed a deputation to deal with the matter.

Burnley.—On Tuesday a L.G.B. inquiry was held into the Corporation's proposal to borrow £36,227 for the purposes of the electricity undertaking, including £7,420 for a 2,000-kw. turbo-alternator, with condensing plant and piping; two 500-kw. rotary converters and transformers, £3,040; new switchgear and alterations, £2,400; two boilers, economisers, cooling-tower, cranes, sub-station, rotaries and transformers, switchgear, transmission cables, mains and services, &c. The town clerk stated that even if the proposed expenditure did not effect any economies at all, the financial position of the works was such that they would stand it. There was an accumulated reserve of £23,000, and the undertaking had paid over to the rates during the last three years £14,500. The demand for electricity was steadily going up. For the year ending March, 1911, there were just over 3,000,000 units sold; in 1912, 3,990,000; and in 1913, 4,524,000. If the largest machine at the works broke down, it was a question whether the remainder of the machinery could supply the demand. The Inspector said he was surprised to see such a small demand for power. In most Lancashire towns it was fairly considerable. The electrical engineer explained that under present conditions they had not been able to entertain inquiries from large users of power.

Castlebar.—Messrs. Bourke & Sons, Castlebar, have given notice to the T.C. that they intend applying to the B.of T. for a provisional order to light the town with electricity.

Carlisle.—On September 23rd Mr. F. O. Stanford held a L.G.B. inquiry into the application of the Corporation for sanction to borrow £7,500 for the extension of the plant at the electricity works and £4,300 for the erection of H.T. feeders for the supply of the outer districts. The Town Clerk stated that the application had to be amended from the sum named to £8,034, the amount of the provisional tenders. The electrical engineer (Mr. F. W. Purse) gave evidence as to the increase of output, and said that the new plant would supply current either for lighting or traction. There was not accommodation for the new plant, and the buildings would have to be extended. The undertaking had been making profit since 1906, and for the past financial year the profit had been £1,510. A working balance had been accumulated of £6,000. It was proposed to install two converters, and the cables would cost £3,000.

China.—Notwithstanding the local, political and other disturbances which have given occasional setbacks to the business of the Compagnie de Tramways et d'Eclairage de Tientsin, the company continues to make steady progress. There are about

8 miles of double-track electric tramways in service in the town, while current is now being supplied to an equivalent of 36,774 10-C.P. lamps, as against only 28,225 at this time a year ago. In view of the increasing demand, especially for power purposes, at some distance from the generating station, the directors have decided to extend the latter, and at the same time to convert the lighting system to alternating current. The new plant, which is expected to be completed by the end of the present year, will comprise two sets of 1,500-KW. steam turbines and generators, working at 5,000 volts, a set of transformers for converting this to 220 volts for lighting purposes, and a 900-KW. converter to supply continuous current to the tramway system. The four existing 325-KW. engines and dynamos will be kept as a reserve plant.

Chobham (Surrey).—The residents are supporting an application by the Woking Electric Lighting Co. for powers to extend their mains to this parish.

Cleckheaton.—Consequent upon an application being made by Messrs. John Walker & Son for the supply of electric power to their Valley Mill, at Moorbottom, in December, and the fact that the feeder cables in this locality are already loaded to their full extent, the Electricity Committee has instructed the engineer to prepare and submit a scheme and estimates for laying larger cables, and allowing for any possible future extensions.

Colne.—The Electricity Committee has accepted a recommendation that a smoke-burning device, known as "Luptarm tubes," be fixed to one of the boilers at the electricity works as a test and for demonstration purposes.

The Electricity Committee is renting temporary premises for the display and demonstration of electrical appliances to consumers of electricity.

In reply to a complaint from the Colne and Trawden Light Railway Co. that the electric current for the tramways was cut off for 47 minutes on the evening of August 2nd, the Council has intimated that this was due to the extraordinary demand for power beyond the quantity agreed upon, for which the department was not prepared.

Continental Notes.—AUSTRIA.—The present electricity supply station connected with the harbour at Trieste having become too small to meet the requirements, and also being unsuitable for extension, it has been decided to establish a new generating station on the River Isongo, at Montalcone, some distance from Trieste. The current will be transmitted at a pressure of 25,000 volts, a transformer station at the harbour reducing this to 2,000 volts.

The municipal authorities of Agram have decided to apply for a concession to utilise the River Litca, near Gospic, for the generation of electricity. The estimated outlay for the installation is placed at 30,000,000 kronen.

The Thomas Parsler Cotton Spinning and Weaving Co., of Krainburg, has applied for a concession to put down plant to utilise certain available water power near that town for the generation of electrical energy for power purposes in its mills. It is stated that about 2,300 H.P. will be available.

A scheme is under consideration to put down a plant to utilise the power of the Kohlbach Falls, near Kossen, in the Tyrol, for the generation of electrical energy for lighting and power purposes.

It is proposed to establish a plant to utilise the water power of the River Berann, near Darowa, Bohemia, for the generation of electrical energy for lighting and power purposes.

BOSNIA.—A new 1,000-H.P. steam turbine and dynamo has recently been installed at the electricity generating station connected with the State collieries at Kreka, Bosnia.

An electricity generating plant has lately been installed in connection with the State Ironworks at Varel, Bosnia; it comprises two boilers fired by the waste gases from the blast furnaces, and a 1,000 H.P. steam turbine and dynamo.

SPAIN.—La Sociedad La Electricista de Sonreca, which has a water-power electricity-generating plant at Romaila la Nueva, has secured a concession to increase the amount of water taken from the River Iago from 6,000 to 11,700 litres per second.

La Sociedad Co-operativa Electrica Popular de Novelda has secured a concession to establish a co-operative central electric lighting station in the little town of Novelda.

A concession has recently been granted to put down a plant to utilise the water power of the River Anna, in the province of Valencia, for the generation of electrical energy for lighting and power purposes.

GERMANY.—The authorities controlling the Upper Rhine power station at Mülhausen contemplate the erection of another generating station, this time on the Schwarzen See (Vosges), in order to utilise the power available at night from the Rheinfelden power station. By means of this station, estimated to yield 180,000 KW. at a cost of 3,500,000 marks, and the power derived from the Rheinfelden station, the waters of the Schwarzen See will be pumped up to the level of the Weissen See (150 metres higher). The first-named lake has a superficies of 150,000 square metres, and the second 260,000 square metres. The return flow of the water to the works, through a specially-constructed channel, day and night is expected to yield a corresponding quantity of electric energy.—*Zeit. f. das gesamte Turbinenwesen.*

An electricity-generating station, operated by water-power, has lately been completed at the Listertalsperre, by the Ruhrtalsperren Verein, of Essen. The plant at present comprises two 500-H.P. high-pressure turbines, built by Messrs. Amme, Giesecke and Co., of Brunswick, and two 420-KW. alternators, supplied by the Bergmann Elektricitätswerke Gesellschaft, of Berlin. Two additional sets of turbines and dynamos, each of 335 KW. capacity, are shortly to be added.

The shipbuilding firm of Schichau, of Elbing, are about to build a great reservoir and water-power installation between Braunsberg, in East Prussia, and Elbing. The reservoir will collect in good years some 100,000,000 cubic metres of water. The power capacity of the installation will amount to between 4,000 and 5,000 H.P. Most of the electricity generated will be utilised in the great Schichau establishment at Elbing, the surplus being disposed of among the neighbouring towns and agricultural districts.

A novel electric lighting plant has recently been installed at the railway station at Ostrowo, Silena, for the supply of electricity for lighting and power purposes at the station at Skalmierzce, on the German-Russian frontier, 10 miles away. The plant consists of two 180-H.P. gas engines, each coupled up to a continuous-current and an alternating-current generator. The novelty lies in the fact that the suction gas used to drive the gas engines is manufactured from the carbon scraped from the smoke boxes of the railway locomotives. There are several installations of the kind in the Konigsberg railway district, but new ones are now not so numerous owing to the fact that on account of the better utilisation of the coal in the modern superheated steam locomotives, the smoke-box residues are not sufficiently rich for gas-making purposes. As a result, plants to utilise the smoke-box carbon are only being put down where fuel is dear and labour cheap.

An interesting hydroelectric undertaking is about to be carried out near Orbey, in Alsace-Lorraine. Two picturesque lakes here, much frequented by tourists, the Lac Blanc and the Lac Noir, separated by a rocky barrier, have a difference of surface of about 100 metres. It is intended to join these two lakes by a tunnel, and by means of pumps to raise about 1,000 cubic metres of water from Lac Noir to Lac Blanc during the night. This will be allowed to flow back to Lac Noir, with the natural outflow of the lake, during the day, and the flow will be utilised for generating electricity, which will be employed for lighting and industrial purposes and for traction on the Alsace railway system.—*Journal Pratique de l'Electricité.*

FRANCE.—The scheme of distribution in Paris, detailed in 1909 in *l'Industrie Electrique*, is now, according to our contemporary, rapidly approaching completion. The two central stations—Nord and Sud—of the Compagnie Parisienne de Distribution, which will render Paris independent of all external sources of energy, are practically completed, and one (the Nord) will very shortly be put in commission. Concurrently with these extensions and the extensions to the sub-stations, the motor load has considerably increased, principally as a result of the reduction of the price per KW.-hour to 2·9d. per unit for small loads, with special tariffs reducing this figure to 1·4d. per unit in the case of larger installations. The direct result is an increase of the day load and an improvement in the diversity factor. The distribution area is divided into four zones, each zone being supplied with electrical energy in a different form; thus there are networks of single and two-phase (five-wire) alternating current and three and five-wire direct-current supply. The single-phase network is fed from static transformer stations, which also supply high-tension energy to certain users. The two-phase network is fed from distributing centres, where high-tension switches of the cell type connect the incoming mains to banks of transformers placed at convenient points of the network. These centres form an entirely new feature of the Paris system, and have already been considerably extended as regards the number of H.T. cells and corresponding transformers. No serious interruption of their service has yet been recorded. Rotary transformers supply two direct-current networks, one three-wire and one five-wire system. These two zones slightly overlap, in order to balance the load to better advantage, and herein lies the only deviation from the original scheme of dividing the Paris area into four zones characterised by the forms of supply. The cost of changing over the mains from two to three, three to five or five to three-wire has been borne by the local authorities, and the work has been carried out by them.

The *Revue Electrique* learns that the Compagnie l'Electrique Centre-Ouest has applied to the State for a concession in respect of 195 communes representing nearly 300,000 inhabitants. The communes are divided among the following departments:—Deux-Sèvres (31), Vienne (60), Vendée (14), Charente (14), Charente Inférieure (21), Creuse (18), Indre (17), and Haute Vienne (20).

The municipal authorities of Rocroi (Ardennes) have granted a concession to the Société des Ardennes Electriques for the electric lighting of the town.

La Société Normandie de Distribution d'Electricité is the name of a new company which has just been formed in Paris (38, Rue Saint Georges) with a capital of £160,000 to establish electricity supply stations in Normandy.

Croydon.—The visit of a party of Thornton Heath ratepayers to the electricity works on Saturday was made the occasion for the formal inauguration, by Alderman D. B. Miller (chairman of the Lighting and Electricity Committee), of the new turbine-driven generating plant just installed. This will supply practically the whole of the alternating-current lighting, and also a portion of the direct-current lighting (for the centre of the town). The turbines can be worked either with high-pressure steam or with exhaust steam, and a great saving in the coal bill is thereby anticipated. The makers of the turbine were Messrs. Belliss & Morcom, and of the generating plant Messrs. Siemens Bros. The capacity is about 3,000 H.P., and the cost, roughly, £7,000. The thanks of the company were extended to the borough electrical engineer (Mr. A. C. Cramb), the deputy manager (Mr. J. W. Burr), the station superintendent (Mr. D. Cowan), and the sales manager (Mr. A. C. Bostal).

Coxhoe (Co. Durham).—The P.C. has under consideration a proposal to have the streets lighted by electricity. The County of Durham E.P.D. Co. is to furnish an estimate of the cost, after which a further meeting will be held.

Dartford.—With reference to the U.D.C.'s proposal to give a supply of current to Crayford, Lord Tredegar's agents have objected to the cables being placed overhead on his estate. Should the agents, upon reconsideration, still refuse consent, the cables are to be laid underground.

Derby.—The Council is recommended to rent for two years premises in Victoria Buildings, London Road, for use as a showroom in connection with the electric light undertaking.

The E.L. Committee recommends the adoption of an alternative system of charge to occupiers of dwelling houses, of 10 per cent. on the rateable value of the premises, plus ¾d. per unit for all current consumed in excess of the number of units equivalent in value at the ordinary lighting rate to the amount of the percentage charge.

Dromore (County Down).—In our last issue the word "company" should not have appeared. The scheme is yet under consideration by the Urban Council, and it will be finally decided at a special meeting.

Eccles.—A 50-KW. transformer is to be installed under the footway in Liverpool Road, and a low-tension distributing main is to be laid from there for a distance of 250 yards.

The Public Lighting and Electricity Committee has approved a recommendation of the electrical engineer for a rearrangement of street lamps at Peel Green, providing for four new lamps and the refixing of 12 existing lamps.

The extension of the mains from the junction of New Lane with Worsley Road to the site of the proposed new church off Parrin Lane, has been confirmed by the Electricity Committee.

Fleetwood.—The Council having been asked by the Lancashire and Yorkshire Railway Co. for terms for the supply of current for lighting and power at Fleetwood Station and Wyre Dock, are making inquiries as to charges elsewhere to railway companies.

Flintshire.—A scheme is projected for introducing electric lighting in the districts of Connah's Quay, Shotton and Queen's Ferry. It is thought that there would be a considerable saving of expenditure if the generating station were erected at the sewerage works in the Deeside district.

Haslingden. — On September 25th, the electrical manager submitted to the T.C. an estimate of the probable cost of laying a cable along Helmshore Road to certain mills at Helmshore, together with a tender received from Messrs. Siemens Bros. & Co., Ltd., for the execution of this work. The manager was instructed to invite tenders from other cable-makers for this cable, and the placing of the contract was left in the hands of the chairman and vice-chairman.

Heston-Isleworth. — Mr. P. E. Rycroft, electrical engineer, has been authorised by the U.D.C., upon receipt of an application for a supply of current to the Brentford Union offices, to extend the electricity mains along the Twickenham Road, a distance of 580 yards, at a cost of £300; and also to lay a cable into the Hounslow barracks, at a cost of £150, for the purpose of furnishing a supply of current to the new gymnasium.

It is proposed to substitute 35 100-C.P. lamps, at £4 each, in place of the arc lamps which now light Richmond and St. Margaret's Roads. A saving of £100 per annum is anticipated.

Ilford.—At the last meeting of the U.D.C., the Electricity Committee recommended, on the report by the electrical engineer, and as an alternative to the present rates, that from the December readings (1) a primary charge of 12½ per cent., of the rateable value of all private houses be made payable in four equal quarterly instalments, together with a fixed rate of ½d. per unit on all current consumed, less the usual discount of 5 per cent., for prompt payment; and (2) that for shops, warehouses, or business premises electrically lighted throughout, and using or paying for electricity up to 2,500 units per annum, a charge of 3½d. per unit be made; for 2,501-5,000 units per annum, 3d. per unit; for 5,001-10,000 units per annum, 2¾d. per unit; and for 10,000 and upwards, 2½d. per unit. Payments must be made at the rate of 3½d. per unit for the quarters ending June, September, and December in each year, and any allowance due to the consumer is to be credited upon the account for the quarter ending March in each year. As regards public houses, &c., a charge of 2¾d. per unit is to be made as an alternative to the present maximum demand rate.

The U.D.C., on September 23rd, approved plans and estimates for a refuse destructor, to cost £21,578.

Ingleton.—The P.C. has accepted a tender of £42, from the Electric Lighting Co., for street lighting from August 1st to April 30th.

Kendal.—Messrs. Austin & Paley, of Lancaster, have been instructed to prepare a scheme for installing electric light in St. Thomas's Church, together with an estimate of the cost.

Leeds.—Mr. Hooper held a L.G.B. inquiry last week into an application by the Corporation for powers to borrow £168,000 for developing the electricity undertaking. The Town Clerk (Sir R. E. Fox) explained that the sum desired included £100,000 for mains, £38,000 for machinery, and £30,000 for sub-stations, transformers, &c., and it was necessary that work should be proceeded with as soon as possible, because during the winter of this year the department would have to deal with a load of 13,000 KW., and during the following winter it was expected that this would be increased to 20,000 KW. It was suggested that the present plant owned by the Corporation should be maintained as a stand-by. The city electrical engineer (Mr. C. N. Hefford) gave evidence in reference to the application. The Inspector said that evidently at no far distant date a good deal of the original plant put down would be of no commercial or other use, and, that being so, both with regard to buildings and plant, there would probably be a very considerable sum of money which would still be outstanding in the next two or three years when it would be necessary to make provision for the new plant. There was only a paltry £3,000 in the present reserve fund, and during recent years there had apparently been no intention of adding to it. Whereas in 1907 the fund stood at about £14,000, it was now only £3,500, and at the same time the profits had increased from £3,400 in 1907 to £15,500 in 1913. He was looking at the matter from a commercial stand-point. The Corporation was putting in very large boilers which would in effect supersede the old Lancs. boilers now in use; and yet there was a considerable debt outstanding when a fund ought to have been built up with the money and profits earned. The time when new plant would be needed was getting nearer every month, and he would like to know what the Corporation proposed to do about the matter. Even if the Board allowed the matter which he had mentioned to go by on this occasion, it was one which must be anticipated. It was a question of obsolescence rather than of depreciation; but it was one which ought to be met. What would the City Council do in two or three years' time, when they had derived the income and had put nothing by to the reserve fund? He had mentioned the matter because it was a serious question, and one which could not be missed on the next occasion. It was drawing the long bow to say that it was not necessary to-day, and there were no funds to meet it. If the profits had been earned and dealt with in other ways, what would be the position when they were applying for a large sum for another station, and there were no funds in hand to wipe out the outstanding debt on the old station? It might mean a great increase in the rates in one year, and it could not be put off much longer. The town clerk replied that the reserve fund of £14,000 had been abolished when a necessary financial arrangement between the Consolidated and City rates was made, the Corporation deciding to take these reserve funds. The plant which the Corporation now had had not been superseded, though the matter which the Inspector had raised was quite appreciated by the authorities, and would be taken notice of. The electricity undertaking was a prosperous one, and the revenue dealt with was likely to increase very greatly.—There was no opposition to the application, and the inquiry was closed.

London.—STEPNEY.—Mains are to be extended through several roads in the borough. Subject to the approval of the B. of T., an agreement is to be entered into with the Shoreditch B.C., similar to that now existing between the Council and Poplar, for "stand-by" or "reciprocal" supplies.

The Port of London Authority is to be supplied, under agreement, with electricity for pumping purposes for a period of 10 years, by the B.C. The minimum annual consumption for the purpose is to be 400,000 units at a load factor of 33⅓ per cent.

Consequent upon a recent accident at the Limehouse station, the department cannot take the full coal supply contracted for for some time. It is therefore proposed that the Poplar Borough Council shall take 300 to 400 tons, paying 14s. per ton, to help the Council out of the temporary difficulty under its coal contract.

POPLAR.—The Electricity Committee, in considering a comparative statement of the annual estimate and the actual results of the undertaking during the past year, states that, but for the inclusion of £625, being 15 months' contribution to superannuation and pension fund, which was not included in the estimate, the net result (a surplus of £3,603) has been fully realised (actual result £3,133), despite the exceptional prices ruling for coal since the strike in March, 1912, the excess cost in this respect amounting to £2,189. The comparison, the Committee continues, is also affected by a different allocation of salaries, inasmuch as all salaries have hitherto been allocated to management charges, but, owing to the transfer of the charge engineers to the staff, it has become necessary to divide salaries into three distinct headings—viz., generating, distribution, and management. Eliminating coal from the comparative figures, the remaining costs were fairly accurately estimated—viz., total costs (estimate), £29,545; actual, £33,964; coal (estimate), £14,103; actual, £18,851; total (estimate), £15,442; actual, £15,113.

Manchester.—The question of the erection of new electricity works has recently been considered by the Electricity Committee, and a scheme has been drawn up which will make it possible to supplement the output at the Dickinson Street and Stuart Street stations. It is proposed to acquire 11 acres of land at Trafford Park. The scheme provides for the ultimate erection of a new station with an output of 100,000 KW.—25 per cent. more than the present total capacity—but it is proposed to carry out the work by stages, and the first instalment of plant will probably have an output of 25,000 KW. Estimates indicate that if such provision is made within the next three years, it will suffice to 1919, and at

this rate of increase the works would not reach the maximum dimensions for something like 15 years. The site proposed is well out of the city. The advantages contemplated include (1) saving on coal carriage (estimated at possibly £17,000 per annum); (2) the likelihood of water being available for condensing purposes from the Ship Canal; in which case the erection of water towers will not be necessary. The final effect of all the possible economies will be that whereas the cost of the plant at the existing stations works out at £20 per KW., that at Trafford Park will be, according to the calculations, scarcely more than half that amount. The chairman of the Electricity Committee (Councillor Dagnall) stated last Friday that the matter was urgent. For some years past the maximum load had been increasing at the rate of 3,000 or 4,000 KW. a year. It was essential that the department should be able to cope with the greatest demand made upon it.

Mansfield.—The T.C. has applied to the L.G.B. for a loan of £3,000 for mains and services.

Paraguay.—Senor Jesús Basante proposes to install in Villa Rica an electric power station to generate light and power for tramway and telephone services.—*Review of the River Plate.*

Portrush.—The U.D.C. has decided to acquire a site for the proposed power station.

The Philippine Islands.—The Suburban Railway Co. has secured a concession to put down a plant to utilise the water power of the River Caliraya, in the Province of Laguna in the generation of electrical energy for lighting and power purposes in Manila. Two other concessions to utilise water power in the Philippine Islands have also lately been granted.

Salford.—The T.C. has appointed Messrs. C. S. Allott and Sons, of Manchester, to prepare the plans, &c., for the sub-station required for the additional supply required by the Manchester Ship Canal Co.

South Africa.—The Siemens-Schuckert Co. has recently completed an installation of 12 alternating synchronised motors at the Rand mines. The machines, which run at a speed of 3,000 R.P.M., are similar in design to alternating generators intended to be driven by steam turbines; they work at 1,700 volts, 50 periods per second, and develop 2,550 H.P. Each motor is provided with a special starting arrangement comprising a starting motor and coupled synchronised 525-KW. generator.

Stalybridge.—The Joint Tramways and Electricity Board has received L.G.B. sanction to the borrowing of £9,250.

At the meeting of the Joint Board on September 25th, discussion took place upon a minute that the question of coal should be left to the chairman of the generating station committee and the engineer. It was suggested that members were shirking their duty in this matter, and were throwing the responsibility on to two individuals. Alderman Ridyard said they were finding their action to be wise. Alderman Noel said they used 2,500 tons of coal per month, and during the last three or four months they had been buying coal under the arrangement which was being criticised, and he dared guarantee they had saved £600 to the Board.

Stoke-on-Trent.—The T.C. has accepted the offer of Messrs. Siemens Bros. Dynamo Works Co., Ltd., to provide boosters to enable the motor-generators to be used for the load for the forthcoming winter, and that as soon after as possible they rewind the stators, provide new pole-pieces, and complete the plant to the reasonable satisfaction of the engineer. Regarding this matter, the engineer reports that the tests of the Siemens motor-generators in the power house had shown that they did not comply with the guaranteed performance.

Sutherlandshire.—The village of Brora has given up its paraffin lamps and gone in for electric light. The power comes from Messrs. Hunter & Co.'s woollen factory. The lamps number 40, of 25 and 50-C.P. each.

Todmorden.—A new scale of charges for electricity has been adopted by the T.C. It is proposed to supply current for lighting, heating and cooking, small motors for purely household work, &c., at a fixed rate per annum of 10 per cent. of the rateable value of the house, and a net charge of 1d. per unit used. The sliding scale for power is based upon the consumption per quarter irrespective of H.P. as follows:—1 to 250 units per quarter, 2d. per unit; 250 to 500, 1¾d.; 500 to 1,000, 1½d.; 1,000 to 2,500, 1¼d.; 2,500 to 5,000, 1⅛d.; 5,000 to 10,000, 1d.; 10,000 to 20,000, ⅞d.; above 20,000, ¾d.

Talgarth.—The P.C. has accepted the offer of the Talgarth Supply Co. for current for lighting the Town Hall, free for the first year, and 3d. per unit afterwards. An offer from the Enig Electric Co. was at 3½d. per unit, including the cost of necessary alterations.

Tunbridge Wells.—The charge for current for heating, cooking and power is to be lowered by the Corporation from 1¾d. to 1d. per unit. The question of installing additional machinery has been deferred.

Walthamstow.—Sanction has been received from the L.G.B. to the borrowing of £828 for a new feeder, and £1,926 for a natural draught cooling tower. Tenders are required for the construction of a tank for the Council's new water cooling tower, with and without expanded metal. A sub-committee has been appointedito consider and report as to the price charged to the tramways department for current.

West Hartlepool.—The accounts for the year ended March 31st last, show that the capital invested in the electricity undertaking was £119,317. There was a gross revenue from electricity of £17,255, and a balance, after paying working expenses, of £6,270.

Whitwood (near Pontefract).—The U.D.C. proposes to extend the electric lighting system.

Wimbledon.—In consequence of the mileage and resistance of the Post Office cables and wires used in connection with the Gamewell fire alarm system now being installed in the borough, the Council find that it will be necessary to purchase 66 accumulators additional to the 60 provided for in the contractor's (G. L. Beasley) tender. Mains are to be extended to the junction of Bathgate and Queensmere Roads at a cost of £250. The Sub-Committee appointed by the Council to consider as to the desirability or otherwise of providing additional generating plant at the electricity works, have issued their report. They state that they have considered a report of the electrical engineer upon (*a*) the necessity for the provision of additional generating plant, and (*b*) the provision of a condensing water-cooling tower, and that they are of opinion that it is necessary, in order to secure an adequate margin of stand-by plant, and thus provide for a continuity of supply in the event of any of the existing plant breaking down, that a 1,500-KW. turbo-alternator be installed at the electric lighting station. Accordingly, they invited tenders for the alternator, with condensing plant, and all necessary foundations, pipework and auxiliaries, and for an overhead crane. Twenty-five tenders were received, and that of the British Thomson-Houston Co., Ltd., for the turbo-alternator, and that of H. Morris, Ltd., for the crane, were accepted. The total estimated cost of the scheme is put at £9,900. With regard to the proposed provision of the water-cooling tower, the engineer recommended that the major portion be postponed for the present, but that the portion relating to the construction of a cascade and improved carrier for the condenser cooling water from the works to a tank near the river Wandle be proceeded with at a cost of £250. This work is to be carried out.

Winton.—The new Church of St. Mary Magdalene, now being built, is to be electrically lighted.

Wolverhampton.—The L.G.B. has fixed October 8th for an inquiry into an application by the T.C. for a loan of £22,000 for electricity purposes.

TRAMWAY and RAILWAY NOTES.

Barnoldswick.—The Light Railway Commissioners have decided that the application for Barnoldswick and Gisburn Light Railway Order should be granted, subject to the withdrawal of the proposals for a short junction line and to the production of evidence as to the intended means of raising capital.

Brazil.—In their annual report, the directors of the South Brazilian Railways Co., Ltd., state that on account of the works for the electrification of the tramways not being completed on October 1st, 1912, for the reason given in the last report, it was found necessary to grant the contractor a further extension of six months for the completion of the works—namely, until March 31st, 1913. In the latter part of December the Banque Fontaine et Cie., which was intimately connected with the contractor, went into voluntary liquidation, and the contractor, on account of his liabilities, was unfortunately unable to carry out his engagements, and was compelled to come to an arrangement with his creditors. In consequence, the company, as on January 1st, 1913, took back the working of the tramways and electric lighting system, and regained possession of the whole of the property. The board made arrangements for an advance of sufficient funds to meet the requirements of the company, against certain of its unissued debentures. All the works, with a few minor exceptions, have been completed, and the tramways have been operated by electricity since January last as regards passenger traffic, but pending the installation of additional plant now on order, the goods traffic is being dealt with by animal traction. The question of the erection of the hydro-electric works is still under consideration.

Burnley.—The Tramways Committee is to be asked to consider the question of granting cheaper fares for scholarship children. Mr. T. C. Ekin has held a L.G.B. inquiry into an application by the Corporation to borrow £36,227 for the electricity undertaking.

Birmingham.—At the meeting of the Corporation on Wednesday (October 1st) the General Purposes Committee submitted a draft of the Council's Parliamentary Bill for the 1914 Session. A large number of the clauses in this Bill are the same as those which appeared in last Session's abortive Bill. Part II of the Bill deals with tramways and omnibuses, and in this connection it may be remembered that the Tramways Committee recommended the Council to construct a line from Hagley Road, *via* Broad Street to Paradise Street, and a connecting line across Victoria Square, and along Colmore Row to join the existing tramways, and that the

latter proposal was referred back to the Committee with instructions to prepare a scheme that would avoid crossing Victoria Square whilst connecting with the existing tramway in Colmore Row. The Committee has now come to the conclusion that there is no satisfactory alternative to the route proposed by it, and it has therefore decided to abandon the projected line down Paradise Street to the corner of Ratcliff Place, and terminate the Broad Street tramway in Easy Row by a junction with the proposed tramway from Suffolk Street along Easy Row and Great Charles Street. The construction of a new single line of tramway from Easy Row along Edmund Street to connect with the existing tramway in Edmund Street, thus making a complete circuit, is also proposed.

Bradford.—The experiment which has been tried by the Bradford Corporation tramway department, of requesting passengers to obtain their tickets as they board the car instead of calling upon the conductor to make a journey upstairs to distribute the tickets, has proved of considerable inconvenience to the public. It is thought that the suggestion is carried too far when, at a city terminus, a large number of people are pushing and hustling to get on to the car through the conductor compelling all top-deck passengers to obtain tickets before they ascend. A suggestion is made that tickets should be issued at the barriers or at little kiosks in the streets at the termini, and so allow the conductors to devote the whole of their time to looking after passengers *en route*. This is done on the Continent, and it is thought would get over the difficulties which are at present being experienced in the distribution of tickets alike by the passengers and the conductors.

Cardiff.—The Council has referred to Committees a demand by its employés for 2s. 6d. a week advance for all other than skilled mechanics, a minimum of 6½d. per hour for motormen and conductors, and advances of 2s. 6d. to other employés in the tramway and electricity department.

China.—Pekin.—It is proposed to construct electric tramways in Pekin, the undertaking to be financed and managed solely by Chinese. At the beginning of September Chinese engineers were engaged in settling the details of the proposed routes.

Connah's Quay.—The Council recently received a letter from the manager of the Wrexham District Electric Tramways Co. stating that his company were preparing to enter upon a scheme for a motor-'bus service for passengers between Chester and Flint, 12 miles distant on the north-west coast. The new service is to include Saltney, Sandycroft, Queensferry, Shotton, Connah's Quay, and thence to Flint. There was no opposition to the proposal.

Continental Notes.—Austria.—Another hydro-electric installation is projected by the Austrian State Railways, this time to provide electric current to work the Vintschgau Railway. The site of the proposed station is the falls district on the Etsch River between Laas and Göflau, where a dam and a reservoir are to be constructed and a 6½-kilometre canal to conduct the impounded water to the projected power house near Schlanders. According to estimates an average power of 8,000 H.P. would be yielded, rising to a maximum of 11,000 H.P.

In connection with the electrification of the railways in the Innsbruck district, the Austrian State Railway authorities are reported to be contemplating the erection of three large electricity-generating stations in the Putter Valley.

Germany.—A scheme is at present under consideration for the construction of an electric railway along the banks of the Rhine between Wiesbaden and Schierstein.

A syndicate is in course of formation with the object of carrying through a scheme for the construction of an electric railway between Pirmasens, Dahn and the Vorderpfalz.

Spain.—The Electric Tramway Co., of Vigo, has been authorised to construct new tramway lines and to extend the service in that town.

Italy.—Negotiations are in hand with regard to the electrification of the tramway between Rome and Civita Castellana.

The *Bulletin Commercial*, of Brussels, states that the provincial council of Alessandria is about to grant concessions for 663 kilometres of new electric lines in that province in three groups.

East Ham.—The London General Omnibus Co. have requested the Council to remove its tramway standards in a portion of Forest Drive in view of the possible danger to the public travelling on their 'buses. At the last meeting of the Town Council the tramways engineer pointed out that considerable expense would have to be incurred in the near future in the Manor Way, where subsidences in the track and roadway have occurred since the inauguration of the service of 'buses. There is a deficiency of £1,217 on the tramways undertaking during the year ended March 31st last, being an increase of £729 as compared with the previous 12 months. The total income amounted to £57,969, including £919 from advertising and other sources, against an expenditure of £45,808, of which £18,078 was for traffic expenses, £11,657 for maintenance and renewals, and £9,522 for power. This shows a gross profit, including bankers' interest, of £12,256, from which has to be deducted £13,473 in respect of the deficiency from the previous year (£488), interest on loans (£5,806), redemption of debt (£6,725), and £454 for the extinguished debt in respect of loans for joint machinery in connection with the electricity undertaking, leaving the deficiency above mentioned.

Flintshire.—The scheme for the proposed new light railway for Flintshire was discussed at a meeting of the County Council last week. There was a recommendation from the Parliamentary Committee that the scheme be approved, and that the County Council contribute the sum of £20,000, in shares or by loan, on terms to be agreed upon, such contribution to be dependent upon the raising of the whole of the necessary capital. It was resolved that a special meeting of the Council in Committee be called to go fully into the whole of the details of the scheme.

Glasgow.—A Special Committee of the Glasgow T.C. is to consider and report as to the feasibility of establishing a system of tube electric railways from east to west (say, Shettleston to Clydebank), and from north to south (say, Bishopbriggs to Rouken Glen).

Halifax.—The Tramways and Electricity Committee has decided that on and after the end of the September quarter, the charges for the supply of electricity for lighting purposes within the borough be as follows:—

Accounts up to 1,200 units per quarter, 4d. per unit; current in excess of 1,200 units per quarter, 2d., "excepting that, in the case of shop premises, where electricity is the chief illuminant for lighting the interior of such premises, then all electricity used for exterior lighting or in connection with illuminated advertising signs at such premises may be obtained at the rate of 2d. per unit; and that a discount of 5 per cent. be allowed on all accounts if paid within the prescribed time."

Lanarkshire.—On September 25th the new part of the Lanarkshire Tramways Co.'s system between New Stevenston Cross and Bellshill Cross was opened for traffic.

Preston.—The Tramways Committee has issued a report containing a scheme which, if approved, will be included in a general application for extended powers next session. The plans comprise a line from Garstang Road, along Addison Road to the Cattle Market, then across the two lines of railways and the canal to join the present terminus in Long Lane, Ashton. Another line would branch from Withy Trees along Lytham Road, down Brook Street, and on to Corporation Street and Fishergate. Another line would proceed along London Road to the bridge over the Ribble at Walton-le-Dale.

South Lancashire.—A scheme is under consideration for utilising the tramways for conveying goods from the Liverpool Docks to the various towns served by the South Lancashire Tramways Co. It is proposed to create depôts at different points along the routes, and from these to distribute goods by motor lorry to places to which tramcars do not run. It is intended to construct special cars for this traffic.

Stirling.—The offer of Messrs. Balfour, Beattie, Paul and Co. to provide Stirling with electric tramways is under consideration. Mr. Robertson, Greenock, and Mr. Fisher, Dundee, are to report to the Council on the subject.

Walsall.—A scheme is being matured by the Tramways Committee for the purpose of extending the tramway system to many of the outlying districts. Application is to be made for extension powers, and when these are obtained it is proposed to continue the system to Cannock, Pelsall, Brownhills, and Great Barr. The extensions to Cannock will tap *en route* the villages of Landywood and Wyrley. It is proposed to run to Pelsall and on to Brownhills, and then join up with the system at Walsall Wood. Motor-'buses on the railless trolley system will, it is believed, be immediately brought into requisition when the necessary powers have been obtained, until the whole district can be thoroughly linked up with Walsall.

York.—The Joint Committee of the Tramways and Streets and Buildings Committees of the York Corporation has decided to recommend the Council to extend the tram-lines down the new street from Pavement to Piccadilly and Hull Road, *viâ* Walmgate; to establish railless cars on the following routes:—Nessgate to Laverthorpe and Heworth; Nessgate to Huntington Road, *viâ* Goodramgate and Monkgate; and from the station down Bootham to Clifton; and also to extend the service over the bridge to be constructed over the Ouse at Clifton Scope to Leeman Road.

TELEGRAPH and TELEPHONE NOTES.

Africa.—Several large mines operated in Central Africa have recently abandoned their telegraph lines from the railroads to the mines and established connections by wireless. The reason given for this action is that it was difficult to maintain the wire lines on account of the demand for the wire by native women for ornamental purposes.—*Telegraph and Telephone Age.*

Telephony in Mining.—Last Friday 150 members of the Institution of Mining Engineers witnessed successful experiments with the wire-less telephones which have been installed in the Pilkington Colliery Co.'s new collieries at Astley Green, in South Lancashire.

Canada.—Arrangements have been concluded for the reduction of the cable rates between Canada and the British West Indies by half. To enable this to be done, the British Government is to make an annual contribution of £8,000, and Canada is to contribute a similar amount.—*Times.*

Italy.—Acting on the suggestion of Mr. Marconi, Signor G. Afani, head of the Florence Observatory, has set up a wireless receiving installation in the Cathedral at Florence, hanging its antennæ within the building so that all parts of the equipment are contained within an enclosed space. Experiments made at night showed that messages from Paris, Toulon and Madrid were faithfully recorded, the efficiency of the receivers being only slightly less than if they were in the open air.

Australia.—A recent award of Mr. Justice Higgins in the case of the Postal Electricians' Union has the effect, according to the Federal Public Service Commissioner, Mr. D. C. McLachlan, of "eating up 99 per cent. of the revenue" of the telephone department, which is chiefly concerned in the award. The award entails an increased cost of at least £30,000 per annum in respect of salaries alone. The hours of work are reduced from 46½ to 44 per week, and the aggregate loss of working time represents an annual value of £10,000.

Submarine Cables and Trawlers.—A report to the Board of Agriculture and Fisheries, recently issued, details the proceedings of the Board with regard to the complaints of damage to submarine cables by trawlers, and the steps taken to diminish the trouble by warning the owners, improving the otter-boards, &c. Up to the end of 1912, 1,211 British steam trawlers had been inspected. It is stated that a very marked decrease took place in the number of cases of interruption to cables reported after 1909, when the Board first took action in the matter; off the Land's End, and the south and west of Ireland, where most of the cases occurred, the following interruptions due to trawlers were recorded: 1908, 16; 1909, 18; 1910, 3; 1911, 8; 1912, 6.

A conference with the States of Western Europe was held on June 13th last, with a view to international co-operation in the matter.

France.—The modified telephone rates between England and France will not come into operation for some weeks. Three-minute calls between Paris and London, Rouen and Birmingham, will cost 4s.; between Lyons and London, 6s.; between London and Bordeaux, and Liverpool and Nantes, 8s. It is anticipated that there will be a considerable reduction for night calls.

Russia.—The wireless stations at Marasale, on the Kara Sea, the Island of Vaigatch, and the Yugor Strait, are all now in communication with that at Archangel.

Postal Servants.—The Association of National Telephone Engineers on Friday last passed a resolution severely condemning the recommendations of the Holt Committee, on the grounds that many of the officers transferred from the service of the National Telephone Co. had suffered in position and prospects, and that the rates of pay proposed were inadequate.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—March 18th, 1914. Tenders are invited by the Postmaster-General for the supply, delivery, and erection of automatic telephone switchboards, with associated equipment, at the Epping, Ryde, Hunter's Hill, Drummoyne, Wahroonga, Paddington and Waverley exchanges, New South Wales.—*Australian Mining Standard.*

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of the specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

October 15th.—20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" September 19th.

Victorian Railways.—November 12th. 17 miles lead-covered impregnated paper-insulated copper cable for track-locking roads. November 19th.—10 tons sulphate of copper for electrical purposes. Specifications may be seen at Board of Trade C.I. Dept. in London.

October 7th.—Six 60-K.V.A. and one 30-K.V.A. single-phase transformers, for the Melbourne City Council. See "Official Notices" September 19th.

Octooer 7th.—33,300 carbon-filament lamps, for the Melbourne City Council. See "Official Notices" September 19th.

October 8th.—Melbourne City Council. Lead-covered cable. See "Official Notices" September 26th.

December 14th.—Two sections switchboard, common battery multiple. See "Official Notices" to-day.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 26th.

Brisbane.—November 19th. For the P.M.G. Wire, bronze, 100 lb. per mile. See "Official Notices" September 26th.

Austria.—October 17th. The authorities of the North Austrian State Railways in Vienna, are inviting tenders for an installation of electric lighting at the goods railway station at Cracow.

Belgium.—October 15th. The municipal authorities of Liége (Annexe de l'Hotel de Ville) are inviting tenders for a 151-KW. steam engine and dynamo and one set of 26·4-KW. capacity. Particulars can be obtained from the Service de l'Electricité, 42, Rue Lambert-le-Begue, Liége.

Canada.—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

Cardiff.—October 17th. Corporation. Passenger tickets and ticket punches for trams. See "Official Notices" to-day.

China.—Shanghai.—October 17th. Extra-H.T. pilot cable, &c., for the Council. See "Official Notices" to-day.

Eastbourne.—October 3rd. Wiring, &c., the workhouse infirmary for lighting. Specification, &c., from Mr. A. Hurst, Clerk, Guardians' Offices, Avenue House.

Edinburgh.—The Parish Council invite contractors to tender for an installation of telephones throughout Craiglockhart Poorhouse. Mr. R. M. Cameron, architect, 53, Great King Street, Edinburgh.

France.—October 6th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for 30 Hughes telegraph instruments without base or regulator.

Halifax.—October 14th. Concrete dam, pump house, &c., at the electricity works. Mr. James Lord, borough engineer, Town Hall. Deposit, £5.

Ilkley.—October 6th. (Sec. 1) Prime-movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" September 12th.

Leicester.—October 7th. Car repairing shops for the Corporation tramway department. Mr. E. G. Mawbey, borough engineer (returnable deposit of £2).

Liverpool.—October 9th. Mersey Railway Co. Electrical and general stores. Specifications, &c., from Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

London.—Bermondsey.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

L.C.C.—October 14th. 200 driving wheel centres for electric cars. Particulars from Chief Officer, 62, Finsbury Pavement, E.C.

Manchester.—October 21st. The Tramways Committee invites tenders for the supply of the following:—(*a*) Permanent way special track work; (*b*) permanent way points, tongues and hardened steel centres; (*c*) granite setts. Mr. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

Middleton.—October 6th. Steam coal, for a year, for the Corporation electricity works. Mr. S. Pauls, electrical engineer.

New Zealand.—December 18th. Hastings Borough Council. Two sets of high-lift turbo pumps and electric motors. Mr. H. W. Climie engineer. Specification may be seen at Board of Trade Com. Int. Department in London.

Rochdale.—October 13th. Mechanical filtration work, including turbine or water motor, &c.; also electric lighting plant. Specifications, &c., from Mr. F. H. Brunt, engineer and manager, Waterworks Office, Lord Street. Deposit £3 3s.

South Africa.—Johannesburg.—November 24th. Electric light fittings for the Town Hall and Municipal Buildings. See "Official Notices" September 26th.

South Shields.—October 15th. Corporation. One 2,000-KW. turbine, direct coupled to two three-phase generators in tandem, together with condensing plant, rotary converters, transformers and switchgear, &c. See "Official Notices" September 26th.

October 25th.—Corporation. Five or ten top-covered tramcars complete. See "Official Notices" September 26th.

Spain.—October 13th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the construction and working of a telephone exchange in the town of Algeciras, near Gibraltar. The concession will cover a radius of 9½ miles, and will be for an initial period of 15 years.

The municipal authorities of Casa de Uceda (province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

(*Continued on page* 544.)

The Electric Truck: English Experiments and American Practice.

Although the electric battery vehicle is no stranger to this country, it is an actual, though regrettable, fact, that its practical development along commercial lines is mainly due to American enterprise and ability.

Looking back through the files of the Electrical Review to 1885, when battery-driven tramway cars were being experimentally run on both the North and South Metropolitan tramways,* one begins to realise how numerous have been the efforts of engineers in this country, in America, and on the Continent, to produce satisfactory battery-driven vehicles of one kind or another.

In this country the names of Elieson and Reckenzaun stand out prominently in this early work; indeed, the latter introduced a specially light motor, and an electrical method of speed regulation which was subsequently copied by Sprague and others; also, in 1883, he found a suitable worm-gearing after a lengthy investigation of the subject of driving gears.

Later, in 1887, there came Volk's electric dog-cart,* built at Brighton, and equipped with a ½-h.p. Immisch motor, "Reinold's" chain drive and E.P.S. battery, with which valuable tractive data were obtained; and in the following year† we illustrated an Immisch electric dog-cart built by the same people for the Sultan of Turkey. Mention may also be made of a three-wheeled battery car produced by the Rover Co., of Coventry, in the same year, and of the Radcliffe Ward electric omnibus‡ tried on the roads in 1889.

In 1896, after the passing of the Light Locomotive Act, which first made practically possible the use of motor-cars on public roads, the London Electrical Cab Co. was formed to run some 200 battery-driven cabs§ in the Metropolis, and our issues for the latter half of the year 1897 show that the electrical carriage was, if anything, even more conspicuous in the London streets then than now—indeed,



Fig. 1.—A Group of "General Vehicle" Trucks supplied to the American Express Co.

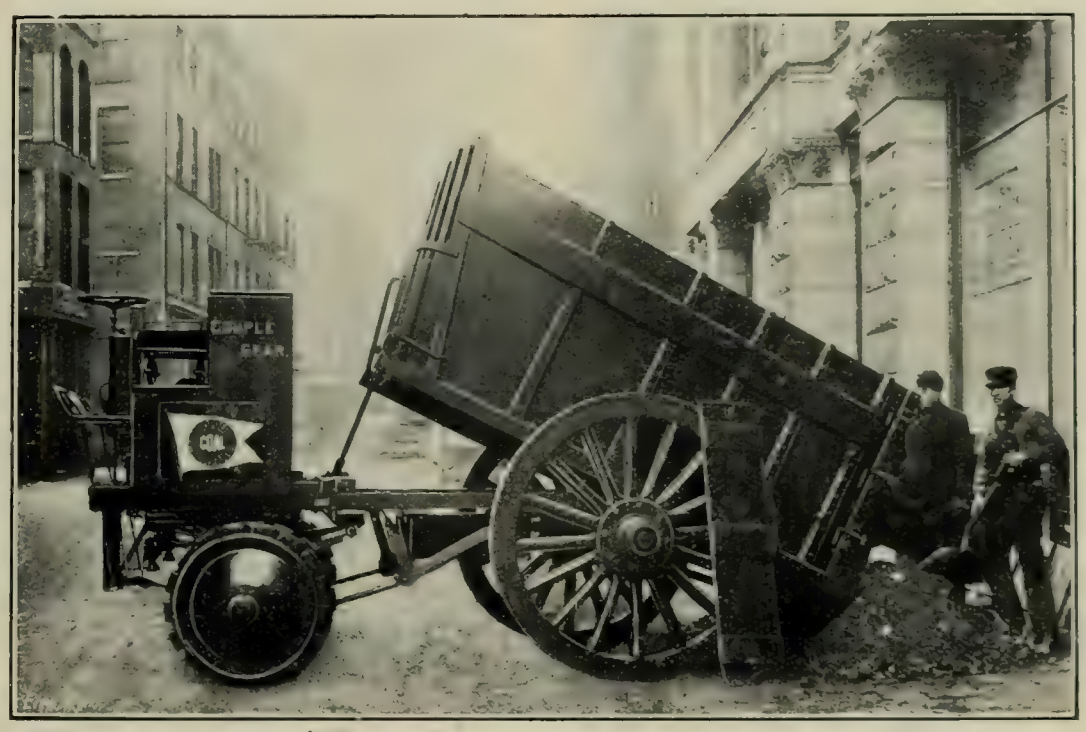


Fig. 2.—A Couple-Gear Truck used by the Metropolitan Coal Co., Boston.



Fig. 3.—Group of "General Vehicle" Trucks forming Part of the Large Fleet of the Boston Edison Co.

* Elec. Rev., April 4th, 1885; November 7th, 1885.

* Elec. Rev., Dec. 30th, 1887. † Elec. Rev., Sept. 21st, 1888.
‡ Elec. Rev., Aug. 25th, 1889. § Elec. Rev., Aug. 27th, 1897.

amongst others, we illustrated* a Headland electric carriage which took part in the Lord Mayor's Show of that year. In the following year we referred to an American "electric," the Ricker phaeton, exhibited at the Agricultural Hall, which was probably one of the earliest trans-Atlantic representatives to be shown in this country.

It was not, however, until 1903, when the Crystal Palace Motor Show† was first held, that American vehicle-makers, or their English agents, really attempted to impress the British



Fig 4.—Electric Brougham.

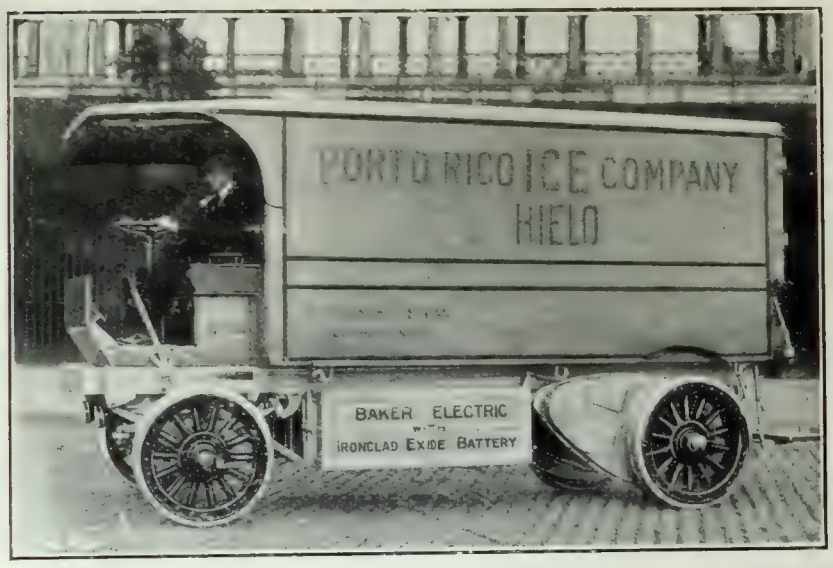


Fig. 5.—3½-ton Insulated Ice Truck, Porto Rico Ice Co.

pleasure car; the commercial vehicle and heavy truck, which has found such a wide sphere of usefulness in the States, has been unaccountably neglected, even in circumstances which would have favoured its use. In mentioning this, we, of course, have not forgotten the ill-fated Electrobus venture of recent times, which came to grief largely through financial difficulties; these vehicles were certainly of the heavy type, but they were not comparable to the electric wagon of up to 5 tons carrying capacity, which is proving so successful in the States, and will, doubtless, do equally satisfactory service in this country in the near future.

In comparison with what has been done in this country, it is interesting to notice that even so far back as 1898 and 1899 there were a few commercial electrics in use in the States, and several 1899 1,000-lb. wagons are still in use. Many 10-year-old electric trucks are in use in the States, and these constitute one of the most convincing arguments which could be found as to the reliability of such vehicles for goods transport. Unfortunately, in this country, owing to the apathy of those who either could not, or would not, take any practical step towards the introduction of the electric truck—the first important step in this direction was the adoption of the Ayton resolution at the Municipal Electrical Convention in June last—we cannot point to any commercial electric truck running under English conditions with even as many months' use to its credit as the Americans have years.

It is, in fact, necessary to turn to the United States if we are to obtain any real idea as to the possible scope for the "electric" in commercial service—the branch of the business in which there is a future full of promise, particularly



Fig. 7.—2-ton Truck used by Mitsui Co., of Tokio.



Fig. 6.—Some Trucks used by the Cleveland Electric Illuminating Co.

Figs. 4—7.—Typical "Baker" Electric Vehicles.

public with the possibilities of the electric car, and reference to our pages shows that both this and the succeeding Palace shows contained representative examples of both American and English electric vehicles.

With later developments our readers are probably familiar, but it is noteworthy that even up to quite recent times attention in this country seems to have been riveted on the to the central-station engineer. Some idea of the range of business covered by the commercial electric truck in the States can be gathered from the accompanying illustrations. It should be noted that, economically speaking, the electric truck is specially adapted to short-haul frequent-stop work; it is not intended for high-speed work, but is stated to be the most economical method of road transportation where heavy loads and moderate speeds are concerned. It has, moreover, inherent advantages which may lead to its adoption

* Elec. Rev., November 12th, 1897.
† Elec. Rev., February 6th, 1903.

for purposes in connection with which it may appear at first sight to be the more costly method.

It is necessary to emphasise the fact, which experience in the States has proved, that comparison with the petrol truck proves little or nothing, as each type of vehicle has its own special and peculiar field, and though both may accomplish the same work, the electric vehicle is by far the more economical in some classes of work, just as the same may be said of the petrol truck, in other classes of work. Under American conditions, experience shows that in about 80 per cent. of the cases where trucks are used for city work, the electric truck is the more economical.



Fig. 8.—Two Examples of numerous G.V. Trucks used by U.S. War Department.



Fig. 10.—5-ton Brewery Truck on Grade; 112 G.V. Trucks used by Firm.

Fig. 12.—Detroit Electric 'Bus for 10 Passengers.

Figs. 8—11.—Typical "General Vehicle" Electric Trucks.

Figs. 12 and 13.—Two Examples of the "Detroit Electric" Vehicles (Anderson Electric Car Co.).

Commercial vehicles are usually equipped with batteries to give 50 to 65 miles running on a single charge, and on a 10-hour day when allowance is made for time expended in loading and unloading, and for traffic delays in the streets, this mileage is usually ample; it can, however, obviously be exceeded if reserve batteries are provided or by boosting the battery at some convenient time.

To quote an example of the handling of such trucks, the following, culled from the *Electrical World*, is worth noting:—

Five 5-ton electric trucks manufactured by the General Vehicle Co., of Chicago, have been purchased by the Manhattan Brewing Co., of Chicago, at different times during the past few months. It is reported that these trucks have been performing work away beyond what they are expected to do. On August 4th one of the 5-ton trucks was driven to South Chicago with a load of 33 barrels and two half-barrels, having a total weight of about 6·5 tons. After delivering its load the truck returned to the brewery for a second load, taking out 29 full barrels and eight half-barrels. After conveying this load to its destination, the batteries received a 30-minute boost, and directly after luncheon a third load of 33 full barrels was delivered. The total deliveries for the day with this truck amounted to 100 full barrels, a total weight of approximately 40,000 lb., or 20 tons. The total mileage for the three trips was 64·3 miles, and the reading of the ampere-hour meter at the end of the day's work showed 70 ampere-hours left in the battery, which represents approximately 7 miles of travel. This performance is considered quite remarkable for a 5 ton electric truck, as it shows that it is able to do the work that was formerly considered strictly in the field of gasoline vehicles. All of these trucks are equipped with Edison storage batteries.



Fig. 9.—2-ton Electric Hose Wagon, General Electric Co.'s Fire Department.



Fig. 11.—3½-ton Truck in Gas and Electricity Service.

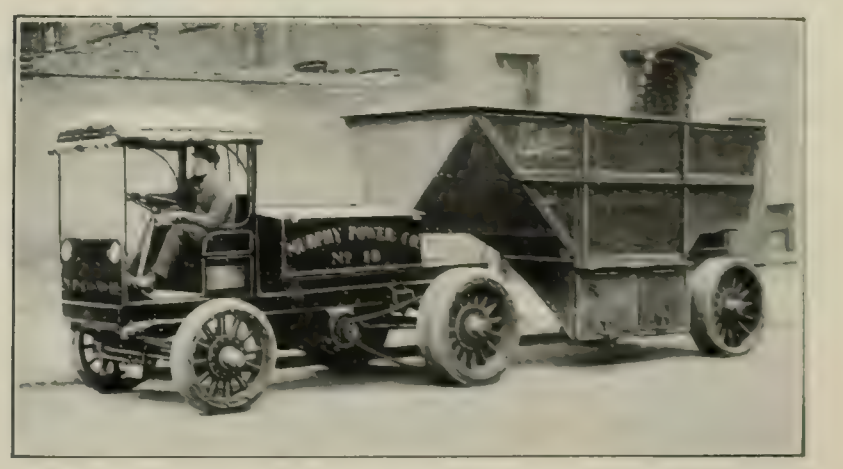


Fig. 13.—12-ton Electric Tractor and Coal Trailer used by Power Co.

Experience has shown that the electric vehicle is capable of keeping on the road 90 per cent. of the time, allowing a balance of 10 per cent. for repairing and overhauling. Such excellent results are attributable to its simple construction, and to the simplicity of its operation.

According to data supplied by the Atlantic Vehicle Co., it is customary with lead-acid batteries to use for a 1-ton vehicle, 44 cells of 11, 13 or 15 plates, weight not to exceed 1,760 lb., or 60 cells of Edison A-6 battery, which weigh approximately 1,260 lb. In a 2-ton truck, 44 cells of 15, 17 or 19 plates, weight not to exceed 2,300 lb., or 50 cells of Edison A-8 battery, which weigh approximately 1,800 lb. In a 3½-ton truck, 44 cells of 17, 21 or 25 plates, weight not to exceed 2,790 lb., or 60 cells of A-10 Edison battery, weighing approximately 2,250 lb. In a 5-ton truck, 44 cells of 19, 21, 25 or 29 plates, weight not to exceed 3,270 lb., or 60 cells of Edison A-12 battery, weighing approximately 2,700 lb. It is practicable when occasion demands it, to utilise the battery equipment of a 5-ton vehicle in a 3½-ton vehicle, but this is an exceptional case.

According to the size of battery, from 13 to 23 KW.-hours will represent a full charge in the case of a 1-ton truck ; 19 to 33 KW.-hours for a 2-ton truck ; 25 to 39 KW.-hours for a 3½-ton truck ; and 29 to 49 KW.-hours in the case of a 5-ton vehicle, the figures being for lead batteries, while the nickel-iron battery requires possibly 20 per cent. more charging energy.

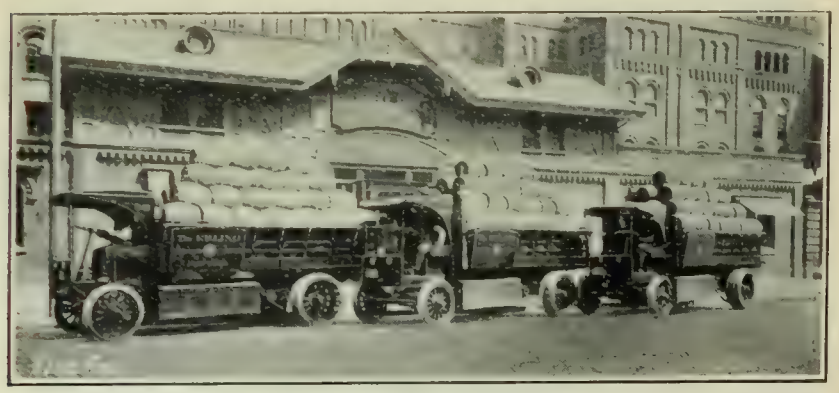


FIG. 14.—5-TON ELECTRIC TRUCKS OF THE EBLING BREWING CO.



FIG. 15.—AN ATLANTIC 5-TONNER END ON.

TEST NO. 2.

Total number of stops	24
Distance between stops	·42 of a mile.
Duration of stop	1 minute.
Course triangular ; road conditions good.	

	Average speed M.P.H. Elec.	Petrol.
Leg 1 Level	11·4	10·08
Leg 2 Up	6·9	7·83
Leg 3 Down	11·8	10·56
Test No. 1 average	9·65	8·48
Test No. 2 average	10·03	9·48
General average speed	9·84	8·98

It must be noted that the electric vehicle shows a general average speed nearly 10 per cent. greater than in the case of the petrol vehicle, although the latter was geared to a 50 per cent. higher speed.

Mr. Thompson states further that the electrical machine shows to better advantage in operating costs. According to him, extended investigations disclosed the fact that for the electric vehicle the average cost per car-mile for maintenance increased only 13⅓ per cent. over a period of four years, while that for the petrol vehicle increased 362½ per cent. in the same time ; moreover, at the end of the four-year period the maintenance cost for the electric was less than 50 per cent. of that of the petrol vehicle.



FIG. 16.—3½-TON TRUCK IN USE BY CHEMICAL CO.

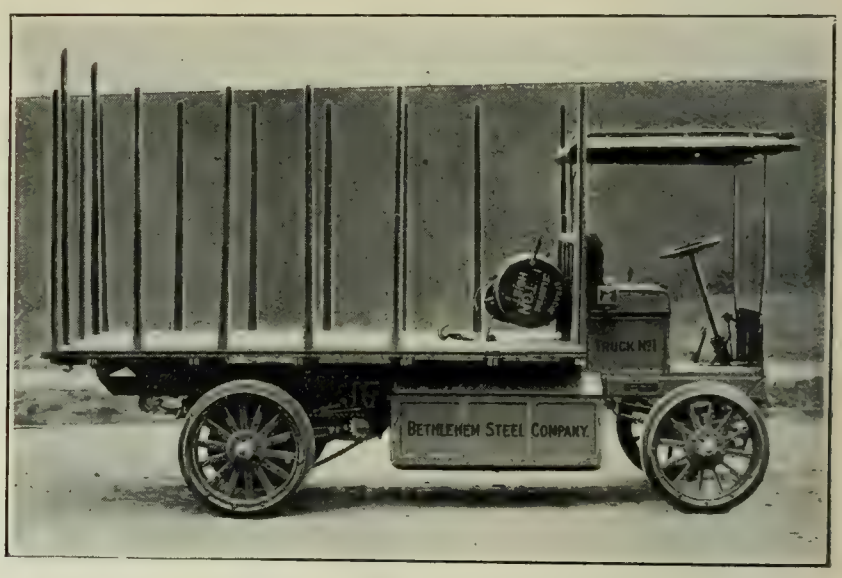


FIG. 17.—2-TON ELECTRIC TRUCK WITH HOIST; BETHLEHEM STEEL CO.

FIGS. 14—17.—TYPICAL TRUCKS OF THE ATLANTIC VEHICLE CO.

The number of lead or iron cells employed is suited to the usual American line voltage (115 volts). The speeds of such vehicles as those mentioned above vary from 12-14 miles an hour for the 1-ton, to 7-9 miles an hour for the 5-ton truck.

These speeds, although moderate, often represent faster travelling in city streets where stops are numerous, than in the case of the petrol truck. Mr. Stephen G. Thompson, writing in the *Central Station*, gives the following comparative data obtained on test under identical conditions. The electric vehicle was geared to a maximum speed of 12 miles per hour ; the petrol to 18 M.P.H. :—

TEST NO. 1.

Total number of stops	24
Distance between stops	·42 of a mile.
Duration of stop	2 minutes.
Course triangular ; road conditions good.	

	Average speed M.P.H. Elec.	Petrol.
Leg 1 Level	10·76	9·41
Leg 2 Up	7·08	8·85
Leg 3 Down	11·12	7·20

The exact figures derived from the records of the operators, and including all items chargable to replacement of mechanical parts, storage batteries and tires, are as follows :—

	No. of machines reported.	Average maintenance cost after 7 months' operation.	Average maintenance cost after 48 months' operation.
Petrol	54	4 c.	18 c.
Electric	69	7·5	8·5

This result is easily understood in view of the simplicity of the electrical machine in comparison with its petrol-driven competitor ; and that this is appreciated in America is shown by the number of large electric vehicle installations, and the fact that fewer than 10 active electric vehicle manufacturers are supplying over 20 per cent. of the total number of commercial power wagons employed, and this in competition with over 300 makers of petrol trucks.

Readers who desire to delve more deeply into the subject of the electric vehicle generally, cannot do better than read the bulky paper contributed by Messrs. Watson and Mitchell to the proceedings of the last Municipal Electrical Convention*, which contains very complete data and estimates relating to modern electric vehicle practice.

Our first illustration of a batch of the American Express Co.'s electric delivery trucks is sufficiently impressive, but it shows a few only out of the hundreds of similar vehicles employed by this company, and other concerns in the same business, as, for instance, the Adams Express Co., are equally prominent users. The latter company depends upon the "electric" almost entirely in eleven cities in the States, and is reported to be the largest individual user of electric vehicles in the country.

Our second view shows an entirely different adaptation of the battery vehicle, namely, for coal haulage—the arrangement, known as the couple-gear, has already been referred to in our pages—and, generally, the various views illustrate the great variety of service to which electric battery propulsion has been applied in the States.

In passing, it will be noted that fig. 6 shows some of the Cleveland Electric Illuminating Co.'s Baker trucks. The two larger trucks are used on general line-construction work and are each equipped with duplicate batteries, as they are often in use both day and night. They operate over a radius of 30 to 35 miles, and during 11 months of 1912 were in use every working day and 18 Sundays.

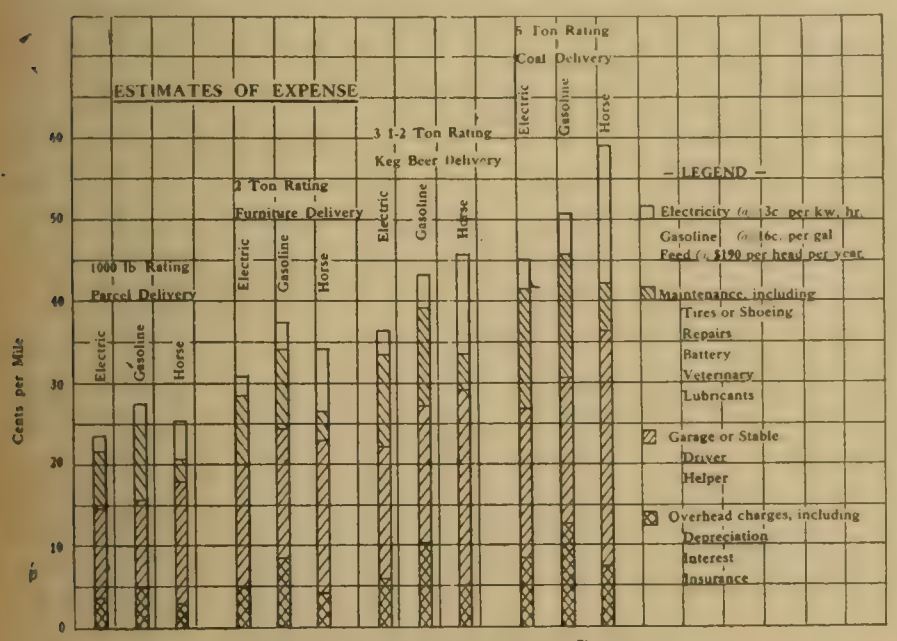


FIG. 18.—COMPARATIVE COSTS.

Fig. 7 shows a Baker truck in Japan, used for hauling charcoal. This firm's vehicles have also been supplied to the Sao Paulo Co., Brazil; the Siam Electric Co., of Bangkok; and the Richardson & Orr Co., of Melbourne, showing that the electric is finding a place in many far-away countries, where the conditions are certainly not better than in Great Britain.

Fortunately for the vehicle manufacturers in the States, the central-station authorities there were ready to co-operate in the movement, and did so, in some cases, before there was any proof of its practical utility.

To-day there is nothing left to be proved; the station engineers have obtained a vehicle load, and it is the most profitable one, in many cases, that they possess. It comes on at night, reaching its maximum about midnight; and it requires scarcely any extra station equipment. As an example, the Denver Gas and Electric Co., which serves the City of Denver (comparable to, say, Leeds or Bristol) during the last year obtained a gross revenue from vehicle charging of $70,000; we have on previous occasions quoted other equally striking figures for American cities.

A question which, perhaps, in this country presents some difficulty is the absence of reliable cost data for operation. Messrs. Watson and Mitchell endeavoured to meet this difficulty in their recent paper, giving estimates based on English conditions, and, as a number of electrics are now on order in the London area, it will soon be possible to quote actual data.

In America the question of operating costs was tackled by the Massachusetts Institute of Technology, which is one of the first engineering colleges in the States. The Institute's figures, which relate to comparative costs of horse, petrol and electric trucking, show that while the horse is cheaper for the lighter loads than the petrol truck, the latter is cheaper for heavier loads, but the electric truck is cheaper than either. The *Scientific American* in January of this year published a diagram showing graphically the results obtained from this investigation, and we reproduce it in fig. 18.

It is pointed out, however, that the figures refer to "horse distances"; the petrol truck has a field of its own where long distances, such as 100 miles a day, are concerned.

During the first seven months of the present year no fewer than 271 new electric industrial vehicles were put into service in Greater New York, bringing the total up to the respectable figure of 2,151, a number which represents 10 per cent. of the commercial motor vehicles of all kinds in use in that important centre. The load which this must bring to the electricity supply companies can be no mean one. That the electric delivery vehicle is by no means restricted in its use is evidenced by the statement that in the district referred to it is being employed in 76 different lines of business. Brewers lead the way with a total of 322; then come the department stores, with 262; parcels delivery companies, with 197; bakers, with 154; and the electricity supply authorities themselves are utilising 127 vehicles in different departments, thus practising what they preach, and demonstrating that the electrically-propelled vehicle forms a thoroughly practical, efficient and economical machine for certain classes of delivery work.

In conclusion, we may add that if the electric vehicle has not progressed in this country as it should have done, it is certainly not due to any lack of attention on the part of the electrical Press. We ourselves have frequently referred to it,* and urged its claims on the central-station engineer, its suitability for English city work, and more particularly the splendid field open to it in the huge mileage of streets in the London area.

Nothing succeeds like success!—and it must be admitted that our American friends deserve all the success which has attended their efforts. To some of them, viz., the General Vehicle Co., of Long Island City, N.Y.; the Atlantic Vehicle Co., of Newark, N.J.; the Anderson Electric Car Co., of Detroit, Michigan, and the Baker Vehicle Co., of Cleveland, Ohio, we are indebted for the representative illustrations which accompany this article.

In a later issue we shall deal with the progress that can now be recorded in this country.

The 25 Club.—We learn from Mr. J. G. Lorrain, the hon. secretary, that the next dinner of the above club will be held at the Connaught Rooms, Great Queen Street, Kingsway, W.C., at 7.15 for 7.30 o'clock on Wednesday, October 22nd.

Gas Publicity.—Powder and Shot.—At Preston on Saturday morning five persons were found unconscious through gas poisoning, viz., Mary Bushall (52), of 314, New Hall Lane, her three sons and her mother. The mother and sons failed to appear at work at the mill, and the mill authorities sent messengers to their house. The house was found full of gas, and the five occupants were unconscious, suffering from gas poisoning. Two of them were removed to the infirmary in a critical condition, and the others were attended at a neighbour's house. Gas superintendent Boast was summoned, and found a defective plate in the gas meter which had given way. At an inquest on Mary Heyhurst (79), of 367, Glossop Road, Sheffield, who was found dead in her bedroom, which was full of gas, the deceased's daughter said she thought her mother had got up as usual to turn off the gas in the early morning, and after turning off the tap the sleeve of her nightdress had caught the tap and turned it on a little. The tap was easily turned, and when the discovery was made it was found to be turned on. The verdict was "Accidentally suffocated by coal gas," and that deceased had "probably inadvertently turned on the gas tap after turning it off."

Miners' Lamps.—A correspondent says: "The management at one of the pits of the Kinneil Collieries, West Lothian, has been lately conducting tests with a variety of electric safety lamps, and these have given so much satisfaction that the miners are very desirous of getting the colliery company to introduce them, and this has led to a strike.

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* ELEC. REV., July 4th, 1913.

* A few of the principal articles appeared as follows:—ELEC. REV., August 27th, 1909; October 22nd, 1909; October 28th, 1910; November 10th, 1911; January 26th, 1912: July 11th and 18th, August 8th, 15th and 28th, 1913.

CONTRACTS OPEN.

(*Continued from page 538.*)

Sweden.—October 8th. Accumulator battery for Stockholm. Tenders to Förestandaren for Kungl, Vattenfallsstyrelsens Elektrotekniska Byra, Stockholm. Specification may be seen at Board of Trade Com. Int. Department in London.

Swindon.—G.W. Railway.—October 13th. One year's supply of stores, including a number of electrical and telegraph supplies. See "Official Notices" to-day.

Walthamstow.—October 8th. L.T. feeder cable for the Electricity Department. See "Official Notices" September 19th.

Warrington.—October 14th. Corporation. (1) Low-tension cable; (2) low-tension feeder panel. See "Official Notices" September 26th.

CLOSED.

Argentina.—On July 22nd the Government called for tenders for a 300-H.P. motor and 215-KW. generator, a 10-ton traverser, switchboard, cables, &c., for the electric power house at Campo de Mayo. A tender has been accepted for the sum of $89,218.

Austria.—The Austrian Bergmann Electrical Co., of Vienna, has secured a contract for the establishment of a central electric lighting station in the town of Hermagor, Corinthia.

Barking.—The U.D.C. has accepted the quotation of Messrs. Marryat & Place to carry out repairs to the No. 1 generator (the armature of which was burnt out some time ago), at a cost of £38, plus cost of extra copper and carriage.

Battle.—The B. of G. has received the following tenders for the installation of the electric light at the workhouse, and has referred the four lowest to a committee, with power to accept :—

Safety Light Co., Ltd.	£511
Messrs. Russell	445
Page & Miles	433
Squirrell & Co.	374
Bruce & Co.	365
Newbald & Co.	320
Mr. J. L. French	315

Belgium.—Three German, one French and three Belgian concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of six lots of copper wire; the Rheydt Kabelwerk, of Rheydt, Germany, submitted the lowest tender for four of the lots totalling 27½ tons, and the Société des Usines à Cuivre, of Liége, for two lots (65 tons).

Bexley.—The U.D.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a motor-generator, at £320.

Bristol.—The Electrical Committee has entered into a contract with the Bedminster, Easton Kingswood and Parkfield Collieries, Ltd., for the supply of coal to the Avonbanks works for 12 months, at an estimated cost of £16,675.

The Docks Committee of the T.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for triple-concentric cable.

China.—The Western Electric Co., of Chicago, has a contract in hand for the establishment of a telephone exchange in the city of Tientsin; it will be equipped for about 4,000 subscribers and have a capacity of 14,000 lines.

Dartford.—The B. of G. has received the following tenders for the electric light installation at the workhouse infirmaries :—

W. Dickinson & Co., Bexley Heath	(accepted)	£96
Mr. E. E. Beaven, Dartford		120
S. W. Gibson & Co., Dartford		103
Mr. W. Bayliss, Dartford		148

Derby.—The E.L. Committee of the T.C. has accepted the following tenders :—

British Thomson-Houston Co., Ltd.—Switchgear, £943.
Simkiss & Knighton.—Cast-iron piping for turbine, £246.
Aiton & Co.—Steel piping for turbine, £142.
Newton Bros.—Balancer, £179.

Dublin.—On the report and recommendation of Mr. Ruddle, the Electric Supply Committee has accepted the tender of the General Electric Co. for a supply of both single and three-phase meters for a period of two years.

East Ham.—The tender of the James Keith & Blackman Co., Ltd., has been accepted by East Ham T.C., at £231 10s., for forced-draught fans, motors, &c., at the refuse destructor works. The tender of Messrs. G. Weston & Sons, Ltd., has also been accepted, at £173, for wiring the new fire station and firemen's dwellings. Tenders were also received from Messrs. A. Newman, Ltd., Ray Electric Co., and F. Hodgson & Co.

Fleetwood.—The contract for the electrical installation at Victoria House, Lord Street, which has been taken over by the Royal National Mission to Deep Sea Fishermen, has been secured by Mr. R. Barrow, of Fleetwood.

Kingston-on-Thames.—The T.C. has accepted the tender of the Rees Roturbo Co. for an electrically-driven pump for the sewage works, at £191.

London.—L.C.C.—The following is a list of the tenders received for installing the electric light at the Tollit Street Special School, Mile End :—

G. E. Taylor & Co.	(accepted)	£378
E. Lawrance & Sons, Ltd.		380
Wells, Raynor & Co.		380
Cunningham, Ltd.		398
H. J. Cash & Co., Ltd.		414
C. H. Cathcart & Co.		415
Pinching & Walton		434
A. Newman, Ltd.		449

Poplar.—The following tenders have been received by the B.C. for the provision of plant for electricity works extensions :—

Additional ash elevator :—

James Harvey	(accepted)	£300
Geo. Robson & Co.		371
New Conveyor Co.		517
Spencer & Co.		578

Steam, feed and blow-down piping :—

Babcock & Wilcox, Ltd.	(accepted)	£325
John Wilson & Co., Ltd. (no detailed specification)		306
Edward Le Bas & Co.		336

Girders for boiler foundations :—

Fairweather & Ranger	(accepted)	£83
Peirson & Co.		79
Redpath, Brown & Co.		96

Switchgear in connection with 1,000-KW. converter at Millwall sub-station :—

General Electric Co.	(accepted)	£257
British Westinghouse Co.		367
Johnson & Phillips, Ltd.		422
Ferranti, Ltd.		397

Wet air filters for two 3,000-KW. turbo-alternators :—

Sturtevant Engineering Co.	(accepted)	£407
Balcke & Co.		408
Heenan & Froude		589

St. Pancras.—The tender of Messrs. Spagnoletti, Ltd., has been accepted by the Guardians, at £269, for converting the present lift in the Infirmary into an electrically-driven one. Tenders were also received from Messrs. R. Waygood & Co., Ltd., at £370, and Medway's Lift Co., at £287.

Stepney.—The B.C. Electricity Committee is ordering six arc lamp columns from Messrs. R. A. Bradshaw & Son, at £9 15s. each.

Southampton.—The tender of Messrs. Babcock & Wilcox, Ltd., has been accepted by the T.C., at £1,661, for a boiler, superheater and mechanical stoker at the electricity works.

Walthamstow.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., at £200, for the supply of 550 yd. of three-core low-tension cable. Other tenders were received from Callender's Cable and Construction Co., Ltd., Messrs. Johnson & Phillips, Ltd., Messrs. Siemens Bros. & Co., Ltd., Union Cable Co., Ltd., and the Western Electric Co., Ltd.

Wimbledon.—The T.C. has accepted the following tenders :—

British Thomson-Houston Co., Ltd.—1,500-KW. turbo-alternator, with condensing plant, pipework and auxiliaries, £8,711.
Herbert Morris, Ltd.—Overhead travelling crane, £258.
British Electric Transformer Co., Ltd.—One 75-KW. and one 50-KW. electric transformers, £123.
Arc Lamp and Engineering Co., Ltd.—500 metallic-filament lamps.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday October 3rd. At 39, Victoria Street, Westminster. Lecture on "Gas Engine Testing," by W. A. Tookey.
Friday, October 10th. At 6.30 p.m. Visit to the Model Engineer Exhibition at the Royal Horticultural Hall.

Salford Technical and Engineering Association.—Saturday, October 4th. At the Royal Technical Institute. At 7 p.m. Lecture on "Automobile Construction," by **Mr. J. A. Mackle**, B. Eng.

Institute of Marine Engineers.—Monday, October 6th. At the Institute, Romford Road, E. At 8 p.m. Paper on "Fuel Gas Analysis and its Advantages," by **Mr. A. E. Jones.**

Society of Engineers.—Monday, October 6th. At 7.30 p.m. At the Institution of Electrical Engineers. A paper entitled "Highways" will be read by Mr. C. H. Cooper, M.Inst.C.E.

Batti-Wallahs' Society.—London. Wednesday, October 8th. Informal evening.

Association of Engineers-in-Charge.—Wednesday, October 8th. At 8 p.m. At St. Bride's Institute. Presidential address by Dr. R. T. Glazebrook, F.R.S.

Institution of Automobile Engineers.—Wednesday, October 8th. In London. Presidential address by J. S. Critchley. Discussion on "The Fuel Question."

Inquiries.—A correspondent asks who are the makers of the "Restler" enclosed high-speed engine, and where he can see one working; one that he has gets very hot after three hours' run. Makers of floor shaving or planing machines are asked for.

Electrical Fatality.—According to a newspaper report, Levy Dell, a labourer employed on the new sea defence works at Southend-on-Sea, attempted to pick up a live electric wire which had fallen from a post, on 26th ult., and was instantly killed.

NOTES.

The Effect of Outer Globes on the Life of Metal-Filament Lamps.—Under the above heading we called attention in our issue of September 19th to the experiments carried out by a Swedish engineer (Herr Sunden), the conclusions of which investigations were:—That the life of a metal-filament lamp was shortened and its efficiency impaired by over-heating; and that a device should be employed for using metal-filament lamps without globes or shades.

The first of these conclusions, which is in accordance with experience derived from other sources, may be accepted without question. It has been pointed out to us, however, by the General Electric Co., Ltd., that Herr Sunden's second conclusion is quite erroneous. That company has inaugurated an illuminating engineering department with a testing laboratory equipped with all the necessary apparatus, and some specially designed for the study of scientific illumination, and the subsequent design and manufacture of the necessary appliances to give effect to the study work. The company points out, quite rightly, that a bare metal-filament lamp for either indoor or outdoor use is almost intolerable. More or less eye strain, due to the glare, is inevitable, and the loss of illumination due to the light rays not being redirected to their useful channel not only means a considerable loss of efficiency, but also that a lamp of much higher consumption is being used than would be necessary with a suitable reflector or diffusing globe.

After a long period of experiment and test, the General Electric Co., Ltd., has produced a glassware whose efficiency and low absorption qualities are, it is claimed, unique. Whether the company's claim, that this glassware is a great advance on anything of the sort so far produced, will be proved in practice remains to be seen; but, apart from its other qualities, there is no question as to its entirely overcoming Herr Sunden's objection. Both the shades and the globes are suspended from galleries specially designed to give efficient ventilation, which entirely disposes of the "over-heating" difficulty with metal-filament lamps. Granted that the sizes of the ventilation orifices in the gallery are sufficient, the power of the lamp is of small consequence, as the greater the heat generated the greater will be the current of air cooling the lamp.

Association of Electrical (Station) Engineers.—An open general meeting of the London Section was held at Chandos Hall, W.C., September 24th, at which there was a very good attendance. The subject down for discussion was "A Fighting Policy" (Mr. W. A. Jones in the chair). The discussion was opened by a member of the London Committee, who outlined the reasons for forming the Association, for the benefit of those who had not previously attended a meeting; he also pointed out the two methods by which the objects of the Association might be attained, which could be summarised as a passive and an active or fighting policy. He then proceeded to show the value of a fighting policy on the principle of the "power behind," to compel those employers who had taken advantage of the lack of organisation to consider the grievances of their employés.

A speaker, on behalf of the passive policy, suggested that the Association should endeavour to obtain the assistance of chief engineers and get them to take a personal interest in the welfare of the station engineers.

The next speaker's policy was "No quarter." He emphatically stated that he believed in a fight to the finish as the only possible remedy for the existing evils.

Another speaker said that force was the predominant feature of existence, and that the station engineer controlled the greatest force of modern times, and had a great power over the community generally. He also said that efforts should be made to compel corporations, &c., to pay their chief engineers adequate salaries to prevent their having to take premium pupils to augment their income. The meeting was forcibly reminded by another speaker, amongst other things, that while engaged in the design, erection, manufacture, and running of all kinds of electrical apparatus, the majority of those engaged in the industry had to go home to 1d. in the slot gas.

Resolutions were put to the meeting asking for the endorsement of a "fighting" or active policy, which were carried by large majorities.

A resolution was put to the meeting with regard to co-operation with other organisations for mutual benefit. The chairman ruled this resolution out of order, but stated that the matter would have the consideration of the committee.

The discussions *re* the fighting policy have aroused considerable interest, and have created such a record in attendance that it has been decided to hold further meetings to discuss details. The next meeting will be held as above, on Tuesday, October 28th.

A meeting of the Bradford Section was held at the Mechanics' Institute, September 25th, Mr. R. P. Spurr in the chair. The delegate to the Conference submitted his report and the rules, which were approved. A resolution was put to the meeting (after a good discussion), asking if they would endorse the fact that the Association was a fighting organisation, and was carried unanimously. Owing to the scattered nature of the district comprising the Bradford Section, it was decided to hold meetings in other towns besides Bradford. The next meeting will be held at Leeds in about a month's time; the exact date will be advertised.

A meeting was held recently at Liverpool, at which Mr. A. C. Black resigned his position as hon. secretary (Liverpool Section), owing to the fact that he was shortly leaving the district. The meeting accepted his resignation with regret, and appointed Mr. F. C. Taylor in his place.

The Batti-Wallahs' Society.—This society's programme for the 1913-14 season includes the following events:—

Wednesday, October 8th.—Informal Evening.
Friday, October 31st.—Smoking Concert.
Wednesday, November 19th.—Informal Evening.
Wednesday, December 10th.—Informal Evening.
Wednesday, January 7th, 1914.—Informal Evening.
Wednesday, February 4th.—Informal Evening.
Saturday, February 28th.—Annual Dinner.
Monday, March 9th.—Annual General Meeting.
Wednesday, April 1st.—Informal Evening.
Friday, April 24th.—Smoking Concert.

Fire on the "Imperator."—The fire which recently broke out on the *Imperator* while she was lying in New York harbour was easily extinguished and caused no widespread damage. Nevertheless, the incident attracted much attention in the European and American daily papers, and editorial notes and comments have been followed by the usual flood of correspondence. The Hamburg-American Co. has since published a statement in which the outbreak is attributed to a short circuit in one of the electric motors driving the air-cooling plant. If this diagnosis is correct, says the *E.T.Z.*, the fault may be due to *force majeure*, or to neglect of the V.D.E. rules either in the installation or operation of the machine. The importance of the matter requires the closest investigation to be made in order that the mishap may not recur, and in order that public uneasiness may be allayed.

Mrs. Williams: Charge Engineer.—We do not know whether Mrs. Lena Williams, of Cookshire, in Canada, has read the recent correspondence in our pages respecting "Women in Power Stations," but we have no doubt that she would be able to write very entertainingly respecting the views of some of our correspondents, for we read the following in the *Canadian Electrical News* just to hand:—

"Mr. H. A. Worby, manager of the Westbury Electric Light and Power Co., Cookshire, P.Q., is particularly fortunate in his choice of operators. For the last year and a half his daughter, Mrs. Lena Williams, has taken complete charge of one shift each day with perfect satisfaction to the owner of the plant, as well as to the customers. We believe this is the only case in Canada of a lady operator of a light and power plant. Mrs. Williams . . . is the wife of Mr. Elmer Williams, power electrician of the Westbury plant."

A 30,000-KW. Steam Turbine Generator.—The Interborough Rapid Transit Co. of New York placed recently with the Westinghouse Machine Co. an order for three immense turbo-generator sets, the design of which promises to bring out some new phases of both manufacturing and operating practice. It was proposed to build the sets in two units, one generator being driven at 1,500 R.P.M. by a high-pressure turbine, the exhaust from which would be used in a low-pressure turbine driving the other generator at 750 R.P.M. The blade speeds involved in this design are low, and each turbine element is of exceedingly simple mechanical construction, involving no unusual engineering problems.

The scheme of employing two turbine elements and having the steam pass serially through them is not new. A number of such units of from 1,000 KW. to 2,000 KW. rating were built by the Westinghouse Machine Co. in 1901. This construction has again come to the front in the case of the English-built Parsons turbine ordered recently by the Commonwealth Edison Co. of Chicago. It is new, however, to employ high-pressure and low-pressure elements driving separate generators, each at a different synchronous speed.

The steam supply for these units will carry 120° superheat, and a vacuum of 29 in. will be required for operation. Under these conditions it is claimed by the manufacturer that the steam consumption of each of them will be approximately the same as that for one of the Parsons sets operating on 200° superheat and with 29·2-in. vacuum, conditions much more favourable than can be obtained for the Interborough installation.—*Electrical World.*

Tramway Workers' Combine.—The tramwaymen of Birmingham, Wolverhampton, West Bromwich, Walsall, Dudley, Wednesbury, Bilston, and South Staffordshire generally, have recently combined and formed a District Council, with the object of taking concerted, if isolated, action when any demand is made for increased wages or improved conditions of labour. The inaugural meeting was held at the Labour Assembly Rooms, Wolverhampton, on Thursday last week. Mr. Sanders, the president of the Council, in the course of an address, remarked that through organisation some wages had been increased by 80 per cent., and the hours of some reduced by from 40 to 60 per cent. As things were, they could not take a gloomy view of their position, for they had moved forward from the time when the tramway worker was once termed "the white slave of England," and was looked upon as the man who could not get work at anything else. However, by being honest, taking an interest in himself, and organising, the tramwayman's position had advanced. Mr. Carter pointed out that their Union was one of the six largest in the country. They had recently made great progress, having enrolled 5,000 members this year. He hoped that before long no one would be employed in the tramway service who was not one of them and who did not do his part towards getting benefits which he shared in through the actions of the Trade Unions.

Mr. Vaughan (Bilston) expressed his pleasure that instead of the branches having so many different programmes and policies, they would now have a united one. By this means their position would be considerably strengthened, and their applications would stand a much brighter prospect of success..

Diesel Engines at Kingston-on-Thames.—On Friday last, in the presence of a large number of residents and visitors, the Mayor of Kingston-upon-Thames formally inaugurated the new horizontal Diesel engines which Mr. J. E. Edgcome, electrical engineer to the Corporation, has installed at the electricity works. These engines were described and illustrated in our issue of June 13th last, on the occasion of the visit of the Municipal Electrical Association: we need not, therefore, here enlarge upon their special features. Suffice it to say that the proceedings were successful in all respects, and Mr. Edgcome was heartily congratulated upon the auspicious start made with the new plant. The total cost of the extensions has been about £15,000. After the ceremony and the inspection of the works, the visitors were entertained at tea by the Mayor, Mr. Councillor C. H. Burge, F.I.C.

Appointments Vacant.—Junior switchboard attendant, A.C. and D.C., for the Halifax Corporation electricity works (£1); mains superintendent for one of the areas of the Stoke-on-Trent County Borough's supply department; shift engineer (Belliss engines and Lancashire boilers) for the Colne Corporation (35s.); canvasser for lighting, cooking and power business for York Corporation (35s. + commission). Particulars are given in our advertisement pages.

Strike.—The *Daily Herald* states that on Wednesday 25 girls employed in the cotton shop of Messrs. Siemens's works at Charlton struck work, refusing to take charge of two machines each.

Institution and Lecture Notes.—Greenock Electrical Society.—We have received a copy of the syllabus of this Society for the 1913-14 session, which opens on October 3rd. Meetings are to be held on alternate Fridays at 7.45 p.m. at the Temperance Institute, West Stewart Street, Greenock. Mr. J. A. Robertson, borough electrical engineer, is hon. president, and Mr. W. A. Toppin vice-president. Mr. A. Hurry, 54, Brougham Street, is secretary. The following is a list of papers announced:—

October 3rd.—"Electricity Supply in Greenock." By J. A. Robertson.
,, 17th.—"Motor-Driven Machinery." By W. A. Toppin.
,, 31st.—"The Principles of the Steam Engine." By James Frew. "Boiler Inspection." By G. R. Reid.
November 14th.—"Electric Tramcar Equipment." By S. James.
,, 28th.—"Steam Turbines." By J. H. Parker. "The Entz Reversible Booster." By P. Kerr.
December 12th.—"Primary Batteries." By A. Bucklitsch. "Secondary Batteries." By H. J. Roberts.
January 9th.—"Thoughts on Cable Chemistry." By Lowrie Sinclair. "Cable Faults and their Causes." By L. Hogg.
January 23rd.—"Aviation." By H. J. Roberts.
February 6th.—"Cinematograph Supplies." By W. B. Smith. "Faults in House Wiring." By W. McGibbon.
February 20th.—"Power Station Design." By J. Punch.
March 6th.—"Power Transmission." By A. Zoller.
,, 20th.—"Sub-Station Equipment." By D. McDougall.

Visits have been arranged for to the Alan Kerr Technical Laboratory, Port Dundas electricity station at Glasgow, and to the works of the Clyde Valley Power Co., and a social evening is fixed for December 26th.

The Association of Engineers-in-Charge.—The programme for the 1913-14 session, which opens on October 8th with the presidential address by Dr. R. T. Glazebrook, includes the following papers, and, as usual, a number of social events, such as dances, concerts, and the annual dinner (March 21st):—

November 12th.—"Wireless Telegraphy." By Capt. H. Riall Sankey.*
December 10th.—"Water Raising and Measuring." By W. H. Booth.
January 14th.—"Commercial Motors, Steam and Petrol." By D. J. Smith.
February 11th.—"Heating of Buildings by Low-Pressure and Exhaust Steam." By T. J. Couglan.
March 11th.—"Reinforced Concrete Construction." By Henry Adams.
April 8th.—"Intercommunication Telephones." By A. F. Cannon.

The meetings take place at the St. Bride's Institute, on Wednesdays, at 7.30 p.m., with the exception of *, which will be at Marconi House.

The Institution of Civil Engineers.—It is announced that the twenty-first James Forrest Lecture will be delivered in the lecture theatre of the new building of the Institution of Civil Engineers, Great George Street, Westminster, on Thursday, October 23rd, at 9 p.m., by Mr. Alexander Gracie, M.V.O., M.Inst.C.E., his subject being "Progress of Marine Construction."

University College, London.—Particulars of a course of Wednesday lectures, by Prof. J. A. Fleming, on "Conductors for the Electrical Transmission of Energy," to commence on October 29th, are given in an advertisement to-day.

Electro-Harmonic Society.—The twenty-eighth season of this society opens on October 17th (Friday) with a smoking concert in the King's Hall, Holborn Restaurant.

The Dynamicables.—The next dinner of the Dynamicables will be held at the Trocadero Restaurant on Wednesday, October 15th, at 7.30 p.m., with Mr. J. F. C. Snell in the chair

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—In our reference to the Rhondda appointment last week a slight error occurred. For Mr. James Bowman read Mr. Joseph M. Bowman. This gentleman is at present resident engineer at the Hertford electricity works of the North Metropolitan Electric Power Supply Co.

On Thursday evening, September 25th, Mr. B. Sankey entertained the staff at the Whitehaven electricity works at dinner before leaving to take up his South African post. The staff took advantage of the occasion to present their old chief with a silver cigarette case and a fountain pen. On the following day the officials of the Corporation presented him with a suit case, an attaché case, and a pair of military brushes. The Town Clerk made the presentation. Later a gold watch was presented by the Mayor on behalf of the members of the Council. It is interesting to note that this month (September) completes the twentieth year of working, the Whitehaven supply having commenced in September, 1893. During the whole of this period Ald. J. R. Musgrave has occupied the chair of the Committee. Mr. Sankey has been in charge for the last seven years.

Mr. J. Mackintosh, of East Ham, has been appointed switchboard attendant at Barking electricity works. The salary of Mr. W. E Kidner, the assistant engineer, is to be advanced by £20 per annum.

Mr. Chas. F. Wade has been appointed to the post of assistant engineer at the Southwark Borough Council's electricity works, from that of charge engineer to the Islington Borough Council.

Mr. R. H. Lee, junior charge engineer, has been appointed third senior engineer-in-charge at Islington electricity works.

Owing to the resignation of one of the shift engineers at the East Ham generating station, the junior shift engineer, Mr. D. Anderson, has been promoted to fill the vacancy.

Mr. D. C. Redfern has resigned his position as southern district mains superintendent at the Stoke-on-Trent electricity works, in order to take up an appointment with the Yorkshire Electric Power Co.

At the last meeting of the Stoke-on-Trent Borough Council, Mr. C. Cuthbertson, the resident engineer of the Longton area, was given the charge of both the Stoke and Longton Electricity Works, and Mr. W. Adams, the resident engineer of the Hanley area, was given the charge of both the Hanley works and the new central power house. The chief electrical engineer is Mr. C. H. Yeaman.

The E.L. Committee of the Derby T.C. has recommended that the salary of Mr. E. G. Boissier, mains superintendent, be increased from £200 to £220 per annum, as from August 1st last.

Tramway Officials.—At Rochdale Town Hall on September 26th the chief officials of the Corporation presented to Mr. J. S. D. Moffet (late tramways manager) a canteen of cutlery upon his removal to West Ham to take up the general managership of the Corporation tramways there. Mr. W. H. Hickson (town clerk), who presided, referred to the valuable assistance he had received from Mr. Moffet in connection with Parliamentary Bill work; and Mr. T. R. Ball (gasworks manager) made the presentation. Mr. S. S. Platt and Mr. Webster, the new tramways manager at Rochdale, also spoke.

Mr. H. J. Somerset has relinquished his position as manager and engineer of the Perth Electric Tramway Co., which has been acquired by the Government, and, according to an Australian exchange, he is on his way to England.

General.—To celebrate the occasion of his forthcoming marriage to Miss Verel, Mr. William Howden, director and only son of Mr. James Howden, of the well-known firm of engineers, was presented by the employés on Thursday last, in the Dining Hall, Scotland Street, with a solid silver tray and silver card case.

Mr. Justus Eck, engineer-in-chief and general manager of the Union Electric Co., left by the R.M.S. *Majestic* on October 1st for a protracted tour in the United States.

The officers of the Blackburn District Postal Telephone Department have presented Mr. Charles Remington, late district manager, with a smoker's cabinet, as a mark of esteem on his removal from Blackburn to the Liverpool district.

Mr. W. Brown, the contract manager in connection with the Blackburn telephone system, has been nominated to a similar position in the Notts. district, with headquarters at Nottingham.

Mr. J. Willey, who is leaving the staff of the Isle of Thanet Traction and Lighting Co., has been presented by the staff with an oak writing desk and oak umbrella stand.

Mr. Walter Ernest Hatfield, electrical engineer at the Smethwick works of Messrs. Harper, Sons & Bean, who has been married to Miss Beatrice Jukes, daughter of Mr. Jukes, engineer and surveyor to the Tipton U.D.C., has been presented by the firm's employés with a silver egg stand.

Mr. A. Bruce Anderson has changed his address from Higher Broughton to 24, Roxborough Park, Harrow-on-the-Hill, Middlesex.

The *Commonwealth Engineer* states that Mr. A. S. Herbert has been appointed general manager in Australia of Siemens Bros. Dynamo Works, Ltd. Mr. Herbert has just relinquished a similar position in charge of the Canadian business of the company.

The same contemporary states that Mr. Ashton Bremner, who went out from England as an engineer in connection with the Hydro-Electric P. and M. Co., Tasmania, has resigned.

An Australian exchange states that Mr. Percy Rosling, Australasian manager for W. T. Henley's Telegraph Works Co., Ltd., at Melbourne, who has come to London, will be succeeded by Mr. H. Norman, who has had charge of the Sydney branch.

Mr. A. S. E. Ackermann, who has been making a series of 35 trials of the Shuman-Boys sun heat absorber in Egypt, has now returned to Westminster after an absence of nearly three months.

Mr. Chas. A. Luke has severed his connection with the *Engineering Review*, both as a director and manager. In future he will devote himself entirely to trade and other exhibition work, and is connected at the present time with schemes in London, Paris, Glasgow, Manchester, Sheffield, &c. Mr. Luke is joint managing director of Walter Cawood, Ltd., whose business is that of organisers of exhibitions of all classes in any country. His address is "Roslyn," Hawthorn Lane, Wilmslow, Cheshire.

Mr. H. J. Osborn, formerly manager of the A.E.G. Electric Co.'s supply department in Manchester, has now severed that connection and gone into business as factor at 7, Blackfriars Street, Manchester, under the title of Crowther & Osborn, Ltd.

The address of Prof. John Perry is now 14A, Campden Hill Court, London, W.

Mr. Herbert E. Tilley, A.M.I.E.E., of Marconi's Wireless Telegraph Co., Ltd, Chelmsford, was married on Thursday last week at the Wesleyan chapel there to Miss Winifred Norris, daughter of Mr. and Mrs. J. A. Norris, Mount Pleasant, Chelmsford. Mr. Tilley was for a number of years connected with Messrs. Bruce Peebles & Co., Ltd., of Edinburgh. Among the many presents received were a clock from "Old Friends" at Bruce Peebles, table silver from the employés of Messrs. Christy & Norris, Chelmsford, and also presents from the staff of the Marconi Co. A unique notification of the wedding was the hoisting of a Union Jack to the top of one of the high Marconi poles (500 ft. high) immediately after the ceremony.

Obituary.—Dr. Rudolf Diesel.—We deeply regret to record that Dr. Diesel, inventor of the Diesel oil engine, disappeared from the vessel on which he was journeying from Antwerp to Harwich on Monday last. He was coming to London in order to be present at the meeting of the Consolidated Diesel Engine Manufacturers, Ltd., on Wednesday. We shall refer to the matter further next week.

Mr. T. Frame Thomson.—It is also with great regret that we have to report the death of Mr. T. Frame Thomson, director or chairman of a number of important electrical undertakings in South America, among them being the United Electric Tramways of Monte Video, Ltd., the Cordoba Light, Power and Traction Co., Ltd., and the Anglo-Argentine Tramways Co., Ltd. Deceased gentleman, who was 46 years of age, and was about to again visit South America, was, it is reported, discovered dead at his residence at Highgate, after accidental shooting.

NEW COMPANIES REGISTERED.

Sandbanks Railless Electric Car Co., Ltd. (131,089).—This company was registered on September 16th, with a capital of £1,000 in £1 shares, to construct, equip, maintain and work and use for the carriage of passengers or goods all kinds of mechanically propelled vehicles adapted for use upon roads, whether moved by electric or other power transmitted thereto by some external source, &c. The subscribers are:—T. B. Scott, 7, Poole Road, Bournemouth, physician, 100 shares; J. J. Allen, Cerne Abbas, Bournemouth, managing director, J. J. Allen, Ltd., 25 shares; C. Carter, Belle Vue, Poole, colliery director, 25 shares; F. Hudson, Penarol, Parkstone, engineer, 25 shares; F. Maddeford, Branksome Park, Bournemouth, contractor, 25 shares; S. J. Mate, 71, Seamoor Road, Bournemouth, printer, 25 shares; H. Newman, Tirgrith, Bournemouth, wine merchant, 25 shares; T. Stevens, Richmond Chambers, Bournemouth, architect, 25 shares. Minimum cash subscription, £750. The number of directors is not to be less than five or more than eight; the first are T. B. Scott, J. J. Allen, C. Carter, F. Hudson, F. Maddeford, S. J. Mate, H. Newman and T. Stevens; qualification, £25. Solicitors: Dickinson, Gwatkin & Manser, Lloyd's Bank Chambers, Poole, Dorset. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Radium Electric Emanation Co., Ltd. (131,069).—This company was registered on September 15th, with a capital of £100 in £1 shares, to take over the business of the London Electric Treatment Co. (1911), Ltd., including the electric light cure and electro-therapeutic institute carried on at 43-4, New Bond Street, W., and to adopt an agreement with E. T. Cocks, receiver for the debenture-holders of the said company. The subscribers (with one share each) are:—J. R. Rowland, 678, Lea Bridge Road, Leyton, accountant; R. W. Maynard, 35, Queen Ann Road, South Hackney, N.E., clerk. Private company. E. W. Barton-Wright is the first sole managing director. Registered office, 43-4, New Bond Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marconi International Marine Communication Co., Ltd. (65,759).—Return dated July 7th, 1913. Capital, £350,000 in £1 shares, 204,056 shares taken up; £1 per share called up on 99,056; £99,056 paid; £105,000 considered as paid on 105,000 shares. Mortgages and charges, £125,000. Return of allotments made up to July 25th, 1913, shows a further 102,028 shares allotted for cash, £1 5s. being paid on each (5s. premium).

Electrical Power Storage Co., Ltd. (30,313).—Return dated August 5th, 1913. Capital, £100,500 in 20,000 ordinary and 100 founders' shares of £5 each; 66 founders' and 18,592 ordinary shares taken up; £5 per share called up on 66 founders' and £4 per share on 3,132 ordinary; £13,332 5s. 1d. paid, including £474 5s. 1d. on 405 founders' and four ordinary shares forfeited; £77,300 considered as paid on 15,460 ordinary shares. Mortgages and charges: £30,000.

General Accessories Co., Ltd. (104,144).—Return dated August 1st, 1913. Capital, £2,000 in £1 shares, 1,500 6 per cent. pref., 250 5 per cent. pref., and 500 ord. A ... shares taken up. £1,500 paid. £1,150 considered as paid. Mortgages and charges: Nil.

Paignton Electric Light and Power Co., Ltd. (25,571).—Return dated July 21st, 1913. Capital, £17,000 in £1 shares. 11,610 shares taken up. £11,610 paid. Mortgages and charges: £10,000 (£7,500 mortgage deb., and £2,500 temporary loans). Return of allotments made up to July 25th 1913, shows a further 100 ord. shares allotted for cash.

Electric Construction Co., Ltd. (39,292).—Capital, £400,000 in £2 shares (50,000 pref.). Return dated July 26th, 1913 (to 1st August 1st). 112,109 ord. and 3,...30 pref. shares taken up. £2 per share called up on 2,100 ord. and 18,215 pref. £40,630 paid. £2...,290 considered as paid on 110,90 0 ord. and 13,145 pref. shares. Mortgages and charges: £170,000.

Chile Telephone Co., Ltd.—Capital, £360,000 in £5 shares. Return dated July 31st, filed August 15th, 1913. ...,000 shares taken up. £5 per share called up on 44,000 shares. £220,000 paid. £110,000 considered as paid on 22,000 shares. Mortgages and charges; Nil.

Electric Ignition Co., Ltd. (In liquidation).—A memorandum of satisfaction in full on May 24th, 1913, of debentures dated (*a*) April 10th, 1905, securing £2,000; (*b*) October 5th, 1908, securing £2,000; and (*c*) December 30th, 1908, securing £1,000, has been filed.

W. S. Laycock, Ltd.—A memorandum of satisfaction in full on September 9th, 1913, of charge by deposit of deeds, dated January 16th, 1913, securing balance of account current has been filed.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

An extraordinary general meeting of the shareholders was held on Friday last at Hamilton House, Victoria Embankment, E.C., Mr. J. Annan Bryce, M.P., in the chair.

The Chairman, in moving the adoption of the special resolutions for the reconstruction of the capital of the company (which appeared in the Electrical Review of September 26th), said they were all aware from the remarks he had made at the last two or three annual meetings, and also from statements recently made in the Press, that it had been the intention of the directors to put before them a scheme for the reconstruction of the capital. The scheme had been delayed, as they would remember, owing to the fact that the litigation between the company and the Underground Electric Railways Co. of London had not come to an end. Their total claim outstanding against the Underground Electric Railways Co., as per the balance-sheet of December 31st, 1911, was approximately £120,000, and certain other items for legal expenses had since been added to this amount, so that approximately £122,000 was the sum they had been fighting for. They knew their appeal to the House of Lords was successful, in that the award of the arbitrator was sent back to him with instructions to take into consideration certain matters which the directors contended should, in fairness, be dealt with. As the first result of the decision of the House of Lords, they got back from the Railways Co. the amount they had paid under the award, so that the amount outstanding was reduced to the sum of £95,680, as in the balance-sheet of December 31st, 1912. After the judgment of the House of Lords which, unfortunately, was not given until the beginning of the long vacation in 1912, every effort was made to obtain a final hearing before the arbitrator, but delays occurred, owing to difficulties in meeting the convenience of the arbitrator as well as of counsel. When at last a meeting was fixed, the arbitrator, the Right Hon. Alfred Lyttelton, fell ill and died, and it became a question of appointing a fresh arbitrator. This would have meant great further delay, and the emergence of fresh complications. It, therefore, seemed best under the circumstances to accept the invitation of the railways company to a meeting with a view to a settlement. This meeting took place, and finally it was agreed that the company should pay them, in addition to what they had already recovered, a sum of £42,500 with an understanding that their former friendly relations should be resumed as though nothing had occurred between them. The result was a loss of £52,000 out of the amount of £95,680 held in suspense in the balance-sheet of December 31st, 1912. Having now ascertained that loss, they were enabled to place before the shareholders the scheme which had been outlined in the circular sent them. The net total by which it was proposed that the capital of the company should be reduced was £725,000. Of this, £225,000 would be applied to writing the ordinary shares down from £5 per share to £2 per share—that was £150,000, the value of patents and goodwill being reduced to the same amount. The balance of £500,000 would be written off the preference shares, reducing them from £3 per share to £2 per share, so that each class of share would now be of the same nominal value. The nominal value of the preference shares would thus stand at £1,000,000. This £500,000 would be applied in the following manner:—(1) Writing down works machinery, plant, &c., from £1,650,346 to £1,232,507, £417,839; (2) writing off loss on Underground Electric Railways contract, £52,049; (3) writing off balance of expenses of issue of prior lien bonds, £11,657; and (4) depreciation of investments, £85,354. Those amounts came to £566,899, against which there was a balance of £66,899 to the credit of profit and loss account on December 31st, 1912. The amount of £417,839 in respect of the works and equipment was mainly accounted for by the fact that on the previous occasion when the capital was reduced the then board did not deem it

necessary, having regard to the large sums at that time to be provided for, to act upon the report of the expert values of the property in its entirety. Had the experts' figures been adopted, it would have meant a further reduction then of approximately £295,000. The board was of opinion that, in the interests of the company, this sum should now be included in the depreciation to be made. Six years had elapsed since the valuation was made, and, of course, further depreciation had been going on all the time. In order to make the position safe, taking a reasonable percentage per annum for these six years, less the sum already provided in those years, the directors were of opinion that, in addition to the £295,000, a further sum of £122,484 should be provided for depreciation of works and plant, making the total amount for this purpose £417,000. With regard to the proposed depreciation of investments, they were aware that their principal investments were in ordinary shares of the Clyde Valley Electric Power Co. £200,000, and the Traction and Power Securities Co., £57,000. At the time of the last reduction of capital those securities were carried forward at their par value, as it was anticipated that they would before long enter upon the dividend-paying stage. While the prospects of both these concerns had continued to improve, there would appear to be no probability of dividends being paid in the immediate future. Neither security was quoted on the market, but, as the result of careful inquiries, the directors recommended a total depreciation of £85,354. They would have seen from the circular that the scheme provided for the maintenance of the relative position of the two classes of shares as it stood at the incorporation of the company, and he did not think he need add anything in respect of this except to emphasise the fact that the new £2 preference shares would be entitled to receive in each year (non-cumulative, of course), the whole of the divisible profits up to 6s. per share, before the ordinary shares could participate. This, of course, was equivalent to 6 per cent. on the original nominal amount of £5, at which they stood when the company was first introduced. He hoped the shareholders would approve of the adoption of this scheme, which had the approval of the American Westinghouse Co., which was the largest holder of preference as well as of ordinary shares. A delay in making the depreciations meant corresponding delay in the payment of dividends, because, as they knew, no dividend could be paid till the loss by depreciation was replaced. If the reduction of capital were made, if trade continued good, and there were no labour troubles, there appeared to be a fair prospect of a dividend in the near future.

Col. Craddock seconded the motion.

Mr. E. Birks said that while he quite agreed that it was desirable to reconstruct the capital of the company if it was to be put on a sound financial basis, he could not agree with the scheme which the directors had put forward. The creation of preference shares entitled to 15 per cent. dividends stood condemned at the very outset. He also objected to the scheme because, if it was carried, it would mean that while the preference shareholders would have been called upon to surrender £1,500,000 of their capital, the ordinary holders would only have been called upon to the extent of £600,000. When they remembered that in a large degree their troubles were due to the administration of the people who held the ordinary shares and who were at the helm in the early days of the company's career, he did not think the preference shareholders should have any sentimental feeling in calling upon them to surrender a great deal more than they thought of doing. Mr. Birks then detailed an alternative scheme which he said he had submitted to the directors in private some time ago.

Mr. Orrell said that as an ordinary shareholder who had paid £7 each for his shares, he had nothing to gain at all, because he did not hold any preference. His idea was that the shareholders did not want immediate dividends—what was required more than anything else to make the machinery hum at Manchester was more cash, and the only way they could get that was to write off a portion of the depreciation out of profits.

The Chairman, in reply, said that the general feeling of the shareholders was that the ordinary shares ought to be written off altogether, for it was the preference shareholders who furnished the cash for the company, many at a premium. The position, however, was that the American Co., who held the great majority of the ordinary shares, approved of the scheme which had been put forward, and would consent to no other. He agreed with Mr. Birks that the proposal of a 15 per cent. preference share was not a nice one, but at the same time he did not think it was likely to have the slightest effect on the company's financial standing. The company had excellent credit, and had got plenty of cash at the present moment, and they were not likely to have any question raised as to their credit by their suppliers. They could go into the market and buy goods on the very best terms. The scheme was the only one that they were likely to carry under existing circumstances, and he hoped it would be agreed to.

The resolutions were then carried, with two dissentients.

Subsequently the scheme was approved at separate meetings of the preference and the ordinary shareholders.

Victoria Falls and Transvaal Power Co., Ltd.

The Marquess of Winchester (chairman) presided at Salisbury House, E.C., on Friday, over the annual general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 465), the Chairman said it was of an equally satisfactory character to that of last year, and they might claim that the foundation of the company's business had been laid on the right lines. The share capital, first and second debenture issues, remained as before. Creditors showed an increase, because contractors' retention account was included in the amount of £328,121, whereas last year this item was under a separate heading. This amount appeared on the other side under the heading "Cash and loans." There was a difference of £878 in these amounts; £47,523 represented money due to contractors and £46,675 the amount deposited with the bank at that date against this liability. On the other side of the balance-sheet, leases concessions at cost and purchase of undertakings showed a slight decrease. This was accounted for because the amount of sales of obsolete plant was slightly more and the depreciation of buildings and plant had been increased on account of further construction. The depreciation and amounts written off expenditure on new stations had been taken on the same basis as for the year 1911, and for the year the amount necessary was less than for the previous year by a sum of £3,000. There were two reasons to account for this: in the first place, the whole of the additional expenditure for 1912 did not rank for depreciation, and, secondly, that in 1911 certain items had been written off, so that this charge did not accrue again in 1912. Expenditure on plant and machinery unerected £48,597 was a new heading. The previous balance-sheet showed an item stores less depreciation. This had now been subdivided into material and plant unerected and general stores and spare parts. Turning to the profit and loss account, the year's operations had resulted satisfactorily. Last year the profit was £323,094, now it was £446,380, an increase of £123,286. The appropriation account showed how this had been dealt with, first in meeting debenture interest; secondly, depreciation and reserve for doubtful debts increased by a sum of £40,790 over the sum devoted last year to this purpose. Thirdly, they carried to the balance-sheet a sum of £169,623, as against £137,093 in the previous year. To this was added the amount brought forward £45,744, giving them £215,367 out of which to consider shareholders' claims. The chairman referred to the delay in calling the shareholders together, but said they trusted they would not be anxious because they knew enough of their financial position to declare and to pay a dividend at the rate of 6 per cent. for 12 months, making the preference shares only 12 months in arrear. He might be asked why, with such a large carry-forward, they did not do more seeing that they had paid a dividend at the same rate over a period of 14½ months in the previous year? Well, they were cautious; they knew that there was evidence of labour unrest in South Africa, and the war clouds in the Near East were still above the horizon. Peace had now ensued, and they might hope that, through the generous consideration of the employers, coupled with the good sense of the majority of the men, the recent scenes enacted in Johannesburg would soon be obliterated by all classes realising that the first duty of a Government was the protection of the individual by the maintenance of law and order and by the individual that citizenship had its obligations as well as its rights. They had paid the dividend which absorbed £118,580, and left £96,788 to carry forward. Briefly to sum up the position, the company's operations for the year under review had resulted in their earning a total net income of £459,579, which had enabled them to provide for depreciations, pay a dividend at the minimum fixed rate on the preferred capital, and to carry forward a substantial sum. Previously, he had always, whilst being confident of the success of the company's business, carefully abstained from any prophecies as to the future. They had now in their statistical department such data as enabled them with as great a degree of certainty as was possible where the human element had to enter into calculations, to foreshadow the future returns from their investment in the company's business. In their first prospectus they foreshadowed that the 6 per cent. preference shares should be participating up to 10 per cent. Their calculations had been based on actual figures of working their business. Assuming again that their profit per unit remained the same and that the notified demands of the mines for power came on at the dates expected, then in 1916 they should be in a position to distribute a dividend on the preference shares at the rate of 10 per cent., and on the ordinary stock at 4 per cent., the back dividend on the preference shares having been met during the intervening years. He thought that might be considered as a justification of the first prospectus, but this result would have been attained without the utilisation of the great power of the Falls, which they still had in reserve as a great hydro-electric problem when the development of Rhodesia was sufficiently forward to demand attention. There were other interesting factors. In January, 1915, the installed plant in the stations of both companies would amount to 265,000 H.P. Another interesting feature of the company's business was the question of coal consumption. He remembered that the advent of the company's operations was viewed by the Transvaal Coal Owners' Association and the Government of the Transvaal, who then controlled the railways, with considerable apprehension. The system which they had adopted in their boiler plants of automatic stokers enabled them advantageously to employ the smaller and least valuable class of coal. The coal owners feared that the general consumption would fall off. At that time the mining companies were their chief consumers of what was known as round coal. The small coal was more or less lost to the collieries; in fact, it cost them money to dispose of it on their dump heaps. By selling them that coal they had been enabled to dispose of their round coal under more satisfactory conditions. They started Brakpan, their first station, in September, 1908. The coal output for the 12 months ending September 30th, 1908, was 2,942,000 tons; the output for the 12 months ending September 30th, 1912, was 4,592,000 tons, or an increase of 1,650,000 tons. The figures for the output for the Transvaal alone for the month of September, 1908, were 250,000 tons; for the month of September, 1912, 392,000 tons; increase, 142,000 tons. Again, the increase of coal traffic over the

railway system, exclusively in the Transvaal, for the year 1911, showed an increase over that of 1910 of 388,095 tons. He thought, therefore, that they could claim to have done no harm to the coal-mining industry of the Transvaal. They were indebted to the Government of the Union of South African States for their response to the appeal of the South African management for adequate protection of their power stations during the labour crisis of last July. They had no differences with their employés, but many of their men were forced to join the strikers. The head office and others of the engineering staff took the places of those who went out, and through their loyalty and zeal, the company was able to maintain supply, the property of the company suffering no damage at the hands of the strikers. During the past year the managing director, Mr. A. E. Hadley, had visited Johannesburg, and previously he accompanied the engineer-in-chief, Mr. Bernard Price, on a visit of inspection of all the large and important power stations in America. All points connected with the generation, transmission and sale of electrical energy were carefully considered by them, but Mr. Hadley told him that he was satisfied that they had a system of supply on the Witwatersrand which embodied all the latest discoveries of the scientific distribution of electrical current. Further, he believed nowhere in the world on anything approaching the same scale had the distribution of compressed air throughout the considerable area over which they supplied power in that form been attempted.

Mr. A. E. Hadley, managing director, in seconding the report, said the chairman had dealt fully with the figures and prospects of their undertaking, but as he had recently returned from Johanesburg, it might be of interest to add a few particulars of a more general character. The total power supplied along the 50 miles of the reef at the present time amounted to 140,000 H.P., and the further business in sight necessary to meet the requirements of consumers represented an increase on this of 40 per cent. With the amount of energy already being sold, the enterprise ranked as the largest supply company in the British Empire, and it was exceeded—and that but slightly—by not more than two or three in the world. To give some idea of the scale of operations, he would mention that at the present time the boilers were burning on an average 1½ tons of coal per minute. After carefully reviewing the knowledge acquired in the last five years under the conditions which existed on the reef, and after examining the practice and installations employed in the largest American plants, he was able to say that the system of their company embodied the best modern experience in the methods of supplying power on a large scale; and were they about to lay out the system again, having the benefit of the experience gained since the stations and lay-out were designed, they would not make any material modifications. In view of the rate of obsolescence in earlier electrical enterprises, this was a matter of great importance. Experience gained, both in South Africa and America, had brought about improvements in details, and these had already been added to the plant on service, being introduced as opportunity permitted, thereby improving the reliability of the supply. The difficulties arising through lightning, which was very severe on the Rand, had been studied with the greatest attention, and had been perceptibly reduced during each of the last two seasons, and the reliability of the supply compared most favourably with any similar undertaking that he had seen in other districts where heavy lightning storms were met with. He was pleased to say that the organisation of the staff was most complete, and comprised in each branch of the business experienced and well-known men, in whom every reliance could be placed. He considered it a great testimonial to the staff that the whole of the plant had been maintained in the highest state of efficiency in spite of the fact that in the past the time available for overhaul had to be reduced to a minimum, due to the difficulty of expanding the company and installing plant quickly enough to deal with the rapid growth of the load. For example, the efficiency of their first stations, which had been supplying for four or five years with the machines on service working practically at full load throughout, showed no diminution, and was as high now as when the plant was installed, while the reliability had steadily improved. This pointed to a long life of the plant. The generating plant was working with a lower coal consumption than he had seen in any other installation, and the tendency was still to improve this.

The report was adopted without discussion.

Sunderland and District Tramways, Ltd.

In a circular issued to the shareholders a scheme for capital reduction, foreshadowed at the last annual meeting, has been prepared. It is proposed to write down the preference shares to 10s. each, to make them non-cumulative, and to extinguish the arrears of dividend thereon, also to write down the ordinary shares to 1s. each. The share capital will then stand at £51,497 (95,495 6 per cent. non-cumulative preference shares of 10s. each, £47,747 10s., 74,990 ordinary shares of 1s. each, £3,749 10s.), in place of £170,485, as at present. Extraordinary general meetings were held on Tuesday to consider the matter, of which we shall publish a report next week.

Eastern Telegraph Co., Ltd.—The second quarterly interim dividend of 1¼ per cent. on the ordinary stock, in respect of the year ending December 31st, is announced.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Dividend of 1¼ per cent., payable November 1st.

Marconi's Wireless Telegraph Co., Ltd.

This company is holding an extraordinary general meeting at the Hotel Metropole to-day (Friday), when a resolution will be proposed increasing the capital by the creation of 500,000 new ordinary shares of £1 each, to rank for dividends declared in respect of the period commencing January 1st, 1914, but in all other respects to rank *pari passu* with the existing 750,000 ordinary shares of £1 each. In a circular issued to the shareholders, the directors announce their intention to at once proceed to erect the stations in accordance with that contract with the Postmaster-General, which provides for payment when completed. The circular continues:—"The company has secured, and is also in negotiation for a number of valuable concessions from foreign countries for the erection of stations and the conduct of telegraphic services between this country and the principal commercial centres abroad, which, when organised, should place the company in a position of controlling perhaps the most extensive telegraph business in the world. With this programme there is every reason to expect that the company will secure a substantial and increasing revenue of a permanent nature without reference to the profit dependent upon the position which the company may hold by virtue of its patents. Additional strength is given to the company's position abroad by an arrangement which has been made for the acquisition by this company of the majority of the shares of the Compagnie Universelle de Telegraphie et Telephonie sans fil, of France, which company not only commands a valuable influence in certain foreign countries, but also owns the world-wide rights, other than those of Germany, of Prof. Goldschmidt's inventions, including his high-frequency alternator."

In order to be in a position to efficiently fulfil the above programme this increase of capital is proposed.

"This increase in the capital will secure the company in the strong financial position which is required, having regard to the rapid development of the wireless industry and to the company's operations. If the resolution be duly passed and confirmed, your directors propose immediately to offer to the shareholders 250,000 shares at the price of £3 5s. per share."

The subscription of the whole of the issue of 250,000 shares at £3 5s. per share has been guaranteed by Messrs. Helbert, Wagg and Russell and the Banque d'Outremer.

Marconi Wireless Telegraph Co., of the River Plate.—The annual general meeting of this company was held on August 29th. The report for year ended May 31st was approved. It states that the plans and specifications of the high-power station to be erected at Punta Piedras have been completed and that the installation of the machinery will commence in October. The station will be the most powerful in the world, and it is anticipated that direct communication with Europe will be carried on day and night, it having been decided, on the advice of Mr. Marconi, to increase the power of the station from 300 to 1,000 kw., in order to eliminate the perturbations hitherto experienced in passing through the tropical regions. The profit and loss account shows a debit balance amounting to $105,740.68 gold.—*Review of the River Plate.*

Dundee, Broughty Ferry and District Tramways Co.—In moving the adoption of the report, which recommended a dividend of 2½ per cent. on the ordinary shares, ex-Provost Brownlee said they would have to face the difficulty in the coming year of the taking over of a portion of their line by Dundee Town Council, which had the right, on August 15th next, of taking over that portion of the line from the old Dundee boundary to the new eastern boundary at Craigie. Everything was going on satisfactorily, and it looked as if that state of affairs would continue, whether the portion of the line was taken over or not. Mr. George Balfour, in seconding, said that whenever Dundee Town Council approached them they could rest assured that the company would display a spirit of sweet reasonableness at least equal to that displayed by the various municipalities engaged in the recent annexation controversy. The report was adopted.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock, payable October 1st, for the six months ended that date, have been posted.

Anglo-Portuguese Telephone Co., Ltd. — The directors have declared an interim dividend of 4 per cent., free of income-tax, on account of the year ending December 31st next.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. on the ordinary shares, payable October 15th, and one of 3½ per cent. on the preference for the six months ending October.

Prospectus.—*Bell Telephone Co., of Canada.*—Messrs. Higginson & Co. have been offering for sale $4,500,000 5 per cent. bonds, 1925, at 98½ per cent.

Japan.—The amount of capital invested in new electrical undertakings, and in the extension of existing concerns in Japan during the eight months ending with August last, amounted to £4,434,700.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the six months ended June 30th last payable on October 15th.

Dick, Kerr & Co., Ltd.

The directors report that the profits earned during the 12 months' trading to June 30th, 1913, amount to £30,092, which, added to the sum brought forward (£10,016), make a total of £40,108. Out of this sum the debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £11,483, leaving a balance of £28,625 available for appropriation as under: To pay a dividend of 6 per cent. per annum on the preference share capital, £18,300 (the dividend for the half-year to December 31st, 1912, has already been paid, and the dividend for the half-year to June 30th, 1913, will be paid on October 1st); to carry forward £10,325. Whilst the profits for the year are sufficient to cover the payment of the debenture interest and the preference dividend, leaving the profit to be carried forward slightly larger than the amount brought forward from last year, the directors regret that they are unable to recommend the payment of a dividend on the ordinary shares. The special reserve of £16,000, which has appeared on previous balance-sheets, being not now required in connection with the matter in respect of which it was originally instituted, the board have transferred the same to a "reserve for depreciation of investments," and have thereby reduced the book value of the investments. The lamp department having been organised on commercial lines, a trading account in respect thereof has been opened as on July 1st last.

The meeting will be held on October 9th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th last of 2s. 6d. per share.

Babcock & Wilcox, Ltd.—An interim dividend of 7 per cent. on the ordinary shares is announced for the half-year ended June.

Continental. — France. — La Société l'Accumulateur Tudor, of Paris, reports a profit of £27,037 for the last financial year.

La Compagnie Electro-Métallurgique Franco-Espagnole is the name of a new company which has lately been formed in Bordeaux (11, Place du Quendrices) with a capital of £20,000.

Bank Rate Changed.—The Bank Rate was yesterday raised from 4½ per cent. to 5 per cent.

STOCKS AND SHARES.

Tuesday Evening.

As though to confuse the Stock Exchange as much as possible, the business in the Balkans seems to be starting over again through the unexpected action of Albania. The possibility of the whole affair being reopened tended to cast a fresh damper upon the Stock Exchange, where spirits fell, and prices with them. The threatening aspect of labour in certain directions is also an unfavourable factor; and as soon as one strike is settled, another springs up to take its place with a regularity that tends to become monotonous.

People in the Stock Exchange are beginning to ask whether events are not drifting towards an intolerable state of affairs in the labour world, and a possible conflict of something more than opinion between employers and employed. The formation of a defence union on behalf of the former class is one of those signs of the times which may prove to be of grave significance; at any rate, the investor views domestic securities more and more from the standpoint of a possibility of labour war upsetting profits and prices, and he demands a return on his money commensurate with the risks run.

Home Railway stocks, on the whole, are dull. The market enjoyed a brief spurt of strength in the middle of last week, but within the last day or two the foreign political situation, which cast a cloud over Consols, weighed heavily also upon the Home Railway section. Metropolitans and Districts gave way with the rest, and Underground Electric shares, after touching 4$\frac{1}{16}$, reacted a trifle; the 1s. shares have been keeping about 10s. East London Ordinary drooped to 7½, and the company's junior Debenture stocks are lower.

Electric Lighting shares remain decidedly firm. It must be admitted that business is on a small scale, and the revived talk about the possibility of the City of London Corporation taking over the City of London Electric Lighting Company has had no particular effect since our last notes were written. County of London Ordinary, on the other hand, hardened to 12, and suggestions are being thrown out that the Corporation might not stop at the City company. The other members of the London group are very firm. Notting Hills have risen to 10⅜, St. James' hardened to 9¼, and Charing Cross Ordinary advanced to 4¾. South Londons are easier; Westminsters went back to 9.

Last Friday's meeting of the British Westinghouse Company was responsible for the bringing forward of an alternative scheme of reorganising the company to that which was proposed by the directors. That this would probably be the case was hinted here last week, but it was known in advance that the modification would be offered in no hostile spirit, and the chairman had no difficulty in showing that the plan put forward by the board was really the only one likely to be accepted by the larger interests. The price of the shares has hardened a little to 20s. 7½d.; the 4 per cent. Mortgage Debenture stock at 67½ is steady, and there seems to be little doubt that the alterations will be carried through in due course.

Marconis went back to 3⅞ upon the proposal to increase the capital by the offer of new shares to proprietors at £3 5s. per share. This was counterbalanced by the announcement that the company had arrived at an agreement with the Goldschmidt interests, which should be an excellent thing for both. The price of Marconis thereupon rose to 4$\frac{1}{16}$, but afterwards dragged a little, and finished the week, so far as we are concerned, at 4. Such a concern must be for years to come a continual spender of money as the development of the business requires it. There will be a small bonus involved by the offer of the new shares at 3¼, and the market ought to be relieved, inasmuch as the chance of a heavy increase in capital had been feared for some time past. Americans and Canadians continue in the close vicinity of 1$\frac{1}{16}$ and 11s. 9d. respectively.

Brazilian Tractions went back to 95½, after being up to 98½. The reaction was associated with statements to the effect that the bond issue lately made in Paris by the Brazil Railways, was not a great success, and that for this reason, sales of other Brazilian securities had been coming from Brussels and other places on the Continent. The public look at Brazilian investments of all kinds with some degree of caution just at present, having regard to the uncertainties surrounding the rubber industry, whose product forms so considerable a part of the revenues of Brazil, its railways, and its other industries. Cables from the country tell of business being upset seriously by the crisis in the rubber trade, so it is not surprising that about all things Brazilian there should be just now more than a flavour of speculation.

The Telegraph market continues to show decided firmness, and the way in which some of the prior-charge stocks have been advancing is particularly noticeable. Several shares, too, which were quoted *ex* dividend last Friday, have recovered the distributions. Anglo-American Telegraphs are better than they were, and Reuters rose ⅛ to 10⅛. Mackay Common stock fails to recover from its flatness of last week, and the Preferred has fallen a point. Oriental Telephones are a little better at 1$\frac{3}{16}$. The rises in the pre-ordinary issues range from ½ to 2½ points.

A feature amongst Mexican descriptions is a sharp fall in the price of Mexico tramway shares, the drop being no less than 6½ points. This came about in consequence of rumours as to a possible reduction in the quarterly dividend, which for some time past has been at the rate of 7 per cent. The bonds are unchanged, and the Common shares recovered from the worst, although the next official intimation of the dividend is awaited with keen interest. Rio Tramway bonds are firmer, and Singapore Tramways 5 per cent. Debenture stock rose 3½ to 88 *ex* dividend, this following upon the recent buying of the shares, to which attention was drawn here last week. British Columbia Electric Railway issues are a trifle easier. Calcutta Trams rose to 6¼.

In the Manufacturing group, British Insulated and Helsby Cable shares advanced to 8½, *ex* the dividend. A small amount of the company's 4½ per cent. Debenture which happened to come to market was eagerly snapped up at 101¾. India-Rubber shares have again improved, at 13¾, being 10s. higher, while small advances occurred in Castner-Kellners and in Callender's Preference. The Rubber share market, after its bout of flatness, rallied a little, but there is no particular faith placed in the outlook for the moment, and only courageous buyers are taking a hand just now.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Sept. 24	4,625	+ 430	39	38,611	+ 2,929	..	..
Blackpool-Fleetw'd	„ 27	7,089	+1,265	12	24,746	+ 3,916	8	..
Bristol	„ 19	35,638	+1,504	..	£04,842	+ 42,832	30·5	..
*Brit. Elec. Trac. Co.	„ 19	167,475	+8,740	..	..	..	429·8	..
Chatham and Dist.	„ 25	4,063	+ 464	38	35,£90	+ 2,114	14·98	..
Cork	„ 25	2,151	+ 149	38	19,2&9	+ 351	9·89	..
Dublin	„ 26	12,498	—11,217	..	220,388	— 6,100	54·25	..
Hastings	„ 25	5,595	+ 414	..	..	+ 2,973	19·3	..
Lancashire United	„ 24	7,085	+1,162	38	58,924	+ 6,886	42	..
Llandudno-Col. Bay	„ 19	2,768	+ 255	42	15,551	+ 1,368	6·5	..
London United ..	„ 26	26,481	+1,002	..	247,096	+ 2,462	..	..
Tyneside	„ 24	2,106	+ 47	13	6,931	+ 478	11	..
Anglo-Argentine ..	„ 23	216,178	+10,306	39	2,100,690	+175,757	..	..
Auckland	Aug. 29	19,543	+ 941	7	41,610	+ 1,150	25·46	1·84
Bombay (B.E.T.) ..	..	..	..	..	..	..	..	..
Brisbane	„ 31	29,970	+ 2,290	35	207,178	+48,784	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 29	19,685	+2,083	..	..	+98,371	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	Aug. 31	3,357	..	35	23,379	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	3,812	+ 248	39	30,620	+ 2,265	15·25	1
Montevideo ..	..	..	..	..	..	..	..	..
Cen. London Rly.	„ 27	17,176	—1,762	38	187,299	+ 9,048	6·78	·4
City & S. Lon. Rly.	„ 27	10,548	— 698	39	108,611	—10,185	7·26	..
Dublin-Lucan Rly.	„ 26	539	— 136	12½	2,190	+ 66	7	..
L'pool Overh'd Rly.	„ 28	6,744	+ 406	39	67,078	+ 5,190	6·6	..
London Elec. Ry. Co.	„ 27	49,565	— 15	39	527,440	+ 3,780	21·25	..
Mersey Railway ..	„ 29	9,189	+ 34	39	86,982	+ 5,018	4·5	..
Metropolitan Rly.	..	71,011	+4,664	39	665,427	+17,816	29·25	11·5
Met. District Rly.	„ 27	49,462	+ 531	39	502,869	+18,459	25	..

* Includes railways and tramways.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9⅛	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	+ ⅛	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 5	+ ⅛	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	.	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4	..	5 12 6
Do. Do. 4 % Deb. ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord. ..	10	6	5†	11¾ — 12¼	+ ⅛	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞ xd	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞ xd	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	..	7¾ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	2	2½	..	1⅝ — 1⅞	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅝ — 3⅞	..	5 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 98	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	.	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10¾	+ ⅛	5 11 7
Oxford	5	7	6†	6⅞ — 6⅞	..	5 9 10
St. James' and Pall Mall, Ord.	5	10	10†	9 — 9½	+ ½	5 5 3
Do. 7 % Pref.	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2¾ — 3⅛	— ⅛	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/32 — 1 3/32	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	94 — 97 xd	..	4 12 9
Urban, Ord.	£3	Nil	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	3	..	2⅜ — 2⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 88 xd	..	5 1 5
Westminster, Ord.	5	10	10†	8⅜ — 9½	— ½	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	.	5 17 1
Calcutta, Ord.	5	8½	..	7⅛ — 7⅜	+ ⅛	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7†	111 —115 xd	..	6 1 9
Do. 7 % Pref.	$100	7	7	117 — 122 xd	+ 1½	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅜ — 4⅜	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93 xd	..	5 7 6
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6		93 — 95	+1	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	— 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	..	9/16 — 5/8	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5		103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5		77 — 81	—1	6 3 5
Mexican Lt. & Power, Common	$100	4	4	66 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	96 —101	— 1½	6 18 7
Do. 5 % 1st Mort. Gold Bds.	.	5	5	90½ — 92½	— ½	5 8 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	78 — 80	..	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	73 — 76	— ½	6 11 7
Montreal, Lt., H. and Power ..	$100	9	10†	217 —227	+2	4 8 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	6½	6†	140 —144	..	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	13/16 — 15/16	+ 1/16	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	+2	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	132 —134 xd	..	5 19 5
Do. Collat. Trust	$1000	4	4	92 — 94	+1	4 5 1
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105½ —106½	..	5 12 8
Do. Def.	Do.	30/-	..	23⅛ — 23⅝	+ ⅛	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81½ — 83½ xd	+2	4 15 10
Cuba Telegraph	10	6	6†	8½ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	14⅝ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝ xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6⅝ — 7¼ xd	+ ¼	6 12 0
Direct United States Cable ..	10	4	4½	6⅝ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	128 —131	+ ½	5 6 10
Do. 8½ % Pref. Stock	Do.	8½	8½	75½ — 77½	+ ½	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	97 — 99	+2	4 0 10
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	95 — 97	+2	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	£5	4	4	99½ —101½	+ ½	3 18 10
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12 — 12⅜ xd	..	4 16 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	..	6 3 1
Indo-European Telegraph ..	25	13	..	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	—1	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅞ — 4	..	5 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	8½ — 8⅝	..	5 0 9
Monte Video Telephone, Ord. ..	1	6	6	1 5/16 — 1 7/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99½ —100⅝	..	4 11 4
Oriental Telep. and Elec. ..	1	10	..	1⅝ — 1⅞	+ 1/32	5 6 8
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9⅞ — 10⅜	+ ⅛	9 18 10
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅞	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9⅝	+ ¼	6 3 1
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	93½ — 95½	+ 2½	4 3 9
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	+2	4 12 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.o. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	5/16 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	3 1/2 — 3 5/8	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75 xd	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	49 — 52	+1	5 15 5
Do. 5 % Perp. Deb. ..	100	5	5	92 — 95 xd	..	5 5 3
Do. 4½ % 2nd Deb. ..	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. Pref.	100	4	4	77 — 79	..	5 1 3
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref. ..	1	5	6†	½ — ¾ xd	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71 xd	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 2/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	77 — 81	+2	6 3 5
London and Suburban, Ord. ..	1	..	..	½ — ⅝	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 9/16	—1/32	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	78 — 78	—1	5 15 5

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.o. £ s. d.
	*					
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	—1	6 5 0
Metropolitan Railway Consol. ..	100	1⅝	1⅝†	46¼ — 46¾	— ⅜	3 4 2
Do. Surplus Lands	100	2⅜	2⅜†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	+1	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord. ..	100	Nil	..	83¾ — 84¼	— ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Potteries, Ord.	1	3½	..	3/32 — 1/32	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	— ⅛	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	109 —111	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	90½ — 91½	— ½	6 11 2
Yorkshire (West Riding), Ord.	5	Nil	..	1/8 — 3/8	..	Nil
Do. 6 % Pref.	5	8	1½†	8⅜ — 8⅞	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams. 1st Pref. ..	5	5½	5½	4 1/16 — 4 1/8	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	+ ½	4 11 5
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	5	6	10⅜ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	95½ — 96½	—2	6 4 4
Brisbane Trams Invt., Ord. ..	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	125 —123	—1	6 5 0
Do. Pref. Ord.	100	6	6	111 —115	—1½	5 4 4
Do. 5 % Pref.	100	5	5	101 —105	—1½	4 15 3
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	91 — 94	—2½	4 10 5
Calcutta Trams, Ord.	5	7½	..	6 — 6½	+ ¼	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1 1/16 — 1 3/16	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5 5/16 — 5 9/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$ .000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	8	..	25 — 35	..	..

La Plata Elec. Trms, Ord. ..	1	..	..	3/8 — 1/2	—1/32	..
Do. Pref.	1	4⅜d.	6	5/8 — 1 xd	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	5	6	1 5/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	5	4⅝ — 5 xd	..	6 0 0
" Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7	90 — 94	—6½	7 8 11
Do. 5 % Bonds	..	5	5	91 — 93	..	5 7 6
Do. 6 % Bonds	100	6	6	93½ — 95½	..	6 5 8
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	6 — 6¼	..	7 18 10
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102½ —103½	+ ¼	4 16 7
Do. 5 % Mort. Bonds ..	100	5	5	97 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102½ — 104½	..	4 15 8
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90 xd	+ 3½	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 1/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100	..	4 9 7

MANUFACTURING COMPANIES.

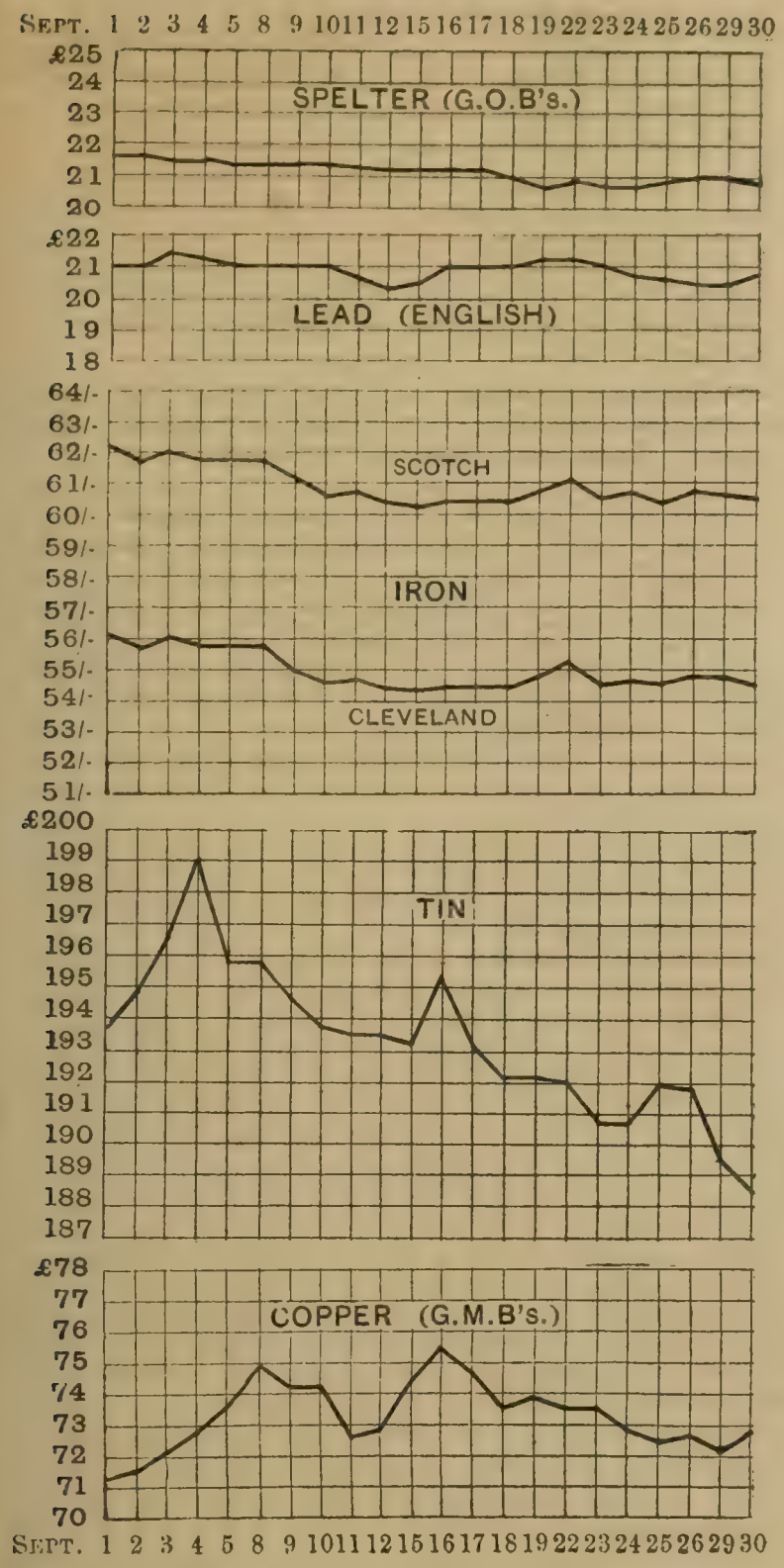
Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	5	6	21/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	3 1/16 — 3 1/8	..	5 0 5
Do. Pref.	1	6	6	1 1/16 — 1 1/16	..	4 3 6
British Aluminium, Ord. ..	1	..	..	31/32 — 1 1/32	..	..
Do. 6 % Cum. Pref.	1	6	6	1/16 — 1/16	..	6 8 0
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 3
Do. Deb. Stk.	100	5	5	84 — 86	+ ½	5 16 8
B. I. & Helsby Cables	5	10	..	8 1/16 — 8¾ xd	+ 3/16	5 14 3
Do. Pref.	5	6	6	6 — 6½	+ ¼	4 12 4
Do. Deb...	100	4½	4½	100 —103	+1	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾	..	4 14 0
British Westinghouse, Pref. ..	3	Nil	..	1/16 — 1⅛	..	Nil
Do. Deb...	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —8/-	..	Nil
Do. Pref.	1	..	..	8/- —8.6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	..	11 — 11¾	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	—1/16	4 17 7
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	8 1/8 — 8 1/16	—1/16	5 1 7
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	..	54½ — 59⅛	..	8 8 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	3/4 — 15/16	..	7 13 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	63 — 68 xd	..	7 7 1
Electric Construction	2	5	..	1 — 1¼	..	8 0 0
Do. Pref.	2	7	7	1⅞ — 2⅛	..	6 11 9
Greenwood & Batley, Pref ..	10	7	7	6¾ — 7½	..	9 13 2
Do. Deb...	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref. ..	10	6	6	9½ — 10½	..	5 14 8
Do. Deb...	100	4	4	87 — 92 xd	..	4 7 11
Henley's, Ord.	5	15	10†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13¼ — 14½	+ ½	5 5 3
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 18 9
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb...	100	4	4	96 — 98	..	4 1 8
Willans & Robinson	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim d

METAL MARKET.

Fluctuations in September.



A Big Gas Engine.—Writing in *Power*, Mr. F. R. Low gives some particulars of the power plant in the Ford Motor-Car Works, in Detroit. The first unit installed was a 35 × 48 in. two-cylinder tandem producer-gas engine, running at 100 R.P.M. It drives an 850-KW. Western Electric generator and a 2,000 cb. ft. air-compressor, to which it is cross-connected, and develops only about one-quarter of the power which the works at present demand. The new large engine was built at Hamilton, Ohio, by the Hooven, Owens, Rentschler Co. The engine casting is designed symmetrically around the centre line. There is no massive bed-plate ; the weight is carried directly by the foundation with light sole-plates and guides at the places where movement will take place. There are four double-acting cylinders, 42 × 72 in., two in tandem upon each side, held together with four 6-in. tie-bolts. The engine is designed to run at 85 R.P.M., or 1,020 ft. piston speed. There have been gas engine cylinders of greater diameter, but this length of stroke gives, it is believed, the greatest displacement that has yet been attained per cylinder. The length of the engine from the front of the pillow-block to the end of the tail-rod extension is 73 ft., and its overall width is 32 ft. The crankshaft is 32 in. in diameter, 25 ft. long, carrying an 80-ton fly-wheel and a 2,500-KW. generator armature, and the connecting rods weigh 10,300 lb. each. The generator is capable of carrying a 25 per cent. overload, and the engine has a capacity of 5,000 I.H.P. The lay-shafts are driven by bronze worms upon the main shaft, and are divided by pin couplings, so that, as expansion takes place, each section remains with its particular cylinder. Each lay-shaft carries four cranks, one for each end of each cylinder, and each crank operates both the inlet and the exhaust valve of the end which it serves. Both of these valves are of the mushroom type, and are located in pockets in the bottom of the cylinder. Governing is by the quantitative method, and the governor, which is of the Jahns type, has no other work to perform than to adjust the position of the tripping cams. The entire gear is direct-acting, simple and accessible. Water for cooling the pistons is taken in at the crosshead between the two cylinders through a telescopic rod.

THE MUNICIPAL TRAMWAYS CONFERENCE.

In our last issue (page 505) we briefly referred to the opening day's proceedings of the Municipal Tramways Convention, which was held at Sheffield last week. The proceedings commenced with an informal reception at the Victoria Station Hotel on the Tuesday evening, and on Wednesday and Thursday Mr. A. R. Fearnley presided over meetings at the Town Hall, where the visitors received an official welcome by the Lord Mayor (Ald. S. Osborn) on Wednesday morning. Fortunately for the visitors, the steel city was in its sunniest mood, and this, coupled with the complete programme which had been arranged, made the three days' stay a very pleasant one.

Many of the visitors were entertained at luncheon by the Sheffield Tramways Committee on both Wednesday and Thursday ; on the evening of the former day, many availed themselves of the Tramways Committee's invitation to the Lyceum Theatre, and subsequently to supper at the Town Hall, at the invitation of the Lord Mayor.

For Thursday afternoon a series of visits had been arranged to local works, including those of Messrs. Edgar Allen & Co., Hadfield's Steel Foundry Co., and S. Osborn & Co., and to the local power stations, tramway depôts, and Sheffield University. In the evening the annual dinner took place at the Victoria Station Hotel, which was the head-quarters of the Association during its visit.

On Friday morning an early start was made with the annual business meeting, at which Ald. H. Lindsley, Salford, was elected president, and Mr. Peter Fisher, Dundee, vice-president of the Association for the ensuing year ; subsequently the day was almost wholly devoted to an excursion to the Dukeries, including a visit to Welbeck.

Presidential Address.

In the course of his Presidential address, Mr. A. R. Fearnley (general manager, Sheffield Corporation Tramways) said that 19 applications were deposited in Parliament by municipalities at the beginning of the year, relating wholly to or containing clauses as to tramways, motor-'buses, or railless traction powers. In actual tramway operation, improvements were constantly being brought about. There was a tendency on all systems to improve "running time," and large sums were being spent in removing small equipments with which cars were fitted 12 or 14 years ago, and replacing them with equipments double the size and of an improved type—the interpole motors having proved a success and now being generally adopted as more capable of coping with the heavier traffic requirements of to-day.

In those towns which were early in the field with electric traction, car bodies were being re-designed and reconstructed, giving easier and safer access, with covered top decks and increased carrying capacity. Speeds were gradually being increased, with the result that calls had been made upon the power-house and permanent-way branches of the department earlier than they would have been under the old condition of things.

As a result of the experience gained, better work was being put into tramway tracks to-day than at any time previously in the history of the undertakings ; the mechanical joint was rapidly becoming obsolete, and welded joints were being almost universally adopted.

The idea of isolating the tramway power house from the other supply stations in the district was being abandoned, and in Sheffield they hoped before the end of the year to have completed arrangements by which any of the three power houses would be available for tramway supply, in case of heavy load, and at other necessary times. In other words, the plant which was being used during 5½ days in the week to supply power to the large works in the east end of the city, would be available for week-end, Bank holiday, and football traffic. In addition, demands for more frequent services had to be met.

The length of the 1d. stage was playing a more important part in the development of municipal areas than many people had any idea of. It was one of the most valuable assets of all large towns to be able to transport their passengers a distance of three miles from the centre for 1d., and very wide benefits would be derived from a policy of this description.

In 1912 the railways of this country only added 24 miles to their tracks, and carried nearly 32 millions fewer passengers than in the previous year ; whereas on the tramways the passengers carried for the 12 months dealt with in the last Board of Trade Return showed an increase of 220 millions on the previous year.

The decision of Parliament on the London County Council (Tramways and Inprovements) Bill, 1913, and the reversal of the Parliamentary Committee's decision with regard to compulsory running powers was a notable victory for the County Council, and might be useful to many of them on future occasions. The decision of the Lords of Appeal on the Rating of Tramways was a disappointment, and meant a reversion to the previous heavy charge that was made upon them each year for the rating of their systems. To the Sheffield tramways the decision meant an extra charge of £4,200 per annum. The report of the Select Committee on Motor

Traffic appeared to assist in many ways the demand for equality of treatment for which they, as tramway owners and operators, were now asking. The essentials on which the Committee agreed were definitely stated. Summarised, they meant control by a Government department in consultation with local authorities. It was quite clear that whatever the results of present developments might be, the leading municipalities, at any rate, intended still to control the systems of traction, and it remained for them to see that their sinking funds were in such a healthy condition that they were in a position to take advantage of any change that might be found to be advisable. The 30-year loan periods which were granted when powers were obtained in the early days to construct the tramways might not after all turn out to be the advantage which at that time they considered them, seeing that in many cases all the available balances were used for other than tramway purposes.

During the past session in Parliament a considerable number of municipal authorities had obtained powers to work motor traffic, and his remarks on this subject chiefly referred to the motor-'bus. He recognised that the question of the motor-'bus was the one that, next to their own business, loomed largest in the minds of most tramway operators in the country, whether municipally or company controlled. To some members it was a question of unfair competition with the tramways, and, perhaps, for the moment only, that was the most serious phase of it. There would, he was sure, be unanimity in accepting and supporting the resolution put forward by the Croydon and other Borough Councils in the Metropolitan area in this matter.

To a number of municipalities it was either a question of extension of their tramways or substitution by the motor vehicle or trolley car, and this was undoubtedly the most interesting problem for the provinces. His personal views on this matter were that there were good types of motor and trolley vehicles to be obtained, the carriage portion of which, however, was somewhat crude and ugly, and followed much too closely upon the lines of the old horse 'bus, and provided very limited accommodation when compared with that to which tramway passengers were now accustomed; that there were very few roads in the provinces which were really suitable yet for such a vehicle, and that it was now more a problem of the road than the vehicle.

There was a large mileage of tramway permanent way which required, or would shortly require, renewal. Here, then, was an opportunity for some authority to make an interesting and valuable experiment by taking an existing tramway route, the traffic results of which were well known, and deciding that the tramway service on this route should at least experimentally, if not permanently, be withdrawn and a suitable road surface be laid down and motor 'buses or trolley vehicles substituted for the cars.

The motor or trolley vehicle would cut down the available comfortable accommodation for over six months in the year to one-third the present accommodation, if a similar service and a similar number of vehicles as were already provided by the tramways were substituted. The total working expenses should certainly not be more than total tramway costs, which figure, however, would not include any allowance for road maintenance over and above the petrol tax of 1½d. per gallon, so that if the routes were outside the city or borough boundaries, this figure would need adding on, at any rate, until the question of contribution to road maintenance was finally settled. There was no difficulty in obtaining contracts for the maintenance from first-class firms at 1d. (or less) per 'bus-mile, and instead of motor spirit being more expensive, as was anticipated, the present indications were that before very long there would be a drop in price, so that 'buses might be worked at an even lower figure than they were to-day. So far as electrically-propelled vehicles were concerned, electric power promised to have the same tendency.

They must try and keep an open mind when considering this question. Although, so far as he could see at present, there was little likelihood of the motor-'bus taking the place of the tramcar for heavy traffic, it must be remembered that great improvements were likely to be made in the efficiency of the present vehicles. It would be of great advantage to them all when reliable figures were published in detail under the standard form of tramway accounts, as he anticipated they would be early next year by quite a number of municipal tramway departments.

The Sheffield Tramways Committee ordered 10 'buses, and they had been working regular services since the beginning of February last; the 'buses were at work on four routes, and a fifth route was to be opened next month. The vehicles had proved reliable in service, and had now run over 100,000 miles. In two instances they had been taken out into the country districts, three miles from the tramway routes, and in both these cases the traffic had been very heavy, especially on fine days and during week ends. If reasonable use could be made of the vehicles during the winter months, there was no doubt that next summer they would require a much larger number of 'buses and would have to go still further afield in order to meet the requirements of their passengers.

Of course, before adopting such a change, trackless trolley cars must have the serious consideration which they undoubtedly deserved.

The Advantages and Disadvantages of Platform Fare Collection.

By Ald. Flint, Leicester.

Although this paper is of considerable interest to the budding tramway manager, it scarcely lends itself to reproduction in the Electrical Review.

It may be briefly summed up as a history of fare collection on the Leicester Corporation tramways, profusely illustrated with tramway tickets, passes, &c., and as the historian happens to be the chairman of the undertaking, probably little has been left untold.

From it we gather that Leicester is blessed with an amazing and, to the stranger, confusing variety of tickets—overlapping discount, transfer, return, return-transfer, &c.—as well as with passes for blind and crippled persons.

While we are, of course, unable to appreciate the niceties of these blessings in disguise, it is at least certain, judging from the statistical table contained in the paper, that the Corporation tramway receipts have steadily gone ahead during the past few years, and that the undertaking is in a flourishing condition.

But the part of Ald. Flint's paper which will appeal to our readers deals with the P.A.Y.E. system in use at Leicester. Referring to the cars, he says :—

> The platform is divided into two gangways by means of a rail, behind which the conductor stands and collects the fares as the passengers board the car.
>
> Passengers, on paying their fares, receive a ticket, the colour of which denotes the stage to which they are entitled to travel, and on leaving the car the ticket is deposited in a sealed box fixed on the platform, specially designed for this system, which enables the motorman or conductor to detect by the colour of the ticket whether a passenger is over-riding.
>
> Transfer and workmen's tickets are issued on these cars, but passengers are not required to deposit these tickets, but to show them on leaving the car.
>
> Pay-as-you-enter tickets are numbered in the usual way, and booked on the way-bill, but are not punched, as, if a conductor issued an old ticket, he would be detected at once by the number if an inspector boarded the car.
>
> In considering the experimental adoption of the pay-as-you-enter system, consideration was given to the advantage of minimising the risk of accidents caused through passengers attempting to board and alight from cars whilst in motion. During the year ended December 31st, 1912, at Leicester, 449 persons received injuries through attempting to board or alight from cars whilst in motion.
>
> Our experience with pay-as-you-enter cars proves that accidents of this description are practically nil. The conductor, always being on the platform of the car, is enabled to prevent people from risking this foolish practice.
>
> We find that the cars run well to time, and there is no more trouble or time lost in loading these cars than the ordinary ones.
>
> The motormen and conductors working these cars are very much in favour of this system, the conductors because they can do their work more efficiently, and without the excessive strain of constantly going up and down stairs to collect fares, and at the same time keep a proper look-out for intending passengers; the motorman, because he can give the whole of his attention to his own end of the car, and knowing that the conductor is always on the back platform, it is not necessary for him to strain his neck in endeavouring to make quite sure the back platform is clear before starting the car.
>
> The route selected for the experimental trial of this system (Narboro' Road) was previously a through route, and was chosen chiefly because it was a short distance and thickly populated.
>
> The passengers are restricted to the district, and over-lapping passengers, who are very numerous, due to the principal railway station being at the end of the over-lapping stage, have been diverted to another section.
>
> The receipts for 12 weeks ending July 5th on P.A.Y.E. cars amounted to £2,798, passengers, 703,134; in the corresponding period of 1912 the receipts were £2,827, passengers, 681,578, or a decrease of £29 in receipts, the increase in passengers being accounted for by the recent introduction of ½d. children's fares.
>
> The Western Park route, however, which has been altered to the through route, shows receipts for the same period of 1913 of £2,176, against £1,444 for the corresponding period of last year, or an increase of £732, due in a great degree to the overlap and through riding.
>
> Taking this into consideration, there has undoubtedly been a considerable increase in the sectional receipts, quite equal to, and, I think, in excess of, the average over the whole system.
>
> Naturally we have had a certain amount of public criticism in introducing a new system; this was only to be expected.
>
> The chief complaints were :—
>
> Passengers on the upper deck had to leave their seats some distance before reaching their stopping point to notify the driver.
>
> The continual opening of doors on the upper deck made the cars very draughty.
>
> There was no accommodation for luggage.
>
> The staircases were narrow and steep.
>
> The last two were the principal objections.
>
> All these points have now been met. Accommodation has been provided for luggage, and the design of the staircases is being improved.
>
> The first objections were overcome by allowing passengers *en route* to leave the car by either staircase.
>
> At the present time I do not think there is anything to which any reasonable person could raise objection.

The paper also contains a list of instructions to conductors on P.A.Y.E. cars; numerous reprints of conductors' way bills; and a plan and statistics of the Corporation tramways.

Councillor J. A. Smith (Aberdeen) complimented the author on his admirable explanation of the complicated ticket system at Leicester. The Aberdeen Corporation had also adopted the P.A.Y.E. system, and 11 such cars had been employed on a 2½-mile route during the past five months. The Aberdeen cars differed somewhat in construction from those in use at Leicester and the fare system was simpler. Although congestion of entering passengers was feared when the cars were introduced, no difficulty had been experienced, as the great majority of the passengers had their fares ready. Under the old system the journey occupied on the average 35·1 min., and with the P.A.Y.E. cars this had been reduced to 34·2 min. Their experience in regard to immunity from accident agreed with that of Leicester, and the Aberdeen police were decidedly in favour of the new cars. Some small constructional alterations had been suggested, and would be incorporated in new cars when, in the near future, the extension of the system to other routes in Aberdeen came up for consideration. Fare collection was much facilitated; the average receipts on the route were over £23 per week better during the 20 weeks of running, although some of this was due to the natural increase in traffic.

Bailie Alston (Glasgow) asked how the author's colour scheme for distinguishing tickets would work with, for instance, a Glasgow route containing 35 ½d. stages, besides 1d., 1½d. and 2d. stages. He also wished for more accurate figures for the natural increase of traffic on the P.A.Y.E. route at Aberdeen.

Mr. W. A. Luntley (Wolverhampton) thought it possible that the conductor might reap the benefit from the ticket discount system at Leicester; he doubted whether the conductor on a P.A.Y.E. car could have more time to look out for passengers.

Mr. A. L. C. Fell (L.C.C.) discussed the application of the P.A.Y.E. system to the L.C.C. cars; it would be a costly matter to alter the present platforms and staircases of 1,750 cars, and there was the question of royalty to be considered. He thought that time would be lost while loading, and waiting passengers would be snapped up by the competing motor-'buses; it would also be impossible to compel all passengers to have their fares ready. It would, however, be in favour of the system that the driver would be free from other duties than driving.

Councillor Buist (Dundee) pointed out that the speed of the P.A.Y.E cars at Aberdeen was only about five miles an hour, and another speaker remarked that the drivers of these cars at Leicester had the additional duty of checking the tickets of passengers getting off the front end.

Mr. J. M. McElroy (Manchester) said that he had been impressed on a former visit to America with two factors in their tramway working, viz., danger to passengers boarding cars and difficulties of ensuring fare collection. On his recent visit he found great changes connected with placing the conductor on the rear platform, which ensured fare collection and practically got over the heavy liability for accidents, which had formerly amounted in compensation to 5 per cent. of the receipts. The universal fare in America facilitated a system such as the P.A.Y.E., but difficulties arose in its application to English undertakings with their complicated fare systems. In the latest American P.A.Y.E. cars, the passengers boarded at the front end, and as the driver had to shut the door and fold the step before he could start, accidents were almost impossible to passengers entering.

Ald. Banton (Leicester) assured the meeting that the P.A.Y.E. cars were, if anything, quicker to load, possibly due to the organised stream of entering passengers.

Ald. Flint, in replying, said it was intended to use the cars on the through routes, and that it would lead to a saving of one car in 20 of those at present in use. Any delay at starting was more than saved during the journey.

To alter ordinary cars to the P.A.Y.E. system cost between £30 and £40 per car, and the royalty was £20 per car altered.

The Maintenance of Paving on Tramway Track as Affected by Sec. 28 of the Tramways Act, 1870.

By Councillor W. C. Fenton, Sheffield.

The theme of Councillor Fenton's paper was sufficiently important to warrant his effort to re-open a discussion on the subject.

Sec. 28 was passed in the days of the horse tramway, and, moreover, at a time when the operation of tramways was in the hands of companies on whom it was considered necessary to impose some safeguard in the interest of the public road authority; but, in view of the altered conditions of tramway working, it has outlived its day, and is in urgent need of revision. Indeed, that a law which has no logical application should still be the law of England is somewhat of a reflection on the gentlemen who boast of their enlightened legislation.

A revision of Sec. 28 would, on the face of it, greatly benefit the privately-owned tramway undertaking, while even the municipally-owned concern would be better off, in that its position as a trading undertaking would no longer be obscured by annual subsidies to the road authority.

This subsidy question is of more importance than appears at first sight, because of the increasing burden of road maintenance arising from the present-day heavy motor traffic, which naturally uses a well-laid tramway track wherever and whenever possible.

All these and other points are referred to by Councillor Fenton, who also draws largely on the earlier discussions on the same subject which have occurred at previous tramway conferences. As showing the vehicular traffic on the road he quotes:—

Two local instances:—In Furnival Road (near the Victoria Station) in a recent 24 hours' observation there were 3,327 vehicles proceeding in the same direction as the *down* track, and only 137 tramcars during the same period. Those 3,327 vehicles were spread over every portion of the available road not occupied by the *up* traffic. The *down* track referred to is very little used by tramcars, but the result to the rails—apart from the paving of the road—as shown by an accompanying diagram, is about $\frac{5}{16}$ in. worn off both tread and lip.

In High Street, where the largest number of trams pass to and fro, there were on an average day from 6 a.m. to 9 p.m. 3,494 vehicles (excluding bicycles) as against 2,940 tramcars, or 554 more, but this was in a wide street where the tram tracks are not so much used for ordinary vehicular traffic as in narrower streets. In this case the carriage-way was 50 ft., and in the former case 31 ft. wide only.

Mr. A. L. C. Fell has kindly supplied me with two typical cases in London from 8 a.m. to 8 p.m.

In Queen Street, Hammersmith, there were 336 electric cars and 4,140 other vehicles (excluding bicycles), including 973 motor-'buses.

In Lea Bridge Road there were 547 electric cars and 2,522 other vehicles, including 771 motor-'buses.

Cases such as the above, if they do not provide an unanswerable argument in favour of the repeal or amendment of Sec. 28 of the 1870 Act, do provide good reasons for a searching inquiry into the operation of the clause with a view to revision.

Figures quoted in the *Tramway and Railway World* for July 11th, 1912, show that for the 16 municipal systems the cost amounts to £132,584 per annum for maintenance of permanent way, and £123,787 per annum for rates, sufficiently startling figures to be worthy of the most careful thought and consideration.

The decision of the House of Lords on July 24th last, in the Tottenham Urban District Council's rating appeal in connection with the Metropolitan Electric Tramways, Ltd., has accentuated the sense of injustice which tramway concerns feel in connection with this subject. In Sheffield it has caused an increase of over £4,000 on the rates for the present year. The rating of tramway tracks is practically a rent for the "partial monopoly" of a portion of the street, and if assessed under Sec. 211 (1) (*b*) of the Public Health Act, 1875, in the proportion of one-fourth only of the net annual value, gives a very handsome rent to the local authority. But if, in addition, it not only keeps in repair the larger area of the road, and out of its profits relieves the rates—and in some important cases pays a proportion of the cost of street improvements—the argument for reconsideration becomes much stronger.

Councillor Fenton gives a number of reasons for and against having the objectionable Section of the Act revised, and further replies to the objections. The various points which he discusses have mostly been covered in our pages; he, however, mentions a matter of some interest, namely, that Parliament has recognised the principle of extraordinary traffic in the Brighton and Hove Omnibus Co.'s Act and the Chesterfield Corporation Act, where provision is made for partial payment of road widening and extra cost of road maintenance falling on those who run the vehicles.

In conclusion, assuming that the present application of Sec. 28 of the Tramways Act, 1870, is inequitable, what, says Councillor Fenton, are the suggested remedies?

(*a*) Differential rating on the basis of one-fourth the net annual value, or

(*b*) The reduction of the cost of track maintenance to tramway concerns by one-half, the local highway authority paying the remainder, or

(*c*) By both (*a*) and (*b*).

(*d*) By the repeal of the exemption under the Finance Act, 1910, referred to previously, and the formation of a fund by which local authorities shall be allocated proper proportions of the yield of the tax towards road maintenance on tramway as well as other routes.

(*e*) By the repeal of the 5th Schedule, Part 1, of the Finance Act, 1910, except Paragraph 4, thus allowing the rebate on petrol to medical men only, and the payment of the increased duty to the proposed fund referred to in (*d*) above.

The proposals (*d*) and (*e*) would then provide that those who mainly use the roads, or who chiefly contribute to their destruction, would pay directly towards maintenance and renewals.

Whilst highway authorities are responsible for the general upkeep of the roads (except as exempted by Sec. 28 of the Tramways Act, 1870), it will be only reasonable that if the burden now placed on tramways is wholly or partly transferred to the highway authorities, there should—in view of the enormous change in the character of the traffic—be some relief from imperial sources. This principle is already recognised in the grants from the Road Board, but the amounts so allotted should be considerably increased.

The paper concludes with a number of appendices intended to show as far as possible the cost of either permanent way or track paving maintenance ; in some cases the rates paid are given. From these particulars we abstract the following for the year 1912 and 1913 :—

	Maintenance and renewal perm. way.	Rates.	Maintenance cost of track paving.
L.C.C.	£125,486	£98,293	£58,334 £215 p.m., s. track.
Manchester ...	£15,169 £87 p. mile	£44,224	—
Leeds	£25,415 £414 per route mile	£19,809	—
Glasgow ...	£74,071	—	—
Bradford ...	—	—	£12,262 (estimated).
Sheffield ...	—	£10,500	£10,796
Yorkshire W.R. Tramways ...	—	£519	£4,600 av. for 5 yrs. to 1911-12.

Discussion.

Councillor Spencer (Halifax), who opened the discussion, argued that it was a financial question ; tramways were rated according to their ability to pay. The tramway was rated for the use of one street only, but the motor-'bus itself was not rated, and could use any street ; it seemed only fair that the 'bus concerns should pay according to their earnings. In Halifax, in narrow streets the tramway authority paved and maintained the whole of the road. The Road Board were apparently engaged in investing money ; he understood that three millions had been so invested, but the local authorities had got little or nothing.

Mr. Smith-Saville (Darwen) said that 12 years ago track maintenance cost them £380 per mile, but since the advent of the heavy motor traffic this had gone up to over £800 per mile. It was true that the paving round the track was the best on the road, and it had to be in order to save the rails now that such heavy motor traffic used the roads.

Ald. Cunliffe (Rochdale) said the question of track paving repairs had been mutually arranged in his town. He suggested that the Road Board was voting large sums of money for the permanent improvement of the country roads.

Ald. Trumble (Croydon) said the paper resolved itself into the question whether the Tramways or Highways Committee should pay for certain work. It did not really affect the local tax-payer. If they were going to tax wheeled traffic, it seemed only equitable to tax every vehicle, but the question was a difficult one, as had been proved in the case of Croydon, where the London 'buses were running in competition with the tramways.

Bailie Alston (Glasgow) urged that there was a difference between a vehicle which merely transported goods over roads and a vehicle which earned its income on the streets. He thought there should be some method of making such concerns as 'bus companies pay something for their accommodation.

Mr. J. B. Hamilton (Leeds) said the payments for maintaining tracks, &c., must be look'd on as a rental. It must be admitted that some wear arose from the presence of the rail, and after all, the tramways had got along very well, despite the payment. The matter had, however, been reconsidered, under present-day conditions, and it was a question whether some action should not be taken, and some resolution agreed on at the conference.

Another speaker that said in his town an arrangement had been come to by which the tramways paid two-fifths and the Highways Committee three-fifths of the cost of road paving repairs, as it was admitted that great wear arose from general dock traffic.

Mr. W. J. Squires (L.C.C.) agreed with a previous speaker that there was a difference between the omnibus earning its income on the streets and the ordinary carrying motor-vehicle.

Mr. H. M. Sayers (Tramway and Light Railways Association) said the question was of the greatest importance to the companies, and it could not be expected that the Corporations should look on the matter in quite the same way as the former. The difficulty in rating a 'bus was that it was not a hereditament in the same way as a tramway or railway was.

Mr. H. England (Wakefield and District Light Railway) voiced the increasing burden of road maintenance due to heavy road traffic in his district. He thought that what was wanted was a general overhaul of tramway legislation ; it would, for instance, be better instead of the present Parliamentary procedure, if experienced men considered proposed tramway schemes, and that they were considered more than once a year.

Mr. Hadfield (Surveyor, Sheffield) said his town had had nearly £30,000 out of the Road Board.

Councillor Fenton, in replying, said that although Sheffield was now receiving a grant of £17,000 from the Road Board, none of that would be spent on any road containing tramway tracks.

Alderman Linsley (Salford) proposed a resolution that the meeting was strongly of opinion that the time had arrived when Sec. 28 should be revised.

The Secretary (Mr. C. J. Spencer, Bradford) read a resolution passed at a special meeting in July, which practically covered the main points of the first proposal.

Mr. J. M. McElroy (Manchester) said the proper course was to let the matter stand as agreed at the July meeting, and this course was adopted.

An appendix supplied by Mr. A. de Turckheim shows local rates and repairs of permanent way paid by 34 tramway companies, 1912, as follows :—

Letter.	Miles of single track.	Total.	Per mile of single track.	Cost of rates. Total.	Per mile of single track.
A		£	£ s. d.	£	£ s. d.
(32 companies)	578·95	66,840	115 9 0	35,860	72 0 0
B	100	12,132	121 0 0	16,067	160 10 0
		22,563*	225 0 0*		
C	28·7	1,715	59 15 0	4,617	160 17 5

* Renewals.

Unfortunately the data for the various towns do not appear to be strictly comparable ; there is, however, in some instances a marked increase in cost per mile of repairs, &c., year by year during the last five years, but Manchester, where one would expect the costs to increase, due to the heavy motor traffic, shows a decreasing cost during the last two years. (*To be continued.*)

AISGILL REFLECTIONS.—II.

It was shown in our last article that on some of the Continental State Railways electricity is being exclusively adopted on all new passenger coaches, and that gas is being gradually superseded by electricity on existing trains. This change has only been brought about by the pressure of public opinion following on accidents similar in their after effects to those at Aisgill.

Many of the British railway companies did not wait for gas accidents to happen before experimenting with electric lighting ; it was tried originally for the purpose of improving the lighting of the carriages, which, in the days of oil lamps, was quite insufficient for reading purposes. In those days long-distance passengers used to provide themselves with candles and carriage lamps, which were fixed to the windows or upholstery, and in the late eighties a company was formed for the purpose of enabling those passengers who wanted a good light to have electric light by paying for it. Several trains on the District and Metropolitan Railways were fitted with the Tourtel system, which was, briefly, the following :—Each coach was provided with an accumulator fitted under the seat of one of the compartments, and each compartment was fitted with several electric lamps fixed under the luggage rack. Near each lamp was fixed a box containing a clockwork mechanism, which could be set in motion by the insertion of a penny, and this also switched on the lamp, which was maintained alight for a definite time—an hour if we remember rightly. The system did not have a long life.

Among the earliest experiments in train lighting by electricity were those carried out on the Liverpool-Manchester section of the London and North-Western Railway about the year 1884. A "Tower" spherical engine, coupled direct to a dynamo, was mounted on the platform in front of the locomotive and supplied with steam direct from the boiler. This set was kept running continuously and supplied electric light to the carriages whilst they were attached to the locomotive. Obviously, if for any reason the engine had to be detached from the train, the lights were extinguished in the meantime. This disadvantage, together with the fact that the small rotary engine was a "steam-eater," probably accounted for the short life of this system.

As long ago as 1889 the Midland Railway Co., on the initiative of Mr. William Langdon, their electrical engineer, lighted several trains by means of axle-driven dynamos. The system employed was the patent of Mr. J. H. Holmes, of Newcastle-on-Tyne, and was devised to meet the conditions specified by Mr. Langdon, who described it fully in his paper on "Railway Train-Lighting," read before the Institution of Civil Engineers in May, 1891. The lighting had to be maintained at a practically constant voltage whether the train was standing or running at any speed up to the maximum in either direction. The main dynamo, which was fixed in the brake van, had two shunt windings, one of which was in series with the armature of a small auxiliary dynamo acting in opposition to the exciting E.M.F. of the main circuit. At full speed these E.M.F.'s

neutralised each other, so that the excitation was produced in the other shunt circuit by the battery only. As the speed fell, the excitation in the first shunt circuit rose and compensated for the fall in speed. When the speed fell below a certain minimum, a centrifugal governor switched the dynamo out of circuit, leaving the lights on the batteries. The system worked very well, but was discarded presumably owing to the introduction of the inverted gas mantle, which materially reduced the cost of gas lighting. Since then, however, the metal-filament electric lamp has neutralised the advantage which the gas mantle gave, but in the meantime incandescent gas lighting had become so general, and so much money was sunk in it, that railway companies were naturally loath to abandon it.

However, many of the leading companies have recognised the great advantages of electricity, and, having adopted it for lighting their sleeping and dining cars, are extending it gradually to their passenger coaches generally, and no doubt the recent accidents will hasten matters in this direction. Among the companies which have already adopted or are adopting electric lighting generally, are the Great Western, the Great North of Scotland, the Great Central, the L. & S.W., the South-Eastern and Chatham, the L.B. & S.C., the Great North of Ireland, the Midland Great Western, Ireland, the North Staffs., the Barry Railway, the Cheshire Lines, &c., and experience shows that the difference in cost between electricity and gas is slight when all things are considered.

The question of gas for cooking has been raised, but electrical cooking is now a proved commercial success, and as regards weight, we have it on the authority of large manufacturers of both gas and electric cooking stoves, that there is very little difference in this respect; designs are at present being got out for electric cooking equipments for some of the Continental railways.

While dealing with this subject, it is curious to note an historical parallel to the Aisgill collision dating back 21 years. In our issue of August 26th, 1892, on page 259, we published an article on "Railway Train Lighting," from which the following extracts are taken :—

The recent accident which occurred at Clapham Junction on the evening of the 20th will have brought before the public and the railway officials, in a forcible manner, the danger which accompanies the employment of gas as an illuminant for railway carriages. . . . . From it we learn what might be expected from gas-lighted trains in collision. We want no argument; the facts are before us, and from them we gather that on the evening in question the 9 50 p.m. train, Waterloo to Windsor, came into collision with a train of empties returning to Clapham Junction at or about 10.5 p.m., close beside the Ludgate Junction signal box. At the rear of the empties was a van—a composite, partly van and partly carriage—and adjoining it came three carriages, all third-class. With the rest of the vehicles we need not trouble ourselves. Into the tail of this train dashed the engine of the Windsor train with such force that the van was carried right over the engine and its tender, the two third-class vehicles in front of it being telescoped in the manner peculiar to such collisions. The guard of the empties was in this van, and was hurled among the *débris*. The gas became ignited, and an explosion is said to have instantly occurred; the brake van and the adjoining carriage were immediately in flames, and wholly, so far as inflammable parts were concerned, reduced to ashes within a very short time. The poor guard was sadly burned, and died within a few hours. Some passengers in the Windsor train complained of injuries, and the driver and fireman were also sufferers. . . . .

What a collision means we learn from the Clapham disaster, attended happily with comparatively slight results; but what would have been the end had those carriages, which were so quickly in a blaze, which were consumed to ashes in so short a time, been filled with human beings instead of being, as they were, empty? Doubtless that which was foreseen by Sir F. Bramwell, who evidently had in his mind the lamentable Abergelly accident, would have been the result, and a thrill of horror would have passed through the land. That which has happened has come to us as a warning—a warning shorn of much of its terrors—but still a warning of a very direct and unmistakable character. We have but to imagine those burnt vehicles filled with our fellow creatures, and the sum of the disaster is before us.

Will railway companies accept the lesson conveyed to them by the Clapham Junction accident? We question it. Will it induce them to foster that to which they must inevitably resort as a means of lighting their carriages? We hope so. We cannot think but that they will see in what has happened (and that the Board of Trade, for the same reason, will also see and impress upon the companies generally the propriety of considering their position), that should the accident be followed, as undoubtedly it, in the course of time, will be by another, the result may be something far more serious. If we concede that electricity is dearer than gas; if we concede that it is more troublesome to deal with in stock partially fitted, or stock in a state of transition; even then comes the question—the all-important question—of safety. Unquestionably, electricity is safer than gas. What if, after all these companies have fitted their stock with gas, the public outcry demands that gas shall not be used; the companies have another illuminant at their command which will afford an equally good light! The public are not, as a rule, considerate of the pockets of others; they will have what they wish, if it is to be had; and if they become terrified with mishaps of this character, some such demand may certainly be anticipated. In such a case, we should regret that electricity had not been more fully developed, for whatever might at such a time be its position, its application would have to be made, and the cost to which the companies had been placed for gas would be sheer loss.

It will be seen that the circumstances closely resembled those which obtained at Aisgill, and the warning then uttered was singularly prophetic; precisely what was foretold has come to pass, or is taking place before our eyes. The author of the article, who is no longer with us, was the electrical engineer to one of our greatest railways; and though we will not break the seal of his anonymity, we doubt not that the directors of the Midland Railway, at any rate, will recognise the hand.

THE RATING OF ELECTRICAL MACHINERY.

One of the most important matters discussed by the International Electrotechnical Commission at Berlin was the question of temperature limits for electrical machinery.

We have already mentioned that the permissible limits of observable temperatures recommended at Zurich in January of this year were adopted with only a few slight modifications. The Zurich meeting agreed upon the figure of 90° C. as the highest observable limit for impregnated cotton, and recommended 30° C. as the cooling-air temperature, but made no definite pronouncement in regard to the extremely important point of temperature rise. Probably 25° C. to 30° C. well represents the average cooling condition ordinarily met with in practice, but it is known that the cooling-air temperature at times rises considerably above this average value, and cooling-air temperatures between 35° C. and 40° C. are by no means unusual.

It has now been agreed that, instead of an average cooling-air temperature, the maximum probable temperature is to be given. Whilst at Berlin the majority were in favour of adopting 40° C. as representing the worst probable cooling-air conditions under which a standard machine might be required to operate in temperate climates, two or three favoured 35° C.; with a view, however, of arriving at a unanimous agreement, this point, as already mentioned, was wisely referred back to the National Committees for further consideration.

Under these conditions of maximum cooling-air temperature, the permissible limits of observable temperature specified for various insulating materials must never be exceeded, and the values adopted at Berlin and given in the table herewith represent the carefully considered opinion of the I.E.C. and are put forward as approved practice for continuous running.

The values are to apply only to windings for rotating machinery, the terminal pressures of which do not exceed 4,000 volts, and to dry transformers with solidly impregnated coils up to 10,000 volts.

The question of temperature limits for oil-immersed transformers has been deferred for future consideration.

We understand that experimental evidence justifies the assumption that in the above-mentioned windings to which the limits are to apply, the hottest internal spots will not be more than 10° C. in excess of the highest temperatures observable by the methods of measurement recommended by the I.E.C., and of which details will be given in the official report.

It is to be noted that the observable temperature limits permissible in windings for higher pressures than those stated above will be less than indicated in the table, so that the same temperature limits at the hottest internal spot shall not be exceeded. Thus for heavier insulations it will evidently be necessary to allow for a greater difference between the temperature at the hottest internal spot and the highest observable temperature, and, doubtless, specific figures to cover such cases will be recommended by the Commission later on.

Limits of Observable Temperature adopted by the I.E.C. in September, 1913.

Non-impregnated cotton	80° C.
Impregnated cotton or paper—general	90° C.
do. single layer field coils, stationary or moving	95° C.
do. stationary coils solidly impregnated throughout	95° C.
do. rotor and stator windings having the slot portion solidly impregnated or moulded...	95° C.
Enamelled wire (without cotton)	105° C.
Mica, micanite, asbestos—general	115° C.
do. single layer field coils, stationary or moving	120° C.
do. stationary coils solidly impregnated or moulded	120° C.
Windings permanently short-circuited :—	
Insulated	100° C.
Non-insulated	110° C.
Commutators—slip rings	90° C.
Bearings	80° C.

THE CADDER PIT DISASTER.

Home Office Inquiry.

On September 22nd Sir Henry Cunynghame, K.C.B., on behalf of the Home Office, opened an inquiry in the Justiciary Court, Glasgow, into the circumstances attending the disaster at Cadder Pit, Bishopbriggs, near Glasgow, whereby 22 lives were lost. The Home Office was represented by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, and Mr. Wm. Walker, H.M. Chief Inspector of Mines for the Scotland Division, while counsel and solicitors represented the Carron Coal Co., the owners of the pit, and the Lanarkshire Mineowners' Association. Mr. Robert Smillie, and other miners' leaders, appeared on behalf of the British Miners' Federation and the Lanarkshire Miners' Union. There was a particularly large attendance of electrical experts in the Court when the inquiry opened, and these included Prof. Burns, Royal Technical College, Glasgow ; Mr. A. B. Muirhead, Glasgow ; Mr. Alexander Anderson, of Messrs. Anderson & Boyes, Motherwell ; and Mr. David Martin, electrical engineer, Hope Street, Glasgow.

There was little that was of striking electrical interest in the opening day's evidence. Archibald Spiers, however, the manager at No. 15 Pit, Cadder Colliery, supplied the Commissioner with some details regarding the electrical equipment at the colliery. He explained that the generating plant in connection with the electrical installation was at No. 17 Pit. The wires, he said, were led above ground from No. 17 to a distributing board at the top of No. 15 Pit, and then taken down that pit. In connection with the supplying of electric light in the pit, the voltage was 500, and 100-volt lamps were arranged five in series.

Porcelain insulators of the flat type were used, and these were fixed on to the timber. These porcelain insulators extended only for a certain distance in No. 15 Pit, and after that string suspenders were used. That type of suspension was quite satisfactory. Since the fire in the pit it had been possible to see the cable as it originally was for a considerable distance inbye from the bottom of No. 15 Pit. The string suspensions were still intact, and if cables caused the fire it must have been those with the porcelain insulators. It was quite impossible that the fire could have had its origin in the electric motors, and he scouted the idea altogether that electricity was the cause of the outbreak.

When the inquiry was resumed on 23rd ult., the first witness called was Wm. Owens, overman at No. 15 Pit, Cadder Colliery. In reply to a question by Sir Henry Cunynghame as to whether the fire had been caused by some accidental action on the part of a miner, or whether the origin of the outbreak could be traced to the electric cables, witness said it might be due to carelessness on the part of a miner in throwing aside a match or a lighted cigarette in the vicinity of the cabin.

Before this fire, did anything come to your knowledge which led you to suspect that the cables, panels or any part of the electrical installation underground were not as they should be?—Nothing like that came to my knowledge, Sir.

By Mr. C. D. Murray, K.C., for the Carron Co. : Can you suggest any way at all how the electric cables, whether power or lighting, could have caused this fire?—I cannot.

John Lawson, engineman, said that on the night of the disaster he was in charge of the electrical generating station. On noticing that something was wrong with the switches, he tried to get into telephonic communication with the cabin and the switch panel room underground, but although he rang several times, he failed to get any response.

By Mr. Robert Nelson, H.M. Electrical Inspector of Mines : Was the leakage detector on the switchboard at No. 17 always switched in or was it sometimes in and sometimes out?—At times it was in and at other times it was out.

Edward Michael Flynn, electrician at No. 15 Pit Cadder Colliery, described the electrical apparatus in the pit where the accident occurred. He considered that the electrical fittings underground were arranged on generally satisfactory lines. Since May of the present year there had been no breakage or damage of cables beyond what might have occurred as a result of ordinary methods of working.

Mr. Nelson (to witness) : Are you aware of the fact that there are cables in contact with the timber?—Yes, but that is since the fire.

By Mr. C. D. Murray, K.C. : Witness could say positively that it was only since the fire that the cables had come in contact with the timbers. Further, he had tested the insulation resistance in the cables which the timber came against, and it was absolutely satisfactory.

On 24th ult., Arnold Hughes, electrical engineer to the Carron Co., deposed that he had been in the employment of the company for seven years. There were resident electricians at the various pits, and his duty was chiefly that of supervision. Electricity was first introduced into No. 15 Pit about 14 years ago, and then only for lighting. It was not until 1906 that the company installed electrical power plant. In the spring of last year a further alteration was made, and armoured power cables were introduced to comply with the new Electricity Order. In the opinion of witness, armoured cables were preferable to, and much safer than, unarmoured cables. At the date of the fire the electric lighting circuit was in good order. His last examination of the plant in this pit was made on June 3rd last.

Speaking, then, from your knowledge of the system, are you of opinion that it is reasonably possible that it was those electric lighting wires which gave rise to the fire?—They did not, in my opinion, cause it.

Do you think that the cables could have given rise to the fire?—I do not.

Witness, in reply to Mr. C. D. Murray, K.C., said he did not give the slightest weight to the suggestion which had been made that any defect in the lighting cables had caused the fire. Tests and experiments had been carried out in his presence by Prof. Burns, Royal Technical College, Glasgow, and Messrs. Alex. Anderson and A. B. Muirhead, electrical engineers, and these satisfied him that there were no defects in the lighting cables. The cables which had survived the fire had been subjected to certain insulation tests, and these had proved most satisfactory.

Mr. Nelson at this stage said he had tested the surviving cables, and admitted that these came up to the standard of requirements.

Dr. W. M. Thornton, Professor of Electrical Engineering in Armstrong College, Newcastle, who was afterwards called, said he had made a special study of the possible risk of fire attending the use of electricity in coal mines. On September 22nd he made an examination of the electrical plant at No. 15 Pit, Cadder Colliery, and his opinion was that the plant, considering the pit was a naked light one, was quite good. So far as the lighting cables in the pit were concerned, it would have been better if these had been armoured. The power cables were insulated with vulcanised bitumen, and he had found recently that bitumen was rather dangerous in certain conditions associated with cables.

Has any new factor been brought to light in the present inquiry into this disaster upon which you wish to express an opinion in so far as it relates to the use of electricity in the mines in future?—In the first place it seems to me that we have evidence now to show that bitumen cables in mines do burn very freely for quite a considerable distance.

Witness, in the course of further examination, said he held to the opinion that the leakage indicators should have been constantly in use. He further held that readings should be taken a little more frequently than they were done, while he considered it would be an advantage if in every pit they could have automatic cut-outs.

On Thursday, September 25th, the Commissioner said that to suit the convenience of Mr. Robert Nelson, who was desirous of getting away, he would take his evidence now.

In reply to the Commissioner, Mr. Nelson said he had had a large experience, since his appointment, in dealing with electrical accidents that had occurred.

Now, from your knowledge of electricity in general, you will say, I presume, that electricity might have been the cause of this fire?—Yes. The conditions I saw at Cadder Colliery are exactly those which I had seen in other cases in which undoubtedly the fire had an electrical origin.

You would not be surprised that other inspectors of mines, gentlemen of experience in mining, would put the origin of the fire down to another cause?—Not at all. Probably their opinion would be of more value on the whole than mine. They would be better familiar with the whole conditions of the mine than I am.

By Mr. Smillie : It has been said by some of the electrical witnesses that electricity could not possibly have caused that fire. What have you to say in regard to that?—Well, I place my greater experience against the evidence of these witnesses.

Do you argue that the possibilities of electricity causing this fire have been placed by witnesses rather too low?—Very emphatically I argue that.

Examined by Mr. C. D. Murray, K.C., for the Carron Co., witness stated that he knew the case of a cable which burst into flame while the men were looking at it.

Witness, in further reply to a question by Sir Henry Cunynghame, said he saw the electrical possibilities in this pit much more clearly, perhaps, than mining engineers did, and it was his evidence that the fire might have been caused in that way.

The report of the Commissioner will be issued in due course.

Olympic Fund.—The Duke of Westminster's Olympic Fund is the central fund to which subscriptions should be sent. Letters containing cheques, postal orders, and stamps should be addressed to the Duke of Westminster at Grosvenor House, London, W. Cheques and envelopes should be marked "Olympic Fund." All individual contributions, as well as collective subscriptions from a farthing upwards, will be acknowledged by him and forwarded to the honorary treasurer of the special committee, Mr. E. Mackay Edgar, Basildon House, Moorgate Street, London E.C.

Mr. Thos. Farrow, of Farrow's Bank, Ltd., proposes that 100 of the large trading and financial concerns of the country shall each raise £250 or £500, and has undertaken that his firm shall contribute £500, besides giving £250 himself.

Lignite Coal in Canada.—The Saskatchewan Government is about to erect plant for developing and testing the lignite coal of the Esteran district. In North Dakota similar lignites are partially carbonised, the product being practically lump charcoal, which can be used in gas producers, under boilers, and for domestic purposes, having about the same heating value as anthracite, but being less dense. The fine carbon screened out of the lump is briquetted, and can then be used for similar purposes. The possibility of establishing a large central electric power plant at the mines to distribute electricity over a wide radius is receiving attention.—*Canadian Engineer.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Proposed New Brazilian Tariff.

The Board of Trade have issued a translation of a new draft Customs Tariff for Brazil with a comparison of the proposed and existing rates of duty. We reproduce below details as to the existing and proposed rates for electrical and similar goods with particulars of alterations in tare allowances when such effect a difference in the amount of duty payable; it will be noticed that in some cases these alterations in tare allowances would have a considerable effect. It is understood that the Draft Tariff will be revised "in the light of such representations from interested parties as may be received by September 30th by a Committee presided over by the Minister of Finance, and that the work of this Committee will subsequently be submitted to the Brazilian Congress." It is considered improbable that the new tariff will become law during the current year. The principal alterations proposed to be made in the Preliminary Dispositions to the Tariff, are as follows:—

1. That all duties shall be payable 40 per cent. in gold, and 60 per cent. in paper.

2. That for the purpose of assessing *ad valorem* duties, the declared or appraised value of the goods is to be converted into milreis at the rate of 16d. to the milreis.

It will be realised that these alterations in the dispositions vitally affect the amount of duty payable on a number of goods, in addition to the effect of alterations in the actual rate of duty itself.

	Proposed tariff. Reis per kilog.	Existing tariff. Reis per kilog.
Leather belting for machines	2,000 (gr. weight)	2,400 (net w'ght)
Asbestos: Cord or string ...	1,000	940
Cloth, packing combined or not with wire or rubber.	1,000	1,100
Sheets, combined or not with wire or rubber.	500	500
Articles not specifically mentioned in the tariff.	20%	20%
Earthenware conduits or pipes	100	100
Receptacles and vessels of earthenware for batteries, insulators or any articles combined or not with copper for electric installations.	200	200
Tare allowances for two previous headings: Proposed: In barrels, cases, hampers or baskets 25 per cent., in any other packages gross. Present: In barrels or cases 8 per cent.		
Carbons prepared for electricity	200	200
China vessels for batteries, insulators, buttons for electric bells and all other articles of china with or without copper for electric installations	200 (gr. weight)	200 (net weight)
Note.—Brackets not soldered on and screws dutiable separately		
Glass insulators for telegraph and telephone poles.	100 (tare 35%)	100 (tare 40% and 30% according to packing)
Note.—As for previous heading.		
Glass vessels for batteries ...	400 (cases 40%, cardboard gross)	400 (cases 45%)
Bells of copper or brass of various kinds, and gongs: Electric with cases of wood, iron or any other material for whatever use.	3,600	4,000
Copper wire: Plain	400 (cases 10%)	400 (cases 20%)
Covered with paper, cotton or rubber, or with any other composition, for submarine or underground cables, for telegraphs, telephones, power, &c.		
With sheath of lead or iron	20% ad val.	20% ad val.
Without such sheath ...	900 (barrels 15%, cases 15%)	900 (barrels 10%, cases 20%)
Zinc rods for electric batteries	100	100
Iron wire, plain or galvanised	100 (barrels or cases 10 %)	100 (cases 20 %, barrels 10 %)
Iron wire covered with paper or tissue.	1,000 (barrels or cases 10 %)	1,200 (cases 20 % barrels 10 %)
Rails	25	50 and 15 according to weight.
Flexible and other pipes for electric installations.	120 (barrels or cases 10 %, other, gross).	Not specified.
Electro-galvanic or electro-magnetic rings, belts, &c.	16,000	16,000
Volta's condensing electroscope	5,000 each.	5,000 each.
Electric lamps: Incandescent	2,000 per kg.	Not specified.
Arc... ...	15 % ad val.	Not specified.
Note.—Glasses for manufacture of incandescent lamps shall pay duty at the rate of 600 reis per kg. gross.		
Dry batteries	100	Not specified.
Electrical apparatus not mentioned in the tariff.	15 % ad val.	15 % ad val.
Driving or transmission apparatus.	150	8 , ad val
Machine belting of cotton, rubber and the like, even when imported with the machines to which they belong.	1,800	1,800
Lifts complete or not excluding the motor.	30 % ad val.	Not specified.
Steam, electric, hydraulic and travelling cranes.	15 % ad val.	15 % ad val.
Machines for mines, factories, workshops and navigation, propelled by steam, water, gas, air, wind, electricity or animal power.	15 % ad val.	8 % ad val.
Motors, stationary, locomotive, or portable, such as: dynamos, and other electric motors for power and light, locomotives and their tenders, locomobiles, hydraulic motors (turbines and hydraulic wheels), windmills and all others.	15 % ad val.	8 % ad val.
Note.—The following articles, which usually accompany locomobiles, shall be included in the value on which duty is assessed: one oilcloth or tarpaulin, the firemen's tools, one brush for cleaning the pipes, one oil cup, a complete set of nut wrenches, three glass tubes for water-gauges, one suction pipe not exceeding 5 metres in length, with its filter (*ralo*).		
The following shall be deemed to form integral parts of locomotives, viz., the wheels with their axles, the tires, the boilers and furnaces, even if imported separately, as well as the cylinders, valves and compressed air or vacuum apparatus belonging to locomotives.		
Wheels of locomobiles, with their axles and cranks, shall only be considered as integral parts of such engines when imported therewith.		
Water and steam pipes connecting the boiler and the motor, as also fly-wheels and transmission pulleys, are considered as integral parts of locomobiles and of all other motors.		
Pipes or joints of iron or steel imported with turbines are considered as forming integral parts thereof on condition that, taken together, they do not exceed 30 metres in length.		
Lightning rods: Complete, with several branches, plain or with a platinum point.	15,000 each.	15,000 each.
Single branch, plain or with platinum point.	6,000 each.	6,000 each.
Note.—Complete lightning rods do not include the conducting cables.		
Machine tools, not specially mentioned.	400 (barrels or cases, 10%)	300 (barrels 20%, cases 10%)
Machinery and exploitation materials for use in mines imported direct by the mines for their own use (includes plant for electric lighting, &c.)	Free.	

Copper.—To judge by the mid-monthly figures, as shown by Messrs. Merton's circular, demand is still brisk, and supply lagging behind. The total deliveries (European) up to September 15th, 1913, were 24,965 tons. North America contributed more than the average quantity for a fortnight; Spain and Portugal, always a fluctuating quantity, a good deal less; Chile shipments were fairly high, and Australian well up. The stock in England and France and afloat thereto from Chile was 26,011 tons, of which England held 16,071 tons, 758 tons less than on August 30th. Total European stocks, including Rotterdam, Hamburg and Bremen, and 850 tons estimated in other ports, were 32,788 tons, 1,667 tons less than at the end of August.

American stocks, as shown by the American Producers' Association figures are also very low, being only 17,104 tons at the end of August, or 6,822 less than for the end of July. The total visible supply from all sources at the end of August was 51,149 tons, a decrease during the month of 8,404 tons.

Institution of Mining Engineers.—On Wednesday last week the annual general meeting of this Institution was opened at Manchester; the Deputy Lord Mayor welcomed the members to the city, and the Council's report was submitted, after which a number of papers were discussed. In the afternoon the works of Messrs. Mather & Platt, and the Pilkington Tile and Pottery Co., were visited, and the annual dinner took place in the evening. On Thursday and Friday various other excursions were made, including one to Messrs. W. T. Glover & Co.'s electric cable works, and one to the National Gas Engine Co.'s works. On Thursday evening a lecture was given by Prof. H. B. Dixon, on "Explosion Experiments at Eskmeals," followed by a reception in the Museum of the University.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,773. "Automatic telegraph-systems." D. H. Cameron. September 15th (Complete.)

20,779. "Galvanic filter-cells." G. Engisch. September 15th.

20,792. "Electric cooking apparatus." N. Prentice. September 15th.

20,796. "Recording galvanometers." P. Braun & Co. (Convention date, September 14th, 1912, Germany.) September 15th. (Complete.)

20,798. "Process and apparatus for establishing synchronisation by means of electric waves." M. P. Otto. (Convention date, September 16th, 1912, France.) September 15th. (Complete.)

20,800. "Ignition devices for explosion or internal-combustion engines." P. E. es Fiai. (Convention date, February 26th, 1913, Hungary.) September 15th. (Complete.)

20,806. "Apparatus for the production and radiation of electrical oscillations." F. Miller. September 15th. (Complete.)

20,821. "Vapour electric apparatus." E. E. Darmois and M. A. E. Leblanc. September 15th.

20,822. "Multiple telephony." H. Tietgen. September 15th.

20,853. "Electrically-operated winch specially applicable as an ash hoist." G. F. D. Campbell. September 16th. (Complete.)

20,856. "Telephone exchange systems." Zivnostenska Banka v. Praze (Firm of). (Convention date, October 28th, 1912, Austria.) September 16th. (Complete.)

20,870. "Means for operating electric switches from a distance." Siemens Bros. Dynamo Works, Ltd., F. Lydall and R. Brooks. September 16th. (Complete.)

20,878. "Process for the electro-deposition of iron." S. O. Cowper-Coles. September 16th.

20,909. "Automatic means for operating and controlling devices used in charging and/or discharging secondary batteries." C. H. de Rusett. September 16th.

20,912. "Commutator trueing devices." F. G. Ludwig. September 16th. (Complete.)

20,929. "Sparking plugs for electric ignition purposes." United Motor Industries, Ltd., and E. de Rodakowski. September 16th. (Complete.)

20,933. "Method of producing electric insulators." W. Boehm. September 16th. (Complete.)

20,934. "Electric heating devices." Jackson Electric Stove Co., Ltd., and F. H. Williams. September 16th.

20,937. "Production of high-tension discharges." W. H. Wilson. September 16th.

20,990. "Electric torch." J. Aikman, Jun. September 17th.

21,029. "Electric glow-lamps, and/or the method of manufacturing and operating the same." C. O. Bastian. September 17th.

21,033. "Wire-strainers." E. E. Moffitt. September 17th.

21,036. "Telegraphic receiving apparatus." J. Gell. September 17th.

21,050. "Electric locks for lift-gates and doors." C. G. Major, P. H. Stevens, and Smith, Major & Stevens, Ltd. September 17th.

21,069. "Means for mounting the terminals of electric lampholders or other coupling members, and electrically connecting wires therewith." G. St. J. Day. September 18th.

21,070. "Contact surfaces of electrical coupling devices." G. St. J. Day. September 18th.

21,109. "Electrical resistances." C. E. Hay and H. W. Sullivan. (Divided application on 22,375, 1912. March 18th, 1913.) September 18th. (Complete.)

21,115. "Submarine electric lamps." R. H. Davis. September 18th. (Complete.)

21,126. "Apparatus for selecting circuits, especially for automatic telephone systems." L. Preece. September 18th.

21,140. "Regenerative braking systems for electric motors." N. W. Storer. (Convention date, October 5th, 1912, United States.) September 18th. (Complete.)

21,143. "Voltmeter." J. Stephenson. (Convention date, September 18th, 1912, Germany.) September 18th. (Complete.)

21,186. "Electromagnetic lifting appliances." H. von Kramer and A. H. Railing. September 19th.

21,191. "Illuminators or reflectors applicable to electric and other advertising signs and the like." H. Goulton.

21,193. "Counter-weights for pendant electric light fittings." G. H. Gyton. September 19th.

21,222. "Circuit arrangements for connectors with multiple connections." Siemens & Halske Akt. Ges. (Convention date, November 9th, 1912, Germany.) September 19th. (Complete.)

21,283. "Sparking plugs." H. G. Longford, W. W. Longford and Sphinx Manufacturing Co. September 20th.

21,309. "Electric tension dividing devices." Soc. Schneider & Cie. (Convention date, October 31st, 1912, France.) September 20th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Self-starters for Automobiles and the Like. W. E. Lake. (United States Light and Heating Co.) 19,514. August 26th.

Electric Signalling Systems. Sir A. T. Dawson and G. T. Buckham. 19,585. August 27th. (Cognate application No. 5,537 of 1913.)

Mechanical Device for Obtaining Synchronism of the Cinematograph with the Phonograph. H. Porter, G. Schaible and F. Darragon. 19,593. August 27th.

Electrically-heated Cookers. A. J. Kercher. 19,754. August 29th.

Electrically-Heated Cookers. A. J. Kercher. 19,771. August 29th.

Electrically-propelled Road Vehicles. E. Cross. 19,825. August 30th.

Means for Fixing Electrical and other Fittings to Concrete and Ferro-Concrete and Like Structures. A. H. Taylor and H. A. Pinney. 19,921. August 31st.

Memorandum and Like Appliances for Use in Connection with Telephones and for other Purposes. E. F. M. Branson and F. H. Bowden. 20,293. September 6th. (Cognate application No. 26,947 of 1912.)

Portable Electric Lamps. Hartmann & Braun Akt.-Ges. 21,917. September 26th. (September 30th, 1911.)

Electro-Magnetic Apparatus, applicable for Telephonic and the like Signalling and other Purposes. M. S. Conner and A. R. Kahl. 24,089. October 22nd.

Method and Apparatus for Starting Multi-Cylinder Internal-Combustion Engines. Robert Bosch (Firm of). 24,533. October 26th. (December 16th, 1911.) Patent of Addition not granted.)

Electro-Magneto Generator. W. P. Thompson. (Splitdorf Electrical Co. 26,323. November 11th.

Fire and Temperature Alarms. J. Hartley. 27,473. November 29th.

Electric Insulators. A. R. Muller. 27,738. December 2nd.

Electric Advertising Devices and Signs. E. H. Bickley. 29,881. December 28th.

Metallising Ceramic and other Surfaces. Q. Marino. 12,642. May 29th.

Alternating-current Electric Motors. L. Rouzet. 12,687. May 29th.

Method of, and Means for, Protecting Electric Circuits against Higher Oscillations. F. A. Becker. 12,908. June 1st. (Convention date not granted.)

Signalling Apparatus for Railways. H Jennings. 16,678. February 17th. (February 17th, 1913.)

Electrical Massage Apparatus. G. W. Mascord. 19,661. August 28th.

Musical Instruments with Electrically-operated Vibratory Sounders. M. L. Severy and G. B. Sinclair. 19,869. August 30th.

Electrolytic Pickling of Metals. P. Marino. 20,180. September 4th.

Electrically-propelled and Operated Agricultural Machines. W. Wortmann. 20,185. September 4th.

Direct-current Generators. A. E. Berdon. 20,225. September 5th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.) 20,662. September 10th.

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co.) 20,744. September 11th.

Switches of the Tumbler Kind. W. J. Charles. 22,477. October 3rd.

Secondary Electric Clocks. W. J. Parker. 21,274. October 24th.

Alternating-current Generators. Ateliers de Constructions Electriques du Nord et de l'Est. 25,207. November 4th. (November 8th, 1911.)

Electric Heating Devices for Buildings and Vehicles. T. J. Digby. 26,356. November 15th.

Electric Railway Systems. W. B. Purvis and A. D. Gritman. 26,344. November 16th.

Electric Heating Devices. M. Albrecht. 26,347. November 16th.

Electric Meters and Meter Systems and Relays Adapted to Control the Same and for other Purposes. Siemens Schuckertwerke Ges. 26,439. November 18th. (November 17th, 1911. Addition to No. 25,831 of 1912.)

Manufacture of Filaments for Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 27,433. November 28th.

Electric Lamps for Mines. H. Joris. 28,816. December 14th.

Ear and Mouth Piece Protectors for Telephones. E. Dannenberg. 30,111. December 31st.

1913.

Electric Oil Switches. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 148. January 2nd.

Electromagnetically-operated Diaphragm Horns and the Like. E. A. Graham. 313. January 4th.

Telephony and Like Systems. E. A. Graham and W. J. Rickets. 1,049. January 14th. (Addition to No. 10,045 of 1911.)

Electric Clock Mechanisms. F. T. Reid. 1,243. January 16th. (August 22nd, 1912.)

Receptacles for Diaphragm-Guards for Telephone Mouthpieces. F. Loewenstein. 3,387. February 10th.

Refillable Electrical Fuses. J. G. Clemens and Monarch Refillable Fuse Co. 3,574. February 11th.

Electrically-heated Cooking and Like Utensils. J. Mann. 4,479. February 21st.

Automobile Signals. J. G. Marsh. 4,816. February 25th.

Method of and Means for Advertising. M. Heinig and A. C. Graeger. 4,957. February 26th. (February 26th, 1912.)

Commutators for Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 6,648. March 18th.

Ships' Compasses. L. W. P. Chetwynd and Dent & Co. and Johnson, Ltd. 6,702. March 18th.

Electrical Distribution Systems. British Thomson-Houston Co. and E. B. Wedmore. 6,807. March 19th. (Divided application on No. 28,868 of 1911, July 22nd, 1912.)

Electric Plug Contacts. A. Schuchardt. 7,243. March 26th.

Telegraphic Transmission. C. Schou. 13,089. June 5th.

Electrolytic Electrodes. Schott & Gen. 17,759. August 2nd. (August 21st, 1912.)

Combined Dynamo Regulators and Switches. E. O. Van Kerckhoven. 1,512. January 18th. (February 3rd, 1912.)

Safety Signalling Apparatus for Use in Mines. J. Close. 2,546. January 31st.

Wireless Telegraphy or Telephony. Signal Ges. 3,246. February 7th. (February 12th, 1912.)

Electricity Meters. J. Elster. 3,466. February 10th.

Electric Driving Mechanism for Spindles, Flyers or Similar Parts Used in Machines for Working Textiles. Soc. l'Eclairage Electrique. 3,759. February 13th. (April 16th, 1912.)

Submarine Signalling Apparatus. E. C. R. Marks. (Submarine Wireless Co.) 5,082. February 28th.

Insulating Gloves. St. Helens Cable and Rubber Co. and H. Evans. 5,242. March 1st.

Form of Contact for Electric Bells, Alarms and the Like. J. H. Cunnington. 7,755. April 2nd.

Means for Use in Directly Measuring Small Variations or Differences in Electrical Resistance. Hartmann & Braun Akt.-Ges. 8,602. April 11th. (May 8th, 1912.)

Regulators for Electric Igniting Apparatus. J. Schulz. 8,738. April 14th. (November 29th, 1912.)

Guards for the Stay Wires of Telegraph, Telephone or other Poles. A. Rogers-Jenkins. 9,869. April 26th.

Fire Alarms. J. Stevens. 11,218. May 13th.

Means for Automatically Operating Electrical Switches for Stopping and Restarting Motors for Compressing Air and other Fluids into Cylinders and other Receivers. T. C. Walter and Displayer Co. 12,218. May 26th.

Switch Arrangements for Electric Heating Apparatus. R. Weaving and Ferranti, Ltd. 12,935. June 4th. (Divided application on No. 17,837 of 1912, August 1st.)

Method of Igniting and Unlocking Miners' Safety Lamps. W. W. Gordon and J. Wright. 13,694. June 13th.

Musical Instruments with Electro-magnetically-vibrated Sonorous Bodies. M. L. Severy and G. B. Sinclair. 16,860. July 22nd. (Divided application on No. 19,869 of 1912, August 30th.)

Apparatus for Regulating the Light Intensity of Electric Arc Lamps. Siemens-Schuckertwerke Ges. 17,086. July 25th. (July 25th, 1912.)

Means for Preventing Excess Voltages in Alternating Electric Circuits F. A. Becker. 19,029. August 21st. (Divided application on No. 12,908 o 1912, June 1st.)

THE

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THE BRITISH ASSOCIATION.

IN looking back over a meeting which was, on the whole, a great success, and worthy of the reputation of the Association and of Birmingham, it is impossible to ignore the fact that as regards the sciences with which our readers are concerned, the interest of the meeting lay chiefly in Sections A and B; and the Engineering Section, G, which ought to claim their attendance, remained in the "parlous state" into which it has of late years fallen. It is true that this Section showed a great improvement at Dundee; and this was, in no small measure, due to the constant attendance of the late Sir Wm. White and his colleagues on the committee at that meeting.

It was fully expected that Section G would be given renewed vitality at Birmingham, on account of the President of the year being chosen (a somewhat rare event) from its ranks. But the sudden and lamented death of Sir William White altered this fair prospect; and instead of gaining the added prestige which would have come from the attendance of the President of the Association, this unfortunate Section seems to have been thrown further into the background than ever. It is hard to assign the cause or causes. The Committee, all excellent men, worked hard and presented a number of papers, which, if not exciting, were at least not open to severe criticism. Perhaps it may be said at once that the inducements held out by Section G seem to be insufficient to attract important and original contributions.

Prof. Kapp made an ideal President of the Section. His address was a good send-off, and dealt thoroughly with the very latest information on one of the most important subjects for the electrical engineer of to-day, the electrification of main lines of railway. But the attendance was always meagre in the extreme, and the discussion, where any discussion at all could be provoked, almost lifeless.

The representatives of the great firms in Birmingham and the district were conspicuous by their absence. The engineering departments of the Universities were well represented, but the great engineering works took little or no part.

Mr. Lanchester's contribution on the petrol locomotive, which we have already reported, was a shining exception, and there was a paper on the reconstruction of Snow Hill Station, Birmingham, by Messrs. Gleadow & Shackle, in the discussion of which the President of the Association joined. On the whole, however, the interchange of ideas between the Professors and the men engaged in practical work was to a great extent lacking. The counter-attractions in the realms of pure science, in the animated discussions which took place in A and B, not less than in the groups of famous people who were to be seen there, proved too strong for the adherents of G, and engineering found itself, once more, rather neglected.

Now, it is in no carping spirit of criticism that we deal with this matter, but rather to provoke a spirit of inquiry in the hope of ascertaining the remedies that should be applied. The Manchester meeting, the year after next, seems a long way off; but, in view of the vast engineering interests in that city, we hope that a real improvement may be brought about before then.

Rightly considered, the present state of Section G is an opportunity for showing the way in the reform of the procedure of Engineering Institutions in general. In order to induce the right men to bring forward the right material, it is necessary to ensure a good audience and wide publicity. It is not, of course, possible to drag members of the British Association into the room by the application of physical violence; they must be got there by an original and attractive bill of fare. And that is only effected by ensuring early and complete publicity for the papers.

If every paper accepted were to be printed in a complete form and handed out at least not later than the day before the paper was to be read; if the time spent in reading the paper were saved; if the audience assembled after reading the paper individually and preparing interesting contributions to the discussion, and if the contributor of the paper were allowed time to introduce his subject and show his pictures or models, all diagrams and drawings being reproduced on the printed sheet, and the writer of the paper winding up the discussion, we venture to think Section G would earn for itself a fresh distinction. The papers might be printed in pamphlet form; and experience shows that they would readily sell at a price to cover the cost of printing.

What a refreshing thing a real debate is! There should be a good deal of heat; a little rudeness even might be permitted, and strong feelings on the point at issue. And the only thing punishable with severity should be the false note—insincerity—the enemy of science. The lists of the Association should be scanned and the men who lead in any given matter should be invited to attend. A real live discussion is the true object of all such meetings, followed by a wide publicity, which would be well looked after by the technical Press.

The papers should be few and very carefully selected, and if there is any time to spare it would be time well spent if one whole morning were given to a joint meeting with the Mathematical and Physical Section, and another were spent with the Section devoted to Chemistry.

Section G is badly in want of new vitality; and unless some drastic remedies can be applied, we fear it will dwindle away.

THE ARCHITECT AND THE ELECTRICIAN.

In view of the prominence which has been given in recent times to the work of the illuminating engineer, and the acknowledged status which this branch of the electrical profession has obtained, it would at first sight appear that nothing more need be said upon the subject. Unfortunately, however, we appear in some cases to lack the practical ability to put into practice the ideals with which we are in theory in thorough agreement, and we do not realise this until, in some way, the matter is brought home to us by comparison. In this sense, it is useful to contrast the position here of the illuminating engineer or the electrician who has a fitting sense of the importance of the principles of proper illumination with the position of the same class of specialist in the United States. Our American contemporary, the *Electrical Review and Western Electrician*, recently remarked that it would be a long time befo individual judgment, based on wide experience, gave way to purely mathematical analyses of lighting requirements. Records of lighting lay-outs, watts per square foot, colour factors and controlling dimensions are all useful; but in no field of engineering is it more important to remember that practically every problem has special limitations requiring special treatment for its successful solution.

From this follows the necessity of trial installations, with the view of testing the variations in height and spacing of light units, the harmonising of shades and reflectors with colour schemes, the adaptation of fixtures to architectural needs, and the comparison of costs by different methods. In order to attain these ends, our contemporary urged that the architect and the lighting engineer should co-operate in the early stages of building construction rather than at the last moment. The growth of the art of illumination renders the location of outlets comparatively simple, and the bulk of the experimental lighting would be used for determining the height of the units above the working plane, the type of shades and the style of energy consumption which were desirable. Emphasis may well be laid upon the importance of adequate co-operation between architect and engineer; the latter being kept informed as to the details of panelling, ceiling and beam arrangements, the proposed use of rooms, and changes in the original plan which may modify the lighting installation needed for the best service.

In another electrical journal, the *National Electrical Contractor*, the necessity that the architect and the electrician should co-operate is still further emphasised, and the model contractor is defined as one who first of all sends in his tender promptly, type-written, and in such a clear form that it is easy to see what he means. If he is awarded the contract, he sees to it that a set of plans and specifications are given to him, and these are studied until the job is understood from beginning to end. The contractor then finds out from the architect exactly when he has to begin work, and makes an appointment in advance at the building to check over every outlet shown on the plan, to see if any changes are to be made. After the position of every outlet has been proved, the contractor's foreman marks their position in the building in blue chalk, the owner is taken round the building to approve the positions, and then the job is ready for the contractor to start work. In this way the troubles which are otherwise experienced, owing to wall outlets, say in a room which is to be panelled, being set so low that they have to be removed when the carpenter comes along, or an outlet or two being left out in one room, or placed in a wrong situation in another, in spite of plans and specifications to the contrary, are avoided.

All this is instructive as indirectly indicating the importance which in the United States adequate lighting is assumed to possess. It would be a very great step in advance gained in this country if the same consideration were shown here. Unfortunately, however, with notable exceptions, we think we are correct in saying that the electric lighting arrangements of a building are among the last things thought of by the architect, and when consideration is given to the matter, some stereotyped form, probably most unsuitable for the best effects, is selected without any very careful

consideration as to the possibilities. One only need visit some of the churches, even of recent construction, to realise how painfully elementary the practice of illumination is in this country. More often than not the lights are arranged so as to shine into the eyes of the worshippers, while a very frequent practice apparently is to suspend a powerful light over the pulpit in such a way that it exercises a hypnotic glare upon those who are striving to penetrate the profundity of the sermon. Moreover, one will find edifices bearing evident tokens of careful architectural arrangement and decoration whose illuminating units are supported by pendant clusters or brackets of either a strictly utilitarian and inartistic type or a style of art totally out of keeping with the general features of the building. Careful lighting appears to be very largely restricted to the better class picture theatres, where, at any rate, we do get an attempt by the use of indirect lighting and artistic pendants to minister to the comfort of the patrons.

Some amount of attention has been given to the subject of scientific illumination from a utilitarian point of view in our public schools, as a result, no doubt, of the alarming increase in recent years of defects of sight among the young, and we would urge that scientific illumination should be considered much more seriously and thoroughly than up to the present it has been. The architect is, we know, a conservative individual, and does not readily take to the idea of co-operation in, or interference with, his designs. He has not yet reached the stage, except in a few honourable exceptions, where he realises that lighting is after all a specialised science, and should be treated by a specialist, but prefers to subordinate this most important sphere of activity to designs, which while looking perfect on paper, and thoroughly effective in natural daylight, show themselves conspicuously defective when the scheme of artificial lighting which he suggests is applied to them. If the architect can once be got to see that anything which tends to give an all-day and all-evening efficiency to the beauty and completeness of his architectural conceptions is really aiding his own interests, he will, perhaps, be more inclined to consider co-operation with the electrical engineer in the early stages of a design; but we fear that until a sufficient body of public opinion has been formed to discriminate between good and bad lighting effects, this important subject will still remain outside the range of practical application.

Useful preliminary reports were issued a few weeks ago by the joint committee of the Illuminating Engineering Society, which has been considering the question of scientific illumination for schools and libraries. We shall await with some interest the publication of their final recommendations, for they should form a valuable guide to the saner lighting of such premises in the future.

Copper. The position of copper is in no way impaired. As the statistics which have been issued show, the intrinsic conditions continue of surpassing strength, and although it may suit the books of some people to affect to discredit them, there is in sober fact no reason why the returns should not command the degree of confidence to-day, when consumption has outstripped production, that they did from the sceptics when the reverse process was in operation. After all, figures in themselves are deceptive things to deal with, but they have the saving grace that they enable a comparison to be made. This comparison, in the case of copper, discloses a position of altogether unequalled strength, and it is fortunate, indeed, for consumers that there has been an absence of speculation in the market, for if anything approaching that seen even last year had been experienced, prices would certainly have been many pounds above to-day's level. That they are on the comparatively reasonable plane seen to-day is a capital thing for all concerned, for it may be taken for granted that the market is in a thoroughly sound condition. How much longer the stringency will continue is a matter of sheer guesswork, but the people who, by reason of their intimate connection with the industry, are best qualified to speak, are confident that there cannot be any material expansion of production for weeks, if not months, to come. The trouble at the mines in the Lake Superior region has not yet been settled, thousands of men being out, while the smelters are not at work, and only a few of the mines are hoisting ores. It is impossible therefore for normal conditions to be resumed as regards production yet awhile.

Attempts are still being made to adjust the dispute, but both parties have got their "backs up." There is no doubt as to the genuineness of the scarcity of Lake Copper, for there are no sellers, and leading producers who have metal to deliver against old contracts have notified their buyers that the copper cannot be shipped, for the reason that the mines and smelters are closed.

The pleading of the strike clause is, of course, inevitable under such circumstances, but it leaves consumers here in a difficult position. It would appear that pretty well every "bull" factor possible has come into play as regards copper during recent months, and it would be hard to conceive any additional events which could happen to stiffen the position. The operation of those now in force is quite sufficient to account for prices far above those now ruling, and it is sincerely to be hoped that there will not be any start up of gambling operations in the London warrant market, for this would work the utmost injury. Consumers can get along all right at to-day's prices, high though they are, for the market, apart from moderate fluctuations of no special moment, has kept quite steady. What is to be feared is an influx, at a high price, of rampant speculation, but this seems scarcely likely to develop now, owing to the succession of unfavourable outside influences which have been at work, notably the Balkan tangle, and, in a lesser degree, labour troubles and political unsettlement at home. Now there is dearer money to be considered, and this may easily put another drag on the wheel. It is a very fortunate circumstance, indeed, for consumers that such strength in the position of copper should have coincided with a period of profound political anxiety, for the latter has tended to keep things in check which might otherwise quite easily have got out of hand and had unfortunate sequels. The temporary closing of the big Washoe smelter is the latest bull point, and will further reduce the supply of rough copper available.

A Daniel come to Judgment. The inaugural address, in June, of the President of the American Society of Civil Engineers was somewhat of a departure from the ordinary style of these addresses. In it the President, Mr. George Fillmore Swain, discussed some of the tendencies and problems of the day in their relation to the engineer, who is so very largely responsible for the present conditions.

His address might almost as well have been delivered in our own country. Mr. Swain is an individualist, and perceives in the false Socialism of to-day a perverted Democratic ideal. The United States constitution is misread in respect of the theory that all are born equal. This he rightly interprets as equal in law, for we are not, nor can we ever be, equal in ability; at the same time he recognises the evil of great wealth unfairly or too-rapidly acquired. Democratic Government with universal suffrage has led to the false interpretation that men are inherently equal in all respects. Macaulay, in 1857, wrote of a soon-coming time when the doctrines of Jefferson would result in very serious evils for the United States. These evils he regarded as only deferred, because of the huge area of land to be ultimately filled and tilled. But when the population becomes dense trouble will arise, and, so thinking, wrote Macaulay:—"I cannot reckon Jefferson among the benefactors of mankind." The address goes on to consider other growing evils, such as the tendency to disregard authority; to disregard experience, an evil

which has, by the way, made itself so prominent in the too-old-at-forty falsity; and the tendency to relax discipline. Another tendency is the craze for innovation—any change, good or bad, so long as it is change. Change is too often mistaken for progress, and the idea of change probably springs from the advance of science, which has brought about also a false idea of the need for change where change will do no good.

Then there is the tendency to luxury, and, finally, the tendency towards race deterioration. This tendency is becoming well recognised the world over, but, so far, our boasted civilisation has been almost wholly occupied in maintaining the unfit even to the extent of taxing the fit into a state of unfitness in order to keep and to breed the unfit. Take, for example, the working of the Poor Law by the men elected by the mass of uneducated voters. It has proved to lead to the creation of palaces in which to house the unfit in luxury far beyond the reach of nine-tenths of the ratepayers; the creation of an army of pampered officials to look after them; of a system which is at least recognised by all as the most disgracefully unscientific and wasteful of all our institutions.

Ostentation, waste, intemperance, are the characteristics of America. Mr. Swain in this, and in all he has said, might just as well have delivered his address in Great George Street, for in many of the bad effects of a perverted democratic ideal, this country has passed America. These perverted ideals have been able to rear their heads because men as a body, not so clear sighted as Macaulay, have failed to grasp the very serious fact that the apparent prosperity of the United States has arisen not out of its political institutions, but out of its excess of virgin soil above the needs of its people. For 100 years the United States has eaten up its fertility and its ancient store of timber, and it barely feeds itself to-day. But this waste of old stores cannot continue, and the time foreshadowed by Macaulay has even now arrived and must compel attention to scientific plant growth and to the recultivation of idle land also. Mr. Swain's address is most illuminating; we wish we could reprint the 43 pages it fills, for, to quote the author, "we are victims to-day of an exaggerated humanity and a decay of discipline, and large numbers of men and women with warm hearts and good intentions are exalting sentiment above sanity, sympathy above truth, and ease above discipline."

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The electrical affairs of the city of Toronto are presided over by a commission of three; some months ago one of the commissioners vacated his position, which has not been filled until quite recently. Of the three members, one is the city's representative, one is the Mayor of Toronto, *ex officio*, while the third is the nominee of the Hydro-Electric Power Commission, of Ontario. Now, in the new appointment a wonderful thing has happened, for the new man (remember this is on a civic commission, whose business it is to deal with engineering matters) is an *engineer*, and an electrical one to boot. It almost makes one gasp to think of it. Why, your lawyer, or barber, or greengrocer, should be the man to look after the electric lighting, power and traction requirements of a large and very rapidly growing city. An engineer?—Perish the thought!

The appointment has been made by the Provincial Commission, whose own staff is composed principally of engineers, so it is not, perhaps, surprising that their choice should have fallen upon a member of that profession.

According to the daily papers, three new wireless telegraph stations are to be completed on the Great Lakes this autumn, which will give Canada the longest single stretch in the world covered in this way. The chain of stations will be complete from Port Arthur, on Lake Superior, to Cape Race, a distance of 2,000 miles.

Electricity is evidently being favoured by the coal-mining industry in Canada, according to the following extract from the 1913 report of the Committee of Conservation:—

> Among the economic uses of coal in Nova Scotia may be mentioned . . . . . the generation of electrical energy at central power plants for transmission to the surrounding collieries. This has been developed to such an extent that some of the collieries are now operated entirely by electricity. Electric cables are carried underground by means of bore holes, and the energy is used for mine haulage and pumping purposes.
>
> These plants present many new and up-to-date features, such as low-pressure and high-pressure steam turbo-generators, and mechanical stokers for firing the boilers with low-grade slack and splint coal.

REMARKABLE MOTOR RECORDS.

The manufacture of D.C. electric motors has been brought to so high a degree of perfection nowadays, that the scope for improvement has apparently been reduced to narrow limits, and, given the dimensions, weight and speed of a machine, one can make a very good guess as to the output which can be obtained from it when running continuously on full load. To suggest that, without any very drastic changes in the design, and without increasing the cost or lowering the efficiency, a machine can be built in such a way as to develop continuously with ease an output more than twice as great as the customary full load, is therefore likely at first sight to invite the scepticism, if not the derision, of the expert designer of such motors. We believe, however, that it can be done.

Naturally, we should not make a statement of this nature if we could not justify our faith; and this can only be satisfactorily accomplished by producing actual examples of machines which are at work and which regularly fulfil the claim outlined above. We therefore place the following facts and data before the reader, who may be left to verify the validity of the claim to increase in output by comparison with the standard designs with which he is familiar.

About five years ago, four motors were installed at the printing offices of Messrs. United Newspapers, Ltd., to drive two of the seven big Hoe presses, and they have been in regular operation since that time. In these machines many of the generally accepted notions regarding dynamo design are largely departed from. The flux densities are pressed up to very high values; a very efficient system of ventilation is provided, which not only keeps down the temperature of the machine, but also, as a consequence, reduces the copper losses; armature reaction is minimised by a special design of pole-piece; sparking is prevented by using interpoles and making the commutator segments of hard phosphor-bronze, and by using carbon brushes of very high quality, collecting about 50 amperes per sq. in. The motors are provided in duplicate, each being capable of driving the whole press, and they work in conjunction with the system of gearing invented and patented by Mr. G. W. Mascord, mechanical superintendent to the above company, which enables the machine to be started for inching purposes, and change over smoothly to direct drive when a suitable speed is attained. This gearing was described and illustrated in our issue of June 3rd, 1910.

The motors were purchased on a full-load rating of 80 B.H.P., but being variable-speed machines, and moreover, being capable of running for any length of time with less than half field, and with an overload of 50 per cent. (= 120 B.H.P.), they should be rated at 120 B H.P., and priced accordingly. The range of speed is from 230 to 650 R P.M.

The principal dimensions of the machines are as follows:—

Armature diameter	22·5 in.
,, length	8 in.
Field magnet over all	41·25 in.
Length outside bearings	29 in.
Width of yoke casting	14 in.
Base.—Distance between centres of bolt holes ...	38 × 16 in.

It will be seen that the motors are exceedingly compact, as compared with other machines capable of developing

120 B.H.P. at 230 R.P.M. The weight of each motor is 30 cwt. As a matter of fact, it was found impossible to obtain motors in the market which would give the same result in anything approaching the limits of space within which these motors are at work. We have watched them starting and running on load, and have not been able to detect the slightest sparking; the commutators are in perfect order, and have never been ground up since the motors were installed. No breakdown has occurred on any of the machines during the four to five years that they have been at work, although the driving of heavy printing presses is one of the most arduous tasks to which a motor can be put. After three hours' run at 63 KW. input, the temperature of the commutator—the hottest part—was 124° F., showing a rise of 56° F. above the surrounding air; the armature front had a temperature of 106° F., a rise of 38°. The temperature rise at the low speed, with full field, is somewhat higher, but not excessive.

These machines were built by the Rees-Roturbo Manufacturing Co., Ltd., to the designs of Mr. Henry Chitty. Their actual cost to manufacture was little over half the price paid for them *as* 80-*H.P. motors*, and there is no reason why these results should not be equalled or improved upon, for the design was not intended to be the very cheapest or the most compact attainable.

The foregoing statements will no doubt seem overdrawn, but we do not ask any reader to believe them without verification. Their accuracy can be tested with ease, as the machines are running on load almost daily, and we feel sure that Mr. Mascord will be pleased to allow them to be inspected after an appointment has been made with him. At present Mr. Chitty has no permanent arrangement with any firm for the manufacture of these machines, but there is nothing to prevent arrangements being made, and in the best interests of the electrical industry, it is very desirable that full advantage should be taken of the possibilities of improvement in output for weight and size that are evidently still far from exhausted.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Charge Engineer's Complaint.

I notice some correspondence in your issue this week respecting one of the drivers at the Burton electricity works having been promoted to the position of shift engineer which we have recently had vacant. Upon referring to the letter signed by Mr. Fredericks in your issue of September 26th, I at once judge that he must be well acquainted with the working of our station, and if this is so, I am extremely surprised that he should have any doubt regarding the capabilities of the driver in question.

As a matter of fact, the gentleman who has been given the position has been employed by this department for about 15 years, and during the last two or three years he has been acting shift engineer, while for three months continuously of each year he has had to take a shift on account of the regular shift engineers being away on holiday.

I have, therefore, had ample opportunity of judging as to his capabilities, and the fact that I did not hesitate to appoint him as permanent shift engineer proves conclusively that I was fully satisfied of his competence for the post.

Thomas Hall,
Borough Electrical Engineer and Tramways Engineer.

Burton-upon-Trent, *October 3rd*, 1913.

[One of our correspondents last week suggested that Burton-upon-Trent might be the subject of the "complaint"; but Mr. Fredericks gave no clue to the identity of the station, and we do not know whether he referred to Burton.—EDS. ELEC. REV.]

Electric Vehicles.

I am sorry to have to support "Chief Engineer's" grumble in your last issue as to the conservatism and lack of enterprise in our manufacturing firms in connection with "electrics."

Three years ago I arranged with my company for a limited supply of free power (200 volts, 100 ~ A.C.), and started out to design an "electric" suitable for mains work. All I could get in answer to my inquiries for various items, was the usual badly-typed, unpunctuated letter of regrets. No one had the sort of controller I wanted, and I was asked over £20 for sorts I did not want. In the end I had to make one—at a cost of about 7s. 6d.

In case the tip may be useful to any electrical man thinking of running an electric, I would say that I used a rotary-converter to run the car itself, the same motor being used to charge the battery by connection with the A.C. mains. This arrangement saves having a motor-generator at home, or having to go home to get a charge. My original idea was to have a simple induction motor (without starting winding) embodied in the frame of the D.C. motor. But, believing that a motor-building firm might know more about motors than a mere mains man, I was persuaded to let the makers "improve" my idea into merely putting slip-rings on the D.C. machine and running it as a synchronous motor off the A.C. This saved weight, but spoilt everything by reason of the fearful hunting making a charge impossible. In the end I got disgusted, and put in a petrol engine, making friends imagine that the car would not run electrically. This was quite wrong, however, for it did 14 on the level and climbed like a tram.

I shall be pleased to give full details to anyone interested, and enclose photo showing car as at present. The strong resemblance (stronger before the front bonnet was altered) to the American car you illustrated on page 540 is quite a coincidence, as I had never seen an enclosed coupé when I designed it.

Assistant.

Lightning Conductors at St. Paul's Cathedral.

There is very little difference of opinion among experts as to copper tape conductors being more lasting than copper ropes, and for this reason, as well as for theoretical considerations, the latter are now almost obsolete in this country. But it is not a matter requiring experience or expert knowledge to decide. The question is, of two conductors, one an inch wide and the other $\frac{1}{8}$ in. diameter (for ropes are composed of a number of wires each liable to corrosion), which will last longest under precisely similar conditions.

Most of the ropes I had removed from St. Paul's are composed of eight wires, each about No. 11 B.W.G., wound round eight others, each about No. 15 B.W.G. In a piece I have unstranded even the inner wires are green and corroded, and it had been in position only about 40 years. When Mr. Hedges brought the question of ropes *v.* tapes into the columns of the ELECTRICAL REVIEW some time ago, I sent you a piece of copper tape I had removed from the Houses of Parliament that had been fixed and exposed to the weather about 60 years and was still in perfect condition.

The specimen that he refers to as at the Science Museum appears to have been originally about $1\frac{1}{2}$ in. × $\frac{1}{16}$ in., and has traces of sulphate of copper, suggesting that it was affected by sulphur, and possibly bedded in coke which generally has a very destructive effect on copper whether in the form of tape or rope, but more on the latter, the greater surface in proportion to the cross-section of each wire allowing of more rapid deterioration of the whole.

Among the "practical suggestions" of the Committee, of which he was a member, was one that "gas pipes should be kept as far as possible from the positions occupied by lightning conductors," which, though delightfully vague, implies that lightning conductors should be kept away from gas pipes. It is to be regretted, therefore, that he did not insist on having them placed outside the building in place of letting them run through the ducts where there were gas pipes and other ramifications of metal. I found the authorities quite willing to have the alterations made when I pointed out the danger, and should have thrown up the

case had my recommendations in this respect not been adopted.

The fact that my tests differed from his is perhaps explained by what follows. When I first tested this system I found every test, both for "earth" and continuity, showed a nominal resistance only, but, owing to the system being interconnected with no provision for testing each "earth" separately, these tests gave no indication of the real state of affairs. I then had test joints made in the main conductors and found, as I suspected, that all the tests had been through one perfectly "earthed" conductor, the others showing more or less high resistances, and three being found to go to the crypt only where they were coiled up inside the ducts.

Even now tests do not show the real condition of the upper part of the system, and so I am undertaking a visual inspection.

I was aware that Mr. Hedges had been at one time concerned with the conductors on this building, having read in "Public Works," of January, 1905, that he "first took up the question of the better protection of buildings from lightning in connection with St. Paul's Cathedral, having been asked to report on the proposed electric lighting," but when I was consulted as to the efficiency of the system I was not interested in what he had or had not done. I had only to deal with it as I found it, and I consider that in removing the conductors from what every authority would consider dangerous proximity to gas pipes, electric light leads and other complications, and giving them the most perfect earths possible, I was acting in accordance with the best principles of the science.

Alfred Hands, M.I.E.E.

London, E.C., *October 6th*, 1913.

Apparatus on Hire.

I notice that Mr. Elliott, in his letter under the above heading, suggests that makers of radiant heat apparatus find it necessary to increase the capacity of their radiators, because of their inefficiency, and beg to point out that your correspondent is labouring under a delusion if this is what he thinks.

The reason 3-KW. radiators are manufactured is because most of the up-to-date and go-ahead electric supply undertakings have found that radiators of the radiant heat pattern are the most satisfactory types of heating apparatus to use, and, moreover, this is the pattern asked for by the public generally.

Of course, as is well known by all electric heating engineers, each type of apparatus has its separate and distinct use. If only hot air is required, then the convector type will answer the purpose, provided it is of sufficient capacity. If instantaneous heat is required, then the luminous radiator cannot be excelled by any other system of heating apparatus, whether electric or otherwise, but for all-round general heating, probably the hot-wire type of radiator, either of the protected quartz pattern, or exposed wire type, would be found the most satisfactory, as with this system, luminous heat is obtained together with a large amount of heated air, and it is appreciated by the general public, because of its resemblance to a glowing coal fire without any of the disadvantages of the latter.

D. Huntley.

London, W., *October 6th*, 1913.

The "Hand" of an Armature.

Your editorial comment and Mr. MacCallum's letter seem to make it necessary for me to elucidate my meaning. The fact I wish to point out is that the nomenclature suggested by Mr. MacCallum differs from the nomenclature which is the standard practice of several leading manufacturers; that some of the windings which he calls "progressive" are called, according to this standard practice of some manufacturers, "retrogressive." And my point is that the existence of this different nomenclature on manufacturers' records will make difficult, if not impossible, any change in the direction of uniformity.

G. Moores.

Stockport, *October 3rd*, 1913.

The Meaning of a Suffix.

On page 494 of your current issue is an interesting letter from Mr. Killingworth Hedges, who prefixes the mystic letters "C.E." to the well-known M.I.E.E., and I am sure it would be of great interest to many of your readers if Mr. Hedges would be good enough to let us know what precisely these first two letters are intended to mean. I have heard, from time to time, that they mean "Chief Engineer," "Consulting Engineer," "Civil Engineer" and "Contracting Engineer," but I fear that none of these are strictly correct.

In the absence of an explanation from Mr. Hedges, perhaps the Editors will be good enough to enlighten us.

B.

[Mr. Hedges is a Member of the Institution of Civil Engineers, and is therefore entitled to place the letters "M.Inst.C.E." after his name. We usually regard the letters "C.E." standing by themselves to imply the *lack* of that honourable title.—Eds. Elec. Rev.]

A.E (S.)E.

In your last issue a letter appeared under the above heading upon which we should like to comment.

In the first place, we would point out to your correspondent that the A.E (S.)E. is an Association for engineers in electrical undertakings (private and public), and is governed mainly by electrical station men.

The meeting referred to was an *open* meeting to electrical engineers. There was nothing to prevent electrical engineers who were also members of the Electrical Trades Union from stating their views; that such views should have been expressed without a strong opposition from the general body of members must have been due to the fact that "Snob" and others who may have views of a different character to those put forward at the meeting, sat quiet and allowed their opponents to have all the say. We hope that at future meetings we shall *again* hear all sides of the question, and urge all electrical station men to attend and take an active part in the meetings.

W. A. Jones, *Chairman, A.E(S.)E.*
W. J. Ebben, *Hon. Secretary, A.E.(S.)E.*

London, E., *October 6th*, 1913.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Automatic Electric Lift.

An automatic lift which we recently inspected in a building in Cheapside, of the well-known Graham type, erected by Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., presents some features which merit attention.

The Graham lift is purely automatic, and is operated entirely by the passengers; it serves four floors, and is designed to carry four persons. The lift travels at a speed of 120 ft. per minute, the gear being placed on the top of the shaft.

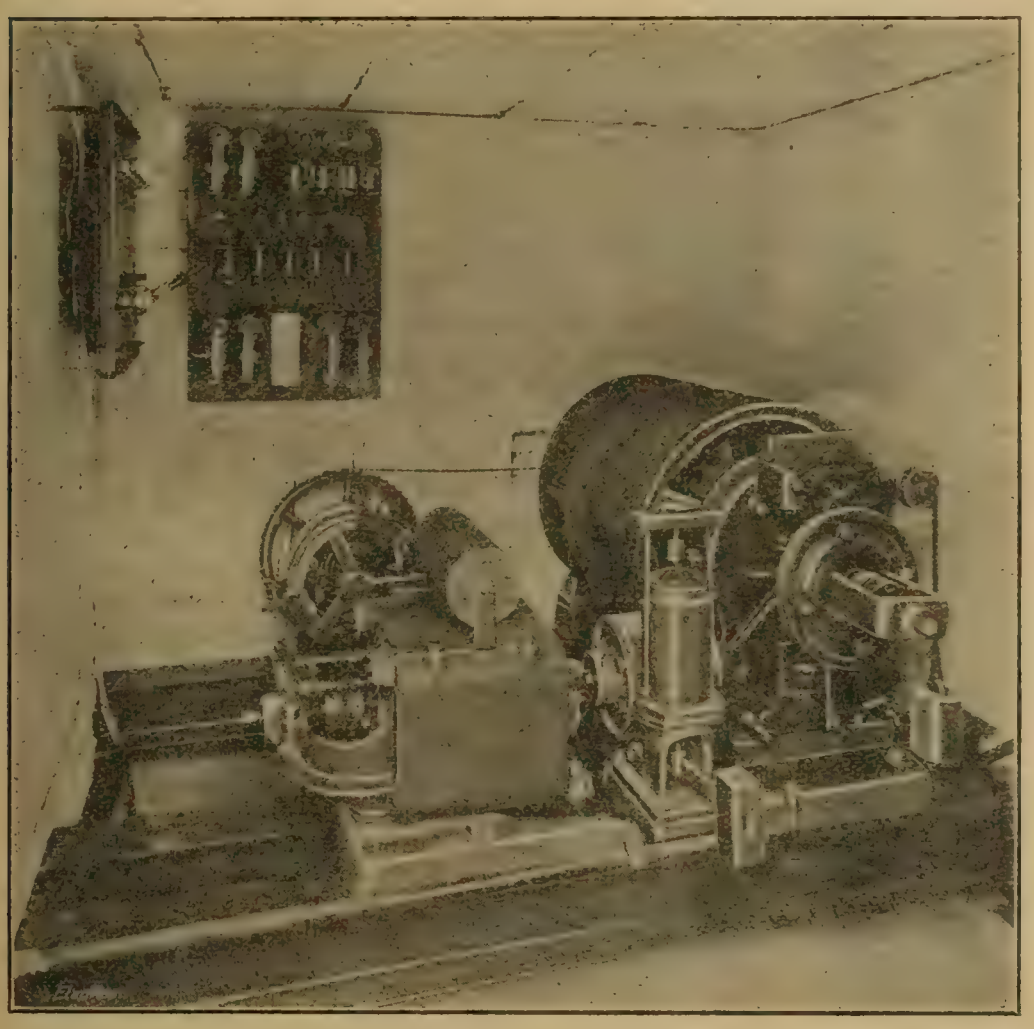
It is impossible to operate the lift until the shaft gates are closed, and, in the same way, when the cage is ascending or descending, it is impossible for anyone to open any of the gates. Another point of interest is that as soon as a passenger takes up his position in the car he completely controls the situation, and as long as he remains there, it is impossible for anyone at another floor to have any control over the lift. This is a noteworthy improvement, as when a person has entered an automatic lift, it is often possible after the gate has been closed for the car to be called to another floor before the passenger has had time to press the button. This possibility is entirely eliminated in the Graham lift.

The gear is of the drum type; the gearing consists of a steel worm engaging with a phosphor-bronze worm wheel. The drum is provided with lugs, on each side of which are inserted large rubber washers. These have between them iron washers, the whole being bolted together, thus ensuring an elastic drive. With this arrangement better acceleration and retardation can be obtained, and it tends to obviate any undue jar which may be thrown back on to the gear. The motor is of special design, and of the open-protected type, the winding being protected by a specially designed frame. To one end of the drum shaft is fitted the overwind gear. This consists of cast-iron reduction gear; the shaft is extended and screwed to take a traversing nut, the travel of which is equivalent to the total travel allowed for on the drum. This traversing nut actuates the overwind switch. The latter has two points or rings, upon which bear copper brushes. To one of

the rings is run the control circuit, to the other the main circuit. The control circuit ring has a slight lead over the other, and this switch comes into action should the lift have a tendency to run-over the limits of travel, the nut travelling along the thread and engaging upon a lug at either end. In doing this, the gear at once turns the contact rings and breaks the control circuit. Should the breaking of the circuit fail to stop the lift the main circuit is then broken, at once cutting off the whole of the current and stopping the lift.

The control is on the full automatic "push-button" system, the landings being provided with "call" and "return" pushes; the car is fitted with a "push-button" box having a suitable number of pushes to correspond with the landings, together with a "stop" push for emergency use. The pushes actuate relays, which operate the control contactors or directional switches, and thus the lift is set running in the direction corresponding to the push pressed.

In connection with the relays, there is also working a floor-setting device, this having a number of contacts corresponding with the various floors. It is driven from the drum shaft and automatically stops the lift opposite the desired landing.



Graham Automatic Lift Gear in a Cheapside Office Building.

The brake is of the leather-lined band type fitted between motor and gear, and arranged to engage upon the two half-couplings of the worm and armature shafts, the action of this being that it releases when current is switched on and engages when current is switched off. The adjustment is easily made by a set screw. The weight is fitted with set screws to enable the brake to be adjusted to suit conditions.

The safety gear is positive in action and is arranged on top of the car. It is adjusted so that if one or any of the ropes should become slack or break, the safety gear at once locks the car to the guides, at the same time cutting off the current and stopping the machine. A special governor is fitted, working in conjunction with the safety gear. This is driven by an independent rope passing over the driving wheel of the governor, the two ends being attached to the safety gear. This is set to suit the speed of the lift, and should the lift by any chance have a tendency to increase in speed, the safety governor immediately comes into action and pulls the safety gear in, thus stopping the lift.

Bell Signal Indicator.

Messrs. Siemens Bros & Co., Ltd., of Woolwich, have introduced an indicator for use in mines, which provides a visual indication of the nature of the order. The apparatus consists of a dial indicator with a pointer which is moved electrically one step for each bell stroke; a contact maker actuated by the bell rope; and a switch with gearing attached to the winding gear for returning the pointer to zero.

The switch is fitted near the bell rope or chain, so that a stop fixed on the latter operates the switch each time the rope or chain is pulled to ring the bell. This causes the pointer on the indicator to move to the order given. The indicator pointer is reset to zero by means of a switch which is operated automatically by the engine, so that immediately the engine-man moves the engine to carry out the order the pointer returns to zero.

Similar apparatus is supplied for use with an electric bell.

LEGAL.

Corfield *v.* The Premier Electric and Hardware Co.

At the Westminster County Court on Friday last, before his Honour Judge Woodfall, the hearing of this case was resumed. In this action, Mr. A. E. Corfield, chartered accountant, acting as receiver for the debenture-holders of the Davis Electrical Co., Ltd., sought to recover a sum of £25 in respect of goods supplied to a Mr. Geo. Cohen, lately trading as the Premier Electric and Hardware Co., at Golder's Green, N. Mr. Harold Brandon, barrister, appeared for the plaintiffs, whilst Mr. Austen Farleigh appeared for the defendant, who counterclaimed for £70 in respect of damage done by reason of the wire supplied being defective.

When the case was resumed, the defendant entered the box, and, in cross-examination by Mr. Brandon, admitted that he made claims against other firms in the trade, alleging their wire to be defective. One firm alone paid him £17 rather than fight an action, but he thought they recognised that they were at fault there. The Davis Co. served their writ upon him some time in February last, and it was a fact that he formed his business into a limited company a few weeks afterwards. He also admitted that judgment was obtained against him in the local County Court for about £30 in respect of electric current supplied only a few weeks ago, and he had not yet settled that claim.

Replying to his Honour, witness admitted that he continued using the same sort of wire from the plaintiffs, although he had found it defective in many ways. Mr. Farleigh said that on the last occasion there was some discussion as to the exact meaning of the words "job-cable," and he had found that the best dictionaries defined the words "job line" as meaning a miscellaneous collection of goods of various kinds, bought with a view to a speculative profit.

Mr. Harold Brandon said the Oxford Dictionary defined the words as meaning a lot of goods bought as a speculation. His contention was that "job line" meant speculative buying of goods which were not equal to the ordinary line of goods. It was his intention to call a number of expert witnesses, to give their opinion of the meaning of the words as they understood them in the trade.

The first witness was Mr. Percy Huddleston, auctioneer, of 72, Finsbury Pavement, E.C. He had been in the business for 24 years, and, in his opinion, the words "job-cable" meant cable which was sold with no warranty. Before putting "job-wire" into houses, &c., buyers ought to subject it to proper tests, otherwise it might "let them down badly." It was also a general practice to sell cheap wire as "job-wire." In cross-examination, witness stated that when holding an auction sale, he always sold the cable with all faults, and each lot was covered by his conditions of sale. He had never had complaints made about the cable he sold as "job."

Mr. F. Krasa, representing the Société Belge, a large organisation, which he stated turned out large quantities of electric cable, said he had been in the trade over 20 years. The expression "job-cable" was very well known in the trade, and it signified that it could not be warranted, as it had small local faults. If his firm turned out any cable which was found to be faulty, they either remade it, or else sold it off as "job-wire."

Evidence was also given by Mr. Henry John Wright, of 15, Garlick Hill, E.C., who stated that his firm sold the cable under review to the Davis Co. As it was a trade secret, he declined to mention the price, but would hand it up to the Judge in private. It was a good class cable, but as it was "job," it could not be sold with a guarantee. Every firm had a large quantity of job-cable at the end of the year, which they usually sold off as best they could. It was a "British-made cable." In cross-examination he said he was absolutely sure it was "British-made."

Mr. Farleigh: Where was it manufactured?—Witness: To the extent of 70 per cent. in Bradford, which is sufficient to bring it into the scope of the Merchandise Marks Act.

Replying to further questions, Witness said the copper wire itself generally came from the U.S.A., but it went from there to France, where it was made up and cased in rubber and vulcanite, &c. If any wire was found to be defective, then it was sold off as "job-cable."

Mr. R. E. Knight was also called, and stated he carried on business as an electrician at Sundridge Parade, Bromley. He put the same meaning upon the words "job-cable" as the last witness.

Mr. Albert James Cross, electrician of Chelsea, said he had had 15 years' practical experience in the trade, and well knew the expression "job-cable." It meant cable without a guarantee. He bought ½ mile of the identical cable, and had no complaint to find with it.

Mr. John Harding, electrical engineer of Soho, also gave evidence, defining the words as meaning "not up to the usual standard."

Mr. Clifford, of the firm of Baxter & Caunter, of Tottenham Court Road, said he knew the meaning of the words "job-cable"

as meaning wire which was not up to the standard required by the Electrical Engineers' Standardisation Committee.

On behalf of the defendant, a Mr. Green, who stated he was a dealer in photographic supplies, gave evidence as to the meaning of "job-line." He admitted he had no connection with the trade, but defined "job-line" as meaning a parcel of merchandise which was perfectly all right, but was a little out of date.

Evidence was next given by a Golder's Green builder named Corelli, who said he also had not had much experience in that particular line, but could testify to the meaning of "job-cable," which was as stated by the last witness.

Mr. Farleigh then addressed the Court on behalf of his client, stating that the Davis Co. knew very well what the cable was required for, and ought not to have supplied wire which was not fit for the purpose.

Mr. Brandon was proceeding with his speech, when the Judge said he need not hear the case any further, as he was satisfied, by reason of the expert evidence which had been called, that the plaintiffs had proved their case. Defendant knew what he was buying, and in those circumstances he gave judgment for the plaintiffs on both the claim and counterclaim, with costs.

Charges against Colliery Officials.

Sheriff Shennan last week heard evidence at Hamilton in the charges against Robert Wilson Dron, mining engineer, Bearsden; James Dalgleish, manager of Dalzell and Broomside Colliery, Motherwell; and James McNeil, electrician at the colliery.

It was alleged that the accused, contrary to the Mines Act, failed to take certain compulsory precautions in connection with the mechanical apparatus and electrical plant at Dalzell and Broomside Colliery, between March 15th and April 16th last. The cases of Messrs. Dron and Dalgleish were taken together. Mr. Robert Nelson, Electrical Inspector of Mines, stated that he visited the colliery on April 16th, along with Messrs. Walker and Pritchard, mine inspectors. In No. 2 pit he found four fuses in a distribution box, which were not so constructed and protected as to prevent accidental contact by persons, and danger from arcs. Certain unarmoured cables were not sufficiently insulated, while several were resting on nails instead of being properly secured by some non-conducting and readily breakable material to efficient insulators. In the pony level in the blackband seam the trailing cable of a coal-cutting machine was not connected to the system by a properly constructed connector. Mr. William Walker, Inspector of Mines, who corroborated, alleged that the cages were not sufficiently covered or enclosed, while there was not adequate means of egress from three of the engine houses and a motor room. Mr. William London, sub-inspector, and Mr. G. M. Pritchard, Inspector of Mines, also gave evidence.

For the defence, Mr. George Livingston Kerr, Secretary of the Mining Institute of Scotland, gave evidence to the effect that the colliery was, in his opinion, well conducted, and all reasonable precautions were taken to prevent accidents. Mr. James Hamilton, mining engineer, of Messrs. McCreath & Stevenson, Glasgow, agreed with Mr. Kerr. Mr. David Morton, electrical engineer, Glasgow, gave evidence as to the condition of the electrical apparatus, which he held to be efficient. Mr. James Dalgleish was examined at length on his own behalf. He stated that since the new Act had come into force he had been taking all reasonable steps to have its provisions complied with. Some of the necessary alterations involved new apparatus, and under the Act they had an extension of time to execute such work. The coal strike of 1912 interfered considerably with the progress of the work.

Braulik *v.* T. W. Vaughan & Co.

In the City of London Court, on Friday, his Honour Judge Rentoul, K.C., continued the hearing (already reported in these columns) of a case in which plaintiff sought to recover £6 12s. 8d. against defendants, electrical engineers, of Islington, balance of account for eight arc lamps supplied. The claim was admitted, but defendants raised a counterclaim for £48 6s. as damages sustained by them through the lamps being defective. Mr. Lever appeared for the plaintiff, and Mr. Giveen for the defendants.

Mr. Giveen stated that in 1911 plaintiff used to sell a certain type, now extinct, of German arc lamps for using outside picture palaces. Defendants had a contract for the installation of electric lamps at the Holloway Picture Palace, Seven Sisters Road. The plaintiff knew the purpose for which the defendants wanted the lamps which were now in dispute. Under the Sale of Goods Act there was an implied condition that the plaintiff should supply arc lamps reasonably fit for the purpose for which they were required. In January, 1911, defendants ordered from the plaintiff four arc lamps, but there had been a long series of disasters in connection with them. They were to be alternating current flame arc lamps 10 amperes, 10 hours, suitable, and to be burnt four in series on 200 volts, 50-period Islington supply, supplied with necessary resistance. In consequence of the coils not being fit to take the current when the lamps were started, two of the coils at the top burnt out. They got too hot, and burnt the lamps, which were rendered useless. Defendants did everything they possibly could to make the lamps go right, but they never all worked properly together. The defendants bought a number of new coils, and had spent £20 in trying to make the lamps go right. They were charging plaintiff with £12 of the £20. The theatre people became discontented with the lamps, and the defendants had to take them down, putting in new ones which were bought elsewhere for £31. Two of the lamps which were taken down were used elsewhere, but with disastrous results.

In answer to the counterclaim, one of the plaintiff's electrical engineers, named Berners, was called, and he said that there was no truth in the suggestion that the lamp was obsolete. They were still supplying it in the ordinary course of business. The plaintiff was one of the largest arc lamp manufacturers, and the lamp in question was the Eclipse. There was absolutely nothing to complain about in regard to the lamp itself, as he found whenever he tested it after complaints. It was only the fusing of the coils about which there could be any complaints, and that was not the plaintiff's fault.

Mr. Lionel Grant, engineer to the Cinematograph Theatres, Ltd., gave evidence in support of the counterclaim.

Judge Rentoul said that the dispute was one that an electrical engineer alone could decide, and he accordingly referred it for that to be done.

BUSINESS NOTES.

Lead.—In their report, dated October 4th, Messrs. James Forster & Co. state as follows:—"Closing prices last week were £20 September, £19 12s. 6d. October, £18 17s. 6d. November, £18 12s. 6d. December, and £18 7s. 6d. January. This week opened with large business on Monday at rather higher values, 'bears' freely selling forward lead. September was done at £20 1s. 3d., October at £19 15s. and £19 17s. 6d., and December at £18 15s. The pressure for early lead, however, again made itself felt, and as little September lead was offered, 'bear' covering forced the price to £20 12s. 6d., consumers also paying this price for September shipment, and as much as £21 for immediate. There is still a good deal of lead to be bought against September sales. £20 5s. has been freely paid for October, and there is a large 'bear' account open for this month The demand for export has again been very heavy, and pretty well all the lead arriving is being shipped away, principally to the Argentine and Russia. Sales for Buenos Ayres during the past fortnight approximate to round about 3,000 tons, a large portion being for prompt shipment, and Russia has also bought heavily. The close, on renewed 'bear' selling, was easier at £20 7s. 6d. September, £20 October, £19 December, and £18 12s. 6d. January. English lead, £20 15s."

Theatre Lighting.—With reference to the notice under this heading in out last issue, we understand that all lamps for the theatres mentioned are supplied through the British Economical Lamp Co., Ltd., of London.

Oil Testing.—The Stern Sonneborn Oil Co., Ltd., of Finsbury Square, London, E.C., announce that readers can have samples of their lubricating oils and greases tested free of charge on the "Sternol" testing machine.

Private Arrangements.—W. J. Fryer & Co., Ltd., Bravington Road Works, Harrow Road, London, W., electrical engineers and contractors. A largely attended meeting of the creditors of the above was held on October 6th, at the Holborn Restaurant, London, W.C. The chair was occupied by Mr. F. C. Harper, I.A., of 27, Chancery Lane, W.C., who reported that the shareholders had passed a resolution in favour of voluntary liquidation, and had appointed him to act as liquidator. Mr. Harper presented a statement of affairs showing the position as at September 20th last, the date when the resolution for the winding up was passed. The statement disclosed ranking liabilities of £19,734, all of which were due to unsecured creditors. In addition there was a fully secured creditor for £3,000, who held securities of the estimated value of £5,000, or an apparent surplus of £2,000. The assets were estimated to realise £15,639, from which had to be deducted £348 for preference creditors, leaving net assets of £15,291, or a deficiency of £4,443. The assets were as follows:—Cash at bank and in hand £149; plant, machinery, wagons, tools, timber, &c., £8,600, expected to produce £5,400; sundry debtors, £8,017, estimated to realise £5,006; and work in course of completion £5,083. Mr. Harper stated that the fully secured creditors were the mortgagees of the leasehold property. The original amount of the mortgage was £5,000, but it had since been reduced to £3,000. There was an apparent surplus of £2,000, but for the purposes of the statement of affairs no value was placed on the equity. Dealing with the work in hand, the chairman said that there was certain work in progress on behalf of the Bosch Magneto Co. The total amount of that work was £13,450, of which £10,050 had been received on account, leaving a balance to come of £3,400. Mr. W. J. Fryer was shown in the statement as a debtor for £9,121, of which amount £7,438 had been paid, leaving a balance of £1,683. That debt was in respect of an arrangement which had been made between the company and Mr. Fryer, by which the former carried out work for the latter at cost price plus 5 per cent. for interest. The amount stated to be due from Mr. Fryer might be subject to a reduction by any claim he might be called upon to pay in connection with guarantees amounting to £1,073, which he had given to creditors. Proceeding, Mr. Harper stated that the company was incorporated on July 16th, 1912, to take over the business, which had formerly been carried on by Mr. W. J. Fryer, under the style of W. J. Fryer & Co. The company had a nominal capital of £30,000, of which £15,000 was in ordinary shares of £1 each, the balance being preference shares.

The company took over the whole of the business as a going concern. It acquired the assets, and undertook to discharge the liabilities. The consideration for the transfer of the assets to the company was a payment £14,000. That payment was discharged by the issue of £13 000 in ordinary shares, and the balance of £1,000 in cash. It was agreed that the cash payment should be satisfied by monthly payments of £50 each. The company took over the business as from May 31st, 1912, and the assets which it acquired included plant and stock £8,400, work in progress £5,400, book debts estimated to realise £11 770, leasehold property £1,500, and goodwill £4 000. Between June and July of last year Mr. Fryer introduced fresh capital into the business to the extent of £3,500. The total value of the assets which the company acquired was £34,610, and on June 1st of last year the liabilities were £20,610. That left the purchase price at £14,000. The company started to trade, and unfortunately it carried on business at a loss. The chairman added that his firm had acted as auditors to Mr. Fryer and also to the company. Recently they were requested to get out a statement so that they might advise as to what course should be adopted. They accordingly prepared the statement, and after bringing everything into account and providing for depreciation and interest, there was a loss shown for the 16 months' trading of £11,348. A statement of affairs was also prepared, and it showed that there was only one course to adopt. His firm strongly advised, and, in fact, almost insisted upon the creditors being at once communicated with. He had looked into the trading losses in order to ascertain how they had arisen. Mr. Fryer's explanation was that the losses were attributable to the rise which had taken place in the price of materials, and to the extra costs of labour. The creditors would observe that no debentures had been issued, and that there was nothing owing to the bank, while the retention moneys had not been charged in any way. In other words, the statement of affairs was a very clean one. In concluding, Mr. Harper suggested that a committee of the principal creditors should be appointed to assist and advise him in winding up the estate to the best possible advantage. At the present time he was negotiating for the sale of the stock by private treaty.

Mr. Collins inquired whether Mr. Fryer carried on the business successfully before the company was formed, and a question was also asked in reference to fees paid to the directors.

The chairman replied that no directors' fees had been paid, but Mr. Fryer had received a salary of £780 per annum. Prior to the company being formed Mr. Fryer carried on the business successfully.

A resolution was proposed in favour of the appointment of an independent liquidator, but this was defeated by a large majority, and a motion was passed in favour of application being made to the Court for the appointment of a nominee of the trade creditors, to act as joint liquidator with Mr. Harper. A committee of the principal creditors was also appointed. The following are creditors :—

Aster Engineering Co., Ltd. ..	£12	Macfarlane, W., & Co.	£385
Braby, F., & Co., Ltd.	72	Metropolitan Electric Supply Co., Ltd.	52
British Luxfer Syndicate, Ltd.	61	Siemens Bros., Woolwich ..	61
Doulton & Co., Ltd.	22	Tucker, J. H.	18
Evered & Co., Ltd.	23	Z. Electric Manufacturing Co., Ltd.	27
Falk, Stadelmann & Co.	85		
General Electric Co., Ltd. ..	38		
Grevener, J. & H., Ltd.	85		

Charge of Stealing.—At the Manchester City Police Court on Monday, James Lever and Wm. Smallman were charged with stealing 1,426 lb. of gunmetal and copper, value £71 6s., the property of the Manchester Corporation, and also with receiving the same knowing it to have been stolen. Mr. Pickford, who prosecuted, said Lever was a metal merchant, and Smallman was employed in the electricity department as an assistant to an electrical fitter. Smallman had access to the stores. Between July 26th and September 19th on 10 occasions Lever had taken large quantities of brass and copper to a licensed broker carrying on business in Hulme, and the latter became suspicious and communicated with the police. Lever was arrested and made a statement implicating Smallman. Smallman denied all knowledge of the thefts, but Lever said the other prisoner brought him the stuff and was paid for it. Both prisoners were committed for trial at the next Quarter Sessions, bail being allowed.

An Electrically-Operated Fire Pump.—Messrs. Merryweather & Son, of Greenwich, have recently completed an interesting electrically-operated fire pump for Balcombe Place, Sussex, one of the country seats of Lord Cowdray. The pump is capable of delivering 300 gals. per minute, and is driven by the motor through spur-wheel reduction gearing; the pump draws its water from a pond in the grounds, and delivers it into a fire main installation with hydrants at various points. Being electrically-driven, the pump can be started up instantly, enabling a powerful stream of water to be brought to bear on a fire in the shortest possible time after the discovery of the outbreak.

The Shops' Act.—Newcastle-on-Tyne T.C. has issued a Shops' Act Order for dealers in electrical fittings to close each Wednesday or Saturday at 1 p.m.

A Storekeeper's Defalcations.—Before the Recorder at the Central Criminal Court on Tuesday, Percy George West, 30, described as an electrician, was brought up in custody, and pleaded guilty to an indictment which charged him with stealing several small sums of money, the property of his employer, Mr George Edward Taylor, electrical engineer, 6, Bush Lane, E.C. The Recorder passed a sentence of nine months' imprisonment in the second division.

Consular Notes.—Italy.—The British Consul at Genoa reports that the proposed electric tramway line from Prazza Ferrari to Quezzi has been approved by the municipality. The estimated cost of construction is £34 [illegible]0. Having in view the satisfactory results obtained by the recently installed electric traction over the Giovi Railway, the Minister of Public Works has decided to extend the system to the second Giovi line which runs from Sampierdarena to Ronco, at an estimated cost of £240,000. The material will be supplied by the State Railways, and the electric power will be furnished by the Societa Forza Idraulica Maira. The line is expected to be in working order by March, 1914.

Roumania.—In a recent report the Consul at Galatz states that the Roumanian market is not looked upon with particular favour by British firms, and individual cases can justify their attitude by the losses they have sustained. German and Austrian manufacturers have their own representatives in the country, while British firms, as matters stand, have to trust to local agents. There are good and bad among these agents, and sufficient caution is not always exercised in their choice. There is no doubt that if proper representation were secured British firms would increase instead of losing the trade they already do with the country in machinery, machine tools, ironwork and other goods. Roumania is less than three days' journey from London, and firms might do worse than pay a personal visit to the country. Germany, Italy, Austria, France and Belgium are our principal competitors in Roumania, and their success is chiefly due to geographical position, rates of freight, and careful nursing of the market. Quick delivery by rail tells heavily in their favour in respect of expensive articles of comparatively small bulk and of small consignments of all descriptions. Foreign firms are said to be more lenient as regards the credit they are prepared to allow, and this in an agricultural and comparatively young country like Roumania has a considerable effect in the placing of orders. Correspondence and catalogues should be in Roumanian, German or French.

On the same subject the Vice-Consul at Constantza says that British firms who may wish to extend their trade there should appoint a reliable general agent in Bucharest, who would send his own travellers round the district. The commercial traveller who can quote c.i.f. prices in francs plays the most important part in securing orders. If catalogues are sent they should, for preference, be in Roumanian, but otherwise in French. English is hardly spoken by anyone except shipping agents. The use of electric light is steadily increasing.

South Africa.—Port Elizabeth's trade in electrical supplies is gradually assuming considerable importance, and the American Consul there has recently urged American firms to give more attention to the market. The imports of electrical machinery into the Port Elizabeth district in 1912 amounted to about £60,000, of which 57 per cent. came from Germany, 32 per cent. from the United Kingdom, and about 12 per cent. from the United States. Imports of electric cable and wire amounted to about £27,000 in 1912, an increase of 20 per cent. over 1911, 80 per cent. coming from the United Kingdom, 17 per cent. from Germany, and the balance from the United States, Austria, Hungary, Italy and Belgium, in the order named. Imports of electrical fittings amounted to about £55,000, an increase of about 37½ per cent. over 1911; Great Britain's share of these was about 58 per cent., Germany 30 per cent., and the United States 8 per cent. of the total. The duty on electrical machinery, wire, posts, and lamps is 3 per cent. *ad valorem*, and on electroliers and all fancy fittings 15 per cent. *ad valorem*. Imports from Great Britain are entitled to a preferential rate of 3 per cent. *ad valorem*, which entitles the first-named articles to enter free and the second to pay 12 per cent.

American packing as a whole has greatly improved. It should, however, be remembered that all cargo for Port Elizabeth must be lightered in the open roadstead in Algoa Bay, where there is nearly always a considerable swell and frequently, during the "southeasters," a fairly heavy sea. In lowering cargo over the ship's side under these conditions it is absolutely necessary that all electrical goods requiring packing should be prepared for hard knocks. A recent consignment of American machinery was an object lesson on the value of proper packing. This shipment of heavy machinery, weighing about 4 tons, in two or three packages, was landed and unpacked without showing the slightest evidence of damage and without a screw, bolt, or plate missing. Manufactures of brass should be covered with soft paper, packed in paper shavings or similar material, and the packages so prepared as to be nearly or quite moisture proof, as the atmosphere along this coast is heavily laden with a salty moisture that badly tarnishes brass. The different municipalities and corporations operating electric plants in the district have only recently realised the necessity of reducing rates to a minimum. Before this was done the electric illumination of houses was not general. Now such lights are quite commonly seen, their use is increasing all the time, and there are promises of further reductions in rates. Nearly all buildings of any consequence are of brick with cement facing and roofed with galvanised iron, tile, or slate. Dwellings are principally of a single story, with an occasional house of two stories; commercial buildings are one to four stories in height. While these buildings are not fireproof, they are, from the nature of their construction, slow to ignite or burn. Speaking generally, it is the custom to conceal the wires in dwelling-houses, offices, and stores and use surface wires in factories, warehouses, &c. In either case the wires are carried in conduits or steel tubes. The lamps used are principally of German make. The "Osram" probably has the largest sale of any locally. The General Electric lamp, made in England, and the Phillips, made

in Holland, are both sold in the Port Elizabeth district. The screw socket is not much used here, the bayonet or pull sockets being much preferred. This socket is of standard English size. Brass lampholders and switch-covers are used, but other fittings are largely of oxidised copper. Plain, solid, substantial fittings, easily cleaned and polished, are the best sellers. In obtaining a foothold in this market it must also be borne in mind that the workman employed to install lights and fixtures has, as a rule, obtained locally such knowledge as he has, and his experience has been limited. Explanations, instructions and descriptions, should be as complete as possible in the plainest language.

The two principal lighting and power plants at Port Elizabeth and East London are owned and operated by the respective municipalities. Originally the rates charged for light were high, varying between 16 and 25 cents per KW., and very little less for power. More recently prices have been gradually reduced until the use of electricity for power, cooking and heating is not uncommon. Fuel is expensive in most parts of this Consular district, and not usually of the best quality. Consequently, as electrical current becomes cheaper, its employment for general household and manufacturing purposes will increase.

Electrical Exhibits at the Canadian National Exhibition.—The *Canadian Electrical News*, in its account of the Canadian National Exhibition, says that along with other departments the electrical display continues to grow in magnitude and interest. "This is especially true with respect to illumination fixtures, and heating and household appliances. The variety of fixtures this year is very great, and their designs are probably more beautiful than ever, though possibly the most noticeable advance is shown in the varied appliances of electricity for the home, including not only irons, toasters, &c., but efficient heating and cooking appliances, sweepers, washing-machines, &c. . . . . There is no doubt, however, that the electrical exhibit still fails to create as favourable an impression as its magnitude and the variety of the equipment shown should demand, on account of the scattered location of the various booths. . . . . The exhibit of electrical appliances will never receive its proper attention, or carry its full value, until a special building is set aside for electrical equipment alone. There is no question but that this building to the vast majority of visitors could be made the most attractive on the grounds."

Among exhibitors, of special interest to electrical men, were the following :—

Chadwick Brass Co.—Electric fixtures.

Lumen Bearing Co.—New type of car wheel for electric railways.

Keiths, Ltd.—Electrical fixtures.

James Morrison Brass Co.—Electric fixtures.

The Jones & Moore Electric Co.—Motors in varied sizes, and Pelouse electric irons.

Stromberg-Carlson Telephoné Manufacturing Co.—A complete line of telephone apparatus.

Norton Telephone Co.—Varied telephone equipments, lighting fixtures and tungsten lamps.

Canadian Carbon Co.—X-cell dry batteries, carbon products and electric sundries.

Toronto Hydro-Electric System.—Attractive kitchen in which the many uses to which electrical equipment can be put were attractively demonstrated.

Toronto Electric Light Co.—Electric dining-room, where the products of electric cooking were displayed ; two other rooms showed many other household appliances in operation.

R. A. Lister & Co.—Gas engines and small electric generating plants, suitable for farm use or for large country homes or hotels. A large number of these plants have been installed at different points in Canada.

International Agencies.—Raw and manufactured aluminium.

Colonial Fixtures, Ltd.—Fixtures in which Colonial design was the most prominent feature.

William Hamilton Co.—Improved Samson water turbines.

Airozone Electric Ventilating Co.—Ozone generating equipment.

Canadian Independent Telephone Co.—Working model of a 25-line "presto-phone" switchboard.

Jones & Glassco.—Working exhibit of a Renold silent chain.

National Electric Heating Co.—Irons, toasters, heaters and radiators.

British Aluminium Co.—Exhibit of the great variety of uses to which aluminium is now put.

Macey Sign Co.—"American Lens" electric signs.

W. H. Banfield & Sons.—Chandelier chains and fixtures.

Automatic Electric Cook Co.—Automatically operated electric stoves and ranges.

Canadian Fairbanks-Morse Co., Ltd.—Gasoline engines, transmission machinery and mill supplies.

Tallmann Brass and Metal Co.—Electric fixtures.

Canada Sanax Co.—Medical equipment, Foen electric hot and cold air producers, electrically-driven vibrator, X-ray apparatus, &c.

Crown Electric Manufacturing Co.—Electrical fixtures.

Northern Electric and Manufacturing Co.—Fire alarm systems, telephones and telephone accessories, and general electric supplies.

McDonald & Willson.—Electric fixtures.

Hot Point Electric Heating Co. — Electric irons, toasters, heaters, &c.

Faircloth & Co.—Coloured glassware and electric fixtures.

Radiant Electric Co.—Household equipment, including irons, toasters, heaters, foot-warmers, radiators, &c.

Catalogues and Lists. — MESSRS. TURNER BROS., LTD., Spotland, Rochdale.—Illustrated leaflets particularising their "Zenith" high-pressure valve twist, "Lomoto" self-lubricating packing, and "Permanite" high-pressure jointing material.

MESSRS. ENGINEERING AND ARC LAMPS, LTD., Sphere Engineering Works, St. Albans.—Leaflet giving full particulars of their new "Beaconette" flame arc lamp, a modification of their "Beacon" lamp which has been on the market for the last five years. Prices are list d.

MR. S. N. BRAYSHAW, 2 and 4, Mulberry Street, Hulme, Manchester.—List No. 48 F (32 pages) contains a number of illustrations indicating the manufactures of the firm, all of which are detailed in separate publications. These specialities are furnaces, pyrometers, steel hardening, light mechanism, and milling cutters. Several pages are occupied with useful well arranged Centigrade and Fahrenheit tables, also tables of millimetre and decimal equivalents. Mr. Brayshaw has just taken an engineering works at Vernon Street, Longsight, to be used as a branch for the furnace department. The milling cutters and light mechanism, &c., will continue to be made at Mulberry Street, but the furnace department will be removed to the branch works, where new machinery is being installed. It is expected that actual manufacturing will commence there in about a month.

THE NEWALL ENGINEERING CO, Blackhorse Lane, Walthamstow, London, E.—Catalogue (No. 150) of 92 pages, containing a great deal of information regarding the firm's gauges, micrometers and measuring machines. The book is very neatly illustrated, and sizes, prices, code-words and weights are tabulated. Increased ranges of nominal sizes, in both Imperial and metric dimensions, are included, also tabular matter relative to Newall standard tolerances and allowances, and to standard screw-threads.

MESSRS. VICKERS, LTD., Broadway, Westminster, London, S W.—This is an excellently produced brochure containing a description in English and French respectively of the firm's electrical and mechanical exhibits in the British Section at the Ghent Exhibition. Between 20 and 30 pages are filled with half-tone views of the firm's works and manufactures and their exhibits.

MESSRS. ROYER & BORGHYS, 59 and 61, New Oxford Street, London, W.C.—A collection of sheets of excellent metal mouldings and stampings used in conjunction with electric light fittings. Also a catalogue of ornamental chains supplied by Mr. F. Thomas-Ponthieu, of Paris, and one of glass shades supplied by Mr. J. Kisch, of Paris, for both of which manufacturers the firm are agents in this country.

THE WESTINGHOUSE COOPER HEWITT CO., LTD., 80, York Road, King's Cross, N.—Three lists : No. 8A showing the Cooper Hewitt lamps for D.C. circuits as used in hosiery works and other industries ; No. 49 dealing with the application of their stationary type blue-printing outfit ; No. 54 relating to mercury vapour lamps for photographic work of all kinds, for which they are particularly well adapted.

THE BRAULIK ENGINEERING CO., 8, Lambeth Hill, London, E.C.—Eighteen-page illustrated pamphlet containing tabulated prices, dimensions, weights, and other information relating to various types of accumulators for pocket, hand, cycle, &c., lamps, also complete pocket, Mignon hand, watchman's, inspection, safety, army map-reading, patrol and other lamps.

THE HOTPOINT ELECTRIC HEATING CO., Ontario, California.—Folders giving particulars and prices of their electric cookers and hotplates.

MESSRS. CROMPTON & CO., LTD., Arc Works, Chelmsford.—Pamphlet No. P29 of 36 pages containing detailed and fully-illustrated information relating to the Crompton-Blondel open-type flame arc lamps for A.C. or C.C. Particulars are given of burning conditions, burning hours and sizes of carbons, diagrams of connections, use of auto-transformers, and raising and lowering gear. Prices are tabulated, and views are given of works, thoroughfares, &c., where the lamps are in service.

THE ARMORDUCT MANUFACTURING CO., LTD., 6, Farringdon Avenue, London, E.C.—Twelve-page pocket booklet, entitled, "Signs of Progress," dealing with the value of the electric sign for advertising purposes, especially emphasing the "Glob-o-lite" sign. Copies will be forwarded on application.

Model Engineering Exhibition.—The fourth exhibition of models, tools and scientific apparatus, organised by the proprietors of the *Model Engineer*, will be held at the Royal Horticultural Hall, Westminster, S.W., from October 10th to 18th. There has been a splendid entry of engineering models from all parts of the kingdom for the various competitions, and some very interesting exhibits will be shown in the loan section. Special rooms are to be devoted to wireless telegraphy in operation, and to aeroplane models of all kinds, and a completely equipped workshop will be manned by members of the London Society of Model and Experimental Engineers, who will give demonstrations of model-making and workshop operations. The principal model yachting and power boat clubs of London will show their latest craft, and other features, such as scientific experiments, demonstrated by Mr. V. E. Johnson, M.A., working models, an 80-ft. miniature railway, with steam and electric locomotives running, &c., will complete a very fascination show. The exhibition will be open from 12 a.m. to 10 p.m. daily.

Point Controllers.—MESSRS. QUILLIAM BROS. have installed one of their point controllers on the Ipswich Corporation tramways system, and have orders in hand for point controllers for the following systems : Torquay, Preston (repeat order), Blackburn (repeat order).

Book Notices.—"Overhead Electric Power Transmission." By A. Still. Price 12s. 6d. net. "Transformer Practice." By W. T. Taylor. Price 10s. 6d. net. 1913. London: Hill Publishing Co.

"Wireless Telegraphy and Telephony without Wires." By C. R. Gibson. 1913. London: Seeley, Service & Co. Price 5s.

"Electric Circuit Theory and Calculations." By W. P. Maycock. 1913. London: Whittaker & Co. Price 3s. 6d. net.

"The Post Office Electrical Engineers' Journal." Vol. VI, Part 3. October, 1913. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Boletin* de Ingenieros." Vol. 3, Part 12. August, 1913. Mexico: Secretario de Guerra.

"Metallographic Testing. Standard Analysed Samples." 1913. Washington: Government Printing Office.

"Atti della associazione Elettrotecnica Italiana." Vol. XVIII, Part 17. September, 1913. Milan: Stucchi, Ceretti & Co. Price L.1.50.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 7. September, 1913. New York: The Society.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXX, No. 8. August, 1913. Santiago, Chile: The Society.

"Fire Tests with Glass." 1913. London: The British Fire Prevention Committee. Price 2s. 6d.

"Aviation." By A. E. Berriman. 1913. London: Methuen & Co. Price 10s. 6d. net.

"Switchgear." By A. G. Collis. 1913. London: Constable and Co., Ltd. Price 1s. net.

"*Journal* of the Institution of Municipal Engineers." Vol. V, No. 17. August, 1913. London: The Institution. Price 1s.

"Working of Steam Boilers." By E. G. Hillier. Fifth edition. Manchester: Taylor, Garnett, Evans & Co. Price 1s. 6d.

"University College (University of London) Calendar, 1913-14." London: Taylor & Francis.

"Foundry Cupola Gases and Temperatures," by A. W. Belden; "The Analysis of Black Powder and Dynamite," by W. C. Snelling and C. G. Storm; "First Series of Coal-Dust Explosion Tests in the Experimental Mine," by G. S. Rice, L. M. Jones, J. K. Clement and W. L. Egy; "Investigations of Detonators and Electric Detonators," by C. Hall and S. P. Howell; "Safety Electric Switches for Mines," and "Portable Electric Mine Lamps," by H. H. Clark; "Monthly Statement of Coal-Mine Fatalities in the United States, May and June, 1913," by A. H. Fay; "The Prevention of Waste of Oil and Gas from Flowing Wells in California," by R. Arnold and V. R. Garfias; "An Electrolytic Method of Preventing Corrosion of Iron and Steel," by J. K. Clement and L. V. Walker; "Heavy Oil as Fuel for Internal-Combustion Engines," by I. C. Allen; "The Flash Point of Oils," by I. C. Allen and A. S. Crossfield. 1913. Washington: Government Printing Office.

We have received a copy of No. 1 of *The Lighting Journal*, a monthly 6d. publication, conducted by Mr. A. W. Robinson, and published by the Lighting Press Syndicate, Ltd., of 116, Charing Cross Road, W.C. It contains a number of articles, some of them illustrated, on interesting subjects, such as the lighting of tennis courts, the Architect and the Illuminating Engineer, Notes on "Period" Designs of Lighting Fixtures, Notes on Lighting (by Haydn T. Harrison), Recent Developments in Gas Lighting (by C. W. Hastings), and so on. The editor announces his intention to reconcile, as far as possible, in his pages of course, the divergent interests of the rival systems of illuminants—gas, electricity, acetylene, air gas, oil, &c., "under the common aim of 'good lighting.'" We wish the undertaking every success.

Trade Announcements.—Messrs. Bi-Metals, Ltd., have removed to larger premises at 57, Lant Street, Southwark, London, S.E.

Messrs. J. Farr & Co., electrical engineers, of Nottingham, have removed from 27, South Sherwood Street, to larger premises at 18 and 20, Parliament Street.

Messrs. T. Harrap & Son, electrical engineers, of 170, Cardigan Road, Leeds, announce that they are retiring from business. The plant, stock, &c., are to be disposed of by auction on October 14th.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, W.C., have been appointed sole agents in this country for the A.C.E.N.E. (Ateliers de Constructions Electriques du Nord et de l'Est), of Jeumont (Nord) France. This firm is the largest company in France manufacturing electrical plant, having a capital of £1,200,000, and in addition to the manufacture of all forms of electrical machinery, both A.C. and D.C., it also manufactures all classes of cables for high and low-tension electric supply.

Bankruptcy Proceedings.—Charles Lewis, "electrical engineer, late licensed victualler," 29, Seymour Grove, Old Trafford.—October 22nd is the last day for the receipt of proofs for dividend, by Mr. J. G. Gibson, Official Receiver, Bryon Street, Manchester.

Wyndham Wadsworth, engineers' agent and dealer in electrical accessories, Chorlton-cum-Hardy, Manchester.—October 22nd is the last day for the receipt of proofs for dividend by Mr. J. G. Gibson, Official Receiver, as above.

J. P. L. Donlevy, consulting electrician, 123, Tulse Hill, London.—Trustee (Mr. H. Wilson) released August 22nd.

Tramway Rail Welding.—The list of contracts which Messrs. Thermit, Ltd., have on hand at the present time includes Bradford, Burnley, Brighton, Bournemouth, Dublin, Dundee, Huddersfield, Leeds, Liverpool, London County Council (four contracts), London United Tramways, Manchester, Sheffield, Southampton, &c.

Dissolutions and Liquidations.—The Aster Engineering Co., Ltd., Wembley, Middlesex.—This company, on October 1st, resolved to wind up voluntarily, with Mr. A. Dobson as liquidator. The freehold land, buildings, plant and stock have been sold to a new company, the Aster Engineering Co. (1913), Ltd., with a capital of £80,000 in ordinary shares. There will be no debentures, mortgages or bank overdraft. The issued capital will be represented by actual assets, the goodwill being entirely eliminated. There will be £30,000 new cash capital (all subscribed). The net profits for 1912 and up to date of liquidation will be carried forward to the new company. The management will remain the same. All accounts of the old company will be paid in full.

The Provincial Electrical Co., Ltd.—A meeting will be held at 125, Edmund Street, Birmingham, on November 4th, to hear an account of the winding up from the liquidator, Mr. T. B. Scattergood.

The De Forest Wireless Telegraph Syndicate, Ltd.—A meeting will be held at the offices of Messrs. Allen, Attfield & Co., 147, Leadenhall Street, E.C., on November 6th, to hear an account of the winding up from the liquidator, Mr. S. J. Ashby.

Ghent Exhibition Awards.—Messrs. Reavell & Co., Ltd, have received the following Awards at the Ghent Exhibition:—The Grand Prix for general excellence in their air compressors exhibited under Class 21.

A Diploma of Honour for their three-stage air compressors exhibited under Class 20.

A Diploma of Honour for their three-stage air compressors attached to Diesel engines for marine work.

The Lea Recorder Co., Ltd., of 32, Deansgate, Manchester, have received the Gold Medal of the French Section for their standard integrating machine.

Aluminium in France.—It is reported from Paris that some concern is being manifested in aluminium consuming circles in consequence of the reported intention of the company, known as L'Aluminium Francais, not to restrict itself to the production of the crude metal, but also to embark on the manufacture of finished products in the future. This decision has induced consumers to consider the question of establishing an independent aluminium works, and negotiations have already been commenced with the object of acquiring water-power for this purpose. Since this report was published the company has issued a denial of the intention to manufacture products.

Norway.—A company has been formed in Christiania, with a capital of 1,000,000 kroner (about £55,550), to manufacture electrical machinery and transformers, and to carry out the installation of electrical apparatus and the sale of electrical material.—*Board of Trade Journal.*

LIGHTING and POWER NOTES.

Aberayron.—Street Lighting, &c.—At a meeting of the U.D.C. on October 2nd, the question of adopting electricity for public lighting in place of the present oil lamps was discussed, and it was decided to make inquiries as to the approximate cost of plant, &c. It was mentioned that steps were being taken to form an electric light company for the town.

Accrington.—Proposed Great Harwood Supply.—The Electric Light Committee has been asked by the Great Harwood Council on what terms it would be willing to distribute and supply energy in the area, taking over the provisional order under an agreement. A Sub-Committee has the matter in hand.

Arabia.—The death of the Sultan of Muscat was recently referred to in the *Times*, which records the fact that about a year ago an electric lighting plant, the first of its kind to be introduced in that part of the world, was installed in the Palace, some 500 lamps being supplied. Two 30-kw. plants were also to be installed for commercial lighting.

Australia.—A special report has been submitted by Mr. H. R. Harper, city electrical engineer, with a view to showing that the supply by Melbourne to outside municipalities is on a profitable basis. The Footscray municipality receives over 400,000 units per annum at the present time delivered at the borough boundary, at an average price of 1·7d. per unit. In Melbourne the average price obtained is 2·11d. per unit, but this includes distribution, &c. The cost of supply to Footscray was 1·225d., leaving a substantial profit. The report has been considered by the City Council, some members of which were of opinion that the Council was supplying at a loss.

The electric light supply to the town of Parramatta was inaugurated at the end of August, a banquet being held to celebrate the occasion. The undertaking is in the hands of the Parramatta Electric Light Co., Ltd., which has installed a 200-H.P. steam-driven plant, with accumulators, &c., and possesses the necessary land for extensions in the event of the whole of the district being supplied

Barrow.—The T.C. on Monday confirmed the reports of the engineer upon the progress of the work in supplying electricity to the airship shed on Walney Island, and the progress in the electricity works extensions and the restacking of the No. 1 cooling tower. In connection with the substitution of metallic-filament lamps for arc lamps in Bridge Road and on Walney Bridge, the work is complete, and it has effected a considerable improvement in the lighting of these thoroughfares.

Bath.—Street Lighting.—At its last meeting, the Surveying Committee decided that the lamps in Henrietta Gardens should be changed from gas to electric light. It was also decided to convert 13 lamps in Holloway and six in Dorset Street and Caledonian Road. A resolution was carried that when a cable was laid in any street the surveyor should have the lamps on the line of such a main transferred from gas to electric light.

Batley.—A deputation from the T.C. visited Darwen electricity works last week, to inspect the new turbo-generator which has been installed.

Beckenham.—The U.D.C. has decided that where rent is being paid for a lighting meter, no rent shall be chargeable for heating or power purposes, as from the commencement of the Michaelmas quarter.

Belfast.—At the fortnightly meeting of the Electrical and Tramways Committee, a resolution was passed instructing the town solicitor to proceed with the preparation of a preliminary agreement with the Harbour Commissioners, for the acquisition of the proposed site for a power station on their property on the lines authorised, such an agreement to be conditional on the approval of the B. of T. The revenue report for the six months showed a balance to the net revenue account of, after allowing for fixed charges, of £14,943.

Bispham.—Prov. Order.—The Council has decided to apply for a prov. order to supply the West Ward at Thornton with electricity.

The Council has also decided to hold an electrical exhibition at the electricity works, on a convenient date.

Blean (Kent).—Workhouse Lighting.—The B. of G. on September 30th adopted a recommendation in favour of having the workhouse lit by electricity in place of the present oil lamps, and to invite Mr. Lewis, of the Canterbury City E.L. works, to advise on the matter, and to prepare specifications, &c.

Bridlington.—Last Sunday the electrical installation at Christ Church was used for the first time, and proved to be a great advance on the old system of lighting. The chancel is lighted by a corona with eight 50-c.p. lamps, the nave with eight 4-light coronas, each light of 50 c.p., and there are also six side-lights and two transept lights of similar power. Outside the church there are three brilliant lights. Adjoining the church is the Wycliffe room, which is well lighted with four 100 c.p. lamps and four lights of lesser power, one being over the door. Cylinder lights provide excellent illumination for the pulpit and lectern in the church, and the total number of lights represents 4,000 c.p. The work has been carried out by Mr. J. V. Lecett, electrical engineer, Bridlington.

Bristol.—The strike of electrical workmen, members of the Electrical Trades Union, has not yet been settled.

Brora.—Village E.L. Scheme.—Last week the public electric lighting scheme for this village was successfully inaugurated. Miss Margaret Hunter, daughter of Mr. Hunter, of Sutherland Woolen Mills, through whose enterprise the scheme has been carried out, switched on the public lamps, and after refreshments had been served to those present, an inspection of the street lamps was made. The lighting was voted a great success, and the improvement on the old oil lamps was remarkable, the village at night having quite a different appearance. The public lamps, which number 34, each of 25 c.p., are fixed to the poles carrying the overhead wires, in lanterns specially designed for street lighting, and the whole of the lamps are switched on from the watchhouse near the generating plant. The latter, housed in a special building consisting of engine and battery rooms built near the boiler house of the mills, consists of a direct-coupled Willans-Crompton compound steam set of 35 h.p. The switchboard, which is of handsome appearance and fixed in the engine room, controls the whole of the supply through convenient switches and instruments. In the battery room is a storage battery of 60 E.P.S. cells of 630 a.h. capacity. The supply pressure is 110 volts, and besides the street lighting wires, there are two pairs of heavy mains for private lighting throughout the village. Several premises are already being fitted for electric light, and it is anticipated that in a short while all the better premises will be supplied. This village scheme, which is notable as being the most northerly public electric lighting scheme in the British Isles, has been carried out by Edmundson's Electricity Corporation, Ltd., and was designed by Mr. E. J. Williams, the electrical engineer, of Inverness, who was also responsible for the village schemes at Evanton and Beauly.

Burnley.—The Electricity Committee has received a letter from the British Westinghouse Co., respecting the supply of machinery for the proposed extension at the electricity works. The company asked for an undertaking that the machinery would be purchased whether the L.G.B. gave its sanction to the borrowing of the money or not; the undertaking was agreed to. In the event of the L.G.B. refusing sanction, the account will be paid out of reserve.

Canada.—Calgary.—Through an arrangement effected by Commissioner Graves, the Calgary Power Co. will enter into a five-year agreement with the city to supply power at $26 per h.p. per year, instead of at $28·50 as under the former agreement. The company will supply 5,000 h.p. per year, which will cost the city about $130,000. Soon after the expiration of the old agreement last December, a new agreement was framed by Mr. R. A. Ross, the city's power expert, but the company contended that the penalty clause was too stringent and refused to sign it. The penalty clause in the new agreement calls for the company paying $52 per h.p. in case of breakdown, or twice the amount of the ordinary price of power. In the event of the city wanting more than the 5,000 h.p. agreed to, it will be supplied at a dollar less per thousand than the regular agreement rate. The company will be able to supply as high as 5,000 h.p. when their new plant is in operation and their system of storage reservoirs is completed, but it is not likely that any demand for excess power will be made, as the city plant is capable of supplying 5,000 h.p.—*Canadian Engineer.*

Canterbury.—The T.C. has decided to extend the charge of 3½d. per unit for outside arc lighting, so as to cover any group of lights on any one fitting of over 200 c.p.

Continental Notes.—Spain.—According to statistics published by the Instituto Geografico, the number of waterfalls utilised in Spain up to the end of 1908 was 1,990, situated on 299 rivers. The provinces possessing the largest number of waterfalls were:—Lerida, 150 waterfalls on 23 rivers; Santander, 122, on 21 rivers; Navarra, 121, on 15 rivers; Guadalajara, 113, on 15 rivers; and Barcelona, 111, on five rivers. Spain, as is well known, is almost equally endowed with France and Italy, with an abundance of water resources available for hydro-electric enterprises.

Turkey.—Constantinople was one day last week visited with an unusually heavy storm, the resulting floods being described as the worst within living memory. Great havoc was done in the city, houses and bridges being swept away, while the construction works at the new electric power station were greatly damaged.

Netherlands.—The provincial authorities of Groningen have been empowered to install generating plants and to supply electric energy for lighting and industrial purposes (excepting for telegraphs and telephones) in the Province of Groningen, and also in certain parts of the Provinces of Drenthe and Friesland.

H.M. Consul at Amsterdam reports that a concession has been granted to the "Kennemerland Electriciteits Maatschappy" at Bloemendaal for the establishment of extensive electric light and power supply works.—*Board of Trade Journal.*

Russia.—A scheme has been published and distributed among the members of the Duma for the canalisation of the Dnieper and the Duna, and the linking of these two rivers together by a canal, with a view to instituting water communication between Riga and the fertile regions of the rivers named. It is also in contemplation to use some of the impounded water for the generation of electricity, and four power stations equipped with vertical turbines are planned. It is estimated that some 100,000 h.p. will be available throughout the year. The estimated cost of the four power stations, with transmission lines and the transformer stations, is put at 33 500,000 roubles. These plans relate more particularly to the Dnieper region. In connection with the works on the Duna, three electric power stations are projected, the available water power being estimated at 9,000 h.p. The cost of the several projects together will amount to upwards of 100,000,000 roubles. The works will be undertaken in stages, the Dnieper being taken in hand first, and probably in the course of the coming year.

The Société de l'Electricité d'Odessa is increasing its capital from £320,000 to £480,000, with the view of catering for the growing demands for electricity supply in the Odessa district.

It is now about two years since reference was made to the onerous conditions which had been accepted by the Société Centrale Electrique, which is a Belgian company domiciled in Brussels, in return for the grant of an electric lighting concession in Moscow, where the St. Petersburg Electric Lighting (1886) Co., is already a supply authority as well as in the Russian capital. According to the agreement the Belgian company should have commenced the erection of the generating station a short time ago, but the company has informed the Moscow Town Council that it is unable to exercise the concession owing to the impossibility of raising the necessary capital in consequence of the unfavourable situation of the money market. It has not yet been determined whether the company will have to forfeit the whole or a portion of the deposit of £110,000 which was lodged with the town as a guarantee. In the meantime the City authorities have instructed the Tramway Committee to investigate the question of establishing municipal supply works.

According to the *Financial News*, the rumour reported by the *Frankfort Gazette* as to the Central Electric Co., of Brussels, not being able to avail itself of the concession to work a central electric power station in Moscow, is officially declared to be without foundation. At the headquarters of the company it was stated that the period for the commencement of the construction work in Moscow does not elapse until October 21st next.

The original 300-h.p. electricity generating plant at the collieries of the Compagnie des Charbonnages de Prokhorow having become too small for requirements, the establishment of a larger and more modern plant has lately been decided upon. The new equipment will comprise two 1,500-h.p. sets of Brown-Boveri steam turbines and dynamos and a battery of boilers adapted to be fired by the waste gases from the coke ovens.

Italy.—La Società Imprese Idrauliche ed Elettriche del Tirso, which was formed in Leghorn at the beginning of the present year

with a capital of £120,000, has decided to construct a large artificial lake in the valley of the Tirso, Sardinia. The lake will not only serve for the irrigation, by means of canals, of a large area of land, but will also enable electrical energy to the extent of 10,000 H.P. to be generated.

BELGIUM.—La Société Ostendaise Lumière et Force Motrices, which has a large gas-making plant at Ostend, has decided not to establish its own electricity generating station. Instead, it has contracted to take a large supply of current from the plant of the Chemin de Fer Electrique d'Ostende Blankenberghe, to whom it is to supply gas for steam raising purposes.

NORWAY.—The company, which is harnessing the Rjukan waterfalls, has completed the first stage of the whole undertaking, while the works for the completion of the next two stages are being pushed forward. The Rjukan power station II is to generate 81,000 H.P., and the order for the machinery, which is to consist of three generators, has been placed with Brown, Boverie. These generators are the largest of their kind that have ever been built, and are to be of 27,000 H.P. each, weighing over 200 tons apiece. At power station III there will be installed six generators of a similar size, to be built by the Allmanna Svenska Elektriska Aktiebolaget, in Sweden. This order is said to be the largest the company has ever received.

It is reported from Christiania that an English syndicate has secured a concession to put down a large plant to utilise the water power of the Ama Falls in the Roms Valley. The electrical energy generated will be utilised for industrial purposes.

Conway.—A report has been submitted to the T.C., on the electric lighting schemes and tenders. Mr. White submitted a specification which he considered would meet the requirements of the Committee and suggested that fresh tenders be invited; this course was adopted.

Crewe.—The T.C. has instructed the electrical engineer to experiment with electrical heating and cooking appliances, with a view to meeting public requirements in this direction.

Derby.—The T.C., on October 1st, adopted the recommendation to rent premises at Victoria Buildings, London Road, for use as an electricity showroom. There was some opposition on the ground of municipal trading and competition with the tradesmen of the town; the Mayor said it was not intended to go in for municipal trading in any different way than heretofore, and contended that the new showroom would prove a benefit to electrical contractors, instead of harming them as asserted.

Devonport.—PROPOSED LOAN.—The T.C. has applied to the L.G.B. for a loan of £7,600 for mains and services.

Dromore (County Down).—At the request of a news correspondent who furnished the original note, we last week corrected a note appearing on p. 499 of our September 26th issue. We have now, however, to correct the correction on the authority of the Dromore Electric Light and Power Co., Ltd., of Belfast, who say that the original announcement was perfectly accurate. The streets of the town are at present lighted by this company under agreement with the Urban Council, who have no further scheme in contemplation.

East Cowes (I. of W.).—The U.D.C., which contemplates duplicating the pumping plant at the waterworks, has asked the Isle of Wight E.L. Co. to quote for the supply of current, with the view to adopting electrical driving.

Eastleigh and Bishopstoke.—The U.D.C. has asked the Southampton T.C. whether it is willing to supply current to the district, and on what terms.

Edinburgh.—The charge for electricity for lighting is to be reduced from 2¾d. to 2⅝d. per unit. The Electric Light Committee is paying 2s. per ton more for coal than last year.

Great Ouseburn.—The R.D.C. has refused permission for the York T.C. to supply current in bulk to the whole of the Great Ouseburn district. The Acomb P.C. had intimated that it was opposed to York supplying current to the parish, as it was firmly believed that it was only the thin end of the wedge preparatory to swallowing up Acomb within the city boundaries. It is understood that York will apply to the B. of T. for a prov. order, and that a public inquiry will follow.

Halifax.—REVISED ELECTRICITY CHARGES.—At the last meeting of the T.C. consideration was given to a recommendation of the Electricity Committee that the charges for electricity for lighting purposes within the borough be as follows: Accounts up to 1,200 units per quarter, 4d. per unit; current in excess of 1,200 units per quarter, 2d. per unit—excepting that in case of shop premises where electricity was the chief illuminant used for lighting the interior, then all electricity used for exterior lighting or in connection with illuminated advertising signs might be obtained at 2d. per unit; and that a discount of 5 per cent. be allowed on all accounts. Members of the Gas Committee who were present urged that these proposals were a violation of the truce between the two Committees pending the report of the Special Committee appointed to arbitrate between the two departments, and if the recommendations were approved a special inducement would be offered to the public to use electricity in place of gas. It was stated on behalf of the Electricity Committee that the price for current in Halifax was higher than in the case of a large number of towns, and some shopkeepers and picture house managers had threatened that if the prices were not reduced they would provide their own current. It was decided that the portion of the recommendations referring to outside lighting should be referred back.

Harb'edown.—The Bridge R.D.C. has given consent to the Canterbury T.C. extending its mains to Harbledown, which is outside the city boundary. A B. of T. order to enable the supply to be given has been applied for.

Haslingden.—YEAR'S WORKING.—Mr. F. A. Green, borough treasurer, has just published his abstract of accounts. In the electricity department the accounts of the first year's working show that the gross income was £1,599, and the gross expenditure £1,166, leaving a gross profit of £433, equal to approximately 6 per cent. on the capital outlay. Interest and redemption charges absorb £294, leaving a net profit of £137, which has been carried forward to a depreciation and renewals fund. Provision was made in the estimates for a deficiency of £400 on the year's working, but in face of the results, the amount was not required.

Hastings.—The T.C. on October 3rd decided to extend the mains, subject to the consent of the B. of T. and the Battle R.D.C., to the residence of Mr. Conway Wertheimer, which is outside the borough, at an estimated cost of £1,105, of which £750 will be paid by Mr. Wertheimer. Another residence, *en route*, will also be supplied from the main, free of capital charges, in consideration of a perpetual right to run the cables through the property.

Heckmondwike.—Considerable time was occupied at the last meeting of the District Council in hearing a statement by the clerk (Mr. A. H. Redfearn) concerning the attitude taken up by Mr. Hooper at the L.G.B. inquiry held in respect of an application to borrow money. Mr. Redfearn said that he had not expected the accounts of the electricity undertaking to be referred to, and, therefore, could not reply at the time. He found now, however, that notwithstanding what had been said by the Inspector, the Council did not have a deficit if the matter was treated fairly. Mr. Hooper excluded everything in the shape of an asset which did not exist in actual cash, and had struck out a sum of £2,398 for electricity rents due and stock in hand. On the other side of the account, however, every item was reckoned in. Mr. Hooper stated that there was a total deficit of about £2,000, but if the item of £2,398 was taken into account, the department was on the right side. After further discussion, it was resolved to consider the various questions raised in Committee.

Heywood.—The loss on the electric light undertaking for the past year amounts to £4,118, against a loss of £2,532 the previous year; £2,694 will be transferred from the district fund to the credit of profit and loss account, which on March 31st stood at £6,659, against £3,882 last year.

India.—STREET LIGHTING.—Interesting comparisons between gas and electric lighting as a means of street illumination are being carried out in Calcutta. After three months' test, details as to the comparative cost of the two systems will be considered, after which the Gas Committee of the Corporation will report as to the advisability or otherwise of adopting electric light as an additional illumination in some streets.

Kettering.—HOSPITAL LIGHTING.—The Joint Hospital Board has decided to have the hospital wired for electric light at a cost of about £125. The U.D.C. is to lay the cable at a cost of about £150.

Knottingley.—E.L. SCHEME.—The U.D.C. at its last meeting decided that Mr. J. W. Speight, of St. Anne's-on-Sea, be appointed to prepare a scheme, for lighting the town with electricity, at a fee of 20 guineas; and that if the scheme be proceeded with he be allowed 5 per cent. commission on capital costs, this to include the fee.

London.—BATTERSEA.—STREET LIGHTING.—The quotation of the Council's electricity department has been accepted, in competition with a quotation from the Gas Light and Coke Co., for improving the lighting in six streets. The lighting is at present carried on by 17 gas lamps, and it is proposed to alter the position of eight of these and provide six additional lamps, one to be of extra illuminating power. The department's quotation provides for lamps of equal illuminating power at a charge of £3 per annum each and £5 for the large lamp, 2s. 6d. of the charges in each case representing repayment of the cost of installation and conversion. The Gas company's quotation provided for the conversion of the whole of the 23 lamps to the inverted type at a charge of £2 16s. each per annum for the 22 ordinary, and £4 for the large lamp. Besides this, there were charges of £6 for altering the position of the eight lamps, and £3 10s. for reinstating the paving disturbed.

HORNSEY.—Sanction has been received from the L.G.B. to the borrowing of £540 for the purchase of land at Fortis Green, as a site for a sub-station.

HACKNEY.—The Council is installing a Taylor-Scotson pressure regulating apparatus on the switchboard at the new power house, at an approximate cost of £200.

MILE END.—WORKHOUSE LIGHTING.—The Chairman of the B. of G. will move, at the meeting on October 16th, that the Guardians consent to the provision of generating plant for lighting by electricity the buildings in Bancroft Road, at an expenditure not exceeding £1,768.

Marylebone.—A 10 years' agreement is to be entered into with the Portman Estate Mansions, Ltd., whereby the Council is to install mains and services for heating and cooking purposes at the Montague Mansions. The agreement provides for the purchase by the company of the mains and services upon six months' notice being given. Reporting upon the revenue account of the Council's electricity undertaking for the June quarter, Messrs. Price, Waterhouse & Co., the auditors, state that there has been an extraordinary increase in the quantity of electrical energy sold to private consumers, amounting to 30·04 per cent. above that of the same period last year—a record for any quarter (summer or winter) in the history of the undertaking. The improvement is not merely transitory, as is shown by the fact that, although the September quarter of 1912, was the most favourable period of last year, the increase in output during the 10 weeks of the present quarter to date is greater than that of the corresponding period last year. The average price realised during the quarter, excluding meter rents, was 2·385d. per unit, compared with 2·668d. in June, 1912, a decrease of 10·6 per cent. The gross income from the sale of energy amounted to £28,287, against £24,227 from this source in June, 1912, an increase of £4,060, or 16·7 per cent., the rate assumed in the annual estimate being 5 per cent. The price of coal, which was one of the most unsatisfactory features of last year's report, shows a decrease of 13 per cent. during the quarter, although the average price of coal for the whole year will not be less than that of last year. Although the department has sold 30 per cent. more energy as compared with the same quarter in 1912, the total expense has increased by 3·14 per cent. only.

Southwark.—The result of the working of the electricity undertaking during the year ended March 31st last shows a net loss of £1,893. This unfavourable result is attributed to the high price paid for coal during the coal strike, which amounted to £1,052 more than would have been paid if the coal had been obtained under the contract price. There was also to be taken into consideration a loss of £200 in the generating power of coal, owing to inferior quality. The Electric Light Committee, while looking upon the foregoing as the result of an abnormal condition of circumstances affecting the undertaking, feels that a thorough investigation into its administration and working should be made with the view of preventing, if possible, any further deficit, and it has therefore appointed a Special Committee to go into the whole question, and also into the advisability of transferring the books from the Electricity Department to the Borough Treasurer's department.

St. Pancras.—Application is to be made to the L.C.C. for sanction to borrow £9,842 required in connection with the electricity undertaking.

Middleton.—The T.C. has decided to rescind the consent given to the Lancashire Electric Power Co. to supply the Calico Printers' Association with current. At the T.C. meeting on October 1st, Councillor Wiggins said that when the resolution was passed, it was done in good faith, but a thought occurred to someone that they might get the power from another source. They had now decided to refuse their consent to the Power Co., inasmuch as they found that they could get the supply from a neighbouring Corporation.

Newcastle Emlyn.—Street Lighting.—The U.D.C. has sealed an agreement with the Electric Light Co., for the public lighting of the town.

Peterborough.—The T.C. has adopted the following rates for energy supplied to the tramway company for power:—First 120,000 units per annum, a minimum payment of £1,000: over 120,000 and up to 160,000, 1·25d. per unit; over 160,000 and up to 200,000, 1·125d. per unit; beyond, 1d. The Council has decided to cancel a loan for £638 for the provision of superheaters at the generating station, as these are not to be installed.

Padstow.—The U.D.C., on September 30th, passed a resolution deciding to proceed with an electric light scheme, under a seven years' contract with the Electric Light Co.

Scarborough.—E.L. Purchase.—The Corporation has decided to engage the services of Mr. J. W. Hame to advise as to the proposed purchase of the undertaking of the Scarborough Electric Supply Co., Ltd.

Royton (near Oldham).—A Committee of the U.D.C. has recommended that the Town Hall, library and baths be lighted with electricity.

South Africa.—Considerable extensions to the Pretoria electric lighting system will be undertaken in the near future, at a preliminary cost of £25,000, for which plant and fittings will be required. A completely separate high-tension system will be necessary.—*The African World.*

The Prince Albert (Cape Province) Municipal Council proposes to borrow £10,000, a portion of which is intended to be applied to the installation of electric lighting.

The Durban T.C. has been authorised to borrow £960,000 for carrying out various public works, including electric lighting and power extensions.

Southampton.—Proposed Loan.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £16,720 for electricity purposes, and of £4,400 for the provision of a refuse destructor. The former sum included £8,200 for generating plant, for which tenders are to be obtained in order to arrive at a specific amount; £3,000 for services (increased at the suggestion of the Inspector to £6,000 for three years); and £3,000 for services (increased to £8,000). A further sum of £1,000 was applied for for connecting up the Pirelli cable factory, with the result that the electricity loan asked for was increased from £16,720 to £25,720. There was no opposition.

Stockport.—The strike of the gas workers at Stockport has caused great disturbance of trade, and in many of the mills and factories whole departments have had to close down. The Empire Theatre was closed one night last week, but an electrical installation was secured on the following day, and there have been full performances since.

Stoke-on-Trent.—Council last week adopted the recommendation of the Electricity Committee that the L.G.B. be asked to sanction an amalgamation of the various electricity undertakings of the Corporation. It is not proposed to abolish any of the stations, but to unify the accounts, which it is increasingly difficult to keep separate, owing to the central station in Hanley supplying the other works, and the separate stations supplying current outside their own areas. A motion that the prices be made uniform throughout the borough was also adopted, with the addition of "as soon as possible."

Walsall.—L.G.B. Inquiry.—Mr. H. R. Hooper held an inquiry on Tuesday, respecting an application by the Corporation to borrow £4,840, to provide additional plant and buildings, and for approval of the appropriation of certain land, forming part of the Wolverhampton Street sanitary depôt. The town clerk said the outstanding electricity loans were £120,898. The Corporation experienced serious difficulty in working the undertaking last winter. There was an excessive consumption of coal, and they had had to face a heavy deficit on the year's working. The Council called in Mr. Lacey as consulting engineer, and he stated that the existing plant would be insufficient to carry them through the winter of 1913-14, and advised that immediate steps should be taken for the provision of additional boiler power, the cost of which would not exceed £5,000. An estimate was submitted showing a total amount of £4,840, for which he recommended application for a loan should be made. In order to be ready for the heavy winter load, the L.G.B. gave provisional assent for the new boiler additions to be carried out.

The Inspector asked Mr. Lacey if any further economies might be suggested.—Mr. Lacey: Only in general repairs, which will be matters for revenue charges.

The Inspector said the buildings would be of a temporary character only, and he expected the period of repayment would be only about 12 or 13 years. No opposition was offered.

West Kent.—B. of T. Inquiry—An inquiry was held at the Surveyors' Institution, Westminster, on August 9th, in the matter of the "West Kent Electric Co., Ltd., *v.* the Bromley Corporation," and the B. of T. has now given its decision. Under the Kent Electric Power Act, 1902, the company has power throughout a large area to lay mains and supply current; but in the Bromley urban district it is not the distributor, and can only supply in bulk. It had in view a scheme of ring mains coming down through the Bromley area, and going right round Orpington, St. Mary Cray and Chislehurst, and back to the South Metropolitan district. The proposal was to lay mains by the shortest route through the Borough of Bromley, *viâ* High Street, to Hayes, Orpington, St. Mary Cray and Chislehurst. Under Sec. 42, the Council objected, and suggested two alternatives each of which the company declined to adopt.

The decision of the Board is in favour of the Corporation, and the company has now to follow the alternative route put forward by the Council.

Winchester.—The T.C. has decided to appeal against the new assessment of the electricity works, which has been increased from £2,632 gross to £5,832, and £918 rateable to £2,832.

Woking.—The B. of T. has revoked the Woking E.S. Co. E.L. (Extension) Order of 1908, in so far as it relates to the parish of Thorpe.

Worthing.—The estimates in connection with the E.L. undertaking for the coming half-year show a surplus on March 31st next of £1,189, after making the customary contribution of £250 to the depreciation fund.

Electrical Cooking.—Some interesting particulars relating to the use of electricity for the Church Nursing and Ambulance Camp were contained in the report of the Electricity Committee, which was submitted to the T.C. They were supplied by the electrical engineer (Mr. Geoffrey Porter), and showed that the whole of the cooking for the Brigade, averaging about 130 persons, was carried out by electricity supplied from the Corporation mains. The "Tricity" cooking ranges and apparatus gave every satisfaction; the kitchen staff were entirely ignorant of electrical cooking, yet within a few hours they were called upon to cook a dinner for 130 persons, and succeeded admirably; all the hot and boiling water requirements of the Camp were also dealt with electrically. The apparatus was hurriedly installed in a tent in a very simple manner, and the success of the Camp kitchen afforded a most convincing illustration of the capabilities of electricity for cooking purposes.

Wrexham.—The T.C. has amended as follows the sliding scale of charges to users of current whose annual consumption exceeds 1,000 units, and to users in hotels, inns, public houses and beer houses:—Up to an amount equivalent to five units per 8-c.p. lamp installed, 5d. per unit; beyond, 2½d., with ½d. per unit discount for prompt payment of accounts.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—A letter has been received from the B. of T. intimating that the Suburban Tramways Co. has applied for powers to use trailer cars.

Australia.—Railway Electrification.—The Victorian Railway Commissioners have referred the question of the suitability of the Yarroville site for the power station for the suburban railway electrification to Mr. C. H. Merz. Little difference would be made by its transfer to Fisherman's Bend or Newport. The sites of the 12 sub-stations have been selected; the buildings will be of brick, uniformly 40 ft. high and 80 ft. wide, with lengths varying from 74 ft. to 212 ft. A large car repair shop is provided for at Jolimont, to be about 400 ft. long and 200 ft. wide.

Birmingham.—At the September meeting of the Chamber of Commerce a report, which was approved, was presented from the Local Finance Committee, objecting to the proposed extension of the overhead system of tramways, "Mainly because of the financial danger of additional capital outlay upon a system on which already £1,750,000 has been expended, and which will probably become obsolete in a few years, and in connection with which there has also been considerable outlay in the electric supply department." It objects to the tramway extensions being "bolstered up" to the inconvenience of the public by the City Council forbidding motor-omnibuses to run on any road on which the Corporation tramways run. There is much development possible on new routes, it is pointed out, and to places too far out to make tramway extension possible at a profit, but to which motor-onmibuses may ply and do good pioneer work; but if all these onmibuses are to be prevented (owing to the existence of tramways) from bringing their passengers to the centre of the city, these routes will not be paying ones, and such enterprise will not be possible.

For some time past, says the *Daily Telegraph*, the Tramways Committee has been in negotiation with the Birmingham Motor-Omnibus Co., for the purchase of all the company's interests in Birmingham. The price agreed upon is £30,600, which includes the purchase of 30 motor-omnibuses, together with the plant and garage in Tennant Street. The Corporation's motor service will be supplementary to the tramway service.

Parliament has twice refused power to lay a tramway to Harborne, and the City Council has rejected a proposal to run cars along Colmore Row, or to cross New Street, a busy shopping thoroughfare in the centre of the city. The motor-propelled 'buses will continue to be utilised for these streets, and the service will in all probability be developed to take in cross-country routes where a tramway is unnecessary. It is understood that the business of the company will be acquired at the end of the current year.

Blackpool.—At a meeting of the T.C., Ald. J. Brodie, chairman of the Tramways and Electricity Committee, announced that during the past six months the tramway receipts were £67,713, against £57,134 last year. The increase was attributed largely to the electrical illuminations.

Bradford.—The preliminary figures for the working of the Corporation tramways during the six months ended September 30th, when compared with the figures for the corresponding period of last year, show an increase of 7 per cent. in the receipts, 4 per cent. in the mileage run and 10 per cent. in the number of passengers carried. The figures are as follows:—Receipts £158,622, as compared with £147,901, an increase of £10,721; car-miles 3,156,070, as against 3,033,869, an increase of 122,201 miles; whilst there is an increase of 3,217,558 in the number of passengers carried (34,227,530, as compared with 31,009,972). Whether or not the undertaking will show as large a profit as 12 months ago remains to be seen, for although the number of miles run and the number of passengers carried show an increase, the working costs of the department have been considerably augmented by reason of the advances in wages to practically everybody in the employ of the undertaking, the payment of full sickness benefit to the men when off duty owing to illness, and the costs incurred for track maintenance.

Brighton.—The T.C. is recommended by the Tramways Committee to renew the track in Beaconsfield Road at a cost of £4,500.

Burnley.—The Tramways Sub-Committee has considered the question of establishing a tramway between Stoneyholme and Brunshaw Bottom, and has instructed the manager to prepare a report respecting the scheme.

Continental Notes.—Baden State Railways.—The opening of the Baden new railway station at Basle has been accompanied by the commencement of electrical working on the Wiesental railway from Basle to Zell, which has a length of 18 6 miles. The power is obtained from the Augst-Wyhlen hydro-electric works, which are situated a few miles distant from Basle, and are able to yield 30,000 H.P. under normal conditions of the water level. Single-phase alternating current at 10,000 volts is used, and the locomotives have a maximum speed of 31 miles an hour. The Baden State Railway authorities have agreed to pay £6,000 per annum for the supply of power, including the lighting of the Baden station at Basle.

Austria.—A syndicate has been formed to push forward a scheme for the construction of an electric tramway between Prague and Roztok.

Italy.—An electrically-operated cable ropeway for the conveyance of passengers has recently been constructed between Lana and the Vigiljoch, in the Tyrol, by Messrs. Cecetti and Tanfani, of Milan. The line is divided into two sections, one being 2,952 ft. long and rising 1,705 ft., and the other 3,198 ft. long with a rise of 2,076 ft. The cars are equipped with electric signalling and telephoning arrangements. The necessary current for the operation of the line is taken from the mains of the central electricity station at Lana at 3,000 volts, this being stepped down to 350 volts. On the ascent, the average power required per vehicle is 35 H.P. and the maximum 70 H.P.

Switzerland.—A limited company has just been formed at Sierre, in the Valais, for the construction of an ordinary-gauge electric railway from that town to Goppenstein, thus giving direct connection by the Loetschberg tunnel line with Berne, and facilitating the tourist traffic on both sides of the Rhone, while reducing the cost of transit of merchandise and produce from, and into, Germany, Austria and France. The line will be 25 km. in length, and will be equipped with the Loetschberg pattern of rails. The traction will be by electric locomotive using single-phase current, supplied from one of the numerous generating stations in this region.—*Lumière Electrique.*

France.—It is reported that arrangements are in hand for the starting of a service of electric motor-'buses in the Dieppe district.

The tramway system in the town of Nantes, which is worked on the compressed-air system, is to be converted to electric traction.

Austria.—The Lower Austrian Provincial Commission has obtained the sanction of the Ministry of Railways to carry out the preliminary studies for a narrow-gauge electric railway from Vienna to St. Polten, across the Sophienalpe, and making connection with the Lower Austria-Styria Alpenbahn.—*Der Elektrotechniker.*

Turkey.—New cars for the Constantinople Metropolitan Underground Railway, which from an English company passed into the hands of the Constantinople Electric Trust, have arrived, and are being put into service as fast as erected.

Russia.—The Moscow tramway employés came out on strike on October 2nd. The Municipal Council threatened to dismiss them if they had not resumed work by 2 o'clock on the 4th. The Public Prosecutor has taken proceedings against the strikers.

Dundee.—Annual Accounts.—The gross receipts of the Corporation tramways for the year amounted to £65,044 and the working expenses to £39,421. This leaves a balance of £25,623, which has been appropriated in meeting interest, sinking fund and depreciation, while £7,400 has been allocated for renewals and £1,500 to the common good. The other returns recorded are:—Mileage run, 1,359,821, an increase of 24,309; passengers carried, 17,734,162, an increase of 711,602. The increase in receipts over the previous year is £2,365. The capital liabilities stand at £352,663. The renewals fund amounts to £44,644; depreciation fund, £19,539; reserve fund, £561; and accident insurance fund, £7,078.

Edinburgh.—According to a report by the burgh engineer, the probable cost of the proposed extension of the tramway system from Craiglockhart by way of Colinton Hospital to Coniston Road will be about £23,000, in addition to which there would be, under certain circumstances, an expenditure of £16,000 on road widening.

Haslingden.—Year's Working.—The abstract of accounts shows that the gross income for the year from the tramway undertaking was £8,345, as compared with £7,916 in the previous year; the gross expenditure was £5,249, as compared with £5,500. The gross profit was £3,095, as compared with £2,416. The charges for interest and redemption absorb £2,463, as compared with £2,574, leaving a net profit of £632 carried forward to the depreciation and renewals fund, against an actual loss on the previous year of £157. The significant feature of this year's accounts is that the undertaking for the first time shows a net profit on the 12 months' working.

Heywood.—Year's Working.—According to the annual abstract of accounts, the loss on the tramway undertaking was £809, against £742 last year. £978 will be transferred from the borough fund to the credit of profit and loss account, which at March 31st last stood at £2,036, against £2,200 last year.

Leeds.—The Tramways and Electricity Committee proposes asking the B. of T. for sanction to borrow £45,000 for new tramcars. It is also intended to apply the side life-guard to the whole of the cars.

Leicester.—The City Council has decided to construct immediately a line of tramways from the West Bridge, along St. Augustine Street and King Richard's Road to Fosse Road, powers for which were obtained in the Corporation Act of this year. The purchase of land to enlarge the site of the power station was also agreed to. The recommendation of the Committee to obtain 10 additional P.A.Y.E.-cars was referred back for further consideration

London.—L.C.C. Tramways Rating.—As a result of the appeal against the assessment of the tramways in Lewisham, the amount has been reduced from £9,080 to £5,500. On the assumption that other tramway assessments were proportionately reduced, the £100,000 at present paid by the L.C.C. undertaking would be reduced to £65,000, an average drop from 2d. to ½d. in the £.

The Woolwich B.C. is informing the B. of T. that it has observed no undue interference with the ordinary traffic consequent on the running of trailer cars by the L.C.C. between Beresford Square and Eltham, and between Nile Street and Abbey Wood.

New Zealand.—The annual report of Mr. S. Richardson, electrical and tramways engineer to the Wellington Corporation, shows total tramway revenue during the past 12 months amounting to £151,839, an increase of £13,310. The operating expenses were £139,936, and the net surplus was £10,662. The gross revenue from lighting was £58,157, an increase of £6,437 on the previous return. For traction purposes, 6,502,820 units were generated, 790,000, however, being supplied for power and private consumers; in the electric light department, 3,983,658 units were generated. Some 258,850 equivalent 8-C.P. lamps, and 1,360 H.P. of motors, are connected.

Northampton.—The traffic return of the Corporation tramways from April to September shows that the receipts amounted to £13,434, as compared with £12,837, an increase of £596. The Committee has been asked by the Corporation to consider the erection of passenger shelters. The tramway extension to Far Cotton, and the doubling of the Kingsthorpe Road route, are expected to be commenced in February.

Oldham.—The Tramways Committee has decided to obtain six new tramcars.

The Committee is to consider the question of the welding of rail joints by the department, and inquiries are to be made into the matter.

South African Railways.—PROPOSED ELECTRIFICATION.—In the course of his annual report (for 1912) on the Railways and Harbours of South Africa, Mr. W. W. Hoy, the general manager, offers the following remarks on the subject of the proposed electrification of certain lines in the Cape Province, and also on the Rand and the Portuguese border :—

Preliminary inquiries have been made as to the probable cost of replacing steam by electricity as the motive power on the Wynberg-Sea Point lines in the Cape Peninsular and on the Springs-Randfontein line on the Rand. While further and more exhaustive investigation is necessary before any definite opinion can be expressed, it is evident that the advisability of adopting electric traction on the lines mentioned is worthy of serious consideration.

Some difference of opinion appears to exist as to the relative merits of the single-phase system and the direct-current system, and as to whether the Administration should, in the event of conversion, purchase or generate its own current; but these are matters on which the best advice can be obtained. The cost of current, however, is the great consideration, and if other public bodies are prepared to co-operate with the administration on reasonable terms so as to reduce the cost, the result should be advantageous both to them and to the Administration.

There are no engineering difficulties in the way of conversion. The change-over would involve additional capital expenditure, but as against this the wages bill of the running staff, the track maintenance expenditure, and the cost of work of the terminal station would be reduced considerably, while I am convinced that the increased comfort and convenience of passengers and the greater expedition of trains will here—as in other countries where electric trains have taken the place of steam trains—attract additional traffic. The increased traffic on the Cape Town-Simonstown line is sufficient indication of the response invariably made by the public to the improved facilities.

At Cape Town the long haul from the coalfields makes coal comparatively expensive. On the Rand, coal is not expensive, but current is generated for mining purposes on a very large scale, and it will probably be found possible to purchase the power necessary there at a sufficiently low figure.

The practicability of electrifying the line from the Portuguese border to Waterval Boven should also receive consideration. The grades and curves on this section and the climatic conditions make the present method of working expensive, and it is quite probable that inquiry will show that electrification will result in a considerable saving, more especially if use can be made of the water power available for the generation of power.

Sunderland.—The Tramways Committee has decided to apply for a prov. order to enable the Sunderland District Electric Tramways Co. to run over the Corporation lines into the centre of the town. The District Co. will, it is understood, bear the cost of the arrangements.

Tasmania.—The Tasmanian Budget estimates make provision, among other things, for the expenditure of £30,000 for new tramways.

West Bromwich.—The Highways Committee has had under consideration the question of the provision of railless trolley vehicles for the All Saints' and Greets Green district. It has had a preliminary report from the borough surveyor showing what the probable profit and loss—loss rather than profit—would be, and the matter will be further considered at an early date.

West Sussex.—An order under the Light Railways Act for West Sussex has been applied for by Messrs. E. H. Allen, L. Clayton, S. A. Garland, and others, and the Commissioners will hold an inquiry at Chichester on November 4th.

Wigan.—The T.C. has decided to purchase six new cars, at a total cost of £5,700, and to apply to the L.G.B. for sanction to borrow this sum.

York.—At the City Council on Monday the Joint Committee recommended a scheme for applying for borrowing powers to construct a bridge at Clifton, and to make up the roadway to Lincoln Street at a cost of £33,350, exclusive of the cost of any land to be acquired. It was stated that it would be possible to run trolley 'buses from Bootham, and to give a good service and open up the district. Alderman Meyer said that with all the extensions proposed to the tramway schemes it would mean practically the doubling of the present mileage, which cost £130,000, at an expenditure of only £72,000. Probably the actual cost to the city would be a ¾d. rate, and if that were so, there was no risk to the city, because the tramway assessment produced that amount for the rates. The scheme of the Joint Committee was adopted by 25 votes to 7.

TELEGRAPH and TELEPHONE NOTES.

Belgium. — Messages from the wireless station at Laeken, near Brussels, have been received at Boma, in the Congo.

Landing Licence.—Notice is given in the *London Gazette* of an application by the Direct Spanish Telegraph Co., Ltd., for the renewal of their licence to land a cable at Kennach Cove, Cornwall.

New Zealand. — The amount expended on telegraph extensions in New Zealand during the last financial year was £422,672. On March 31st there were 12,508 miles of telegraph line and 41,892 miles of wire. The length of submarine cables within the Dominion was 374 nauts. Two low-power wireless stations at Wellington and Auckland are in successful operation. One high-power station at Awanui and another at Awarua are completed, and a low-power station at the Chatham Islands is approaching completion.—*A.M.S.*

The Postmaster-General has accepted the tender of the Western Electric Co., of Australasia, for the supply of automatic telephone exchanges at Auckland, Blenheim, Wellington, Hamilton, Oamaru and Masterton, for £89,555. The expenditure of this amount will be spread over four years, and the first payment will be due in 1914-15. The offer provides for full automatic switchboards at the centres named, with branch exchanges.

Post Office Engineering Department.—Coventry was, until five or six years ago, a centre for Post Office engineering, and then the headquarters were removed to Leamington. It has now been decided to re-establish the quarters at Coventry.

Postal Servants.—The National Joint Committee of Postal and Telegraph Associations on Saturday discussed the Holt Committee's report, and decided to ask the Prime Minister and the Postmaster-General to receive a deputation to protest against its recommendations. It was decided to demand an immediate increase of pay for all bodies affiliated to the National Committee, on a basis of 15 per cent., to submit a detailed analysis of the staff's objections to the report to the Postmaster-General, and to hold mass meetings all over the United Kingdom.

The Executive Committee of the Amalgamated Society of Telephone Employés, representing all sections of the staff of the Post Office telephone service throughout the United Kingdom, at a special meeting in London during the week-end, after carefully considering the report of the Select Committee on Post Office Servants, declared itself unable to accept it as a reasonable and equitable verdict on its claims, and rejected as totally inadequate such modifications of pay and conditions as were recommended.

The Pacific Cable.—The accounts for the year ending March 31st last show net traffic receipts £166,027, and total receipts £167,901, exceeding the expenditure by £45,275. Interest and sinking fund on the loan capital required £77,545, the difference, £32,270, being contributed by the Imperial and Dominion Governments. The net traffic receipts exceeded those of 1911-12 by £11,135, while expenditure was up by £520 only, on the surface, but actually by £2,870. The Australian and New Zealand extensions were completed during the year, the total cost being approximately £177,730, which was provided from the renewal fund. The latter stood at £335,746 on March 31st, 1912, and at £191,383 in 1913. Owing to the continued refusal of the Postmaster-General of New Zealand to allow the mail steamers to call occasionally at Fanning Island, it has become necessary to provide and maintain a vessel to ply between the Island and Honolulu. During the year rates have been lowered, week-end cable letters at 9d. a word being accepted, and Press messages at 7½d. The number of words sent during the quarter to March 31st, 1911, when neither the deferred rate nor the week-end rate was in force, was 329,438, and this was increased by 44 per cent. to 473,491 during the first quarter of 1913, which was also the first three months of the week-end service. The cost to the public increased by 16 per cent. The total number of words dealt with in 1912-13 was 2,670,575, as compared with 2,131,376 in the previous year.

The Severn Tunnel.—To meet the demands for improved telegraph and telephone facilities, a new cable has been laid through the Severn Tunnel. The cable, which is 4½ miles long, was supplied by the British Insulated and Helsby Cables, Ltd.; it is composed of 20 pairs of h.c. copper wire, weighing 40 lb. to the mile, insulated by dry paper ribbon and air, and enclosed in a lead

sheath, protected with bitumen-served hemp. The cable is suspended from hooks 4 ft. apart driven into the wall of the tunnel. Special arrangements had to be adopted to install the cable, this being effected by means of a platform fitted above a goods wagon, by means of which it was possible to pay out two ½-mile lengths during a 10-hour occupation of the line. The jointing and testing had to be done under unfavourable conditions, but everything was carried through successfully. The east and west cable terminals are situated in huts close to the tunnel mouths, where lightning protecting apparatus are provided, as the overhead wires are connected at these points.

United States.—It is reported that the Government is contemplating the purchase of the telegraph and telephone systems of the country.

The War Department has transferred the Alaskan military cable telegraph system to the Post Office Department. This is the first positive step towards Government ownership of the telegraphs.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Tenders were opened last week by the Corporation Tramways Committee for the electrical equipment of six new cars. It was decided not to accept any offer at present, but to ask two of the firms to send in amended offers.

Australia.—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—Sydney.—November 26th. For the Commonwealth Railways Department. One 2,000-lb. storage battery freight truck.

March 18th, 1914.—For the P.M.G. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

N.S.W. Government Tramways.—Additions to lines, workshops and buildings, duplication of lines, and for other purposes, £280,000; rolling stock to meet expansion of traffic and equipment of new lines, £91,000; additional power house to meet expansion of traffic, £71,500; city electric railway, £3,000; eastern suburban electric railway, £900; western suburbs electric railway, £900; tramway construction, tramways generally (further sum), £20,000. —*Tenders.*

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of the specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

October 15th.—20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" September 19th.

Victorian Railways.—November 12th. 17 miles lead-covered impregnated paper-insulated copper cable for track-locking roads. November 19th.—10 tons sulphate of copper for electrical purposes. Specifications may be seen at Board of Trade C.I. Dept. in London.

November 12th.—One 60-H.P. electric motor and accessories. *Australian Mining Standard.*

November 11th.—For the P.M.G. Eight automatic telephone switchboards. See "Official Notices" to-day.

December 14th.—Two sections switchboard, common battery multiple. See "Official Notices" October 3rd.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 26th.

Brisbane.—November 19th. For the P.M.G. Wire, bronze, 100 lb. per mile. See "Official Notices" September 26th.

Bradford.—October 18th. Corporation Tramways Department. Miscellaneous electrical and other stores for year ending December 31st, 1914. Tenders to Town Clerk.

Brymbo (near Wrexham).—October 20th. Parish Council. Incandescent electric lighting of the streets. Overhead system. 40 lamps. See "Official Notices" to-day.

Canada.—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

Cardiff.—October 17th. Corporation. Passenger tickets and ticket punches for trams. See "Official Notices" October 3rd.

China.—Shanghai.—October 17th. Extra-H.T. pilot cable, &c., for the Council. See "Official Notices" October 3rd.

Dublin.—November 1st. G.N. Railway Co. (Ireland). One year's supply of stores, including a number of electric and telegraph supplies. See "Official Notices" to-day

Glamorgan.—The County Council desires to negotiate for the construction and working of five miles of light railway from Ynysforgan to Pontardawe. See "Official Notices" to-day.

Halifax.—October 11th. Concrete dam, pump house, &c., at the electricity works. Mr. James Lord, borough engineer, Town Hall. Deposit, £5.

London.—Bermondsey.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

L.C.C.—October 14th. 200 driving wheel centres for electric cars. Particulars from Chief Officer, 62, Finsbury Pavement, E.C.

Manchester.—October 21st. Tramways Committee:—(*a*) Permanent way special track work; (*b*) permanent way points, tongues and hardened steel centres; (*c*) granite setts. Mr. J. M. McElroy, general manager.

October 16th.—(*a*) One 1,800/2,200-KW. motor converter or rotary converter and static transformers; (*b*) H.T. switchboard; (*c*) static transformers. Specifications, £1 1s. each, from Mr. F. E. Hughes, secretary, Electricity Department.

New Zealand.—December 18th. Hastings Borough Council. Two sets of high-lift turbo pumps and electric motors. Mr. H. W. Climie engineer. Specification may be seen at Board of Trade Com. Int. Department in London.

December 11th.—Wellington City Council. One switchboard, complete with instruments and accessories, for the electric lighting department. Specification at the office of the Electrical Engineer.

Gisborne Borough Council.—325 direct-current meters. Specification from the Town Clerk.—*New Zealand Shipping and Commerce.*

Rochdale.—October 13th. Mechanical filtration work, including turbine or water motor, &c.; also electric lighting plant. Specifications, &c., from Mr. F. H. Brunt, engineer and manager, Waterworks Office, Lord Street. Deposit £3 3s.

South Africa.—Johannesburg.—November 24th. Electric light fittings for the Town Hall and Municipal Buildings. See "Official Notices" September 26th.

Tenders are about to be invited for plant and material for extension works to be undertaken by the Durban Municipal Council in connection with the electric lighting, power and telephone systems, at a cost of £175,000.

Tenders are called for by the Uganda Public Works Department for electric light and power supply for 10 years to the township of Kampala and a 10-mile radius therefrom. Included will be 300 32-C.P. lamps for street lighting and 200 16-C.P. lamps for the Government quarters. Tenders will be received at Entebbe up to December 31st.

Contracts will shortly be given out in connection with the duplication of the turbo-alternator and converter plant of the Cape Town municipal electric lighting system. The cost is estimated at £11,000.

Contracts for tramway material and rolling stock will be given out at an early date by the Durban Municipality, at a cost of £100,000.—*British and South African Export Gazette.*

South Shields.—October 15th. Corporation. One 2,000-KW. turbine, direct coupled to two three-phase generators in tandem, together with condensing plant, rotary converters, transformers and switchgear, &c. See "Official Notices" September 26th.

October 25th.—Corporation. Five or ten top-covered tramcars complete. See "Official Notices" September 26th.

Spain.—October 14th. The municipal authorities of Chamartin de la Rosa (province of Madrid), are inviting tenders for the concession for the electric lighting of the town during a period of seven years.

October 23rd.—The municipal authorities of Salvaleon (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

October 28th.—The municipal authorities of Castellon recently invited tenders for the concession for the electric lighting of that town, and also of El Grao. As no bids were, however, received, it has been decided to again offer the concession to tender.

Tenders have just been invited by the municipal authorities of Llerena (province of Badajoz) for the concession for the electric lighting of the town during a period of ten years.

Swindon.—G.W. Railway.—October 13th. One year's supply of stores, including a number of electrical and telegraph supplies. See "Official Notices" October 3rd.

Warrington.—October 14th. Corporation. (1) Low-tension cable; (2) low-tension feeder panel. See "Official Notices" September 26th.

October 28th.—Corporation. (1) One 2000-KW. turbo-alternator, condensing plant, pumps, piping and fittings. (2) One water-tube boiler, mechanical stokers, superheaters, &c. See "Official Notices" to-day.

York.—October 16th. Electric lighting installation, board room and offices, for the B. of G. Mr. Geo. Sykes, clerk, Museum Street.

CLOSED.

Australia.—Victoria.—The *Australian Mining Standard* reports the placing of the following contracts :—

Footscray.—500 5-ampere A.C. meters, 21s. each.—Siemens Bros. Dynamo Works, Ltd.
Department of Home Affairs.—Federal Capital.—1,000 Locke insulators, £700.—The Australian General Electric Co.
Melbourne Harbour Trust Commissioners.—One direct-coupled electric light set, £235.—Clayton, Joel & Co.

Battle.—The B. of G. has accepted the tender of Messrs. French & Co., of Bexhill-on-Sea, for the electric light installation at the workhouse, at £319, £4 extra on their quotation of £315 being allowed for an Aster engine. A list of the tenders received appeared in the last issue of the Electrical Review.

Blackpool.—The tender of Messrs. Richardsons, Westgarth & Co., for a 1000-kw. turbo-generator and condensing plant for the electricity works, has been accepted.

Burnley.—The Board of Guardians has accepted the tender of Messrs. Simpson Bros., Ltd., for electrical requirements for the workhouse for the half-year.

Bury.—An agreement has been sealed by the Corporation with Messrs. J. Musgrave & Sons for the supply of one 3,000-kw. turbo-alternator, with exciter and surface condenser.

The order for electrically equipping the works of Messrs. Spencer and Curedale, Ltd., waste bleachers, of Bury, has been placed with Mr. A. M. Cramp.

Coventry.—The City Council has accepted the tender of the Maudslay Motor Co., Ltd., Coventry, for the supply of six 40-h.p. motor-omnibuses, at £739 each (total £4,434).

Eastbourne.—The B. of G. has accepted the tender of Messrs. Pearson, Ltd., for the electric light installation at the infirmary, at £66.

Germany.—The Norddeutsche Maschinenbauanstalt Fritz Klinke & Homeln, of Bohmte, have succeeded in submitting the lowest tender, £18,645, to the Bremen Harbour Works authorities for the supply of 22 2½-ton electrically-operated cranes.

Glasgow.—The T.C.'s Tramways Committee on Works and Stores recommends acceptance of the following tenders :—

Steel traction poles.—Stewarts & Lloyds, Ltd.
Copper collector bushes.—General Electric Co., Ltd.
Motor gear cases.—Electrical Engineering and Equipment Co., Ltd.
Bastian radiators.—Gillespie & Beales.
Lighting fittings.—Falk, Stadelman & Co., Ltd.

The offer of Messrs. Dykes Bros. for the supplying and fitting up of an electric clock at the junction of Old and New Dalmarnock Roads has been accepted (£27). Messrs. W. Silversteen & Co.'s offer to supply a magnetic separator for extracting metal from the clinker at Dalmarnock destructor works has been accepted, it being the lowest.

Gloucester.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son for rough small steam coal from the Cannop Colliery for the electricity works for a year, at 12s. 10d. per ton.

Haslingden.—Messrs. C. Whittaker & Co., Ltd., Dowry Works, Accrington, have placed an order for a 25-h.p. and a 20-h.p. motor for electrically driving a portion of their Haslingden works, also for the electric lighting of their moulding shop, with Mr. A. M. Cramp, of Haslingden. Mr. Cramp has also received an order from the Haslingden Conservative Club for a system of electric ventilating fans.

Huddersfield.—The contract for the electricians' work in connection with the enlargement of the New North Road Baptist Sunday School has been secured by Messrs. J. H. Taylor & Co.

India.—Bombay.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., have received the contract for all the underground cables required by the Bombay Port Trust in connection with the electrification of the new Alexandra Docks.—*Indian and Eastern Engineer.*

Lancaster.—The T.C. has accepted the tender of the United Electric Car Co., of Preston, for two tramcar top-deck covers, at £130 10s. each.

Leyton.—The T.C. has accepted the tender of Messrs. W. Cottis & Sons, Ltd., at £41, for the supply of 25 public lighting lanterns. Other tenders were :—

C. Lang, on behalf of the Cable Accessories Co., £42.
W. Lucy & Co., Ltd., £48.
Reason Manufacturing Co., £61.
Laing, Wharton, Ltd, £96.

London.—Deptford.—The Anglo-Swedish Electric Welding Co., Ltd., of Wood Wharf, Greenwich, are to repair No. 2 boiler of the Baths Committee, at £24 10s.

Hackney.—The Electricity Committee recommends that the new switchboard be fitted with a Taylor-Scotson regulating apparatus (Cox-Walkers, Ltd.) for four alternators, at £200.

Marylebone.—The tender of Messrs. Venner & Co. (agents to Messrs. Chamberlain & Hookham) has been accepted by the B.C. for the supply of 1,000 meters as required, ranging from 1½ amps. to 100 amps. sizes.

Manchester.—The Electricity Committee has accepted the following tenders for requirements for the period ending June 30th, 1914 :—

Joseph Stubbs, Ltd.; Alex. Dunn & Son; J. & S. Eyres, Ltd; and Ferranti, Ltd.—Iron castings.
Diatomite Co., Ltd.—Asbestos non-conducting composition.

Tenders from the following have also been accepted :—

W. T. Glover & Co., Ltd.; Johnson & Phillips, Ltd.; and the Western Electric Co., Ltd.—L.T. paper-insulated cable.

Middleton.—The Corporation has accepted the tender of Mr. B. Thomas for lighting switchboard.

New Zealand.—25,000 Leclanché No. 2 cells (A quality), £1,250.—A. & T. Burt, Ltd.

70 tons copper wire, £5,939.—Richardson, McCabe & Co., Ltd.—*Australian Mining Standard.*

Perth.—Messrs. Colin Wood & Co., Montrose, have secured the contract from H.M. Office of Works, for the electric light installation at the new Perth Post Office Sorting Department.

Rawtenstall.—The Corporation has placed an order for the electric lighting of the Education Offices with Mr. A. M. Cramp.

Rotherham.—The following tenders have been accepted by the T.C., for annual supplies to the Electricity and Tramway Departments :—

Electricity Department.—

Meters.—Bastian Meter Co., 2½ and 5-ampere meters.
Chamberlain & Hookham, Ltd., 10, 25, 50 and 100-ampere meters.
High and low tension cable.—Callender's Cable Co., Ltd.
Coal.—Sheepbridge Coal and Iron Co., Ltd., 8s. per ton; W. A. Durnford (Earl Fitzwilliam's Collieries), 9s. 1d. per ton; J. Brown & Co., Ltd., washed slack, 9s. 9d. per ton.

Tramway Department.—

Trolley wire.—B.I. & Helsby Cables, Ltd., £414.
Oil, &c.—Joseph France's Executors.
Gold ribbon and gold leaf.—Coe Ribbon and Gold Leaf Co.
Waste, wash-leathers and white cloths.—Boardman Bros.
Brake castings.—Tenter Foundry Co., Ltd.
Axle collars.—United Electric Car Co., Ltd.
Brake blocks.—National Rail and Tramways Appliance Co., Ltd.
Trolley wheels.—Imeson, Finch & Co., Ltd.
Brake chains.—The Weldless Chains, Ltd.
Slipper blocks.—W. Wilson, Ltd.
Metal polish.—Sharp & Co.
Carbon brushes.—Le Carbone.
Armature coils, Okonite, tape, gear wheels.—British Westinghouse Co.
Axle brass keeps, armature brasses.—Anti-Attrition Metal Co.
Controller fingers, binding wire, trolley heads, &c.—Bonser & Co.
Trolley brushes.—Brecknell, Munro & Rogers.
Cable, lamps, &c.—Smith Bros., Ltd.
Anti-friction metal.—Glacier Anti-Friction Metal Co.
P.B. and white cotton tape.—L. Andrews & Co., Ltd.
Blackley tape.—Hallamshire Electric Co., Ltd.
Presspahn.—Spicer Bros., Ltd.
Pinion wheels, trolley poles.—Watlington & Co., Ltd.
Motor grease, &c.—Newsome & Co.
Varnish, &c.—Ingham, Clark & Co., Ltd.

Salford.—Tenders accepted by Corporation Committees include the following :—

British Westinghouse Co., Ltd.—Equipping two spare cubicles on the E.H.T. switchboard, including the remote control switchboard, £275.
Stewarts & Lloyds.—Two new boiler feed pipes, £18 12s. 6d.
Dewrance & Co., Ltd.—Four slide valves in connection with the above pipes, £6 5s. each.
Balcke & Co, Ltd.—Treating the timber of the water-cooling tower with a non-rotting composition, £84.
British Westinghouse Co., Ltd.—Fitting the E H.T. switchboard with indicator lamps, £18.
Bertram Thomas.—Repair of two of the change-over switches required for the traction generators, £14.

Sheffield.—The City Council has accepted the tenders of Messrs. Bayliss, Jones & Bayliss, Ltd., and Messrs. Dorman, Long and Co., Ltd., for a supply of tramway tie bars and anchor joints; also the tender of Messrs. Steel, Peech & Tozer for a further supply of tram rails. The Council's contract with Messrs. A. Reyrolle & Co., Ltd., for the supply of extra-high-tension switchgear at the Neepsend power station, has been extended to provide four additional panels, at a cost of £2,453. A supplemental contract is to be entered into with Messrs. R. White & Sons, at £702, for extending the ashes aerial ropeway at Neepsend.

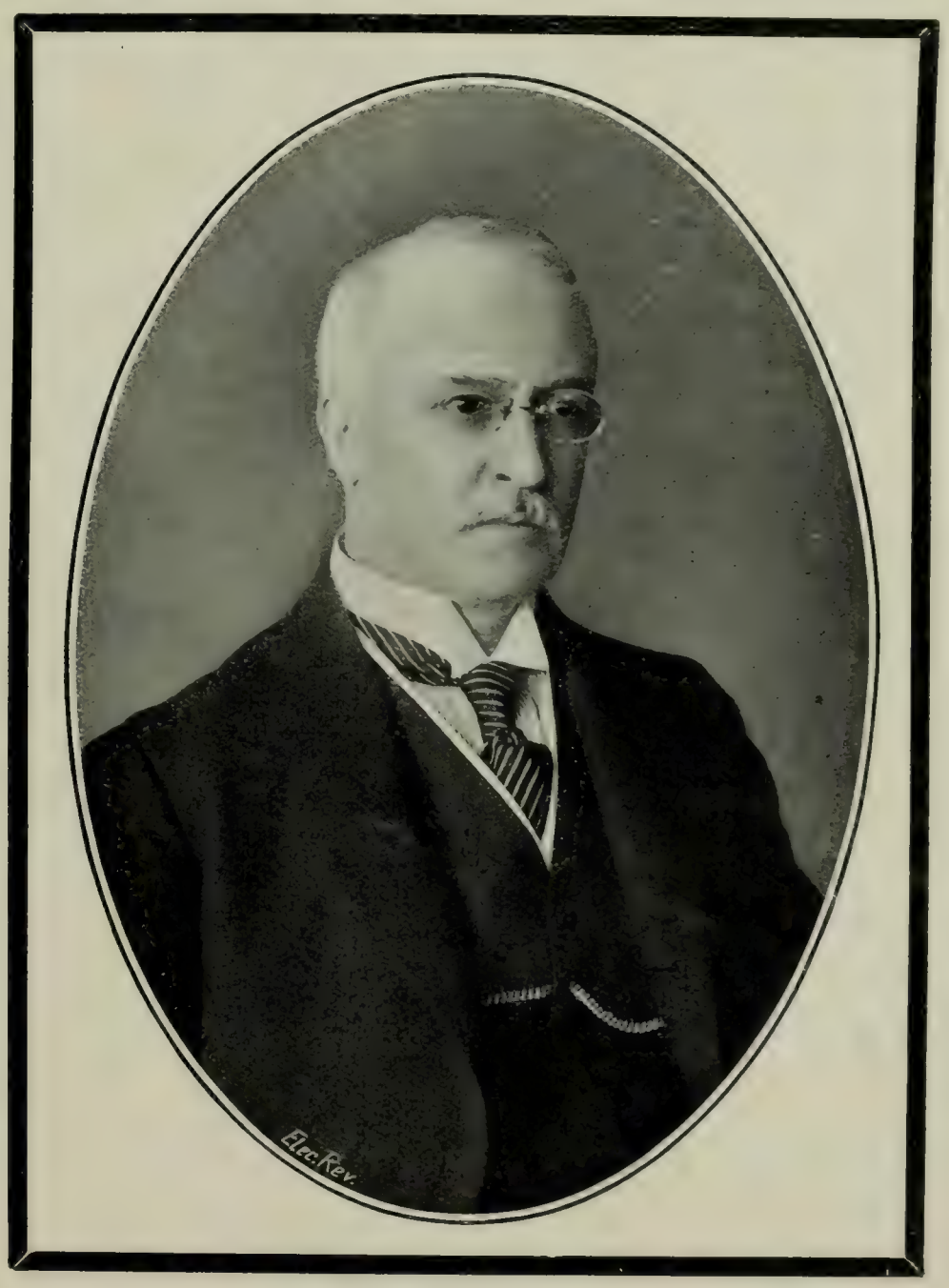
Stoke-on-Trent.—The Borough Education Committee has accepted the tender of Messrs. Barnett & Sons, of Stoke, for the electric light installation at the Central School of Science and Technology as follows :—Wiring and fitting in the lighting section, £490; wiring and fitting in the power circuit section, £303; total, £794.

Woolwich.—The B.C. has accepted the tender of the Electric Construction Co., Ltd., at £44 10s., for a motor-generator. Tenders (ranging from £46 to £65 10s.) were also received from Crypto Electrical Co.; Adnil Electric Co.; Wilson, Hartnell & Co., Ltd.; General Electric Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.; Siemens Bros. Dynamo Works Co., Ltd.; Rhodes Motors, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Greenwood & Batley, Ltd.; Crompton & Co., Ltd.; Johnson and Phillips, Ltd.

The tenders of Messrs. G. & J. Weir, Ltd., and the General Electric Co., Ltd., have also been accepted, at £390 and £395, respectively, for two steam-driven turbine pumps of the roto-feed type, and for switchgear.

DR. RUDOLPH DIESEL.

Among engineers everywhere the mysterious disappearance of Dr. Rudolph Diesel has given rise to expressions of regret both sincere and profound. From day to day since the unoccupied bed on the *Dresden* aroused the first suspicion, there has been an anxious listening for news, but the silence has remained unbroken. What happened after Dr. Diesel bade Mr. Georges Carels and Mr. Luckmann, the chief engineer of the Carels Co., "Good night!" at 10 o'clock on the night of Monday, September 29th, we may never know. The renowned inventor left Antwerp, but he never reached Harwich, and the contemplated visit to the Ipswich works of the Consolidated Diesel Engine Manufacturers, Ltd., on the Tuesday, and attendance at the meeting of that company in London on the Monday, did not take place.



DR. RUDOLPH DIESEL.

Photo by] [*Record Press Co.*

Dr. Diesel was a peculiarly sensitive man. He had suffered from insomnia for years, and he was short-sighted. These conditions, together with the possible effect of walking on deck at night, may have caused an accident or a momentary aberration, but it is fully established that he was in buoyant mood up to the time of leaving his companions for the night. Mr. Sidney Whitman, the oldest director of the original company, and an intimate friend of Dr. Diesel's, tells us that, while on deck with Mr. Carels, the doctor drew the latter's attention to a certain peculiarity in the ship's course, which, he said, he could detect by observing her position relative to the Pole Star. Mr. Whitman mentions the incident as affording evidence of the serene lucidity of the great inventor's mind down to the last hour he was seen alive.

The late Dr. Diesel was born in Paris 56 years ago, of German parentage. As a young man he was for a number of years at the Technical College of Augsburg, and later attended the Technical High School at Munich. It seems that the germ of the Diesel engine idea came to him while he was studying at the latter place, and many years' close investigation of the theory, followed by lengthy practical experiments, led to the completion of the first of his engines, just 20 years ago. The engine, however, still continued in the experimental stage, until five years later, when one was put into commercial use. During the several stages through which the work passed, the inventor was indebted for assistance to Krupp, Sulzer and the Augsburg firm. It is understood that all Dr. Diesel's papers and correspondence relating to his invention were handed over to the Munich Institute already referred to. Of the engine itself, its subsequent development and practical application in electrical, marine, and other service, it is not necessary to write here, for our readers know the story; but there is one aspect of its development upon which we must dwell. It had long been one of Dr. Diesel's most cherished desires to himself establish works for the production of the engine in this country. It was due to the financial support of Sir Carl Meyer, who early pinned his faith to the Diesel principle, and acquired the patents, that things ultimately developed into the formation of the Consolidated Co., for the purpose of carrying Dr. Diesel's ideas into effect. The difficulties encountered were numerous, and manufacturing at Ipswich only became possible through the co-operation of the great Belgian firm of Carels Frères, aided by one of the foremost authorities on the Diesel engine, Mr. Otto Borner, a Swiss engineer, who has taken out several patents for minor improvements, which are now the property of the Consolidated Co. Mr. Borner, in collaboration with Messrs. Carels Frères, has erected and organised the Ipswich works on large and up-to-date lines. The disturbed state of the Near East had a temporary effect upon the volume of business received by Carels Frères, but it is anticipated by authorities that the course events have taken will lead, now that things are settling down, to a far bigger field being open to the Diesel engine than would have been the case had there been no war, since the hindering influence of the impossible Turk is now modified.

A further difficulty had presented itself in the high price of oil, leading Dr. Diesel to experiment with Mexican oils. This was one of the last things upon which he brought his knowledge to bear at the Carels works at Ghent, and he had expressed himself as highly satisfied with the results obtained.

It is sad that so brilliant a career should have ended at the early age of 56. Diesel had, however, lived long enough to know that his invention had so far left its impress on engineering practice that engines of his type aggregating 3,000,000 H.P. were in operation in different parts of the globe.

F

THE LJUNGSTRÖM RADIAL-FLOW STEAM TURBINE.

About three years ago we announced the advent of a new steam turbine, the invention of a Swedish engineer, Mr. B. Ljungström, who had been experimenting in this direction for several years. A company was formed in Sweden to manufacture the turbine, and, at a later date, the Brush Electrical Engineering Co., Ltd., of Loughborough, acquired manufacturing rights. The first Ljungström turbine supplied by that company, which is also the first installed in this country, has been put down in the Willesden station of the North Metropolitan Electric Power Co., and is described below. The set is of 1,000 kw. capacity, and, as illustrated above, is provided with a condenser beneath it.

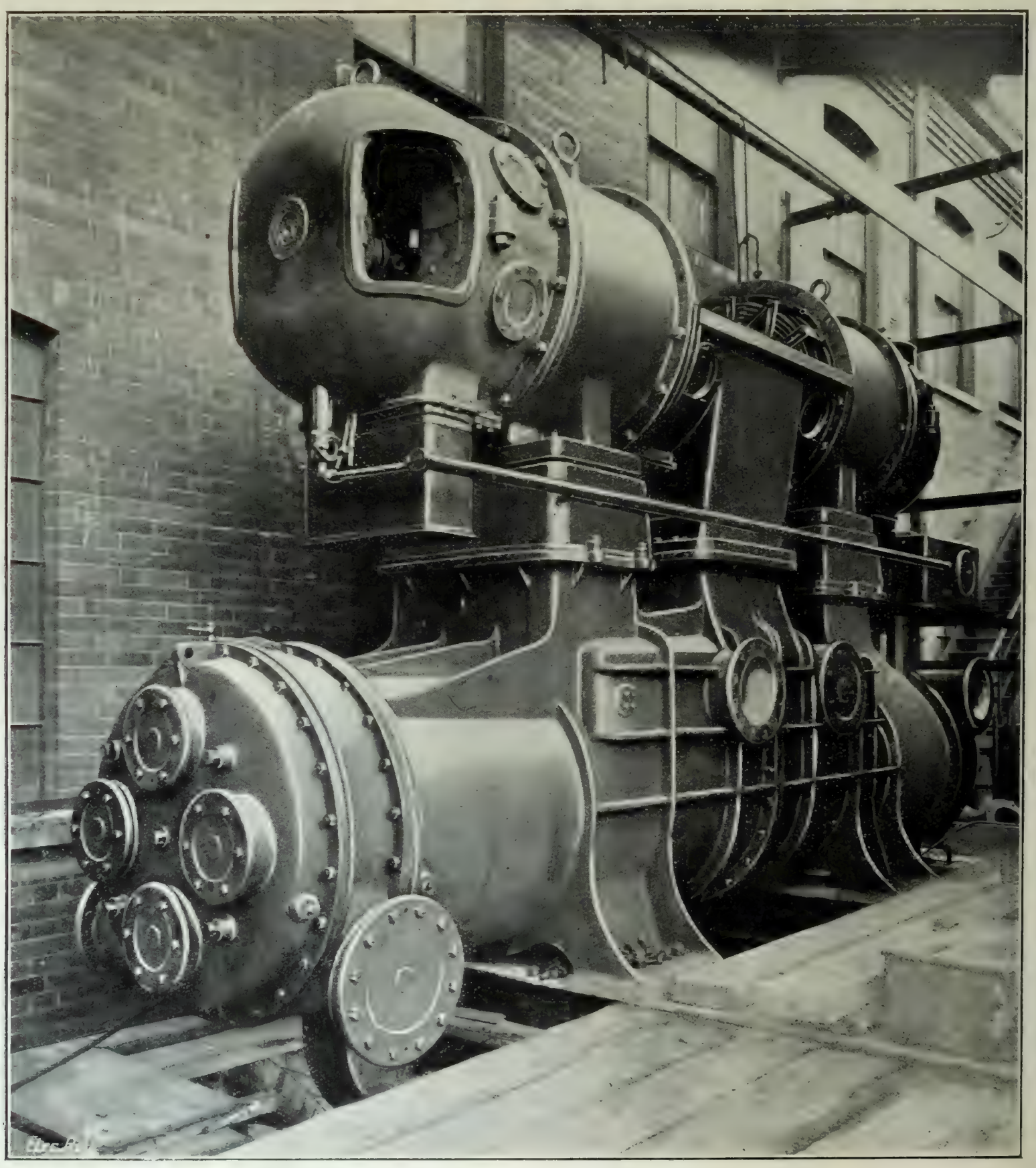


Fig. 1.—Brush-Ljungström 1,000-kw. Turbo-generator and Condenser.

The new turbine has been brought to its present high state of development by the brothers B. and F. Ljungström, of Stockholm; its chief characteristics are the use of the radial-flow principle, and that there are no fixed guide blades, there being two rotors revolving in opposite directions. Thus, without increasing the absolute circumferential speed, the relative speed of the two sets of blades has been doubled, with a corresponding gain in efficiency. Each half of the rotor drives an alternating-current generator, and the two alternators when run up to speed are synchronised and paralleled, so that they electrically interlock—a third peculiarity in the design, and a feature which can be described as entirely novel.

The turbine is of the reaction type, which profits more than the impulse type by increase of speed. The steam enters at the centre, by way of the divided steam pipe shown in fig. 5, and flows out radially between the two opposing and interlacing sets of rings of blades belonging to the two rotors, as shown in fig. 6, p. 582. The path of the steam is at first convergent axially, but of course divergent tangentially; but after about one-half of the blading has been traversed, it becomes rapidly divergent axially also, the outermost blades being comparatively very large, and discharging the spent steam into an exhaust diffuser chamber fitted with guide vanes which, it is claimed, assist in maintaining the lowest possible pressure at the outlet of the last circle of blading.

In fig. 8, p. 583, two of the rings of blades are shown in section, together with a diagram showing the slopes of some of the blades. The latter will be seen at A, and are securely held in supporting rings E, which in turn are attached to the disks D by the conical bulb-headed rings B; the rings E and F

are spun tightly over the bulbs, and F is fixed into a groove in the face of D by soft-iron caulking strips C. To prevent lateral leakage of steam between the successive rings, these are provided with thin nickel packing strips G G.

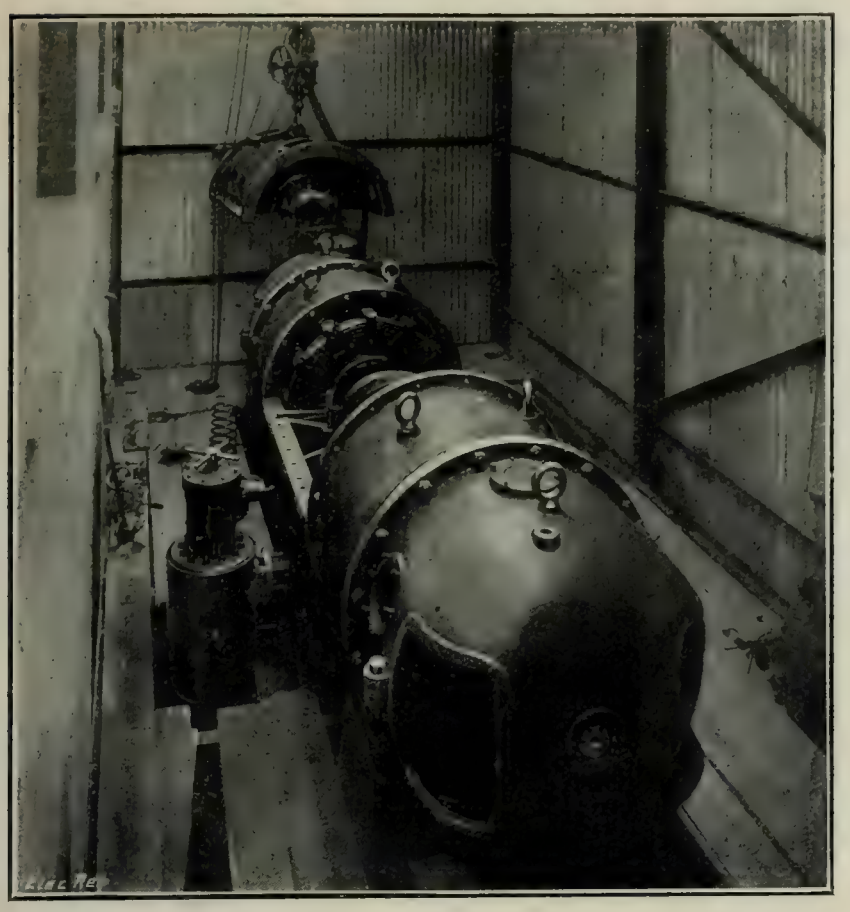


Fig. 2.—Another View of Turbo-Generator.

As shown in fig. 6, the steam flows through the inlet A to the chambers B and C, whence it passes radially through the blading to the exhaust. The ends of the rotors are made steam-tight with labyrinth packings carried by the dummy pistons G, and the stationary cheeks, to which the sections of packing are secured at K. Provision is made for overload by admitting steam to the passages H, by means of by-pass valves. The end pressure of the steam between the disks is counteracted by that on the dummy pistons G. The necessary packing where the shaft passes through the casing, to cope with the full initial pressure, consists of a series of inter-

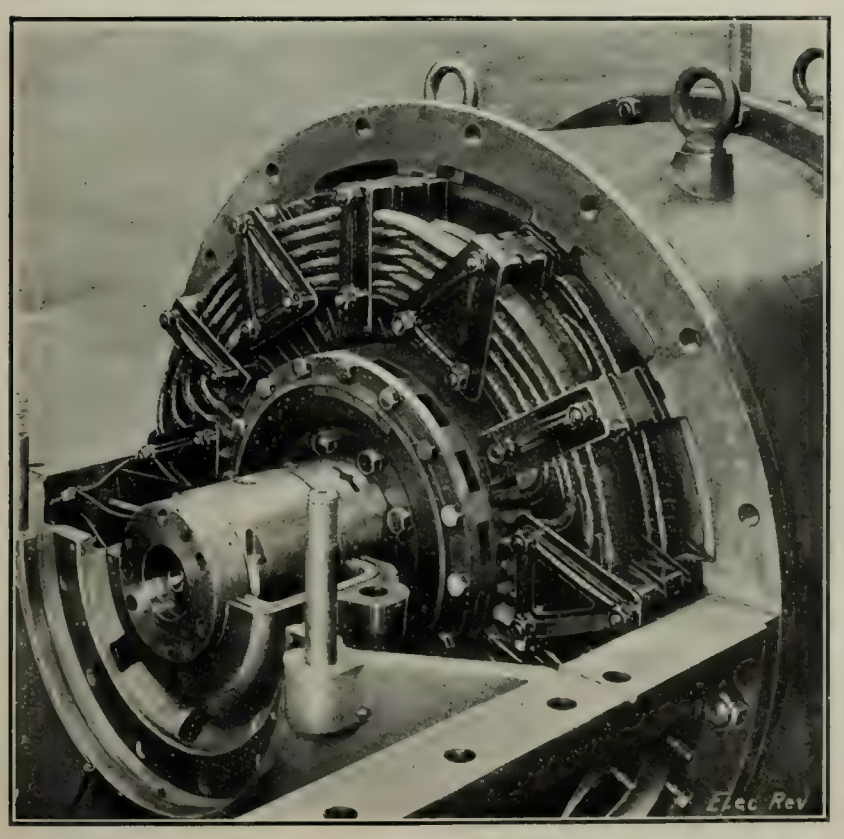


Fig. 3.—End Winding of Stator, and Main Bearing.

locking annular steel combs, which, at first, are spun over to touch one another, sufficient working clearance (fig. 9) being obtained by running the turbine for a short time. In the axial space of $3\frac{1}{4}$ in. no fewer than 158 constrictions are thus provided. The small quantity of steam leaking through is collected in a chamber and led away to the hot-well.

The steam is both supplied and exhausted at the middle of the set, and in fact the only rigid support of the turbo-generator is the inlet to the condenser, to which the turbine casing is directly bolted without any provision for expansion. The weight of the generators is carried on the condenser also, so that no foundations are required except those on which the condenser stands. The whole of the condenser casing being in direct communication with the condenser, loss of heat by radiation is reduced to the minimum, and no lagging is required. It will be noticed that the divided steam pipe, which passes through the exhaust space, is covered with a thin steel casing forming an air jacket, to prevent heat loss. The joints between the branched pipes and the steam inlets

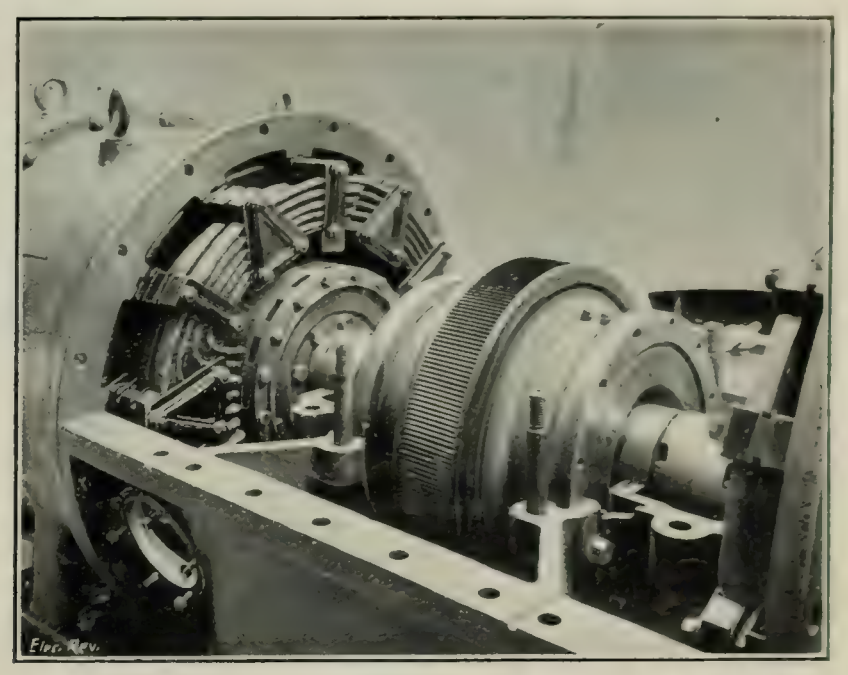


Fig. 4.—Complete Turbine without Exhaust Casing.

on the turbine frame are metal to metal, and are made simply by lowering the turbine upon its seat and bolting it in place; the actual joint is shown in elevation at L in fig. 6, being a collar fitting tightly into a thin steel tubular bush attached to the turbine end disk.

Remembering that the two generators run in opposite directions, it will be seen that each rotor must have its own shaft. This is less than a foot long, and is entirely overhung, being bolted to the end of the generator shaft, close to the bearing of the latter. The turbine disks are keyed to the shafts with taper pins, flanged spigots screwed into the ends of the shafts securing them in place. As the weight of the parts is not great—the total weight of the two rotors and blading being about 5 cwt.—there is no difficulty in

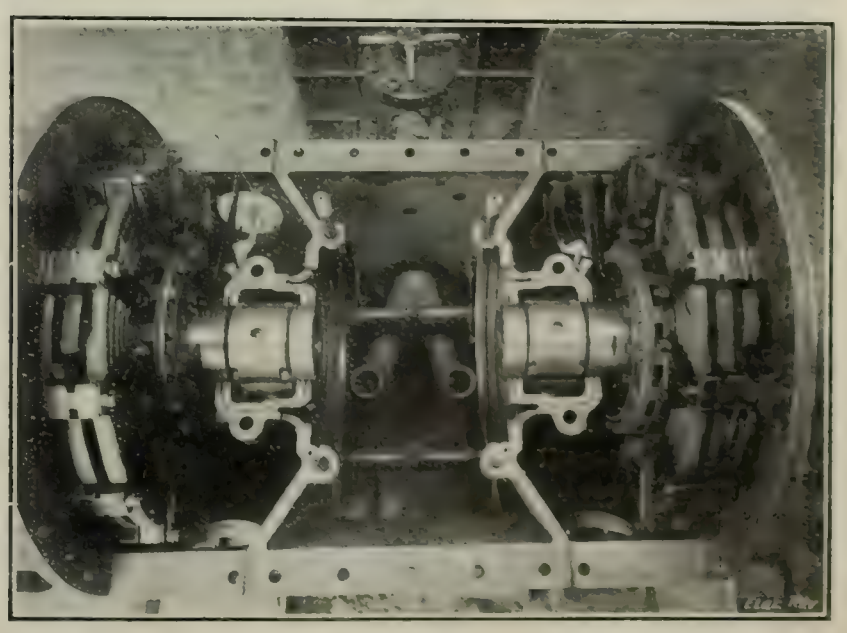


Fig. 5.—Turbine Removed, showing Bearings and Steam Pipe.

ensuring their true running. All the running parts are circular, and without radial joints; they are made of nickel steel, and the utmost precautions are taken against distortion in the design of the disks and other large parts. The conical rings used to support the disks and rings have especial advantages in this respect. There are 38 rings of

blades, which are of the Parsons type, the widths ranging from 5 to 20 mm., in four steps. The blades are milled out of solid nickel steel rod, and are welded into the rings which carry them by melting iron wire into a groove into which the ends of the blades project through the ring. A strengthening ring is secured to the blade ring by rolling down the edges of a groove in it over a dovetail turned on the blade ring, and, finally, the conical bulb-headed ring is similarly attached to one of the strengthening rings. All the rings are turned from solid steel disks. As already mentioned, each of the strengthening rings is provided with a very thin nickel packing ring on the outer periphery, which practically touches the next ring.

The dummy pistons at the ends of the rotors are provided with interlocking grooves, and the teeth between the grooves on one face are fitted with thin nickel flanges, which closely fit the opposing grooves, in the case of the two inner annular pistons; in the case of the third piston, a slight clearance is left. The novel and ingenious labyrinth packing round the shafts, which is exposed to steam at the highest pressure and superheat, is so designed that it is not liable to distortion, and the minute clearance which is worn on the fine edges of the interlocking rings when the rotors are first run remains unaltered.

The turbine can be started and brought up to speed (3,000 R.P.M.) within 10 minutes, and the two alternators, being coupled electrically in parallel, automatically come into synchronism at about half full speed. A single exciter is mounted on the outer end of one of the generator shafts, and excites both fields in series. The amount of switchgear necessary is exactly the same as in the case of a single generator, and provision is made to lock either rotor fast, so that the other can be used alone in case of emergency, giving half the normal output.

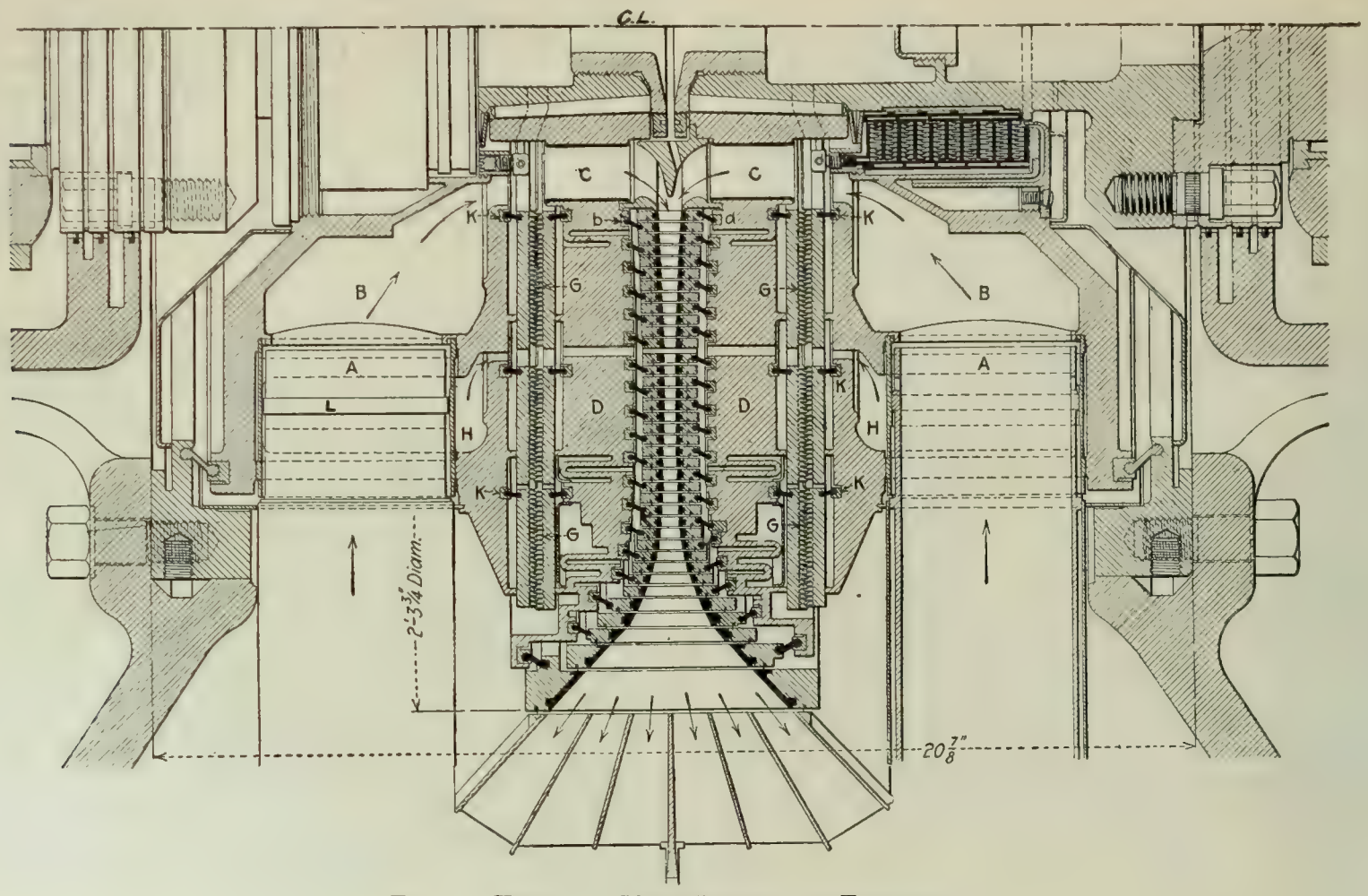


Fig. 6.—Vertical Half-Section of Turbine.

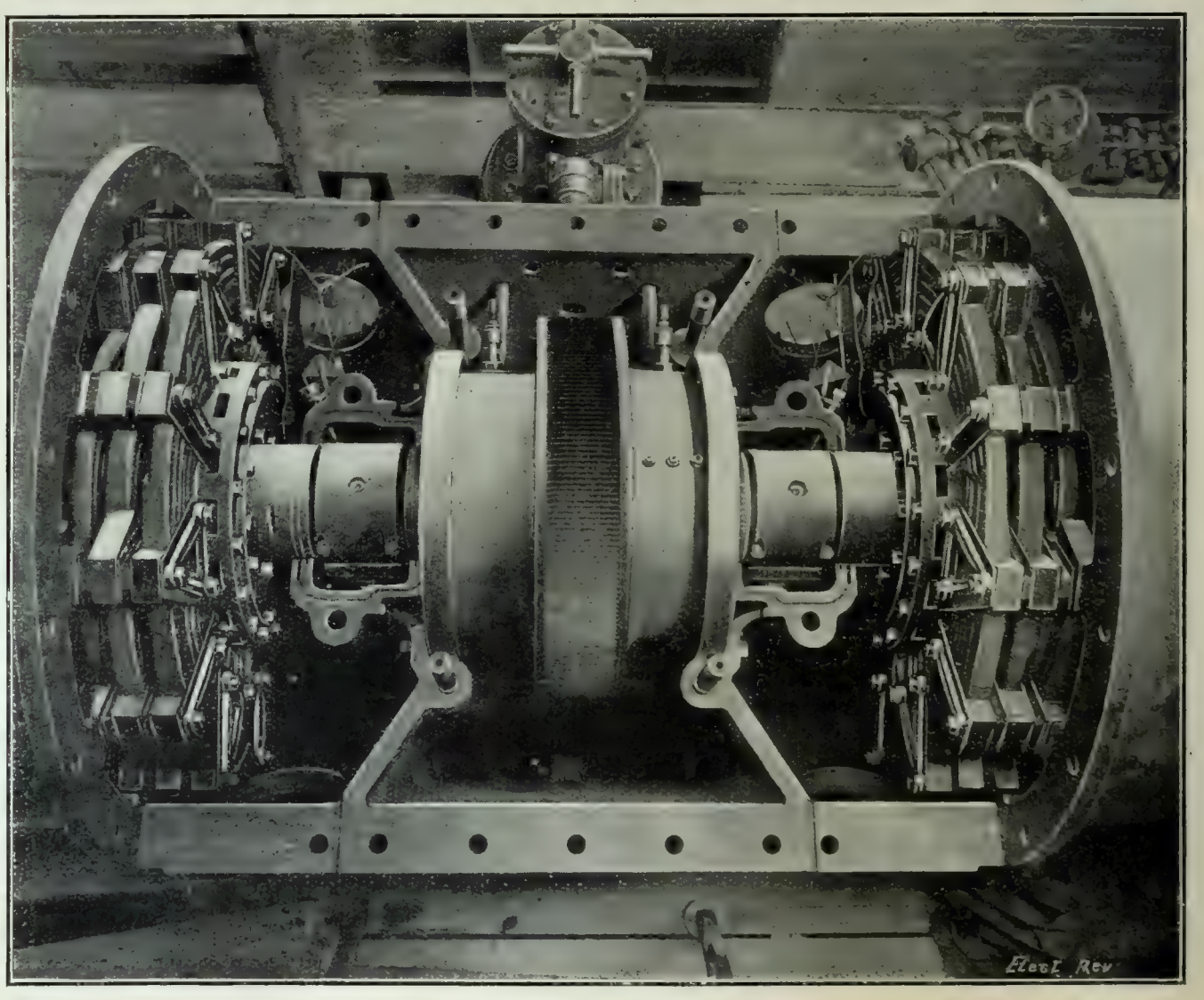


Fig. 7.—Turbine in Position, without Exhaust Casing.

An ordinary centrifugal governor controls the speed, with the aid of an oil relay, and an emergency device is provided, which not only cuts off the steam by releasing the oil

pressure in case of excessive speed, but also shuts down the turbine if the bearings overheat. Forced lubrication is

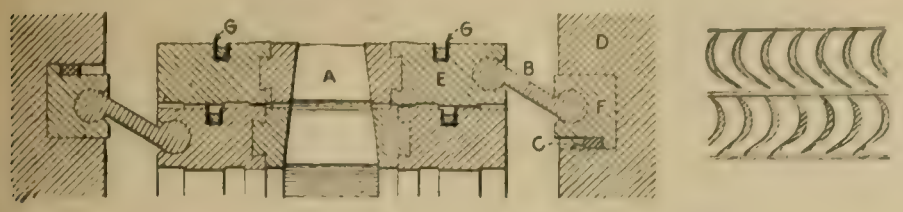


FIG. 8.—SECTION THROUGH TWO BLADE RINGS.

provided by an oil pump, which also supplies oil under pressure to control the stop-valve.

Amongst the advantages gained by the construction above described are the following :—Owing to the high relative speed of the two rotors, the number of rows of blades is only one-fourth of the number required in an ordinary reaction

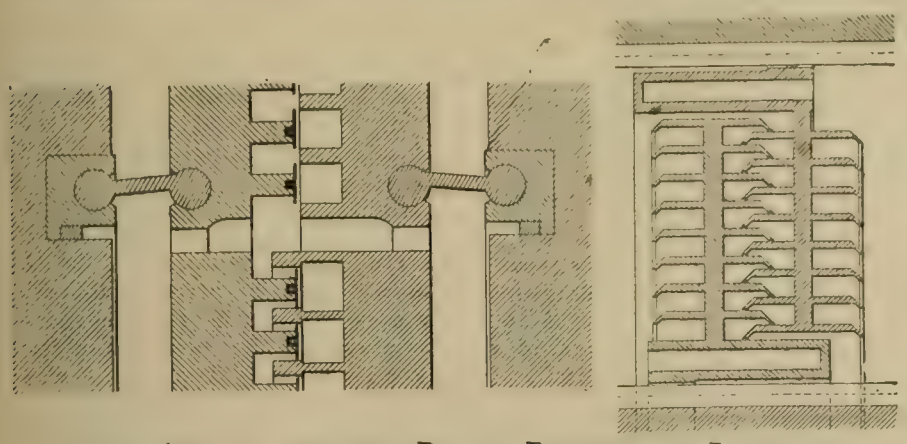


FIG. 9.—SECTION THROUGH DUMMY PISTONS AND LABYRINTH SHAFT PACKING.

turbine. There is no split cast-iron casing carrying stationary blades and dummy packings, the whole of the corresponding parts in the Ljungström turbine being mounted symmetrically on solid disks, so that there is no liability to distortion due to temperature changes, and steam can be used at the highest degree of superheat.

The turbine is exceedingly compact ; although it requires two generators, the whole set is smaller than an ordinary reaction turbo-generator. Tests on a 1,000-KW. set showed that on full load, with steam at 167 lb. per square inch and 296° F. superheat, and a condenser pressure of 1·34 in. of mercury, the consumption was 11·68 lb. steam per KW.-hour, and the thermal efficiency was 73·6 per cent. The steam leaking through the shaft packing amounted to 106 lb. per hour. At half-load the steam consumption was 12·98 lb., and at one-quarter load 15·57 lb., per KW.-hour.

We are indebted to our American contemporary *Power* for the drawings, and to the Brush Electrical Engineering Co., Ltd., for the photographs, here reproduced.

The Ideal Home Exhibition. — This Exhibition, organised by the *Daily Mail*, at Olympia was opened to the public yesterday, and it will close on 25th inst. From observations made on the occasion of a preliminary Press tour on Wednesday, we judge that it will be visited by multitudes of people during the next fortnight, for its attractions are numerous. We are pleased to find a fairly strong representation of electrical applications. Gas lighting authorities have not devoted all their publicity effort and money to the White City display, for they are also prominently in evidence at the Ideal Home Exhibition. To La Maison Electrique, the effort of the Electricity Supply Publicity Committee, we will refer later. That it will be a great attraction we have no doubt, especially by reason of the novelty of the servantless dining table, but we could wish that the exhibit's position in the Hall had been a trifle more prominent, making it easier to find. Among electrical exhibits calling for special mention at this stage, is a fine and well-placed display of lighting, heating and cooking devices and apparatus by Messrs. Rashleigh, Phipps & Co., a showroom and automatic petrol-electric plant by Edmundson's Electricity Corporation, an exhibit of heating and cooking apparatus by the Dowsing Co., while Electric Appliances, Ltd., Linolite, Magic Appliances, the Daisy Vacuum Cleaner Co., and Major & Co. also have stands. In the gallery there is something interesting to be seen and heard at the stand of Mr. Cook, of Orpington, who has adopted electricity for lighting his extensive hen-houses and gets more eggs in consequence. He also makes extensive and successful use of electric incubators. But we will refer to the Exhibition further in a later issue.

The Association of Consulting Engineers.—An advertisement appeared in the *Times* of October 1st announcing the application of the Association to the Board of Trade for a certificate of incorporation.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, October 16th. At 6.30 p.m. Visit to the Model Engineer Exhibition at the Royal Horticultural Hall.

Friday, October 17th. At 39, Victoria Street, Westminster. Paper on "Education: Some Random Reflections," by G. [illegible].

Model Engineer Exhibition.—Friday, October 10th. At the Royal Horticultural Hall, Westminster. Opening. Last day, October 18th.

Manchester Association of Engineers.—Saturday, October 11th. Opening meeting. Afternoon: (1) Visit, Mather & Platt's works, Newton Heath. (2) tea, Grand Hotel. Evening meeting: Inaugural address by the President, Dr. E. Hopkinson.

North-East Coast Institution of Engineers and Shipbuilders (Graduate Section).—Saturday, October 11th. At 7.15 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 11th. At 2 p.m. At Newcastle-upon-Tyne. General meeting.

Institution of Post Office Electrical Engineers.—Monday, October 13th. At 6 p.m. At Institution of Electrical Engineers. Paper on "Telegraph Traffic and Power Plant for Pneumatic Tubes in Post Offices," by A. B. Eason, M.A.

Institute of Marine Engineers.—Monday, October 13th. At 8 p.m. Discussion on fuel test.

Institution of Mechanical Engineers (Graduates' Association).—Monday, October 13th. Paper on "The Automatic Vacuum Brake," by C. H. Adams.

Institution of Heating and Ventilating Engineers.—Tuesday, October 14th. At 5 p.m. At the Botanical Theatre of the University College, Gower Street, W.C. Lecture on "The Reading of a Thermometer," by A. H. Barker, B.A. At 7 p.m. Autumnal general meeting. Paper on "Temperature Guarantee and the Heat Loss Factor," with some observations on standard practice, by G. Chasser; paper on "Accelerated Circulation," by A. E. Wheeler.

Dynamicables.—Wednesday, October 15th. At 7.30 p.m. At the Trocadero. Dinner.

Electro-Harmonic Society.—Friday, October 17th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, October 17th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Motor-driven Machinery," by W. A. Toppin.

Manchester Electro-Harmonic Society.—Friday, October 17th. At 7.45 p.m. At Albion Hotel. First concert.

NOTES.

Copper.—The rise in price of this metal does not correspond to the indications of the visible supply figures, a variety of other factors rendering the market conditions more complex. With so brisk a demand as 52,704 tons deliveries indicates, one would have expected a greater rise over September than £1 7s. 6d. on the price per ton, especially considering the reduced condition of visible supplies. As shown by Messrs. Merton's statistical circular, English visible supplies at the end of September were 15,134 tons, European (including Rotterdam, Hamburg and Bremen, and estimates for other European ports) 28,919, and the stock in American producers' hands at the end of August was only 17,104 tons. The reduction in European supplies for the month was 6,026 tons, and the reduction in American stocks during August was 6,822 tons, or one-third of the whole quantity.

The Osram and Robertson Club.—On Friday last the new club premises of the office and works staff of the Osram and Robertson Lamp Works at Hammersmith were formally inaugurated. The building, which faces Brook Green, has had a chequered history, but has been put in repair and redecorated so effectively that not a trace of its former vicissitudes remains, and its appearance, both inside and out, is that of an "ideal home" for the staff in their leisure moments. Its ample resources include billiard, reading, smoking and other recreation rooms, and at the centre of gravity of the whole the indispensable buffet ; about 160 luncheons are served daily, of the best quality and at a nominal price, and light refreshments are always obtainable. Certainly the staff are to be congratulated upon having at their command so commodious and well-appointed an establishment, which is managed by a committee of themselves with marked ability. Mr. Gosling, the hon. secretary, and Mr. Leo, hon. treasurer, in particular have earned the gratitude of their colleagues by their untiring efforts.

The proceedings at the official opening took the form of a Bohemian concert in a large upper room. The Chairman of the Committee, Mr. Adams, who presided, stated that the proposal to form a staff club was warmly supported by the managing director, Mr. Chris. Wilson, and welcomed by the board of directors, who generously defrayed the whole of the heavy cost of alterations, repairs and decorations, and in addition paid the rent of the building. Mr. H. Hirst, the chairman of directors, then briefly expressed the pleasure of himself and his colleagues at the happy outcome of the proposal ; the well-being of the staff and employés, he said, had always been considered by the company as important as the efficient organisation of the works, and the directors did not hesitate to foot the bill—neither would they hesitate to carry out extensions if these became necessary, as they usually did. Hearty cheers were given for Mr. Hirst and the directors ; and Mr. Wilson, who made a brief speech, was also accorded a warm reception.

The rooms were, of course, illuminated with Osram lamps, whose brilliancy was undeniable ; and if we dare venture on one word of criticism with regard to so admirable an institution, it is this : the new illuminating engineering department of the G.E. Co. evidently had not been invited to draw up the specifications for the shading of the lamps. *Verbum sat sap.*

Inquiry.—Makers of the "Warldin" ironclad switchgear and of the hot-plate called the "Sluggard's Delight" are asked for.

Educational Notes.—The Goldschmidt Entrance Scholarship to the Faculty of Engineering at University College has been awarded to Mr. H. P. Gardham, of Bancroft's School. The scholarship is of the value of £30 a year, and is tenable for three years.

The British Fire Prevention Committee.—The Winter Session of the British Fire Prevention Committee will commence on October 15th, when a large reinforced concrete floor, and also some materials intended for fire-resisting partitions, will be subjected to high-temperature fire tests at the Committee's Regent's Park testing station. Two important reports are to be issued shortly, dealing with the Committee's extensive series of tests with chemical fire extinguishers, no fewer than 100 of such appliances having been under investigation. A summarised report in tabular form on some 16 fire-resisting partitions that have been under test is also in course of preparation, and will be issued early next year.

Association of Electrical (Station) Engineers.—A general meeting of the Manchester branch was held on Thursday, October 2nd, in the Exeter Café. Mr. G. D. Coe was in the chair, and about 40 gentlemen were present. The meeting had been arranged for the purpose of discussing the new progressive policy as outlined by the members of the London executive, the hon. secretary (London) having been invited to explain their views. Mr. W. J. Ebben gave, in the first place, a brief account of the history of the Association from its inauguration, describing the efforts it had made to improve conditions in electrical stations, and the results. The meeting was very gratified to hear of the effective influence it had exerted in this direction, and of the widespread interest it had aroused, much practical sympathy having been extended towards it by a large number of engineers. But, on the other hand, the experience of the last few months had demonstrated the fact that its success had been to some extent hampered by the indifference of many, and also by the direct antagonism of some engineers in high places. The Association had frequently protested against conditions that were unjust and humiliating, and had endeavoured by persuasive methods to have these remedied, but its good intentions had been frustrated by the high-handed methods of those in authority who persistently refused to consider the reasonable claims of the Association for better treatment for its members. Several cases of recent date had gradually led the executive to the conclusion that where persuasive efforts were unsuccessful the Association should seriously contemplate the adoption of a policy more convincing and aggressive. The speaker pointed out that such a policy would lay itself open to the charge of being Trade Unionist in character, but why should such a charge be distasteful to the majority of engineers? There need be nothing reprehensible in the adoption of certain Trade Union principles if conducted honourably. It was much to be feared that engineers in their horror of such a policy had been frightened by a bogey, and had sacrificed their present advantages and future prospects for the sake of a false dignity. The time had arrived for them to realise that if they were not prepared to maintain their interests in the face of the opposition of employers they would soon cease to be a profession, and would be degraded below the rank of the unskilled labourer.

If persuasive methods failed, what was the alternative if such a policy was not adopted? "There was none," said the speaker, "except submission." What was a Trade Union? In his opinion it was an organisation having for its object the protection of its members from the unjust aggression of employers, first by peaceful methods, and if these failed by more active ones.

Whatever term they might apply to it, this was henceforward to be the attitude of the Association. Employers of men in electrical stations must be made to understand that if peaceful efforts for the improvement of conditions were repudiated, engineers were prepared as a last resource to withhold their labour.

Such an attitude could only be thoroughly maintained by solidarity and union amongst engineers themselves, and the speaker urgently appealed for a further increase in membership, so that a bold and determined front might be presented.

At the close of the speaker's remarks several questions were asked and answered, and an interesting discussion followed. A vote of thanks was accorded to the Hon. Secretary for his "enlightening speech." At the conclusion of the meeting a resolution was proposed and carried unanimously, to the following effect: "That this meeting of engineers heartily approves of the new progressive policy of the Association as explained by the Hon. Secretary."

Library Lighting.—In connection with the notes which appeared in our issue of September 5th on the report of the Joint Committee regarding the artificial lighting of libraries, we are asked by the General Electric Co., Ltd., to state that they have under preparation a scheme for library illumination on the lines of the Committee's report. This scheme has been rendered possible by the introduction of the new series of scientific light controllers, which has been named "Superlux," and has proved particularly adaptable for the purpose in question. For table, desk and newspaper stand lighting, the company propose utilising the concentrating type of "Superlux" glassware. For bookcase and shelf lighting (where less illumination is required, and where the units are less exposed to view) the distributing type of aluminium is recommended. The general illumination of the rooms would be carried out with "Superlux" semi-indirect fittings, and in this way total absence of glare, and the invisibility of the filament, is ensured.

Institution and Lecture Notes.—Greenock Electrical Society.—The winter session was inaugurated on 3rd inst., when Mr. J. A. Robertson, borough electrical engineer, lectured on "Electricity Supply in Greenock, 1883-1913." The meeting was a large one, and was attended by members of the Council. The lecture was illustrated by lantern slides. In referring to the great developments that had taken place, the lecturer recalled the fact that the original water-power scheme was of 15 kw. The Hunter Place station commenced with 250 and later reached 2,000 kw., while the present works were capable of delivering 6,300 kw. With the supply to Port Glasgow in view, for which a 5,000-kw. turbine was to be installed, the undertaking in a few years might have an output of 20,000,000 units per annum if the present spell of good trade continued.

East London College, Faculty of Engineering.—A course of eight lectures on "The Design, Construction and Testing of Electric Power Cables" will be delivered at this college, Mile End Road, by Mr. H. Savage, M.I.E.E., of Messrs. W. T. Henley's Telegraph Works Co., Ltd., on Mondays, October 20th and 27th, December 3rd, 10th, 17th and 24th, and December 8th.

Cape Town.—At a meeting of the local section of the Institution of Electrical Engineers, held on September 17th, a paper entitled "The Supply of Electricity for Small South African Towns" was read by Prof. Bohle. In the paper details were given of the Stellenbosch Municipal Installation (for which Prof. Bohle is consulting engineer) which is now in course of erection. The discussion on the paper was adjourned until the October meeting.

The Society of Engineers (Incorporated).—On Monday a paper on "Highways" was read by Mr. C. H. Cooper, M.Inst.C.E. The author directed special attention to the failure of local authorities to realise the necessity of providing highways sufficient for present-day traffic. Although road crusts were, as a rule, carefully constructed, the indifferent manner in which excavations for mains, &c., were filled in had a destructive effect. The author was strongly of opinion that all trenches should be filled in by the local authority at the expense of the undertaker. Wood-paving laid on 6-in. concrete, which was an expensive paving, could no longer be considered reliable for heavy motor traffic, the concrete having to be increased to at least 9 in. in thickness.

Mr. Alfred Hands, M.I.E.E., F.R.Met.S., whose lectures on "Thunder and Lightning," illustrated by lantern slides and experiments, were listened to with so much interest in many parts of the kingdom last winter, has accepted engagements to lecture on the subject during the coming season. The list before us shows 19 engagements between October 16th and April 7th, with literary and lecture societies, and at public halls and institutes in London, Epsom, Liverpool, Greenock, and so on. Any of our readers who may be actively concerned with the local lecture arrangements would, we are sure, find Mr. Hands's lecture acceptable to the general public. The elements periodically force the subject upon us all, whether we will or no, but the average man knows little about it, and we have ourselves observed with what close interest and delight the lecturer's story is followed.

The Association of Mining Electrical Engineers held their annual meeting at Birmingham recently. The members were welcomed by the Lord Mayor, Lieut.-Col. Martineau. Mr. Alexander Anderson, Motherwell, the new president, in his address, predicted a steady development in the use of electricity in mines. Many collieries, he said, were already electrically equipped from the winding engine to the undercutting of the coal, and this class of colliery was rapidly extending. He advocated a thorough course of technical study for young men entering the profession. Unreliable plant was often the outcome of unreliable attention due to the lack of technical knowledge. Electrically-driven coal-cutters would become more numerous in the near future, as the time was coming when little coal would be mined by hand.—*Morning Post.*

Junior Institution of Engineers.—On Monday, October 20th, the first monthly ordinary general meeting will be held at the Lecture Hall of the Institution of Electrical Engineers, Victoria Embankment, W.C., when a paper by Mr. G. S. Cooper, upon "Modern Coke Ovens" and embodying notes upon the recovery of sulphate of ammonia, will be read and discussed. A smoking concert will be held early in November. This will be followed by the annual general meeting and election of officers, on Monday, November 17th, on which occasion a paper will be read by Mr. Ernest King (member of Council) upon the J.I.E., and its aims and objects, with a view to eliciting the opinions of members and friends upon the manner in which these are fulfilled in the interest of private members. The incoming president, Sir Boverton Redwood, will deliver his presidential address on Friday, December 5th, and will deal with "The Future of Oil Fuel." At this meeting, Sir A. Trevor Rawson, the retiring president, will present the Canet gold medal to Dr. Dugald Clerk for his lecture delivered in June last. "The Working Fluid of Internal Combustion Engines," and the silver and bronze institution medals will also be awarded to Mr. Arthur Ross, and to Mr. E. E. Jeavons, respectively. Arrangements for the annual conversazione and dance in December are well in hand. Amongst the Papers down for discussion in the new year, are the subjects of "Modern Gearing" and "Lighting of Factories," which will be introduced by two members who specialise in these important matters.

We understand that the numerical strength of the Institution is still steadily progressing. A local section with Manchester for its centre is now in process of formation.

A pamphlet has recently been issued giving particulars of the J.I.E., for the benefit of prospective members and associates, and copies can be obtained upon application to the secretary, Mr. A. Clifford Swales, at 39, Victoria Street, Westminster, S.W.

The Electro-Harmonic Society.—As mentioned in our last issue, the twenty-eighth season of this Society will open on Friday next, October 17th, with a smoking concert. The other fixtures for the season are as follow :—

Ladies' night on Monday, October 17th, 1913.
Smoking concert on Friday, December 12th, 1913.
Smoking concert on Friday, January 2nd, 1914.
Ladies' night on Monday, February 16th, 1914.
Smoking concert on Friday, March 20th, 1914.

All of the concerts take place at the King's Hall, Holborn Restaurant.

The preliminary programme for the 17th inst. is as follows :—Vocalists, Senhor José de Moraes (tenor), Mr. Herbert Heyner (baritone) ; solo violoncello, Mr. B. Patterson Parker ; magician—entertainer, Mr. Louis Nikola ; novel instrumentalist and humorist, Mr. Walter Montague ; art humorist, Mr. Ernest H. Mills ; entertainer at the piano, Mr. Ernest Hastings ; and the St. James's Glee Singers. Accompanist, Mr. Bernard Flanders, A.R.A.M.

The Manchester Electro-Harmonic Society.—The first concert of this Society for its second season will open on Friday next, October 17th. It will be remembered that that is also the opening night of the Electro-Harmonic Society in London. The Manchester concert will begin at 7.45 o'clock, Mr. S. L. Pearce presiding. We observe from an advance copy of the programme that six minutes are to be allowed for the chairman's "few remarks," and there are to be plenty of opportunities for fraternising and social chat, five intervals being included—three of ten, one of fifteen, and one of five minutes. There are nine items in the programme, and it is expected that the concluding artiste will come on at 10.45 o'clock. The following artistes have been engaged :—Mr. Charles Tree, solo baritone ; Mr. J. H. Foulds, solo 'cello ; Mr. H. A. Palmer, entertainer and conjurer ; Mr. E. Bennet North, accompanist. The second concert of the Society will take place in November, when the artistes will be :—Mr. H. Bridge Peters, baritone ; Mr. Sydney Coltham (principal tenor, Westminster Abbey) ; Mr. Foden Williams, entertainer ; and Mr. E. Bennet North, accompanist. We most cordially wish our Manchester friends just that splendid measure of success that we know that they wish for themselves in starting out on the new season. From a membership point of view, things have been by no means unsatisfactory, but further additions are necessary in order to ensure financial success, enabling the hon. musical director (Mr. W. J. Smith) and others actively interested in the movement, to supply artistic talent.

Foreign Trade in September.—The following are the electrical and machinery figures given in the official returns for September trade :—

	Month of Sept.	*Inc. or dec.*	*Nine months, 1913.*	*Inc. or dec.*
Imports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	£141,998	+ £27,429	£1,130,923	+ £95,547
Machinery ...	522,277	+ 33,265	5,444,611	+ 448,782
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	£287,304	−£199,052	£3,764,389	+ £565,619
Machinery ...	3,047,561	+ 172,895	27,489,564	+ 3,433,179

Appointments Vacant.—Electrical foreman, for the Government Railway, Malay States (£280 + duty and other allowances) ; shift engineer for the Wednesbury Corporation ; canvasser for the Wolverhampton Corporation (£2) ; clerk of works to superintend installation at Caerleon Training College, for Monmouthshire Educational Committee ; electrical fitters, for H.M. Dockyard, Devonport (38s.) ; switchboard attendant, for the Stoke-on-Trent Corporation (27s. 6d.). Switchboard attendant for Blackburn Corporation (30s.). Particulars are given in our advertisement pages.

Sub-Station Attendants at Hull.—The Hull Corporation Electricity Committee last week decided to recommend an increase of the starting wages of sub-station attendants from 28s. to 30s.

Milking by Electricity.—The Devon Education Committee have decided to carry out experiments in milking cows by an electrical process.

Legal.—Electric Lighting Equipment for Motor-Cars (Partnership).—In the Vacation Court on Wednesday, October 8th, Mr. Justice Bailhache had before him a motion in the action of Polkey *v.* Jarrott, by which the plaintiff sought the appointment of a receiver of a partnership carried on with the defendant for the fitting of electric lighting equipment to motor-cars. According to the opening statement of counsel, the plaintiff, John Polkey, and the defendant, Charles Jarrott, were directors respectively of George Polkey, Ltd., who manufactured electrical equipment for motor-cars, and Jarrott, Ltd., who fitted motor-cars. The plaintiff and defendant became partners, and the partnership entered into an agreement with the plaintiff's company, under which they were to take a certain number of the electric lighting equipments, and were for a term of years to be the sole agents for fitting such equipments. The plaintiff's case was that the business of fitting these equipments had practically come to an end, and while the defendant said it was owing to the equipments supplied, the plaintiff's evidence was that it was due to the defendant's faulty fitting. The plaintiff further alleged that the defendant had pledged the credit of the partnership beyond the limit prescribed for by the articles, and it was necessary, for the protection of the assets, that a Receiver should be appointed. Counsel for the defendant said that under the agreement with the plaintiff's company, the partnership was to be the sole selling agent for these equipments, and the benefit of that agreement would be lost if a Receiver was appointed. There was no evidence of any jeopardy, and the only result of appointing a Receiver would be to stop business and release the plaintiff's company from its obligations under the agreement. His Lordship said that he did not see his way to grant an interim Receiver, though he did not express any opinion adverse to the plaintiff's rights. The motion was therefore refused, costs being made costs in the action.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Leek U.D.C. has appointed Mr. John Bemrose, of Tunbridge Wells, as electrical engineer, in succession to Mr. Carr, at a salary of £225 per annum, rising by £10 a year to £275.

The Woolwich B.C. has appointed Mr. C. E. Margerison, of Sunderland, as district representative of the electrical undertaking to attend to consumers' requirements, to supervise the installation work, &c.

Mr. Alfred Clough, late resident electrical engineer to the Liverpool Corporation, was on Wednesday, October 1st, the recipient of a presentation consisting of two Divan chairs and an illuminated address from the electric supply department. The presentation was made by Alderman Fred Smith, chairman of the Tramways and Electrical Power Committee, who was supported by several members of the City Council, Mr. C. W. Mallins (tramways manager), Mr. H. Dickinson (city electrical engineer), and a large number of the general staff. Eulogistic references to Mr. Clough's work were made by all the speakers.

Mr. J. R. Davison, of Poplar, has been appointed shift engineer at the Stuart Street station, Manchester, at £175 per annum, rising to £190 at the end of 12 months.

Mr. W. H. Johns, resident assistant engineer and superintendent of the Birmingham Gas Works, has been appointed gas and electrical engineer to the Malvern Urban Council.

Mr. Herbert A. Fleet, superintendent engineer to the Yorkshire Electric Power Co., was made the recipient of a silver tea tray and a case of pipes at a gathering of the company's officials and staff at the Railway Hotel, Dewsbury, on Friday, the 3rd inst. The occasion was the termination of Mr. Fleet's connection with the company, after 9 years' service, which commenced in 1904, when the power station, at Thornhill was in course of construction. This station is now over 10,000 kw. capacity with 200 miles of overhead and underground feeders and 50 sub-stations. Mr. E. W. L. Nicol, assistant superintendent, presided, and Mr. J. Grier, senior charge engineer, made the presentation on behalf of the staff. A jovial evening was spent, and reference was made to Mr. Fleet's skill and tact. Mr. Fleet's address is now :—Wilberforce House, Broomwood Road, Clapham Common, S.W.

A correspondent says that Mr. Nayler, electrical engineer at Nelson, who has been seriously ill with pneumonia, is now improving.

The Brighton Lighting Committee has recommended the Council to increase the salary of Mr. F. C. N. Bergh, assistant mains superintendent, from £2 17s. 6d. per week, to £165 per annum.

The West Bromwich T.C. has increased the salary of Mr. W. W. Alston, assistant electrical engineer, from £150 to £170 per annum.

Bailie W. B. Smith, convener of the Glasgow T.C.'s Committee on Electricity and Mr. W. W. Lackie, chief electrical engineer, have returned to Glasgow after a tour of Canada and the United States, in the course of which they visited, among other centres, Montreal, Ottawa, Toronto, Chicago, Pittsburg and New York. Mr. James Dalrymple, the manager of the T.C tramways department, and Mr. Thomas Nisbit, the master of works, are still in the United States investigating the problem of cross-river communication, with special reference to bridges carrying tramways over the Clyde.

General.—On Friday evening last, a number of the friends of Mr. W. Wyld (late manager of the Birkenhead Electricity Supply Co. and Tramway Department) entertained Mr. and Mrs. Wyld at the Imperial Restaurant, Regent Street, W., in order to welcome them both to London, and to congratulate Mr. Wyld on his appointment as borough electrical engineer to Hampstead Corporation. The chair was taken by Mr. H. E. Blain, who, after the usual Royal toast, proposed the health of the guests in felicitous terms. Mr. Wyld responded, and gave an amusing bio-

graphical sketch of his career. Commencing with Blackpool, he took the company in imagination to Salford, Wednesbury, Doncaster and Birkenhead, finally landing them at Hampstead, with which he expressed great satisfaction. These speeches were interspersed with a musical programme, and an impromptu speech was made by Mr. Harry England, of Wakefield. The health of the chairman was proposed briefly by Mr. C. Newton Russell, and Mr. Barfield (hon. sec.) and Mr. Barallet (hon. musical director) also contributed short speeches. Altogether a very pleasant evening was spent.

Signor Guido Semenza, consulting engineer of Milan, is making an extended trip in Brazil on behalf of a syndicate of Belgian interests.

The employés of Messrs. Heenan & Froude, Ltd., engineers and refuse destructor makers, of Shrub Hill, Malvern Link, have presented an illuminated address and a cowhide leather dressing-case, with silver contents, to Mr. Dundas Heenan, second son of Mr. Hammersley Heenan, chairman of the directors, on his coming of age.

Mr. A. Pougher has resigned the position of supplies manager at the Newcastle local branch of Messrs. Siemens Bros. Dynamo Works, Ltd., to take up the position of chief assistant in the supplies department of the British Westinghouse Co, at Manchester. Mr. Pougher's service with Messrs. Siemens Bros. & Co.,Ltd., and Siemens Bros. Dynamo Works, Ltd., extends over 10 years, four of which were spent at the London office and six years (from September, 1907) at the Newcastle branch.

Mr. Robert Onions, manager of the Reddish (Stockport) works of Messrs. Richard Hornsby & Sons, Ltd., engineers, is leaving, after 23 years' service, to become works manager to Messrs. Mirrless, Bickerton & Day, Ltd., of Hazel Grove, near Stockport. As parting gifts the staff and employés of Hornsby & Sons, Ltd., have presented Mr. Onions with a silver rose bowl and set of vases.

Mr. John Grogan, late manager of Ross & Co., 62, Robertson Street, Glasgow, has severed his connection with the firm, and has secured several agencies for the supply of accessories, &c.

The *British South African Export Gazette* states that Mr. W. Odger, the South African manager of Messrs. Henley's (S A.) Telegraph Works Co., Ltd., Johannesburg, has now returned after six months' visit home; also that after six months' stay in England, Mr. C. W. R. Campbell, of the Victoria Falls and Transvaal Power Co., Ltd, has now resumed his duties on the Rand.

Prof. John Dewar Cormack, D Sc., M.Inst.C.E., M.I.Mech.E., Professor of Engineering in University College, London, has been appointed to the Chair of Civil Engineering and Mechanics in the University of Glasgow, vacant by the resignation of Prof. Barr.

Mr. A. A. Watkins, M I.E.E., late manager and engineer of the Musselburgh and District Electric Lighting and Traction Co., Ltd., has joined the staff of Messrs. G. B. Lincolne & J. K. Macdougall, consulting engineers, Melbourne.—*Australian Mining Standard.*

Obituary.—Mr. J. Ross.—The death is announced of Mr. J. Ross, an engineer of Scotch extraction, who emigrated to the United States in 1870, and a few years later moved on to Canada, where he became associated with the construction of the Rocky Mountains section of the Canadian Pacific Railway. Mr. Ross, for the last few years of his life, devoted himself to electrical engineering, and especially to the electrification of steam and horse tramways. He was associated with tramway enterprise at Montreal, Winnipeg, St. John, London, and other Canadian towns, and he also undertook, with Mr. Mackenzie, the electrification of tramways at Birmingham, England.

Mr. T. Frame Thomson.—At the inquest, held on October 2nd, a verdict of "Accidental death" was returned.

Mr. J. E. J. Philipps.—The death took place on September 30th, at Greenwich, S.E., after a long illness, of Mr. Julius E. J. Philipps, with Messrs. Elliott Bros., electrical engineers, of Lewisham, S.E., and Messrs. Siemens Bros.

Mr. G. F. Milnes.—The death is announced of Mr. Geo. Fredk. Milnes, of Birkenhead. In 1871 he became a member of the firm of Geo. Starbuck & Co., out of which grew the concern of G. F. Milnes & Co., which ultimately became absorbed in the United Electric Car Co., Ltd. Mr. Milnes became the resident representative of that company in London, from which illness compelled him to retire a few years back. Later, deceased's son, Mr. Geo. C. Milnes, who is now in Alberta, and Mr. Voss, established the firm of Milnes, Voss & Co., of which Mr. Voss is now the head.

NEW COMPANIES REGISTERED.

Coast Improvement Co., Ltd. (131,162).—This company was registered on September 20th, with a capital of £2,000 in £1 shares, to carry on the business of general contractors for all kinds of works, including railways, tramways, canals, gas and electric light and power works, buildings, &c., and to adopt an agreement with A. Mitchell and W. H. Hosking. The subscribers (with one share each) are:—W. P. Rellerby, 34, Rosendale Road, West Dulwich, S.E., accountant; R. G. George, 105, Newport Road, Leyton, E., clerk. Private company. Table "A" mainly applies. Registered office, 20, St. Mary Axe, E.C.

Ostro Light Co., Ltd. (131,212.)—This company was registered on September 23rd, with a capital of £1,650 in £1 shares, to carry on the business of dealers in electric and other lamps, apparatus and fittings, &c. The subscribers (with one share each) are:—K. Werth, 11, Queen Victoria Street, E.C., merchant; Mrs. A. Werth, 11, Queen Victoria Street, E.C. Private company. The number of directors is not to be less than two or more than five; the first are Baron Joseph de Gruber, of Antwerp, Munich, and Karl Werth. Registered office, 11, Queen Victoria Street, E.C.

Crowther & Osborne, Ltd. (131,172).—This company was registered on September 22nd, with a capital of £2,000 in £1 shares, to carry on the business of electricians, electrical, mechanical and general engineers, manufacturers, contractors and dealers, &c. The subscribers (with one share each) are:—G. V. Drakin, Blawith, Grange-over-Sands, gentleman; H. J. Osborn, Fern Bank, Gravel Lane, Wilmslow, engineer. Private company. Table "A" mainly applies. Registered office, 7, Blackfriars Street, Manchester.

British Combustion Turbines, Ltd. (131,242).—This company was registered on September 25th, with a capital of £2,500 in £1 shares, to carry on the business of engineers, &c. The subscribers (with one share each) are:—R. F. Collinge, New Broad Street House, E.C., engineer; P. A. Dunderdale, Dashwood House, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are R. F. Collinge and P. A. Dunderdale; qualification, £100; remuneration, £20 per annum, divisible. Registered office, New Broad Street House, E.C.

Wensleydale Gas and Electricity Co., Ltd. (131)—This company was registered on September 24th, with a capital of £3,000 in £1 shares, to take over the business of the Leyburn Mutual Gas Light Co., carried on at Leyburn, Yorks, and to carry on the same and the business indicated by the title, and to adopt an agreement with A. Cradock, W. Bell, J. Chapleo, J. B. Smithson, and E. Alderson. The subscribers (with one share each) are:—Mrs. M. M. Smithson, Leyburn; H. R. Chapman, Leyburn, gentleman; W. Graves, Constable Burton, Yorks., auctioneer; T. Bestwick, Leyburn, Yorks., hotel keeper; Mrs. M. M. Dale, Leyburn, Yorks.; A. Cradock, Leyburn, Yorks, ironmonger; E. Alderson, Leyburn, Yorks., hotel keeper. Minimum cash subscription seven shares. The number of directors is not to be less than three or more than five; the first are A. Cradock, E. Alderson, W. Bell, J. Chapleo, and J. B. Smithson; qualification, £50. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C. Solicitors: Chapman & Wilkinson, Leyburn.

Screen-Light Co., Ltd. (131,185).—This company was registered on September 22nd, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, lamps, illuminating devices and lighting equipment, electricians, electrical engineers, owners of patents and inventions relating to illumination or to motor accessories, &c. The subscribers (with one share each) are:—S. K. Nichols, 17, Farringdon Street, E.C., solicitor; F. W. Smith, 17, Farringdon Street, E.C., law clerk. Private company. The number of directors is not to be less than two or more than seven; the first are M. O. Illingworth (chairman), G. Brooke and R. Brooke. Registered office, Meeting House Lane, Lancaster.

Continuity Joint and Tube Co., Ltd. (131,352).—This company was registered on October 1st, with a capital of £5,000 in £1 shares, to carry on the business indicated by the title and that of electrical engineers and contractors, suppliers of electricity, &c., and to adopt an agreement with J. H. Jackson. The subscribers (with one share each) are:—F. Verheyden, 27, St. Mary Axe, E.C., shipbroker; J. H. Jackson, 97, Drayton Gardens, S.W., electrician. Private company. The number of directors is not to be less than three or more than five; the first are J. H. Jackson, P. H. Farrington and F. Verheyden (permanent original directors); qualification, £100; remuneration as fixed by the company. Registered office, 27, St. Mary Axe, E.C.

F. L. Mitchell & Co., Ltd. (131,357).—This company was registered on October 1st, with a capital of £1,000 in £1 shares, to take over the business of an electrical engineer and ironmonger carried on by C. W. Coverdale at 188, Rye Lane, Peckham, as F. L. Mitchell & Co., and to carry on the same and the business of vendors of electrical fittings and appliances, motor and cycle accessories, manufacturers and importers of "Electrolite" specialities, electric pocket lamps, batteries and accumulators, &c. The subscribers (with one share each) are:—T. W. Mitchell, 30, Melgund Road, Highbury, N., scientific instrument maker; C. Coverdale, 7, East Dulwich Grove, S.E., secretary; F. L. Mitchell, 17, Eddystone Road, Brockley, S.E., electrician; A. W. Knight, 169, Hornsey Road, Holloway, N., electrician. Private company. The number of directors is not to be less than two or more than three; the first are F. L. Mitchell, general manager, and T. W. Mitchell. Registered office, 188, Rye Lane, Peckham, S.E.

Aster Engineering Co. (1913), Ltd. (131,318)—Registered September 30th, by Jenkins, Baker, Reynolds & Co., 38, Old Jewry, E.C. Capital, £80,000 in £1 shares. Objects: To take over the business of the Aster Engineering Co., Ltd., and to carry on the business of manufacturers of internal combustion engines, motor-cars, aeroplanes, motor-ships and boats, motor-omnibuses, cabs and cycles, water meters, pumps, railway appliances, electrical goods, &c. The subscribers (with one share each) are:—Lieut. A. M. Willoughby, R N., Southwell, Notts.; S. D. Begbie, Wembley, Middlesex, engineer; Mrs. E. Clench, 6, Cambridge Court, East Twickenham; A. Dobson, 3, Sutton Court Road, Chiswick, W., company secretary; Mrs. F. Dobson, 3, Sutton Court Road, Chiswick, W.; C. Clench, 6, Cambridge Court, East Twickenham, engineer; Helen P. Shorland, 22, Lonsdale Avenue, Wembley, Middlesex, secretary. Minimum cash subscription, £7. The first directors (to be not less than four or more than nine) are J. E. West, M. Cherronnet, F. H. Meade, A. Monard, G. M. Bertault, S. D. Begbie and Lieut. A. M. Willoughby, R.N.; qualification, £100; remuneration, £100 each per annum (£100 extra for the chairman).

Forward Electric Co., Ltd. (131,359).—This company was registered on October 1st with a capital of £2,000 in £1 shares, to carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The subscribers (with one share each) are:—C. H. Twigg, 72, Potter's Hill, Aston, Birmingham, manufacturer; C. Cutt, 63, Rosary Road, Erdington, Birmingham, fireman; H. H. Hooper, 29, Tintern Road, Handsworth, Birmingham, order clerk. Private company. The first directors are C. H. Twigg, C. Cutt and H. H. Hooper (all permanent); qualification, £100. Registered office, Fountain Works, Lennox Street, Birmingham.

Renew Electric Lamp Co, Ltd. (131,339).—This company was registered on September 30th, with a capital of £5,000 in £1 shares, to take over certain patents, to carry on the business of manufacturers of and dealers in metal filaments, metal-filament lamps, &c., and to adopt an agreement with C. Ellis, F. Harrison, F. L. Harrison, and Mrs. C. A. Harrison. The subscribers (with one share each) are:—C. Ellis, 12, Lawrence Lane, E.C., merchant; H. Dickson, 3, Mumford Court, Milk Street, E.C., merchant. Private company. The first directors are C. Ellis (permanent), H. Dickson and L. A. Thomson; remuneration of directors, £50 per annum and a percentage of the profits, divisible. Registered office, 12, Lawrence Lane, Cheapside, E.C.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

The annual meeting was held yesterday at Electrical Federation Offices, Kingsway, W.C. The report submitted by the directors for the year ended June 30th, 1913, showed that the total revenue for the year was £261,714. The traffic receipts were £257,591, an increase of £28,449 over the previous year. After providing for all expenses chargeable to revenue, including £19,975 for debenture and other interest, the rental and percentage of profits payable to the Auckland City Council amounting to £5,670, and setting aside £25,000 to the renewals and depreciation account (as compared

with £20,000 in the preceding year), there is a surplus on the year's working of £54,178, making, with £8,268 brought forward, a total of £62,446. The dividend on preference shares paid and accrued to June 30th, 1913, requires £8,455, and an interim dividend on the ordinary shares for the half-year ended December 31st, 1912, of 7d. per share, free of income-tax, was paid in May last, and amounted to £10,208. The directors now recommend that £17,500 of the available balance be transferred to reserve account, bringing the account to £102,500, and that a further dividend be paid on the ordinary shares of 1s. per share, free of income-tax, for the half-year ended June 30th, 1913, making a total dividend of 1s. 7d. per share for the year. This will require £17,500, and leave £8,782 to be carried forward.

During the year £25,000 first mortgage debenture stock and 50,000 preference shares of £1 each were issued. The debenture stock was disposed of at par. The preference shares were offered to the existing shareholders *pro rata* to their holdings at par, and were all taken up with the exception of a small number which were subsequently disposed of at a premium. Under the terms of the debenture stock trust deed £4,487 first mortgage debenture stock was bought and cancelled. The premiums paid upon the purchases have been charged direct to the revenue account.

At June 30th, 1913, the issued share and debenture capital was:—£150,000 in 6 per cent. preference shares; £350,000 in ordinary shares; £388,557 in first mortgage debenture stock.

The extensions in Remuera and Morningside, with a total route mileage of 2·11 miles, have been opened for traffic.

A plot of land has been purchased for central repair works; the contract for the building has been let and the work is to be completed before the end of this year. The capital expenditure during the year on electrical construction amounted to £115,304. A large portion of this amount was the cost of additional cars. Considerable sums were also spent upon extension of the power house plant, the erection of new repair works, extensions of the distributing system, various duplications of the track and other capital purposes. The amount also includes the cost of the extensions of the lines above referred to. At the close of the year the number of cars in stock was 156, being an addition of 30 during the year—and 10 more were approaching completion.

An exhibition on an extensive scale will be opened in Auckland in December next, and at the request of the Exhibition Commissioners the company has undertaken to run a service of motor-omnibuses connecting its lines with the Exhibition entrance. Six vehicles of the latest type have been acquired for this purpose. Since the close of the year, the company has acquired a property adjoining the power station, which will enable extensions of the generating plant to be carried out as requirements necessitate. It is intended to install at once a further 1,000-KW. set. A proposal to make an issue of £100,000 in ordinary shares to provide the necessary funds for the company's purposes was before yesterday's meeting.

Mr. S. E. Garcke has resigned his seat on the board, and Mr. Leo. M. Myers has been elected to fill the vacancy.

	1912.	1913.
Miles open—Route miles..	23·31	25·42
Passengers carried..	36,053,050	40,331,316
Average receipts per passenger	1·53d.	1·53d.
Average expenditure per passenger	·92d.	·93d.
Proportion of expenditure to receipts ..	60 %	60 %
Number of cars working	126	156

Drake & Gorham, Ltd.—The directors' report for the year ended June 30th, 1913, shows that after payment of all charges, including bonuses due to staff, there remains a net profit of £10,268, which, with the sum of £1,698 brought forward, makes a total of £11,966, out of which it is proposed to pay a dividend at the rate of 5 per cent. per annum, absorbing £6,250, writing off balance of underwriting commission (£4,000), and carrying forward £1,716. The steady increase in turnover has been maintained, and encouraging reports continue to be received concerning the efficiency of the firm's lighting system, the details of which are constantly being perfected. The scope of the wholesale department has been further extended, and orders and profits have increased. The retiring director (Mr. J. C. Forster) does not seek re-election.

The report for 1912 showed a net profit of £9,021, recommended a 4½ per cent. dividend, placed £3,000 to writing off underwriting commission, and carried forward £1,698.

Callender's Cable and Construction Co., Ltd.—An interim dividend at the rate of 10 per cent. per annum, less tax, is announced, payable on November 1st.

Lisbon Electric Tramways, Ltd.—An interim dividend of 3 per cent., free of income-tax, on account of the current year is announced.

Japan.—During August last a sum of £350,000 was invested in new electrical concerns in Japan and £600,000 in the extension of old undertakings.

Parsons Foreign Patents Co., Ltd.—The directors (according to the *Financial Times*) recommend a dividend of 16½ per cent. on the ordinary shares, and of 8s. 3d. each on the deferred shares for the year ended June 30th.

New Issues.—The *Times* states that arrangements have been made for the issue of £400,000 5 per cent. second mortgage debentures of the Newcastle-upon-Tyne Electric Supply Co., at 95; also that the first issue of the new St. Petersburg Municipal Loan taken by the Russian English Bank will be applied principally to tramway extension.

United River Plate Telephone Co., Ltd.—The directors have declared an interim dividend of 3 per cent.

Sunderland and District Tramways, Ltd.

An extraordinary general meeting of the preference shareholders of the above company was held on Tuesday last week at Winchester House, E.C., Mr. H. R. Hogg presiding.

The CHAIRMAN said that the meeting had been called for the purpose of adjusting the share capital of the company to the assets, so that should the net profits reach a point when the board saw their way to advise the payment of a dividend, there would be nothing in the way to prevent its immediate payment. The first year's working of the company to October 31st, 1906, gave net profits amounting only to £5,136, and for some years they were so small compared with the possibilities that they altogether failed to reach the standing charges. The result was that the company in June, 1910, fell into the hands of a receiver. It was a much easier matter for a company to get into that plight than to get out again, and the number of divergent interests to be reconciled presented considerable difficulties before they could be adjusted. Two members of the old board took the matter in hand, and eventually succeeded in bringing it back to the possession of the original shareholders without having added to the burden that they carried before. The company served a population working at a succession of collieries connecting them with the town of Sunderland, depending mainly on the shipbuilding industry. The takings had been constantly unsettled by industrial strikes in the neighbourhood, but in spite of this, net profits had been steadily increasing. For the year ending October 31st, 1912, the traffic returns supplied £9,443, a net increase of £4,307 in six years. The board were now gratified to be able to meet the shareholders with the knowledge that they had been able to preserve their interests intact. The amount required to be written off in order to balance the assets with the liabilities was nearly £120,000, of which it was proposed to withdraw 95 per cent., or £71,240 10s., from the ordinary share capital, and 50 per cent., or £47,747 10s., of the preference, leaving in existence respectively £3,749 10s. of ordinary and £47,747 10s. of preference, and the latter being reckoned as if they had no cumulative interest. The whole matter of the cutting down resolved itself into a fair adjustment between the two bodies of shareholders, and although a large majority of preference shareholders thought the bargain proposed a fair one (and they were the chief parties concerned in the settlement), the board had been asked by a minority of the preference shareholders to modify the earlier proposition to the extent of allowing them to retain their present preferential interest in exchange for what they gave up. So far as they had gone in the present year, there had been an increase of some 20 per cent. in the profits, and if there was a similar increase in the succeeding year, they would be getting into a position of possibly being able to pay something to the preference shareholders, but it still required a large annual increase before they could pay them in full. Consequently it was only a remote hope of a dividend in the far future that they had to offer to the ordinaries, even after removing the cumulative dividend on the preference shares and reducing by one-half any balance accruing to them after an eventual realisation of the property. In conclusion, the CHAIRMAN proposed the following resolutions:—

1. That this meeting of ordinary shareholders hereby approves the proposed reduction of the capital of the company from £170,485 to £51,497 by the cancellation of the sum of 10s. per share upon each of the 95,495 preference shares of £1 each, and the sum of 19s. per share upon each of the 74,990 ordinary shares of £1 each.
2. That the rights of the preference shareholders may be varied or modified in the following manner:—(*a*) That all arrears of dividend in respect of the preference shares be extinguished and cancelled. (*b*) That as and from the date of this resolution the preference shares be changed from cumulative shares to non-cumulative shares.

MR. R. TAYLOR seconded.

MR. G. C. HOWARD said he thought the directors had not acted altogether fairly to the shareholders in only giving the seven clear days' statutory notice of the meeting. He was simply astonished, when he received the circular, that any board could put forward such proposals. In the short time at his disposal he had circularised the shareholders against the proposals, and altogether he had received, or had been promised, proxies respecting £22,000 against the scheme. He was willing to support the scheme if the directors would alter it so that the preference shareholders received the same dividend as they were at present entitled to, viz., 6 per cent. on the £1 share, or 12 per cent. on the reduced 10s. share.

The CHAIRMAN explained that he had endeavoured to see as many of the large shareholders as possible before bringing forward the scheme, and it had, he said, received the approval of by far the larger number. The board had received sufficient proxies to carry the resolutions as they stood, but it was not their wish to use them—they wanted to do what was fair to the shareholders as a whole. Personally, he was agreeable to accept the suggestion thrown out and make the 10s. preference share bear the 12 per cent. interest.

Eventually, after further discussion, the resolutions were agreed to as proposed, with the addition of the following words to (*b*):—"Entitled to a non-cumulative preference dividend of 12 per cent. per annum."

Subsequently, similar resolutions were carried at a meeting of the ordinary shareholders.

Ingleton Electric Lighting and Power Co., Ltd.—At the annual meeting last week considerable improvement was shown in the position of the undertaking. The directors were fully convinced that the decision to remove to the company's present premises had been fully justified by succeeding events, not only financially, but also from the point of view of increased facilities for supply. The whole of the property had now been obtained by the company on favourable terms.

Marconi's Wireless Telegraph Co., Ltd.

Commendatore Marconi presided on Friday at the Hotel Metropole over an extraordinary meeting of the above company, and formally moved the resolution referred to in our last issue for the increase of capital.

Mr. G. Isaacs (managing director), in seconding the motion, said that if the resolution was passed it was the intention to make an immediate issue of 250,000 shares, and to offer them to the shareholders at £3 5s. per share. Of the remaining 250,000 shares, part would be issued for cash in connection with the arrangements which had been made with respect to the shares to be acquired in the Cie. Universelle de Telegraphie et Telephonie sans Fil, of France, and the balance for the present would remain unissued. The recommendation to increase the company's capital would not have come as any surprise to the shareholders. Wireless telegraphy was destined to play a very important part indeed in the future telegraphic business of the world, and shareholders were aware that the policy of this company aimed at conducting that telegraphic business for its own account wherever it might be possible. Considerable progress had been made in that direction in recent times, and a number of important concessions had been secured, which would provide to the company the means of organising telegraphic services with some of the busiest commercial centres of the world. Negotiations were pending with other countries, and they had every reason to believe that they would be brought to a satisfactory conclusion in the very near future. To fulfil the terms of the concessions and create such telegraphic services, a number of stations had to be built requiring a substantial expenditure. As each station was opened and a satisfactory telegraphic service conducted, a continuously increasing revenue would accrue. Additional and cheaper means of communication between all the busy centres of the world, together with the ever increasing commerce, should add very considerably to the sum which was to-day expended upon the world's telegraph messages. He thought he was right in saying that the money expended yearly for telegraphic communications across the seas was already sufficient to pay satisfactory dividends upon a capitalisation which, he believed, exceeded £100,000,000 sterling, independently of the increase which might be reasonably expected through the advent of wireless telegraphy and the general development of the world's trade, and when they had completed the work which lay before them, and secured, if only a small share of the telegraph business, it should prove sufficient to enable them to earn substantial dividends upon what he thought they would be able then to regard, with their million and a half sterling, as a very moderate capitalisation considering the extensive telegraph routes which they would control. Given efficient management of the company's affairs during the next two or three years, he was confident they would then find that they owned one of the biggest and most important industries in the world, capable of holding its own against any competition and furnishing remunerative return to those who had supplied the capital and aided in the creation of the enterprise. They would have learned also from the circular sent to them that they were acquiring a large number of shares in the Cie. Universelle de Telegraphie et Telephonie sans Fil, which company owned the rights throughout the world, with the exception of the interior of Germany, of Dr. Goldschmidt's high-frequency alternator, and his other wireless patents. The Cie. Universelle de Telegraphie et Telephonie sans Fil was a company registered in France with a subscribed capital of 10,000,000 fr. in 100,000 shares of 100 fr. each, and 100,000 parts beneficiares or founder shares which participated in the profits to the extent of 45 per cent., thus making the capital equal to nearly 20,000,000 fr., or £800,000. This capital was subscribed by a few important and very influential persons, who wielded considerable power in certain countries abroad. Their board was composed of men of eminence and ability in France, Germany and this country, and their support of the Goldschmidt system, no matter what might be its merits, represented a serious menace to their programme in certain countries; the board did not fear their competition, but they were anxious that they should not prevent or delay them obtaining certain concessions to which they attached importance. The company was in possession of some 7,500,000 fr. or £300,000 in liquid capital, and, therefore, in this respect also carried no small weight in the foreign countries to which he had referred. From every point of view, and in using these words he meant to cover something more than the interests of the company, it appeared to the directors to be of the utmost importance that they should assure the telegraph services which were embraced in their programme becoming an English enterprise under the control and direction of an English company. These were some of the considerations which induced them to make the arrangements they had made with the Compagnie Universelle. They were satisfied with the conditions they had obtained, and believed they had entered into transactions which would prove beneficial to the company. All the shares in the Cie. Universelle, which were previously held in Germany, passed into their hands, and all the German directors retired from the board, a consideration of no small importance in France, and one which they hoped would enable the Cie. Universelle, who would also probably hold the Marconi long-distance licence for France and the French Colonies, to secure the whole of the important business in wireless telephony which was comprised in the programme of the French Government. It was probable that the Goldschmidt patents for the rest of the world would become the property of the Marconi Co. Now, with regard to the Goldschmidt high-frequency alternator, this was an extremely clever machine for the generation of continuous waves: it had been erected in a station near Hanover, which Mr. Marconi, one of his ablest engineers, and he (the speaker), visited a few weeks back. There was great merit in the invention, and Prof. Goldschmidt was, no doubt, a very able engineer. But it should be understood that he had not invented, and did not claim to have invented, a system of wireless telegraphy, but a machine for the generation and utilisation of continuous waves. The station in Hanover was well designed and of great promise; it had succeeded in sending across the Atlantic signals and even messages—but as they had told the shareholders on frequent occasions, there was a great difference between sending signals and messages and conducting a continuous telegraphic commercial service—and the Hanoverian station, in their opinion, without the assistance, experience and patents of the Marconi Co., was still a very long way from being able to conduct such a service. In saying this, he did not want to be understood to be taking from Prof. Goldschmidt one whit of the merit to which he was entitled; on the contrary, his was the only method other than those of the Marconi Co. of which they had any knowledge, which, in their opinion, had any prospect of success, but it was natural that a long period of tests, experiments and further inventions would be necessary with Prof. Goldschmidt, as they were with Commendatore Marconi. However, there were many considerations which caused them to make the arrangements referred to. There was one about which he must say a few words. They had had, as they knew, a Select Committee of the House of Commons and an advisory committee composed of scientific men. That committee reported that the Marconi Co. alone was able to carry out the Government work at the present moment, but it nevertheless spoke of Prof. Goldschmidt's machine in words which would have served the Cie. Universelle as a certificate with any foreign Government and consequently provided the means of seriously impeding, if not damaging, this company's programme. It would have been little or no satisfaction to them to see the Cie. Universelle obtain a contract or a concession abroad, and fail two or three years later to fulfil it: for even though it fell subsequently to the Marconi Co. to carry out, it would not have compensated them for the delay or the prejudice they would have suffered meantime. These were considerations of importance which obtained to-day, but in a very short time, they hoped, they would no longer exist; the important foundations of their business would have been securely laid, and no interference with their programme could then arise. It had been stated that one of the reasons which induced them to enter into this transaction was that the station at Hanover had succeeded in transmitting wireless messages to Tuckerton, U.S.A., at a regular rate of 100 words per minute for hours at a stretch. There was not an atom of foundation for that statement, for no better reason than that the Hanoverian station had not done any thing of the kind, nor anything approaching it. It had also been said by a paper which was usually more accurate in its statements, that Lord Parker's Committee reported that the future was likely to belong to continuous waves, which was the Goldschmidt and not the Marconi system, whereas what in fact the Committee reported was that the only continuous wave machine which they had seen tried with success over long distances was the Marconi continuous wave machine. A good deal more had been written upon this subject mainly with the object of attacking the Government in connection with the contract for the Imperial stations, but these were matters which did not concern them; they were political, and the Marconi Co. had no politics. But when the public was told, as one paper had told them, that the nation's interests had been sacrificed, he, for one, protested, for it would seem to him that the course they had taken would prove to be of very marked advantage to the nation, and that for the following reasons: They did not know, and nobody yet knew, whether continuous waves would be able to do a continuous long-distance commercial service; if they could, would they prove superior in any way to the non-continuous waves? Those who had no experience of long-distance wireless telegraphy might be willing to express their opinions, but Mr. Marconi and his engineers, who had such experience, declined to express themselves. Before doing so they wished to see what they were about to do, viz., work the continuous and non-continuous waves side by side across the Atlantic, and compare them at all times and in all weathers. Similarly they would be able to test the Goldschmidt continuous-wave machine, and compare it in every respect with the Marconi continuous-wave machine. If the continuous wave proved to be superior to the non-continuous, they would be in a position to decide which of the two machines was the better; they would preserve an absolutely open mind, and adopt whichever offered the greater advantage, and Mr. Marconi would be the first to insist upon that. Should the Goldschmidt machine prove the better, the nation would have the benefit of it under the contract with the company without any extra cost, and without having run any risk whatever. Had the arrangement which they had entered into not been made, the Government would not have had the opportunity of such a comparative test; but if it had, did anybody suppose that if the superiority proved to be with the Goldschmidt machine, the German and French interests would have been willing to furnish it on any better terms, if as good, as those entered into with their company? The Government had dealt with an English company; if the foreign machine proved of advantage, the Government still got the benefit of it through an English company. Was that how the nation's interests had been sacrificed? And, again, if the Goldschmidt machine proved to be of the value that some contended, and markedly superior, as it pleased others to say, to the Marconi machine, the commercial wireless telegraph business of the world would have been in the hands of foreign companies, whereas by their arrangements they would be in the control of an English company. He did not think that a sacrifice of the nation. He would say no more upon that subject. He hoped

he had said enough to convince them that whether the Marconi continuous-wave machine, or the Goldschmidt continuous-wave machine, or the combination of the two, proved the best in wireless telegraphy, the Marconi Co. would possess them, and under the contract the nation would have the benefit of them. He trusted they would approve the course they had taken and pass the resolution which the chairman had submitted. It might interest shareholders to know that 2,303 shareholders, representing 275,657 shares had signified their approval and sent their proxies.

The resolution was carried without discussion.

Consolidated Diesel Engine Manufacturers, Ltd.

The first annual meeting of the shareholders of the above company was held on Wednesday, October 1st, at the Cannon Street Hotel, Mr. C. C. Ellis presiding.

The Chairman said that before he began the business of the meeting it was his sorrowful duty to inform them that their colleague, Dr. Diesel, the inventor of the engine, had most mysteriously disappeared. He had been spending some days at Ghent, and had been over the works of Messrs. Usines Carels Frères. He was in the best of spirits from what he had seen, and was on his way back to attend that meeting. Dr. Diesel was travelling with Mr. Georges Carels and the chief engineer of the company on the steamer *Dresden*, from Antwerp to Harwich. They dined together, and about 10 o'clock at night Dr. Diesel retired to his cabin. In the morning he could not be found, the idea being that he must have fallen overboard. Dr. Diesel would be a loss not only to the company, but to the whole world, and he (the chairman) could not sufficiently express the feelings of sorrow with which his colleagues had heard the news. Though Dr. Diesel did not take a prominent or active part in the management of the company, still he was always ready when they wanted him for advice. They could hardly hope to see him again, and he was sure that Dr. Diesel's wife and friends had the deep sympathy of the shareholders and directors. They had also to mourn the loss of another director—Admiral Sir Archibald Douglas—who died on March 12th. They had not filled his seat on the board, and did not intend to do so at present. Proceeding to refer to the business of the company, the Chairman said the shareholders would doubtless be interested in a short *résumé* of the work which the directors and staff had done since the formation of the company. The first thing to be done was to obtain a suitable site for the erection of works. They decided upon Ipswich, but there was a great deal to decide before the best site could be obtained. In a matter of that kind, a great many arrangements had to be made simultaneously, as it did not do to buy land before they had made arrangements with the Railway Co. and the local authorities as to taxation. Everything being happily arranged on these two points, they secured about 23 acres of most suitable ground and the option of another 23 acres adjoining. The ground had water communication on one side and the railway on the other, and was about a mile from the centre of Ipswich. As the building of the works proceeded, it was quite evident that the directors had made no mistake in the choice of land, as the land adjoining it had increased very greatly in value, and it would be necessary for them to exercise their option and purchase the other 23 acres. They hoped that the additional land would be necessary for them in the near future for extension purposes. The preparation of the plans and preliminaries took considerable time, as did also the agreement with the town clerk and the railway company respecting the sidings. Excavation work was begun in November, 1912, and the foundations were laid at the end of that year. The erection of the steelwork was started in January of this year and finished in July. A considerable delay was experienced owing to a shortage of steel on the market, and though the arrangement with the contractors was to have the machine shop ready at the end of January, they could not adhere to that. The pattern shop building was ready in March, and pattern making was started then. A temporary tool room was arranged in the pattern shop and the manufacture of tools and jigs was commenced in May. Immediately the steelwork was finished in July, preparations for starting the foundry were made and foundry work had been in progress since then. The machine shop was not completed owing to the late delivery of the tools, which was due to the great number of strikes which had taken place in the Midlands—in fact, they had suffered right through the construction of the works from a number of strikes. The total amount of money spent on the works, including the land, &c., was in the vicinity of £140,000. The organisation of the company's London business and offices had also given the directors much consideration, and was now satisfactorily completed. Some difficulty had been experienced in obtaining orders during the past few months, owing to the present high price of oil, and with a view to meeting the difficulty the board had been conducting experiments at the works with fuel other than that hitherto used for Diesel engines. The experiments, although not yet completed, had already proved very satisfactory, and they looked forward with some confidence to a satisfactory solution of the fuel problem. A fair number of orders had been booked by the company, several of which were for large engines, which took many months to build, and therefore the contracts would not be completed for some considerable time. At the Universal Exhibition at Ghent, Messrs. Usines Carels Frères exhibited a 1,500-B.H.P. Carels-Diesel six-cylinder marine engine, which engine, together with another of the same type and output, had been sold to the British Admiralty. In order that the company might be widely represented, agencies had been established in nearly all parts of the world, and negotiations were being conducted with a view to appointing agents in districts not already covered. The work done so far being entirely of a pioneer nature, a return on the expense incurred could not be expected in the immediate future, but they had no doubt that the expenditure would bear fruit later on. He then moved that the meeting stand adjourned to a date subsequent to October 31st, formal notice of which would be duly given to the shareholders.

Mr. Georges Carels seconded the motion.

Mr. Lowry, Mr. G. B. Ball, and other shareholders complained of the sparse nature of the information which the chairman had given the meeting, and asked whether the accounts of Messrs. Usines Carels Frères had yet been received.

Mr. G. Carels, in replying, said that the meeting of his company would take place on October 14th, which was the earliest date at which it could be held according to the Belgian Company law. Their profits were not what they had hoped for. Owing to the war in Roumania, their orders there had gone down, and they had also been very greatly handicapped by the price of oil. They had made very lengthy experiments with Mexican oil, and he was pleased to say had obtained very practical results. If oil had remained at its old price they had no doubt that shipowners would have ordered Diesel engines without waiting to see the results of the different types, but now, unfortunately, owing to the high price of oil, there was very little difference in the cost of working between the steam engine and the Diesel engine. As he had said, they hoped to get over that difficulty with the Mexican oil. He might say that those boats that had been engined with Carels engines, had given very good results.

After further discussion, the resolution was carried on the understanding that the adjourned meeting should be held some time before the end of this year.

Prospectuses.—*Buenos Ayres Lacroze Tramways Co.*—The list was to close on Wednesday in an issue of £500,000 5 per cent. consolidated mortgage debentures at £88 per £100 debenture. Part of the proceeds is to be devoted to tramways extensions, for which powers have been secured.

British Columbia Electric Railway Co., Ltd., and Vancouver Power Co., Ltd.—The list was to close yesterday in an issue of £650,000 4½ per cent. perpetual guaranteed debenture stock of the Vancouver Power Co., Ltd., guaranteed both as to capital and interest by the B.C. Electric Railway Co. The price of issue is 88 per cent. The proceeds of the issue are required to meet the cost of various hydro-electric works, to extend electric generating plants, and partly to pay for the shares of the Vancouver Island Power Co., the whole of which have been acquired by the Vancouver Power Co. at par from the railway company.

Cleveland and Durham Electric Power, Ltd.—The list was to close yesterday in an issue of £130,000 5 per cent. first mortgage debentures at £97 10s. per £100. £72,700 is reserved for exchange for debenture stock of the Cleveland and Durham County Electric Power Co., leaving for future requirements £47,300, of which £25,000 will be deposited as collateral security pending completion of certain hire-purchase payments for plant.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year, ending June 30th last, at the rate of 5 per cent. per annum, free of income-tax, payable November 1st.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a dividend on the capital stock at the rate of 2½ per cent.

Parsons Marine Steam Turbine Co., Ltd.—For the year ended June the dividend is 10 per cent. per annum plus a bonus of 5 per cent. (2½ per cent. better than for the preceding year), and £19,301 is carried forward. According to an abstract of the report in the *Times*, the total horse-power of marine turbines of the Parsons type, complete down to the present time and under construction in the works of the company, and of licensees, as well as in the works of the Continental sub-companies and licensees of Parsons Foreign Patents Co., amounts to about 10,600,000 H.P., an increase during the year of about 2,100,000 H.P. Of this total horse-power nearly 9,200,000 H.P. are, or will be, employed for the propulsion of warships, and over 1,400,000 H.P. in vessels of the mercantile marine and yachts.

Stock Exchange Notices.—The Committee has appointed a special settling day in and ordered the following to be quoted in the Official List :—

Wednesday, October 22rd.—Morgan Crucible Co., Ltd.—3,467 7 per cent. non-cumulative preferred ordinary shares of £10 each, £5 paid, within Nos. 10,001 to 30,000; and 16,533 7 per cent. non-cumulative preferred ordinary shares of £10 each fully paid, within Nos. 10,001 to 30,000.

Applications have been made to the Committee to appoint a special settling day in—

New British Every-Ready Co., Ltd.—85,000 7 per cent. cumulative preference shares of £1 each, fully-paid, Nos. 1 to 85,000.

Universal Cheap Cables, Ltd.—80,000 vendors' shares of £1 each fully paid, Nos. 20,001 to 100,000.

And ordered the following to be quoted in the Official List :—

North Metropolitan Electric Power Supply Co.—Further issue of £40,000 5 per cent. mortgages of £100 each, Nos. 1,501 to 1,900 (registered).

Calcutta Tramways Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum, free of income-tax, on the ordinary shares for the past half-year.

STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange remain in an unsatisfactory condition. The ferment in the Balkans probably had something to do with the rise in the Bank Rate last Thursday, which came earlier than had been expected. A 5 per cent. minimum is not pleasant, even in days of market activity; and in quiet times it presses as a load upon the shoulders of the Stock Exchange. As things are now, it drives another nail into the frail shell of confidence and faith on the part of the investor.

The crisis that has come about in Brazil in consequence of the position in the rubber trade is a factor which bears hardly upon investment and speculation alike. While it might be supposed to be in the interests of the Plantation industry, its direct effect is the opposite, for, instead of becoming more buoyant by reason of the troubles of wild rubber collectors, shareholders in the Plantation companies appear to have drifted into a state of mind still more nervous than before. Its unfavourable influence, too, has extended to the securities of certain Latin-Canadian utility companies, the connection being established through the various undertakings of people closely related to the electric light and power business in the Western hemisphere.

The Home Railway market has its troubles like the rest. Its prices have suffered because of the rise in the Bank Rate, which, of course, mean the incidence of heavier carry-over rates at forthcoming settlements. The Undergrounds have withstood the prevailing depression with a fair amount of firmness, but Metropolitans show a decline of ¾ on the week. Underground Electric Railway Incomes are a shade easier. British Electric Traction Preferred stocks improved; London and Suburban descriptions remained unchanged. It may be mentioned that East Londons are weak, the Ordinary stock having fallen ½ to 7, while the company's Debenture stocks have also given way.

British Columbia Electric Stocks are flat. The Deferred shed 4, the Preferred Ordinary, the Preference and 4¼ per cent. Debenture all lost 2. This was due to a new issue of Vancouver Power 4¼ per cent. Debenture stock at 88, the underwriting being offered to proprietors of British Columbia Railway stocks at a cash commission of 2½ per cent., bringing down the price to 85½. This compared with the British Columbia 4¼ per cent. Debenture stock standing at 92½, and no doubt some of the proprietors of the older securities have been realising in order to exchange into the latest comer, having regard to the comparatively low prices at which it was offered.

Another new issue this week is that of £500,000 5 per cent. Consolidated Mortgage Debentures at 88, offered by the Buenos Ayres Lacroze Tramways Company. The yield on these works out to about 5$\frac{11}{16}$ per cent., and, in view of the nature of the security, the Debentures look cheap. So far as the market was concerned, it had little effect upon other prices. The company's existing 5 per First Mortgage Debenture stock stands at 100, while it also has 5 per cent. Extension Mortgage Debentures, the middle price of which is 95½.

Brazilian Traction slumped to 92, following upon their drop of last week, and fresh falls have occurred in Mexico Tramways and Mexican Light and Power issues. Rio Tramway bonds and Sao Paulo bonds have given way, the whole of the section being affected by the trouble in Brazil. Moreover, as we were pointing out recently, there is the Cuban Ports affair to give investors pause before entering this department, in which, however, values in some cases have now reached a level at which they are decidedly cheap, when it is considered what substantial blocks of security they have to rest upon. The Calcutta Tramways Company has declared an interim dividend of 6 per cent. on the Ordinary shares, the price of which remains steady at 6¼.

In the Electricity Supply market, the only features this week are falls of ⅛ in both the London Electric issues, and of 10s. in City of London Preference. The last-named has taken the price back to 12½. Business in these stocks and shares has meandered to a mere trickle. There is nothing doing even in City Lights. At the same time, the recent improvements are in most cases well held; and the broker who came with a merry twinkle in his eye to inquire whether electric shares had been affected by the opening of the Shepherd's Bush Exhibition, appeared to be a little disappointed at the reply to his kind inquiries.

Marconis have dwindled to 3⅞ middle, the Preference to 3$\frac{3}{16}$, while Canadians have slipped back to half-a-guinea, and Americans to a few pence above 1. The recent life which animated the shares has evaporated, and the apathy which has overtaken the market led to a certain amount of selling. National Telephone Deferred hardened to 7⅞. It is thought that the final distribution on this stock will be announced somewhere about the end of the present month.

Anglo-American Telegraph Preferred and Deferred stocks continue to harden, and Eastern Telegraph Ordinary is again ½ to the good. On the other hand, West India and Panama shares fell ⅛; and Reuters shares, falling 5s., lost more than the improvement which they gained last week. American Telephone and Telegraph stock shed 2 points, because of the weakness in Americans as a whole, induced by the revision of the tariff to which President Wilson appended his signature last Friday. Mackay shares have given way, for the same reason. The American market for the time being prefers to think that the revision of the tariff must mean a bad time for the various trusts and monopolies, and the professional operators in New York amused themselves with hammering prices fiercely at the beginning of this week.

The Manufacturing division is quietly firm. There are no features of interest. The report of the Dick, Kerr Company had the effect of putting up the price of the Preference to $\frac{19}{16}$, a rise of $\frac{3}{32}$, the Ordinary being left at $\frac{7}{16}$ middle. Electric Construction shares of both kinds are now quoted in their new denominations of £1 shares, the Ordinary being 12s. 6d. middle, and the Preference £1, which is much the same as they were before the splitting took place, when the middle prices were 1⅛ and 2 respectively. The Miscellaneous market is upset by the continual crumbling of prices in the rubber share market, where the various panaceas which are proposed for the rehabilitation of the price of the raw material are not sufficiently convincing to cause Stock Exchange men to think that the time for buying shares has arrived even yet.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, October 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£24	..
a Lead, Nitrate	„	£30	..
a „ White Sugar	„	£27 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) ..	„	7½d.	..
(for mining purposes only)			
a Shellac	per cwt.	100/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8¼d.	⅛d. dec.
c „ Tube (brazed)	„	10¼d.	..
c „ „ (solid drawn) ..	„	9¼d.	..
c „ Wire, basis	„	8⅝d.	⅛d. dec.
c Copper Tubes (brazed)	„	1/-	..
c „ „ (solid drawn) ..	„	11⅛d.	..
g „ Bars (best selected) ..	per ton	£91	..
g „ Sheet	„	£91	..
g „ Rod	„	£91	..
d „ (Electrolytic) Bars ..	„	£78 10	..
d „ „ Sheets ..	„	£96 10	..
d „ „ Rods ..	„	£84	..
d „ „ H.C. Wire	per lb.	10⅛d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	..
h India-rubber, Para fine	„	8/4	4d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	53/3	1/6 dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 10	10/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£188 to £189	£6 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/6	1d. dec.
p White Anti-friction Metals ..	per ton	£50 to £328	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4⅛	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17⅓	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	12 — 18	— ½	4 13 4
Do. 5 % Deb.	Stock	5	5	114 — 118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅜ — 12¼	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 105	+ ½	4 5 8
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	8 8 7
Do. 6% Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞ xd	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞ xd	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	..	7⅞ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7⅞ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	3	2½	..	1½ — 1⅝	— ⅛	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	— ⅛	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	8⅜ — 8⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	5	6	10 — 10½	..	5 11 7
Oxford	5	7	6†	6⅞ — 6⅞	..	5 9 10
St. James' and Pall Mall, Ord.	5	10	10†	9 — 9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅜ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb.	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/32 — 1 5/32	..	6 1 3
Do. 4½ % First Deb. Stock	100	4½	4½	94 — 97 xd	..	4 12 9
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	3	..	2⅜ — 2¾	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86 xd	..	5 4 8
Westminster, Ord.	5	10	10†	8⅞ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	..	7⅛ — 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	110 — 115	..	6 1 9
Do. 7 % Pref.	$100	7	7	117 — 122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 11/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93 xd	..	5 7 6
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6		93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	— 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	..	9/16 — 11/16	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 — 104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5		103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5		77 — 81	..	6 3 5
Mexican Lt. & Power, Common	$100	4	4	63 — 67	— 3	5 19 5
Do. 7 % Cum. Pref.	$100	7	7	95 — 100	— 1	7 0 0
Do. 5 % 1st Mort. Gold Bds.		5	5	90½ — 92½	..	5 8 1
Do. 5 % 2nd Mort. Bonds	100	5	5	78 — 80	..	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	73 — 76	..	6 11 7
Montreal, Lt., H. and Power	$100	9	10†	217 — 227	..	4 8 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 6
Do. 6 % Non-Cum. Pref.	Do.	6	6	102 — 107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 100 xd	..	4 10 0
Shawinigan Water, Capital	$100	5½	6†	138 — 143	— 1½	4 4 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 — 107	— ½	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ — 102½	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref.	1	6	6	11/16 — 13/16	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	180 — 182 xd	— 2	6 1 8
Do. Collat. Trust	$1000	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	106 — 107	+ ½	5 12 2
Do. Def.	Do.	80/-	..	23½ — 23¾	+ ⅛	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81½ — 83½ xd	..	4 15 10
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14⅜ — 15⅝	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8¾ xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼ xd	..	6 18 0
Direct United States Cable	10	4	4†	6⅝ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	128½ — 131½	+ ½	5 6 5
Do. 3½ % Pref. Stock	Do.	3½	3½	75½ — 77½	..	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	97 — 99	..	4 0 10
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ — 101½	..	3 18 10
Globe Telegraph and Trust	10	6	6†	11 — 11⅛ xd	..	5 4 4
Do. 6 % Pref.	10	6	6	12 — 12⅓ xd	..	4 16 0
Great Northern Telegraph	10	20	5†	80⅛ — 82⅛	..	6 3 1
Indo-European Telegraph	25	13	..	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3 3/16 — 3 5/16	— 1/32	5 1 6
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅛ — 3¼	— ⅛	5 4 7
Monte Video Telephone, Ord.	1	5	6	1 1/16 — 1 3/16	..	5 18 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99⅜ — 100⅝	..	4 9 4
Oriental Telep. and Elec.	1	10	..	1⅜ — 1½	..	5 6 8
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 8
Reuter's	10	10	10†	9⅜ — 10⅜	— ¼	9 17 6
Submarine Cables Trust	Cert.	6	6	124 — 127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 7/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Brss. Sub. Tel.	100	4	4	94 — 97	..	4 2 8
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅝	— ⅛	4 11 0
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ — 10⅜	..	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	9¼ — 9⅝	..	6 3 1
Do. 5 % Debs.	100	5	5	99 — 101	..	4 19 0
Western Telegraph, Ltd.	10	7½	7	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	94 — 96	+ ⅛	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3 1/32 — 3 5/32	..	6 8 0
Do 4½ % Deb.	100	4½	4½	70 — 75 xd	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12½ — 14½	+ ½	..
Do. Do. Deferred ..	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	50 — 53	+1	5 13 2
Do. 5 % Perp. Deb. ..	100	5	5	93 — 95 xd	..	5 5 3
Do. 4½ % 2nd Deb. ..	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. Pref.	100	4	4	77 — 79	..	5 1 3
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 8
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 8
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾ xd	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71 xd	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 9/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord. ..	1	..	..	¼ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 21/32	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	73 — 78	..	5 15 5
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol. ..	100	1⅝	1½†	45½ — 46	— ¾	3 10 8
Do. Surplus Lands	100	2⅝	2⅝†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord. ..	100	Nil	..	33¾ — 34¼	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89 xd	..	5 12 0
Potteries, Ord.	1	3½	..	2/32 — 3/32	..	..
Do. 5 % Pref.	1	0	5	1/16 — 1/8	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	110 —112	+1	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	90 — 91	— ½	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	3	1½†	3⅜ — 3⅞	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	91½ — 92½	—4	6 9 9
Brisbane Trams Invt., Ord. ..	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	121 —124	- 4	6 9 1
Do. Pref. Ord.	100	6	6	109 —113	—2	5 6 2
Do. 5 % Pref.	100	5	5	99 —102	- 2	4 18 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 6
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —104	+ 1	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	89 — 92	—2	4 12 5
Calcutta Trams, Ord.	5	7½	6†	6 — 6⅛	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1 1/16 — 1 3/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	—1/16	4 11 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	8	..	25 — 35	..	..
La Plata Elec. Trms, Ord. ..	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1 xd	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4⅝ — 5 xd	..	6 0 0
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7	89 — 92	—1½	7 12 2
Do. Gen. Con. 5 % Bonds ..	..	5	5	90 — 92	—1	5 8 8
Do. 6 % Bonds	100	6	6	93 — 95	— ½	6 6 4
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100½ - 102½	- 2	4 17 7
Do. 5 % Mort. Bonds ..	100	5	5	93 — 95 xd	— ½	5 5 3
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 — 104	..	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90 xd	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ - 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 18 4
Babcock & Wilcox	1	16	..	3 1/16 — 3 3/16	..	5 0 5
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord. ..	1	..	..	31/32 — 1 3/32	..	..
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	+1	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	+1	5 15 0
B. I. & Helsby Cables	5	10	..	8¼ — 8¾ xd	..	5 14 3
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb...	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾	..	4 14 0
British Westinghouse, Pref. ..	8	Nil	..	1 5/16 — 1⅛	..	Nil
Do. Deb...	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103 xd	+2	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- - 8,6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	..	11 — 11¾	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 13/16 — 3 15/16	..	5 1 7
Do. Deb...	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	1/16 — 1/8	..	..
Do. Pref.	1	6	6	⅝ — ¾	+ 3/32	6 17 3
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	63 — 68 xd	..	7 7 1
Electric Construction	1	5	..	3/16 — 1/4	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/8	..	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb...	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	8	6	9½ — 10¼	..	5 14 8
Do. Deb...	100	4	4	87 — 92 xd	..	4 7 11
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb...	100	4½	4½	101—103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13¼ — 14½	..	5 5 8
Do. Pref.	10	6	6	9⅜ — 10⅜	..	4 18 9
Telegraph Construction.. ..	12	20	5†	37 — 39	..	6 3 1
Do. Deb...	100	4	4	96 — 98	..	4 1 8
Willans & Robinson	100	4	4	56 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

THE BRITISH ASSOCIATION.—IV.

Sir Joseph Larmor, F.R.S., gave a short preliminary note on "Protection from Lightning," in Section A. He said the influence of a lightning conductor depended upon its causing a modification of the electric field. The building attracted the charge of electricity. The lightning rod was designed to carry off the discharge when it reached it. The rod must be efficiently earthed and connected with any metallic masses in the building. Separate spears projecting upwards from the corners of the building did not much affect the electrical field; but if they were connected at their summits by horizontal wires, they would raise the electrical field to a plane above the top of the building and would thus take the discharge, which they helped to attract, before it could reach the building.

Sir Oliver Lodge, who took part in the discussion, supported this conclusion, which he said was borne out by experiment.

On Wednesday, the concluding day of the meeting, Section G devoted itself to civil engineering; to Panama Canal landslides; the Snow Hill Station at Birmingham; harbour work; and sand bars, all subjects somewhat out of our line.

Section A worked on Tuesday afternoon, Prof. Bragg's paper on the work carried out by himself and his son on X-rays and crystals attracting a great deal of attention.

On Wednesday, in Section A, Mr. J. S. Anderson read a paper on a "New Method of Sealing Electrical Conductors through Glass." The metal and glass are fused together in the usual way. After it has cooled to a red heat the seal is immersed in an oil bath for two or three seconds, several times, until it is completely cooled. This method is applicable to all kinds of glass.

In Section B, on Tuesday, Mr. Frederick Soddy, F.R.S., contributed a most interesting paper to a crowded audience, on the "Radio-Active Elements and the Periodic Law." He stated that during the present year the general law governing the passage through the periodic table of the elements in process of radio-active change had been discovered; and that it was now possible to write the three disintegration series of uranium, thorium and actinium across the periodic table, so that each of the 27 substances of which the chemistry was known, fell into its proper place. He remarked, in conclusion, that although these advances showed that matter was even more complex than chemical analysis alone had been able to reveal, they indicated at the same time that the problem of atomic constitution might be simpler than had been supposed from the lack of simple numerical relations between the atomic weights. Mr. A. Fleck and Dr. Hevesy followed with papers on the radio-active elements.

The general concluding meeting took place on Wednesday at the Midland Institute.

Sir Oliver Lodge proposed a vote of thanks to the Lord Mayor, Lieut.-Col. E. Martineau, and the Corporation of Birmingham, and to the citizens for their generous hospitality, to which the Lord Mayor and Ald. Bowater responded.

Principal Griffiths, of Cardiff, proposed a vote of thanks to the University and other institutions, to which Mr. Gilbert Barling (the Vice-Chancellor), and Dr. Sumpner, Principal of the Municipal Technical College, responded. The local secretaries, Messrs. H. Heaton, J. Humphreys, W. Byng Kenrick, and Prof. Gamble were also thanked, and, truly, their energy, ability and courtesy had been appreciated on all sides.

Seldom has a longer or more interesting list of works to be visited been offered to the Association. Set visits were arranged with the Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd.; Messrs. Milward & Sons, needle manufacturers; Messrs. F. & C. Osler, glass making and cutting; Messrs. Avery's, Ltd., weighing machines; Messrs. Elkington & Co., silver plating; the Birmingham Small Arms Co., Ltd.; Messrs. Cadbury Bros.; the Great Western Locomotive Works at Wolverhampton; Messrs. Alfred Hickmans, Ltd., and the Daimler Co., Ltd., at Coventry. The last-named firm, employing over 5,000 hands, welcomed a large party, and showed them over the works, which is up to date in every respect.

The visitors were especially struck with the lightness and good ventilation of the whole establishment, even the iron and steel foundry being light and spacious to a degree seldom associated with that department. Each visitor was given a sumptuous catalogue and an ingenious cardboard model of the standard sleeve-valve engine, which is made throughout on the premises, and is now fitted to all the motor-cars turned out. Electric starting and lighting sets are being developed, and, indeed, electric lighting of the cars has been the standard practice of the firm for some time.

An interesting object in a bay of the erecting shop was the powerful petrol locomotive, which was described by Mr. Lanchester in Section G. The works are electrically-driven throughout, the power being derived from Diesel engines of the vertical type, burning crude oil.

Many other works invited the inspection of members, some without restrictions, others only by special arrangement; brewing, bedstead-making, bridge-building, chemical works, cycle-making, coal-mining, gun-making, hollow ware, jewellery, watch-making, steel pens, saddlery, and stationery, were amongst the trades exhibited. Messrs. Belliss and Morcom's Engineering Works attracted a large party. The municipal electricity works, gas, water and sewage works were all visited.

It was noticeable that only one tube-drawing and rolling mill establishment opened its doors, and none of the rubber works. At the works of Messrs. Winfield's Rolling Mills, Ltd., copper and brass tubes and sections and wire are produced.

One of the most interesting things to be seen in Birmingham is a Boulton and Watt condensing beam-engine of 350 H.P., bearing the date 1825, and still doing its full share of the work. The working pressure is 20 to 25 lb. to the sq. in. Side by side with it works a 300-H.P. motor on the Birmingham Corporation mains.

The social side of the meeting was, as might be expected, well looked after, and the entertainments included a crowded and brilliant reception by the Lord Mayor, in the beautiful Art Galleries; and special performances at the Prince of Wales' Theatre, the Picture House, and the theatre of the Birmingham Repertory theatre.

There were, as usual, two evening discourses, the first on "Explosions in Mines," by Sir H. Cunynghame, K.C.B., and the second on "Missing Links among Extinct Animals," by Dr. Smith Woodward, F.R.S.

Several "Citizen's Lectures" were well attended, and much appreciated, one being by Dr. Vaughan Cornish, on the "Panama Canal," and another by Mr. Frederick Soddy, on "The Evolution of Matter." Dr. Walter Rosenhain also lectured on "Metals under the Microscope."

Taken altogether, the Birmingham meeting must be reckoned as a great success. The British Association does important work in "spreading the light," even sometimes carrying the torch a few steps forward. Perhaps it inspires the love of science in the Newtons and Kelvins of the future. At least it gives sufficient publicity to the progress of science to instruct the multitude up to the point of tolerating its work. Some day it may go further and inspire campaigns, and induce votes for practical assistance from the Government. If the splendid help it receives from the Press—not only the technical Press, but the daily papers—were fully appreciated, and fully utilised, we feel sure that it would attract many more contributions of first-rate importance, and bring together the whole body of scientific workers. No other institution enjoys the publicity which is given to the proceedings of the British Association, and no other receives such hearty support in the shape of ungrudging work and boundless hospitality from the localities it visits.

Smoke Abatement.

Dr. R. Lessing read a paper in Section B on "Smokeless Fuel and Coal Oil, and their relation to Smoke Abatement," in which he emphasised the importance of the losses indicated by the production of smoke. As the result of improvements in the design of furnaces and in the provision of facilities for the control of their working, he said, a diminution of the smoke evil had been noticeable during recent years. Part of the improvement had been due to the law against the emission of black smoke from industrial furnaces, and

to the efforts of the Coal Smoke Abatement Society, but the pollution of the atmosphere by the domestic chimney continued unabated. The growing popularity of gas fires might prevent a further increase of the coal consumption for household purposes, but five tons of coal had to be carbonised to produce gas equal in heating value to one ton of coal, and the excess of gas coke made was more than likely to prove a drug in the market. Some palliative appeared to lie in the direction of carbonisation of house coal at low temperature—about 400° or 500° C., as compared with 1,000-1,200° C. in ordinary coal-gas manufacture. This would yield a "semi-coke" or "smokeless fuel," a larger quantity of tar and ammonia, and a richer gas, but less than half as much gas as in the case of high-temperature carbonisation.

A number of processes for low-temperature carbonisation have been brought forward, notably the ill-starred "Coalite" venture. The demand for liquid fuel has led inventors to endeavour to recover the largest possible quantity of "coal oil," which is a legitimate object of pursuit, but it is essential to the success of the new industry that the solid residue shall be the main product, with gas, tar and ammonia as by-products. The principal fault of "semi-coke" as at present produced is its bulkiness, which may be twice that of the same weight of coal, and entails expense and inconvenience. There is also a higher percentage of ash. The solid smokeless fuel, if freed from ash, water, &c., will do the heating work of the amount of coal from which it is produced, and the volatile constituents will satisfy a large part of the demand for motor spirit, fuel oil, and pitch for road making.

It is estimated that the annual loss of liquid fuel in domestic fires amounts to 210,000 tons, which would supply the oil fuel requirements of the Navy for a year, instead of defiling the atmosphere of our towns. The "coal oil" recoverable from house coals by low-temperature carbonisation would amount to three million tons per annum. Thus a great saving could be made, which would increase the National wealth and comfort, and help to render this country independent of the supply of fuel oil from foreign sources.

Dr. G. T. Beilby, F.R.S., in the same Section dealt with "Fuel Economy and Low-Temperature Carbonisation." After referring to the awakening of interest in British coal consumption and various reports on the subject, he considered the application of destructive distillation to raw coal as a means of promoting economy, efficiency and cleanliness in its use for industrial and domestic purposes.

The industrial applications of destructive distillation, he said, were naturally classed under three principal divisions according to the primary product which it was desired to obtain: hard coke, illuminating gas, and paraffin wax and oils. In each case secondary products resulted from the distillation, and in each case the primary product was being produced to supply the demands of markets which already existed. If an important revolution in any division of the industry were contemplated, its effect on these existing markets must be carefully considered.

It was about eight years since Mr. Parker brought forward a scheme for the production of "Coalite," a smokeless domestic fuel made by the distillation of coal at a temperature of 400° to 500° C.; from the gas engineer's point of view Mr. Parker's proposal was regarded as revolutionary and hardly worth serious consideration, but it contained the germ of a very big idea.

A fairly extensive experience of low-temperature distillation as applied to coal as well as to oil shale led the author from the outset to question whether the proposal to distil bituminous coal in long vertical tubes of small diameter would be industrially successful. An experimental inquiry into the possibilities of other methods of distilling coal at a low temperature was carried on by him and his colleagues in the works of the Cassel Cyanide Co. in Glasgow.

The object was to devise a form of apparatus in which the coal could be exposed to the action of heat in thin layers.

The apparatus passed through various stages till a unit with a capacity of 15 tons per day was reached. The mechanical difficulties to be overcome as the scale of operations was increased were serious. They were now preparing designs for a further step in which they hoped to profit by the experience of the past four years. They were, however, satisfied that the principle of exposing coal to heat in thin layers was sound, and that the production of a mechanically perfect apparatus into which small coal was automatically fed, passed through the distilling zone and finally passed out through a cooling chamber, only required a little more patient step by step development.

The greater part of the coke from this unit plant had been used in water gas prodcers, into which it could be passed while it was still warm and dry. It had thus an initial advantage over the gas works coke, which usually contained 10 to 15 per cent. of water. The use of the low-temperature coke for water-gas making proved quite satisfactory.

A good deal of the coke had also been converted into briquettes for domestic fuel. These were easily kindled and kept alight in an ordinary grate and burned almost without smoke. The experience of numerous householders in Glasgow in the use of this fuel had been most encouraging, and his colleagues were quite satisfied that a steady outlet for a moderately large output could at once be obtained.

The really significant points were covered by the economic and engineering questions: Can an outlet be found for the low-temperature coke? and can a satisfactory apparatus be devised?

He was not without hope that ere long an apparatus would be produced which would tempt the orthodox gas engineers to give low-temperature distillation a serious trial on its merits.

A paper read by Prof. F. W. Burstall in Section G, to which we have already referred, dealt with the subject of "Liquid, Solid and Gaseous Fuels for Power Production" on similar lines, but in accordance with its title the author regarded the matter more directly from the point of view of the power engineer. He pointed out that the inherent difficulties in the use of gaseous fuel rendered it unlikely that the gas engine could ever compete with the steam turbine in size of generating unit; with liquid fuel the matter assumed a different aspect, and he saw no reason why the oil engine should not be made in the largest sizes. The difficulties in the way of constructing a practicable gas turbine had so far proved insurmountable.

As only 50 million tons of crude oil were available per annum, while 1,200 million tons of coal were consumed, it was evident that the supply of oil was quite inadequate to take the place of coal for power production on the present scale. Coal might be carbonised under altered conditions which would result in a high yield of fuel oils and other compounds of value, especially sulphate of ammonia, the most valuable manure where nitrogen was needed. In a modern gasworks one ton of coal yielded 11,500-12,500 cb. ft. of gas having a calorific value of 550 B.Th.U. per ft.; 10 gallons of tar, and 25-30 lb. of sulphate of ammonia. The town gas could not be supplied at much under 10d. per 1,000 cb. ft. A good gas engine and dynamo would give 1 KW.-hour for 20 cb. ft. of gas, costing 0·2d. for fuel only.

The author suggested that large works be erected on a suitable coal field, the carbonisation plant being placed near the pit head so that the tubs would discharge coal direct into the bunkers of the retort-charging machines. The coke and sulphate of ammonia would be ready for market without further treatment, but the tar and gas would be taken by pipe lines to suitable points, the former being passed through automatic stills for the separation of its valuable constituents, and the latter being employed in gas engines for generating electricity. Sulphuric acid would be recovered from the exhaust gases, and would be returned to the pit-head for the manufacture of sulphate of ammonia. Nothing except soda ash would have to be purchased in addition to the coal.

Producer gas had a large field for power and heating; 120,000 to 140,000 cb. ft. of gas and 80-90 lb. of sulphate of ammonia could be obtained per ton of coal, the gas having a calorific value of 140 B.Th.U. per cb. ft.

The author held that there was no real rivalry between gas and electricity; the engineer should consider them both, with a view to obtaining from the coal the greatest yield of useful products.

Mr. W. Hamilton Patterson contributed a note on "The Improvement of Combustion and Blending of Coals." He stated that coal ought to be purchased not at so much a ton, but at a certain price per million units of heat, allowance always being made for ash contents. There was only one form of calorimeter quite reliable for fuels; that was some form of bomb calorimeter. Statements of calorific value were sometimes returned net and sometimes gross. The net value was the effective heat the fuel could give under a boiler, &c., being corrected from the gross value for the hydrogen and water, &c., in the fuel. It was very general to find the calorific value of the oils overstated; the difference between gross and net values averaged 6 per cent. Experiments were carried out on mixing or blending coal under a Scotch boiler of marine type, hand fired, at atmospheric pressure. The same amount of fuel was burnt in each test. Two coals, A and B, gave the following results when analysed:—

	A.	B.
Moisture	10·44 %	4·08 %
Ash	5·10 %	3·57 %
Net calorific value	6,524 cals.	7,351 cals.
Theoretical evaporation, lb. water from and at 212° F. ...	12·15	13·69

In a boiler test the following results were obtained:—

	A.	B.
Lb. water evaporated from and at 212° F.	8·87	10·56
Time to burn, hrs. and mins. ...	2.36	4.0
Boiler efficiency, from above ...	73·0 %	77·1 %

When the two coals were mixed in equal proportions the following results were obtained:—

Lb. water evaporated	10·54
Time to burn in hours and minutes	3.45
From which the boiler efficiency was	81·6 %

Thus the mixing of the better coal with the worse gave a result practically equivalent to the result which would have been obtained if only the better coal had been burnt.

On the other hand, if the mixing were not scientifically carried out, it was possible to get a result which was worse than the mean.

Another case for consideration was what practically amounted to a treatment of coal with chlorine. This was the subject of a patent of the Fuel Improvement Co., Ltd. Ordinary bituminous coal in water would slowly take up chlorine, which was absorbed by the coal, and not by the water.

This treated coal was very little different to untreated coal in appearance, and seemed to stand exposure to sunlight and weathering as well. Its analysis was practically identical with that of untreated coal, and when burnt in a bomb calorimeter it gave rise to the same calorific value. A boiler test showed an increased evaporation of 25 per cent. in favour of the treated fuel; in this case a bituminous slack. The treatment seemed to confer on bituminous coal many of the properties of anthracite.

Radiotelegraphic Investigations.

Report of the Committee: Sir Oliver Lodge (*chairman*), Dr. W. H. Eccles (*secretary*.).

(*Section A. Abstract.*)

At a meeting held on June 13th, 1913, the Committee came to the conclusion that the most urgent and most profitable work they could promote was the investigation of the following large-scale phenomena:—

1. The influence of sunrise and sunset, of daylight and darkness, and of meteorological conditions, on the propagation of electric waves over long distances.

2. The origin and the laws of "strays"—*i.e.*, natural electric waves.

These are subjects which seem particularly suitable for the British Association, since they are such as cannot be efficiently pursued by unco-ordinated individual effort.

In order to promote the necessary widespread observations, the Committee propose to draw up a simple scheme of instructions which will be circulated to amateurs throughout this country, and also, with the permission of the companies concerned, to operators on ships. These instructions would include directions for simultaneous observations of, for example, the strength of the time-signals from such stations as the Eiffel Tower, and the average strength and frequency of strays. The observations would subsequently be classified and reduced by this Committee; and it is felt that this work would open up at once an almost unexplored, and exceedingly promising, branch of research—one which cannot be entered upon in any other way. It is, of course, essential that the work should be carried out over a very large area and by very numerous observers; and after full consideration of this fact the Committee resolved to apply for a grant of £200 to enable the work to be started in a thorough manner.

Contacts between Electrical Conductors.

By W. H. Eccles, D.Sc.

(*Section A. Abstract.*)

When a current is passed across a "loose contact" the relation between the applied electromotive force and the current produced is, in general, not a linear one, and no sufficient explanation of the observed phenomena has hitherto been offered. The present author investigates whether the behaviour of contacts can be accounted for by purely thermal actions in the matter near the contact. The Joule, the Peltier, and the Thomson effects will all play a part, and the alterations of resistivity with temperature, as well as alterations of the geometrical configuration of the surfaces in contact caused by thermal expansion, ought all to be taken into account. These thermal effects are, of course, most noticeable in contacts between bad conductors of electricity and of heat, as, *e.g.*, the natural crystalline oxides and sulphides.

It is advantageous to separate contacts into two classes: First, those between like substances; second, those between unlike substances. In the first class there is in general no thermoelectric action, and the non-linearity of the relation between applied E.M.F. and current is mainly due to resistivity changes produced by Joulean heating. In the second class there is in general some thermoelectric action imposed on the resistivity-temperature phenomenon; and in the case of the crystalline substances mentioned the thermoelectric actions may be the more important.

For the first class, theory yields a cubic equation connecting E.M.F. and current. Experiments are adduced by the author which show that the thermal explanation is in many cases sufficient. In the second class, thermoelectric theory yields a quantic equation. The curve connecting E.M.F. and current takes very various shapes according to the signs and the relative magnitudes of the Peltier and Thomson coefficients in the substances forming the contact. The author has measured these coefficients in some typical substances and has thus carried out a comparison between the theoretical curves and the experimental curves of contacts between pairs of these substances. The evidence gathered in this way tends in the main to support the theory.

The Sensitiveness of the Human Skin as a Detector of Low-Voltage Alternating E.M.F.

By Prof. H. Stansfield, D.Sc.

(*Section A. Abstract.*)

An alternating difference of potential of 40 volts, with a frequency of 50 cycles per second between a piece of metal and the human body, is sufficient to produce a vibration which can be felt when the back of the hand is lightly rubbed against the metal. If the metal is connected to a live wire, the observer should be well insulated from the earth.

The alternating E.M.F. acting across the thin badly-conducting surface layer of the skin produces a rapid variation of the frictional force. If the metal is allowed to rub against the ear, instead of the hand, the vibration is heard as a musical note.

The human skin may be imitated for this purpose by gilding a rounded lump of jelly with gold leaf and then covering it with a piece of thin silk. The imitation is not, however, as sensitive as the original.

THE MUNICIPAL TRAMWAYS CONFERENCE.

(*Concluded from page 556.*)

Urban Passenger Transport.

By J. B. Hamilton, Leeds Corporation Tramways.

The provision of a regular form of transit between the centre of the city and the various suburban districts at low fares, at frequent intervals and higher speeds, has completely metamorphosed the distribution of the residential parts of all the towns.

It has been found by the writer impracticable to get figures illustrating the alteration in the distribution of the population from many of the towns in the country. It may, however, indicate the position sufficiently to state that in Leeds, in 1912 as compared with 1895, just shortly after the Corporation had taken over the working of the tramways undertaking, the population residing in the two central business wards of the city has decreased in one case by 25 per cent., and in the other by 35 per cent., whilst during the same period increases of from 40 per cent. to 60 per cent. have taken place in districts outside the central zone.

In 1893, by means of horse and steam cars and omnibuses, the number of times the population was carried was 30, whilst the average fare per mile was 1·124d. For the last completed year, 1912-13, the figures are as follows: Number of times population carried during the year, 179; average fare per mile, ·5d. This shows that the travelling habit has developed by nearly 500 per cent.

The form of traction necessary to meet the conditions must first provide for vehicles capable of dealing with large variations in the number of passengers.

Secondly, economy in operation. Unquestionably a very large proportion of the success which has attended the introduction of electric traction is due to the fact that its economy of operation has enabled the undertakers to reduce fares lower and lower, and it is marvellous to note the response in increased travel which each reduction of fare has produced.

Immediately upon the Glasgow Corporation commencing operations, they gave half-penny fares of approximately half a mile in length. From time to time, and within a very short period, the penny fare was increased from one mile up to two miles. The result of all this was that on every occasion when the fares were lowered, the total receipts were increased. Under the last fare change which has taken place, viz., the granting of about a mile for a half-penny instead of half a mile as formerly, the number of passengers within a year has increased nearly 20 per cent., whilst the gross revenue has increased by 2 per cent., or £20,373. In Leeds, since 1902 the same phenomena have been noted.

Thirdly, frequency of service, comfort, and speed of conveyance. The frequency of the service must be arranged according to what experience has shown are the requirements of each route. The best results, however, will be obtained by an over-provision rather than with a narrow margin of seating capacity over the actual number who travel.

The point in the whole matter is that if a vehicle with a capacity of approximately 60 passengers can be provided at the same cost, or less, than a vehicle with a capacity of about 34 passengers, then even at the less busy periods of the day it is very likely to pick up more passengers, and at any rate will carry them, other things being equal, with greater comfort than a smaller vehicle possibly could.

The higher the speed at which the conveyance can travel with safety in this hurrying age, the greater is the attraction to the public.

To enable a comparison of the results of operation of their tramway undertakings by municipalities to be made on a broad basis, I have taken every town—except London, where the form and cost of construction and other conditions are quite exceptional—which contains a population of over 150,000. These are scattered over all parts of the United Kingdom.

The object has been to ascertain.—First, the average annual earnings per car running daily in the towns quoted. Secondly, the average cost, per mile and per car, of running those cars—this cost to include operating expenses, and interest and sinking fund required by Parliament. Thirdly (*a*) I have estimated the annual value per car of the sums which the various tramway undertakings pay for maintenence of paving and sub-structure under Sec. 28 of the Tramways Act of 1870, and which, although unaffected by the operation of the cars, goes to the relief of the department charged with the general maintenance of highways, and (*b*) the amounts paid in rates upon lines only.

In the case of motor-'buses I have estimated the receipts (based on the earning capacity), the expenses of running, the cost of wear and tear of roads, in respect of which no contribution is made at the present time, and also the amount which would be paid to the Inland Revenue as a result of the use of petrol.

Dealing with these points seriatim. I find there are 27 towns with a population of over 150,000, and that as a result of tramway operations in these towns there is an aggregate annual revenue of £6,769,705, that the average number of cars in daily use on the various undertakinge on the basis of a 14 to 16-hour day is 3,996, whilst the total number of cars in stock is 5,687.

Dividing the total revenue by the number of running cars, the average annual revenue per car is £1,694.

The total expenses, which include working expenses, interest, and sinking fund, income-tax, rental of lines, less credits for bank interests, &c., amount to £5 607,732.

The total mileage run amounts to 146,810,902, which gives an average cost per mile for expenses of 9·167d.

The average annual mileage per car is 36,740; and multiplying this by the expenses per car-mile gives an average cost per car per

annum of £1,403, which deducted from the earnings leaves a surplus of £291.

The amounts shown in the published accounts for rates do not separate the amounts paid for buildings and for lines. It seems to the writer that the amount of rates for tramways should, for the purpose of comparison with motor-'buses, be confined to lines only.

As the basis of allocation of the rates to be made as between lines and buildings, I have taken the Leeds accounts as an illustration. From these I find that about 75 per cent. of the total rates is for lines and 25 per cent. for buildings. In Leeds the tramways undertaking owns the power station, which, in this case, therefore, is a portion of the 25 per cent.

The total annual charge for rates on lines and buildings for the 27 tramway undertakings amounts to £315,239. Allocating this as between lines and buildings on the Leeds basis, viz., 75 per cent. of the amount for lines, gives £236,429, or £59 per vehicle.

It is impossible from the accounts of the various tramway undertakings to get an accurate statement of the amount which Clause 28 of the Tramways Act imposes upon tramway undertakers as apart from costs incidental to the construction, maintenance, and renewal of the rails. There is no doubt that the presence of the rail does cause a certain amount of extra wear upon the setts which are placed alongside of it, whilst rail movement, which from time to time must occur on all routes, also increases the cost of maintenance of the paved surface.

To form a reasonable estimate, I have assumed that the cost of the maintenance of the concrete, the paving bed and setts at the periods when the rail requires to be taken up should be taken to be work performed not for the tramways undertaking, but for the advantage of the highways rate.

For that assumption I have estimated the average life of the rail at 15 years. The whole of the maintenance of the setts during the 15 years of the life of the rail—and this is a considerable item—I have charged as being directly caused by the presence of the rails. On this basis I find that at the end of 15 years a sum of £1,331 per mile of single track would be the cost of taking up, redressing, and relaying the setts, repair of any concrete required, and provision of floating, paving bed, &c.

At the end of 30 years from the laying of the track, a cost per mile of £3,040 would be required. This figure represents the replacement cost of the concrete bed and paving setts, &c., less the residual values.

These figures applied to the number of cars give an average charge per vehicle per annum of £61.

By adding together the items dealt with, a total is arrived at of £411 per tramway vehicle per annum. In other words, an average surplus of £291 per car accrues from the operation of tramways in the towns referred to, and owing to the presence and operation of the tramways an addition to that amount of £120 in rates paid, and in maintenance of roads, goes to the general benefit of the town, and in none of these respects would the operation of petrol omnibuses furnish any return to the city.

Turning to the financial consideration of motor-omnibuses, it must be obvious to everyone who considers it that the carrying capacity of a passenger vehicle is an important factor in determining its earning power.

In carrying capacity it is clear that the motor-'bus, even of the most up-to-date type, cannot hope to compete. On paved streets and on gradients such as exist in nearly every provincial town, such a vehicle for passenger traffic which has a capacity of over 34 passengers is not a practicable proposition. It is, of course, quite easy to increase the engine and size of the vehicle, and relatively its load, but it is not possible to do so and maintain the effective rate of speed at which tramcars are operated. The question of brake control, skidding, and road wear, becomes a most serious consideration, and indeed a prohibitory condition, if the size and consequently the weight of the motor-'bus is increased much beyond the London type, which seats 34.

If the seating capacity of a tramcar at 56 is compared with that of a motor-'bus for 34, then the latter has only 60 per cent. of the capacity of a tramcar.

It may be urged that at the periods of the day when the minimum amount of travel occurs, a vehicle with a capacity of 34 can earn as much per mile run as a vehicle with a capacity of 56. To provide a comparison, I have caused very careful examination to be made into the actual results obtained from tramway operation on a representative route.

On the assumption for the purposes of this paper that each 'bus will earn 80 per cent. of each tramcar's receipts, then as the latter as shown earns £1,694, each motor-'bus would earn £1,355 running the same number of miles per annum, viz., 36,740.

With regard to the cost of running motor-'buses per mile, it must be agreed that considerable improvements, which reflect themselves in lessened costs of repairs and maintenance, have been applied to motor-'buses during recent years.

The physical barrier to the extension of the tramways through the centre of London gave for many years a protective area to the horse-drawn omnibus which, due to the limitations of this form of traction, was only able to extend its services beyond the centre for a very short distance to the areas outside.

The advent of the motor-'bus which has superseded horse traction, coupled with the improvements in weight and reliability of the last few years, has enabled the motor-'bus, subsidised by its protected area and freed from the onerous charges imposed upon tramways in the form of rates, road maintenance, &c., to adopt an aggressive competition with the electric lines operated by the London County Council and the various municipalities and private companies surrounding the central area.

This enormous volume of street traffic has imposed upon the road authorities in the centre of London and the Borough Councils around it, the necessity of maintaining a very high standard of road surface.

Looking to all these conditions which only exist in London and in no other part of the country, it is obvious that an impartial consideration of urban passenger transport to be operated in all the great centres of population in Britain cannot accept the revenues or operating costs of motor-'buses in London as providing a fair estimate of what might occur from installing the same form of transport in the provinces.

Mr. Pott who carefully prepared a paper last year, gave some figures for the cost per 'bus-mile of omnibuses. As Mr. Pott's figures were evidently prepared before the very large increase in the cost of petrol during the early part of the present year, I estimate an increase of 1d. per mile for petrol.

Further, the figures do not include any sum for depreciation. On the basis of the time allowed by Parliament for sinking fund, viz., five years, this amounts on a mileage of about 25,000 miles to 1·54d. per mile, making the total cost 10d. per mile.

Petrol	·7d.
Repairs of cars :—Electrical equipment or engines	·25d.
Truck or chassis repairs	·5d.
Rubber tires	1·0d.
Bodies and paint	·298d.
Petrol tax	·3d.
Buildings, repairs and maintenance ...	·01d.
Running	2 617d.
Administration	·75d.
Insurance	·1d.
Rates and taxes	·12d.
Licenses	·075d.
Accidents	·4d.
Interest on capital	·4d.
	7·52d.
Increased cost of petrol	1·0d.
Depreciation...	1·54d.
	10·06d.

In the case of municipalities whose figures are usually available, the costs of operation are as follows:—Keighley, 16d.; Halifax, 12·7d.; Eastbourne, 14·39d. per mile.

Any conclusions, however, drawn from the figures appertaining to Keighley or Eastbourne would be unfair to the motor-'bus, inasmuch as these are mainly vehicles which are not of the most modern type.

On the basis of 10d. per mile, the total expenses per vehicle would be £1,531. This amount is greater than the earnings, and therefore leaves a deficit of £176 per vehicle per annum.

Much discussion has taken place during the last year or two on the question of road maintenance by vehicles, and in a previous part of the paper the writer has stated that in his view the time is now urgent when amendments to the existing law as to the method of taxation for road purposes should be carried out. In practically every case during the last Session of Parliament in which powers have been sought for railless cars and motor-'buses, the decisions were that they shall directly contribute to the repair of the wear and tear and what was termed damage to the highways in varying degrees. The amount generally imposed has been ⅜d. per mile. I express no opinion here as to whether this is or is not a sufficient sum, or as to whether or not in the absence of charges being made general upon all road users, this obligation should be placed upon promoters of motor-'bus traction. I compare the ⅜d. per car-mile which has been imposed for running usually on macadamised roads, with the amount of wear which might occur upon streets which are paved and partly macadamised, and as a result debit the operation of motor-'buses in urban districts with ¼d. per mile as an estimate of the cost of repairing in consequence of their running. This amounts on the mileage to £38 per vehicle per annum, and increases the deficit from £156 to £214. As a credit, however, to this, there must be given to motor-'bus operation the amount at which the petrol they use is taxed by the Government and earmarked for road purposes. This amounts to 1½d. per gallon, and on the basis of 7½ miles per gallon this amounts to a total of approximately £31 per annum. This leaves a net deficit per motor 'bus of £183.

This for the whole of the 27 undertakings is an annual loss of £914,085.

Summarising the position, it means that instead of the various towns getting, as at present, a profit in receipts and other services of £1,642,356, there would be a loss of £2,556 441, due to the assumed substitution of motor-'buses for the existing tramways.

Summarising the position as between tramways and motor-'buses, it does not seem to the writer that even if tramways were not already installed and the expenditure made, there could be the slightest hesitation from any point of view in the selection of tramways for urban passenger transport as against motor-'buses.

Railless traction, as a means of transport for urban traffic, suffers from the same limitation in size which applies to the motor-'bus and all other vehicles which run upon the road surface at a sufficiently high speed to meet the customary requirements of passengers. Unlike the motor-'bus, however, it is entirely free from smell, and it may also be claimed for it that it is almost entirely free from the tendency to skid.

In total costs of operation under ordinary conditions, it is at least from 20 per cent. to 25 per cent. less per car-mile than motor-'buses. It is equal in flexibility in an ordinary width of roadway, viz., 30 ft. to 35 ft., to a motor-'bus.

It has never been claimed for it that, except under special conditions, it should be substituted for tramways in cases where very large volumes of traffic are required to be dealt with, nor where a very close and frequent service is necessary.

Its lessened costs as compared with that of motor-'buses, and its greater reliability in operation, make it preferable as a feeder to an electrically operated undertaking than that form of traction.

Each case must be judged on the local conditions, and in relation to the cost of installation and operation. Routes can certainly be more readily dropped and new ones opened with the migratory motor-'bus.

Other forms of supplying urban transport, such as petrol-electric motor-'buses, storage battery, steam, &c., vehicles, I do not think it necessary to enlarge upon. In every case the remarks as to higher costs of operation and general disadvantages as referred to in connection with petrol motor-'buses, apply equally to them.

Discussion.

Ald. Littler (West Ham), who opened the discussion, emphasised the question of the relative danger to users of the street, of the motor-'bus and tramway, respectively, in the London area. Although the modern tramway undertaking had its origin in the Act of 1870, yet the defects of the latter, under present-day conditions, had resulted in the present troubles. Interrunning was common amongst the tramway undertakings in the eastern area of London, and if such facilities had been provided at an earlier date he doubted whether the present enormous 'bus service would have made its appearance there. It was estimated that the 'buses ran 65 million miles per annum, and carried some 640 million passengers, earning 1·3d. per passenger. Some idea of the service of tramway cars and 'buses maintained could be gathered from the vehicles passing Bow Bridge in a single hour in both directions—viz, 89 cars containing an average of 20½ passengers each, and 87 'buses containing an average of 14½ passengers per 'bus. The highest number of passengers per car was 49, and per 'bus 31. If full 'buses replaced the tramway service, 220 per hour would be required. Ald. Littler further gave copious extracts from reports on London traffic conditions to prove the impossibility of supplanting the tramway car by the motor-'bus; he believed that if the London municipal authorities could get ⅜d. per mile allocated to them in respect of road maintenance for the 'bus services, they would be satisfied.

Mr. Worby Beaumont (London) said a large proportion of the arguments advanced by Mr. Hamilton had been practically answered by Mr. Fearnley, who pointed out the necessity of taking a broad view of traffic problems; the author's paper was written apparently with a single view. The various quotations from his (the speaker's) remarks at different times gave a wrong impression, as they were incomplete and separated from the context. He had never condemned tramways generally, but there were cases where the tramway was not the best method of traction. The London traffic was unparalleled, and the conditions could not be met by any form of transit chosen solely on the basis of cost to operate. To give the figures for running 3,000 'buses in London would only mislead anyone operating 30 'buses in the provinces, and, generally, figures such as those given by Mr. Hamilton as to costs, accidents, &c., were of little real value.

Ald. Smith (Liverpool) said that, against all advice, the London authorities had adopted a most expensive method of tramway working, and they deserved the hard knocks they were receiving. The L.C.C. and other tramway authorities were tinged with sentiment, and their undertakings would not pay unless run on commercial lines.

Mr. A. Baker (Birmingham) while thanking the author for his paper, which contained useful arguments, warned members not to go away with the idea that tramways were going to fill the bill for all time. It was necessary for them to consider the best means of conducting traffic and to be supreme in controlling it; they must be right up to date.

Councillor Heather (Leyton) said he had warned them at the last convention that the 'bus companies would in time attack the provinces, and he understood that this would shortly happen. Efforts were, he believed, now being made to get the licensing facilities enjoyed by provincial towns transferred to a central authority. If this were an injustice to the provincial authorities, it was obvious that the London authorities were unfairly treated. The 'buses were needed, but their favoured treatment should be removed.

Mr. C. J. Spencer (Bradford) said that tramways were the best means of passenger transit in towns, and the paper stated their case; Mr. Hamilton decided to communicate his reply to the discussion.

Amongst the various visits arranged for the "off" afternoon was one to Messrs. Edgar Allen & Co.'s works. Unfortunately, owing to a moulders' strike, the foundry was closed, and with it the electric steel furnace, which we believe Messrs. Allen were the first to introduce into Sheffield. However, the visitors were able to inspect the pattern, machine, smiths', and fettling shops, and were shown the large new foundry which is being built in a more central position to supersede the older one. In the tramway and railway department, besides the usual run of track material, the visitors were shown examples of patent pinless points, and a new grooved tongue point; large tramway lay-outs for Spain and New Zealand, and railway turnouts, in rolled manganese steel, for the Metropolitan, Brazilian and Argentine railways were also on view. Electric driving is very largely employed throughout the works, and "'Tricity" electric ovens have been introduced into the men's kitchen.

Although for certain reasons it was decided not to hold a tramways exhibition on the lines of that held last year at West Ham, the Tilling-Stevens petrol-electric 'bus was in evidence, and specimens of the Rotherham and Bradford railless trolley vehicles had also been imported for the benefit of the visitors, whose time was, moreover, very fully occupied during the three days of the visit.

COAL-CUTTING MACHINES AND COAL OUTPUT FOR THE YEAR 1912.

The year 1912 will be remembered in the coal trade as the year of the great national strike, which lasted for a period of about six weeks, from the beginning of March to the second week in April, and which would have resulted in the unconditional surrender of the men but for the interference of the present Government, who passed an Act fixing a minimum wage to most underground workmen. The effect of the strike, however, was not so serious as might be supposed, as prior to the stoppage, and in anticipation of it, the coal trade was exceedingly brisk, and during the stoppage all stocks were exhausted—some at very enhanced prices—and since the pits restarted trade has been very satisfactory, and full time has been the rule. In fact, Mr. Walker, H.M. Inspector of Mines for Scotland, in his report says: "I have heard complaints of shortage of railway wagons, and at the present time (March 13th, 1913) there is a scarcity of labour at nearly all the pits. The former can be remedied, but the latter is a serious question and is due, I think, in a large measure to the number of mine workers who have emigrated during the last few years to Canada and other Colonies."

In previous years the output of coal given in the reports of H.M. Inspectors of Mines has not been strictly the *ne* weight, as many owners returned the actual weight sent out of the pit before screening or sorting, but this year in accordance with instructions the actual net weight has been given together with an estimate of the weight of dirt thus excluded, but which in previous years would have been included. Further, the value of the coal is also given.

The output of coal is shown in the following table, together with the quantity produced in 1911 for comparison:—

Quantity and Value of Coal Raised.

Inspection District.	1912. Quantity. Tons.	1912. Value £	1912. Estimated quantity of dirt.	1911. Quantity. Tons.
No. 1. Scotland	39,518,629	16,603,665	513,564	41,718,163
No. 2. Newcastle	27,834,698	12,804,506	608,055	30,791,500
No. 3. Durham	25,574,551	11,409,934	418,507	27,909,200
No. 4. Yorkshire and North Midlands ...	64,881,937	26,059,008	275,173	66,976,877
No. 5. Manchester and Ireland ...	10,416,174	4,029,295	131,096	11,020,695
	90,307	50,359	—	84,564
No. 6. Liverpool and North Wales ...	15,894,156	7,093,932	43,000	16,402,349
No. 7. South Wales ...	50,116,624	27,891,043	151,659	50,200,727
No. 8. Midland and Southern District ...	26,071,862	10,965,493	154,945	26,774,049
Totals...	260,398,938	£116,917,235	2,295,999	271,878,124

From this we see the output was only 11,479,306 tons less than the year previous, or allowing for the dirt which would be included in the previous year's returns only 9,183,307 tons. From the figures for 1912 we may assume a weekly production of five millions of tons, hence the strike was responsible for a loss of 30,000,000 tons of coal, and as the value was about

9s. per ton, this would be equal to about £13,500,000, of which about 10 millions would have gone to the workers. Evidently the minimum wage Act was a costly piece of legislation to the miners.

In regard to the employment of coal-cutting machinery, it is notable that in the Scottish mines there is an increase of no less than 95 machines, of which 92 are electrically-driven machines.

The following table gives particulars of the machines at work :—

—	Disk		Bar.		Chain.		Percussive.		Rotary heading.	
	Electricity.	Com. air.	E.	C.	E.	C.	E.	C.	E.	C.
No. 1 District	392	142	177	5	12	1	9	29	3	1
No. 2 ,,	24	37	12	0	14	0	—	267	1	—
No. 3 ,,	23	16	20	12	14	4	2	57	—	1
No. 4 ,,	143	168	63	45	84	20	—	78	—	—
No. 5 ,,	—	36	6	6	3	2	—	106	—	—
No. 6 ,,	7	62	12	14	4	—	1	48	—	—
No. 7 ,,	7	6	37	34	4	1	2	21	—	2
No. 8 ,,	27	13	18	7	13	6	—	60	—	3
Totals ...	623	480	345	123	148	34	14	666	4	7

The disk, bar and chain machines are all long-wall machines which are adapted for cutting on a long face, whereas the percussive type of machine is only used in narrow workings, while the rotary heading machine, as its name denotes, is only used for "heading" work. A "heading" may be described as an advance tunnel for exploration or safety purposes, and is usually driven by hand.

Altogether there were at work 2,444 machines, of which 1,134 were electrical machines and 1,310 driven by compressed air. Analysing these figures further, however, we see that leaving out the percussive type of machine, the majority of the other machines are electrically driven, the figures being 1,120 against 644.

The tonnage obtained in the various districts by the machines is shown in the following table :—

	Electrical machines.	Compressed air machines.
No. 1 district	6,288.221	1,380.917
No. 2 ,, ...	574.705	1,170.890
No. 3 ,, ...	488,855	434,861
No. 4 ,, ...	3,045,927	3,138,494
No. 5 ,, ...	64,550	477,827
No. 6 ,, ...	251,299	1,019,346
No. 7 ,, ...	335,721	256.808
No. 8 ,, ...	655,134	469,527
Totals	11,744,412	8,348,670

Of the compressed air machines 680 were of the percussive type, seven were rotary headers, while the others consisted of the chain, bar and disk long-wall type machines ; 574 percussive and seven heading machines were responsible for 1,441,154 tons and 2,024 tons respectively. Altogether there were 680 percussive machines, 106 of which are in No. 5 district (Lancashire), but the Inspector—Mr. Gerrard—does not give the quantities of coal obtained separately, but together with 44 long-wall type machines they produced 477,827 tons. The average tonnage, however, for each percussive machine is about 2,510 tons, so that it may be assumed that the 106 machines in Lancashire would produce, say, 266,060, which, added to the 1,441,154 tons actually obtained by the 574 machines, gives a total of 1,707,214 tons for 680 machines, while 644 long-wall machines produced 6,641,456 tons, and 1,120 electrical long-wall machines produced 11,744,412 tons.

The figures are mainly interesting in showing the enormous difference in the relative outputs of the long-wall and percussive types of machines, and as we have shown on previous occasions, a long-wall coal-cutter will, on the average, produce 10,000 tons of coal per annum, whilst a percussive machine will only produce from 2,500 to 3,000 tons, or roughly, less than one-third. It is true the percussive coal-cutter itself is much cheaper than the long-wall type, but in regard to power it is much more expensive, as an air-compressing plant must be installed, and each machine will consume about the same power as an electric long-wall machine producing more than three times the tonnage.

Regarding the use of the face conveyors, there were 284 at work during 1912, being 33 less than in the previous year. This, however, is accounted for by the somewhat peculiar circumstances that in the year 1911 there were 79 face conveyors at work in the Lancashire district, which dropped to six in the following year. In other districts, however, they increased by 42. There is no doubt that when conditions are suitable, a conveyor on a long-wall face pays not only by reducing the actual cost of production, but by increasing it as well.

It is also interesting to note how the output per person employed is decreasing, as no less than 21,877 more persons were employed, while the output was some 11 million tons less. Mr. Wilson, the Divisional Inspector for No. 6 District, remarks, "Complaints are very general that suitable labour is unobtainable ; and I am assured from all quarters that a reasonable output is not being maintained owing to the large numbers of workmen who daily absent themselves from the mines, 25 to 30 per cent. of absentees is very common." This is a very general complaint, and, speaking generally, the output per person employed is roughly about 30 tons less than for the previous year. The strike, no doubt, would have some effect upon this point, but it is also safe to say that legislation has also tended towards less work per man.

ARC LIGHTING AND HIGH-PRESSURE GAS FOR STREET LIGHTING.*

To determine the best and cheapest form of street illumination, the Strassburg authorities had a street section experimentally lit by different firms with arc lamps and pressure gas. Messrs. Siemens-Schuckert, with the consent of the local authorities, took accurate measurements of the results obtained independently of the tests by the local authorities, and these are summarised below.

It follows from the condition of affairs that the various lighting systems were in use under the most favourable conditions ; the current or watt values were determined by continuous meter records, partly before the lamps were erected and partly during the test period by the local authorities.

Two classes of open type flame arc lamps with superposed flame carbons for 50-cycle A.C. circuit were used, together with high-pressure and low-pressure inverted mantle gas lamps ; the latter were spaced diagonally along the street curb on standards with an average height to mantle of 18 ft. 4 in., and also in the centre of the road on cross-wire suspensions at an average height of 23 ft. 7 in. These arrangements are subsequently referred to as low-pressure gas lamps I and II respectively.

For the photometric tests areas were marked off which included the entire space between two lamps, so that the total light flux inpinging on the test area represented the effective flux from one lamp for the street illumination. With the low-pressure gas lamps arranged diagonally, the test area was extended to three lamps, so that it was defined by two standards on the same side of the street. On an average the test area between two lamps was approximately 634 sq. yards, and owing to the local conditions, the width varied between 19·1 and 16·4 yards. On these test areas some 30 to 40 photometric tests were made using a Weber photometer with plaster and magnesium oxide screen at 3 ft. 3 in. from road level, and in all tests, shop window or advertisement lighting was extinguished. The main results of the test are set out in the following table. It should be noted that the figures for consumption by the arc and gas lamps include the watts in the choker and transformer, and the pilot jets, as determined by the yearly consumption :—

Class of lamp.	Flame arc, I.	Flame arc, II.	High-pressure gas. Two mantles.	Low-pressure gas, I. Three mantles.	Low-pressure gas, II. Three mantles.
Lamp distance, yards ...	42	35	39 37	33·45	39·8
Width of area illuminated, yards	19 13	19·13	19·13	18·36	16·4
Area illuminated per lamp sq. yards	805	669	753	604	645
Watts or cb. ft. per lamp-hour	625	615	36·12	22·8	22·34
Mean horizontal illumination, lux	5	13·3	5·7	4·2	5
Consumption for one lux and 100 sq. yards ...	8·62	6·88	0 844	0·9	1·15
Inequality of illumination max./min.	5·2	4	10 4	37	17

In calculating the cost of electricity or gas, the values given by the Strassburg authorities were used, they defined the cost of gas

* From *Elektrotechnischer Anzeiger*, No. 69.

as 23·78d. per 1,000 cb. ft., and of electricity up to 10 p.m., as 1·44d. per KW.-hour, and from then and till morning as 0·48d. Based on the average yearly use of the all-night and the half-night lamps before and after 10 p.m., the mean price of the KW.-hour was fixed at 0·828d.

On these figures the current costs for one Lux 100 sq. yd., and one hour, are—

For arc lamp I... ... ... 0·00714d.
„ II... ... ... 0·0057d.

and the gas costs under similar conditions—

For high-pressure gas ... ... 0·02d.
For low-pressure gas I ... ... 0·021d.
„ II ... ... 0·027d.

In conjunction with these very favourable results for the arc lighting, the total running costs for a year were then determined. The calculations are given in detail to admit of accurate checking.

Running Costs of Arc Lamps.—The running costs comprising carbon cost, tax on lighting material, maintenance, interest, depreciation, are tabulated as—

An all-night lamp, yearly, approximately ... 3,800 hours
A half-night „ „ „ ... 1,765 „
Mean burning hours of all lamps ... ... 2,780 „

Mean consumption of one lamp per year—

0·615 × 2,780 = 1,726 KW-hours.

Mean current cost per lamp per year—

1,720 × 0·828 = £5 18s. 8d.

Price of carbons per pair, 3·86d. Burning hours per pair, 16 hours.
Pairs of carbons per lamp per year, 2 780/16 = 174 pairs.

Average carbon cost per lamp per year, 174 × 3·86 ...	£2	15	1
Add 25 per cent. for unconsumed ends	0	13	9
Lighting material tax per pair 1·27d., tax per lamp per year 174 × 1·27	0	18	4
Add 25 per cent. for unconsumed ends	0	4	7
Maintenance costs (cleaning, carboning, repairs, lighting and switching out) per year, estimate for all-night lamp £2 10s.; for half-night lamp £2. Mean ...	2	5	0
Price of lamp, with accessories and complete street span-wire system £12 10s. approx., interest at 5 per cent....	0	12	6
Depreciation (written off in 10 years entirely) 7·95 per cent.	1	0	0
Running costs	£8	9	3

or 143 per cent. of the actual current cost.

Running Costs of the High-pressure Gas Lamps.—The running costs comprising mantle cost, lighting material tax, compressed air cost, maintenance, interest and depreciation are tabulated as follows:

Each lamp burns yearly 3,800 hours approx., of which 1,765 hours are at 36·12 cb. ft. with two mantles, and 2,035 hours at 18·46 cb. ft. with one mantle.

The total consumption per lamp per year is therefore 1,765 × 36·12 + 2,035 × 18·46 = 101,318 cb. ft.

Gas cost per lamp per year 101,318 × 23·78 = £10 0s. 8d.

Price of one mantle 0·66d.

Average life of a mantle as stated by the Strassburg authorities, 150 hours.

Year's requirements:—

$\frac{1,765 + 2,035 + 1,765}{150}$ = 38 mantles	£1	0	10
Lighting material tax, 1·2d. per mantle	0	3	9
Compressed air cost per lamp per year	0	6	0
Maintenance costs (cleaning, mantle fitting, repairs, lighting and extinction, assuming automatic ignition) per lamp per year	1	0	0
Price of one lamp with complete street span-wire gear and lowering arrangement, £18 15s. approximately, interest 5 per cent.	0	18	9
Depreciation (written off in 10 years entirely), 7·95 per cent.	1	9	10
Running costs...	£4	19	2

or 50 per cent. of the actual gas cost.

Running costs of the low-pressure inverted gas lamps.—The running costs comprising mantle cost, lighting material tax, maintenance, interest and depreciation are tabulated as:—

Each lamp burns yearly 3,800 hours approximately, 1,765 hours, with three mantles at 22·59 cb. ft., and 2,035 hours, with one mantle at 7·98 cb. ft. The total consumption per lamp per year is:—

1,765 × 22·59 + 2,035 × 7·98 = 56,100 cb. ft.

Gas cost per lamp per year, 56,110 × 23·78 = £5 11s. 2d. Price of one mantle, 4·8d., average life of one mantle as given by the Gas Co., 200 hours.

Year's requirements:—

$\frac{1,765 \times 3 + 2,035}{200}$ = 37 mantles	£0	14	9			
Costs for mantle replacement	0	3	8			
Maintenance costs (cleaning, mantle fitting, repairs, lighting and extinction, assuming automatic ignition) per lamp per year	0	15	3			
Price of one lamp complete with standard or street span-wire gear, £7 10s. to £15; interest 5 per cent.	£0	7	6	to	0	15	0
Depreciation (written off in 10 years entirely), 7·95 per cent.	0	12	0	to	1	4	0
Running costs ...	£2	13	2	to	£3	12	8

or 48 to 66 per cent. of the actual gas cost.

The total running costs per 1 lux, 100 sq. yards, and 1 hour are therefore—

For arc lamps ... I 0·00714 + 1·43 × 0·00714 = 0·0172d.
„ „ ... II 0·0057 + 1·43 × 0·0057 = 0·0139d.
For high-pressure gas lamps 0·02 + 0·5 × 0·02 = 0·03d.
For low-pressure gas lamps I 0·021 + 0·48 × 0·021 = 0·031d.
to 0·021 + 0·66 × 0·021 = 0·035d.
„ „ „ II 0·027 + 0·48 × 0·027 = 0·04d.
to 0·027 + 0·66 × 0·027 = 0·045d.

These final figures show clearly the immense superiority of the arc lighting over the different gas systems for street lighting.

The accuracy of these tests was further confirmed by the Strassburg authorities deciding on arc lighting as the result of their own tests—one of the few cases in which cheapness and not municipal gas interests was the deciding factor.

The tests also fully confirm the results obtained by Prof. Wedding and in the Carlsruhe tests of a similar character.

Taking equal total running costs and the price of 0·03d. for gas illumination, the best result above determined, the cost per KW.-hour would work out to 3·18d. This confirms what is practically visible at the first glance, that these figures are practically of general application, and that for all gas and electricity prices which are available for street lighting, the arc lighting is not only the cheapest but also the best on account of the exceptionally high degree of equality in the illumination when compared with the tabulated values for the various gas lamps.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

ST. VINCENT (WEST INDIES).—The Government of St. Vincent have decided to admit, free of duty, electric or other appliances imported by dentists or veterinary surgeons for their own use in the exercise of their professions.

CONGO.—The export duties on rubber exported from the Belgian Congo have been reduced as follows:—

	Francs.
Grass rubber:	
When the price does not exceed 3 francs per kg. ...	free
„ exceeds 3 francs per kg.	·25 per kg.
Tree or vine rubber:	
When the price does not exceed 5 francs per kg. ...	free
„ exceeds 5 but not 7 francs per kg. ...	·25 per kg.
„ „ 7 „ 8 „ „ ...	·50 „
„ „ 8 „ 12 „ „ ...	1·00 „
„ „ 12 francs per kg.	1·25 „
Plantation rubber	free

The average price during each quarter is to form the basis for the calculation of the export tax during the succeeding quarter. This price will be notified by Royal Decree, or by Ordinance of the Governor-General before the end of each quarter.

SOUTH AFRICA.—In view of many inquiries as to the form of the invoice which is now necessary on entering goods for importation into the Union of South Africa, the Board of Trade have published a copy of Sec. 103 of the recent Customs Management Act which bears on the matter. It is as follows:—

"103. The person entering goods at importation shall produce, if required by the proper officer of Customs, any document relating to the goods, and the invoice shall contain a statement in a prominent place made by the suppliers, showing clearly the current value for home consumption in the open market for similar goods at the place of purchase bought in the ordinary manner from the manufacturer or supplier in normal quantities. The invoice and any covering statement shall also clearly show cost of packing and packages."

SWEDEN.—The Swedish Customs authorities have decided that mica, unmanufactured or pulverised, as well as coloured, shall be admitted into the country free of duty.

AUSTRALIA.—The Australian Customs authorities have decided that lighting fixtures being circular electric lamp globes suspended by a chain are to be dutiable at the rate of 25 per cent. *ad val.* if of British origin; similar foreign goods are to pay 35 per cent. *ad val.*

FRANCE.—The Board of Trade have received a copy of a new French finance law, which modifies the existing tariff of Consular fees. One provision of this law is that no fees are to be levied for the *visa* of certificates of origin in respect of consignments of goods valued at less than 100 fr., and sent from a country into which French goods of the same value are admitted without a certificate of origin, or with a certificate of origin which is *visé* free of charge. This provision will apply to goods imported from the United Kingdom, on which the Consular fee at present leviable is 6 fr. The revision is to come into force on a date to be fixed by a decree which has not yet been published, but it is understood that the date in question will not be earlier than January 1st next.

CHINA.—It has been decided to levy a surtax of 5 per cent. (to be increased to 7½ per cent. if necessary) on all Customs duties paid on goods imported into Chefoo, in order to provide funds for the construction of a breakwater at that port.

* In the original the values are given in metric and mark units; they are here converted to English and sterling values.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,388. "Electric signalling system for railways and the like." T. D. Parr. September 22nd.

21,390. "Electric incandescent lamps." V. Terry and E. Terry. September 22nd. (Complete.)

21,395. "Electrically-illuminated shirt-bosom." H. O. Henry. September 22nd.

21,396. "Electric arc lamps." British Thomson Houston Co., Ltd. (General Electric Co., United States.) September 22nd.

21,428. "Telegraph instruments used in block-signalling on railways." R. R. Harper. September 23rd.

21,445. "Safety apparatus for electric lighting installations." Soc. Anon. des Automobiles and Cycles Peugeot. (Convention date, December 17th, 1912, France.) September 23rd. (Complete.)

21,446. "Tiles for carrying and protecting electric cables, gas-pipes, water-pipes, and the like." A. J. Howard. September 23rd.

21,461. "Cut-outs for electrical instruments, glow-lamps and the like." A. J. Downes. September 23rd.

21,462. "Means to be employed in the electrolysis of alkali chlorides and alkali earth chlorides." A. Clemm. (Convention date, December 3rd, 1912, Germany.) September 23rd. (Complete.)

21,472. "Magneto-electric machines." F. L. Hollister. September 23rd.

21,480. "Electrical connection devices for railway and like vehicles." L. Boirault. (Addition to 13,820, 1913.) September 23rd. (Complete.)

21,505. "Variable-speed gear for electrically-lighted vehicles." E. Nuttall. September 24th.

21,507. "Device for an electric system of signalling to and from trains and signal cabins and the like." J. S. Wood. September 24th.

21,509. "Magneto-electric ignition apparatus." W. A. Hill. (Apparate-Bauanstalt Fischer G.m.b.H., Germany.) September 24th.

21,537. "Electric carrier systems." G. T. Hanchett. September 24th.

21,539. "Controllers, brakes, switches, and the like for electrical apparatus." J. Bush. September 24th.

21,544. "Wall-plugs and like electrical fittings." W. H. Mackesy. September 24th.

21,551. "Dynamo-electric machines." F. L. Hollister. September 24th.

21,574. "Mercury vapour rectifiers." British Thomson-Houston Co., Ltd. (Allgemeine Elektrizitäts Ges., Germany). September 24th.

21,607. "Automatically-adjustable ignition for internal-combustion engines." S. A. Horstmann. September 25th.

21,618. "Electric safety drop lock for railway carriages and the like." J. E. Crossley. September 25th.

21,623. "Control of series motor machines." Byrds Electrical Co., H. T. Byford and H. W. Robinson. September 25th.

21,640. "Electric speed-controlling systems for prime movers." P. D. Ionides. September 25th.

21,646. "Electric joint and apparatus therefor." C. J. Beaver and E. A. Claremont. September 25th.

21,672. "Connections of electrical condensers." Marconi's Wireless Telegeph Co., Ltd., and R. N. Vyvyan. September 25th.

21,678. "Construction of electric switch." Aldous & Campbell, Ltd., and C. F. Arher. September 25th.

21,732. "Microphones, transmitters, detectors, and the like." J. K. Pickford. September 26th.

21,735. "Switching system for handling traffic in only one direction between two trunk exchanges by each of which the connection of the concerned subscriber lines with the junction lines is obtained by means of an order wire service." C. R. H. Arntzenius. (Convention date, September 26th, 1912, Germany.) September 26th. (Complete.)

21,751. "Switches for opening and closing electric circuits." H. Leitner. (Addition to 2,747, 1912.) September 26th. (Complete.)

21,758. "Electric signalling apparatus for ships' telegraphs and the like purposes." H. L. Stocks. September 26th. (Complete.)

21,766. "Circuit arrangements for semi-automatic telephone systems." Siemens & Halske Akt. Ges. (Addition to 6,664, 1913. Convention date, September 26th, 1912, Germany.) September 26th. (Complete.)

21,802. "Electrically-heated vessels." Mickelwright, Ltd., W. W. Peck and W. R. Mickelwright. September 27th.

21,814. "Detachable wire electric or gas light shade fitting." C. Wakeman and G. R. S. Tebbitt. September 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Processes for the Manufacture of Articles of Refractory Metals and Alloys. Dr. P. Schwarzkopf, Dr. S. Burgstaller and Wolfram Laboratorium Dr. Ing. P. Schwarzkopf Ges. 13,282. June 5th.

Wall and the Like Plugs. W. W. Timewell and S. Sheen. 20,295. September 6th.

Safety Electric Battery Lamps. F. Farber. 20,352. September 6th.

Electric Sealing or Junction Boxes and the Like. H. H. R. Green. 20,831. September 12th.

Advertising Devices. J. R. Hicks. 21,007. September 14th.

Apparatus for Use in the Synchronisation of Talking Machines and Cinematographs. E. S. Donisthorpe. 21,195. September 17th.

Conduit or Tubular Fittings for Electrical Conductors. E. P. Cottier and H. L. Downes. 21,971. September 27th.

Means for the Storage and Transit of Incandescent Electric Lamps. G. Poulton. 22,209. September 30th.

Method of, and Means for, Preventing Explosions in Mines by Damaged Electric Lamps and Motors. F. Palmer. 23,344. October 12th.

Electric Controller Contact. J. Dawson. 23,402. October 14th.

Electric Heaters. J. Nathan. 24,13[illegible]. October 22nd.

Miners' Electric Safety Lamps. O. Oldham. 24,438. October 25th. (Patent of addition not granted.)

Magneto Trip Gear for Internal-Combustion Engines. Bristol Wagon and Carriage Works Co. and W. A. B. Copsey. 25,374. November 5th.

Reflectors for Electric Incandescent Lamps. F. W. Suter. 25,536. November 7th. (Cognate application, 8,590, 1913.)

Time-Element Devices, applicable to Electric Circuit-Breakers and Other Apparatus. J. G. Statter. 25,606. November 8th.

Apparatus for Injecting Fuel into Internal-Combustion Engines, and Means for Igniting the same. E. C. Blackstone, F. Carter and E. Carter. 29,122. December 18th.

Tell-tale or Alarm Mechanism for Use in Connection with Engine-Room Telegraphs. H. Smith (Smith). 29,311. December 20th.

Signals for Road Vehicles. G. A. Holder. 29,626. December 18th. (April 8th, 1913.)

1913.

Series Systems for Incandescent Electric Lamp Lighting. E. Booth and N. R. Booth. 1,002. January 14th.

Disinfecting Apparatus for Telephones and the like. L. Block. 2,215. January 27th. (March 13th, 1912.)

Polyphase Alternating-Current Motors and Generators. Crompton and Co. and H. Burge. 3,227. February 7th.

Telephone Repeater System. H. E. Shreeve. 4,611. February 21th. (February 24th, 1912.)

Liquid Compasses. W. D. White. 6,112. March 12th.

Block-Signalling and Train-Controlling Signals. A. J. Allard. 6,185. March 12th.

Process of Electrolysis and Apparatus therefor. K. S. Guiteman. 8,352. April 9th.

Balance-Weight Suspension with Double Conductor-Supporting Cord for Electric Lighting. A. Schuchardt. 8,467. April 10th.

Supports for the Filaments of Glow Lamps. Wolfram Lampen Akt.-Ges. 12,753. June 2nd. (June 3rd, 1912.)

Electrolytic Production of Hydrosulphites. Akt.-Ges. für Anilin Fabrikation. 13,901. June 16th. (July 6th, 1912.)

Electric Liquid Heaters. E. A. Raves. 14,562. June 24th.

Methods for the Construction of Contact Sets for the Bank Contacts of Electric Selectors. Siemens & Halske Akt.-Ges. 15,164. July 1st. (July 4th, 1912.)

New York's Largest Turbine.—Not to be outdone by Chicago in turbines of large capacity, the Interborough Rapid Transit Co., of New York City, has recently awarded a contract to the Westinghouse Machine Co. for a horizontal turbine of 30,000 KW. capacity. The feature of this particular unit will be its division into two turbine elements; the high-pressure element being a single-flow turbine, operating at 1,500 R.P.M., and the low-pressure element being a double-flow turbine, operating at 750 R.P.M. The machine is of reaction type throughout, and comparatively low blade speeds are involved.

The scheme of employing two turbine elements with the steam passing serially through them is not new. A number of such units of from 1,000 to 2,000 KW. capacity were built by the Westinghouse Co. in 1901. This construction has again come to the front in the case of the English-built Parsons turbine, purchased by, but not yet delivered to, the Commonwealth Edison Co., of Chicago. It is new, however, to employ high-pressure and low-pressure elements driving separate generators, each at a different synchronous speed.

When any turbine is designed for high expansion ratios the engineer is confronted with the problem of having to deal with relatively minute volumes of steam at the high-pressure end and enormous volumes at the low-pressure end. It is therefore evident that if the high-pressure portion of a turbine may be operated at twice the rotative speed of the low pressure, this problem is largely eliminated.

Besides the gain from using different speeds, the division of the turbine into two separate elements has other advantages. The temperature range in either element is reduced. A sufficient number of stages may be introduced to give high hydraulic efficiency without any mechanical difficulties, such as increased length between bearings, &c. Some little advantage is also to be gained by separating the water between the two turbine elements which has been precipitated in the steam expansion. Either element is more reliable and simple because of its smaller size. Doubtless there is some loss of efficiency due to the employment of two generators instead of one at twice the capacity, but this is more than overbalanced by the gain in economy, due to the two elements operating at different speeds. For want of a better term these units have been called "cross-compound" machines.

It is planned to carry a vacuum of 29 in. on the turbine and 120° of superheat. The steam-consumption guarantee provides for 75·75 per cent. of the energy available in the expanding steam materialising as electrical energy at the terminals of the generators. —*Power*.

Terrestrial Magnetism.—Prof. F. E. Nipher, writing to our American contemporary *Science*, announces the results of observations made during July last, which indicate that:—"Cloud shadows diminish the permeability of the space within them in precisely the same way that the earth's shadow does at night. The molecules of air are ionised by solar radiation. They are then little magnets, which tend to set along the lines of force of the earth's field, in such a way as to add their magnetic effect to that of the earth's field. When solar radiation is cut off, the air molecules begin to return to their normal condition. Wind gusts and falling rain drops assist in this operation. They decrease the permeability.

"These results appear to furnish a rational explanation of the conditions which bring about local, daily and annual variations in the earth's magnetic field. Local variations are due to local variations in the weather. Clouds and sunshine, wind storms and rain, are the agents which bring about a continual swaying of the lines of force.

"They also indicate an explanation of what causes the difference in permeability of solid matter."

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ELECTRICAL TERMINOLOGY.

THE subject of electrotechnical units, terms and symbols is one which never fails to arouse discussion when it is broached; to many it is of fascinating interest, and from time to time new propositions are put forward with the honest intention, undoubtedly, of facilitating the free interchange of ideas and assimilation of knowledge. Unfortunately, too often these proposals are by no means well adapted to attain the desired end, but on the contrary tend to obscure the light, or to aggravate confusion where it already exists. We recently drew attention to some examples of the latter description in our notes on "Nunits and Abbns" and the "Myriawatt," and we are pleased to note that many eminent engineers in the United States have joined with us in condemning the myriawatt on the ground of its absolute lack of scientific justification. In spite of its official adoption by a joint Committee of American Engineers, we anticipate that it will never come into practical use.

That uniformity in technical terminology is very greatly to be desired is, however, beyond question, and excellent work is being done in the direction of its attainment by the periodical International Electrical Congresses and by the International Electrotechnical Commission; the latter body in particular places this object in the forefront of its programme, and though progress is necessarily slow, owing to the great number of divergent interests to be reconciled, it is sound and enduring. In view of the authority which is wielded by the Commission as an international body, we were surprised to find amongst the *Proceedings* of the British Association a report issued on behalf of a Committee on Electrical Nomenclature, in which not only were the recommendations of the I.E.C. criticised, mainly on somewhat academical grounds, but a somewhat different set of symbols was put forward, together with a number of definitions, &c. We have no wish to detract from the high merits of the British Association, to which we owe the admirable system of electrical units which has been of such immense value to the progress of the industry; but an international body must take precedence of a semi-private organisation, and while criticism of the I.E.C.'s proposals may be perfectly in order, we cannot sympathise with the attempt to supersede them with a set drawn up by half a dozen representatives of the electrical industry. There is, indeed, a doubt whether the report really represents the views of the Committee, judging from a letter published in one of our contemporaries; but the fact remains that the report was officially printed and issued, with the names of the Committee attached, and it contains nothing to show that it is not perfectly authentic.

Passing from the general to the particular, we wish to take this opportunity of protesting against the use of certain terms which were employed at the meeting of the British Association, by men from whom one is justified in expecting better things. First, and worst, is the introduc-

tion of the term "Electromotive," as an abbreviation for the phrase "electric locomotive," by no less an authority than the President of the Engineering Section. We cannot understand on what grounds this unwelcome innovation can be supported. The word is an adjective in common use in technical phraseology; if it were employed in conjunction with another word, as "electromotive engine," it might pass, but by itself—! We feel sure that Dr. Kapp on reflection has repented of this fault; and happily we are certain that the usage will never come into vogue.

Next take "electrocute," used by Prof. Morris with reference to accidental death by electric shock. This word was coined by American newspaper men to designate execution by electricity—base coinage, indeed, for etymologically the word is execrable; like its congener "electrolier," it is a bastard, and has no right to live. However, it has been forced upon the language and must be tolerated; but let us try to restrict it to its true meaning—the execution of a *criminal* by electric shock, a penalty which is reserved for murderers. Again, in the title of one of the papers appears the phrase "Trades Unionism." So far as we know, "Trades Unions" is the only phrase in the language in which an adjective is given a plural form. It is, of course, entirely wrong, though it is often met with in the daily Press; but in the case referred to above there is not even the excuse of a plural noun. Lastly, we once more protest against the use of the symbol ~ in formulæ. A symbol *must have a name*—a fact which is sometimes overlooked. When we read $2\pi f$ we say two pi eff; when we read $2\pi \sim$ we say two pi—what? two pi cycles? If so, should we read $I = E/R$ as "amperes equals volts divided by ohms"? Let it be remembered that symbols are symbols—not quantities, nor yet the names of quantities; and signs such as $^\circ$ ′ ″ ~ should never appear in formulae. Space forbids us to animadvert upon the use of the monstrosity "dynamotor," the superfluity of "motorman" when simply "driver" is meant, and other abuses of the English language; we hope that all such matters will be dealt with in due course by the International Electrotechnical Commission.

The Chester Hydro-Electric Plant.

Elsewhere in our pages this week we illustrate and describe the new water-power plant, which, through the instrumentality of Mr. S. E. Britton, the city electrical engineer, has been installed at Chester, on the site of the Old Dee Mills. The scheme is the only one of its kind in this country dealing with both tidal and head waters, and, so far as we are aware, the Chester plant and that at Worcester are the only municipal hydro-electric installations in Great Britain.

It is generally assumed that the conditions in this country do not lend themselves to water-power development, but while this is apparently true as regards large powers, which the Snowdon plant of the North Wales Power Co. and the Loch Leven installation of the British Aluminium Co., are the only examples, there are numerous small water-power schemes for electric lighting in various parts of the kingdom.

Probably the rivers of North Yorkshire can show more of these small plants than any similar area, a dozen or more being in operation, for lighting remote villages and townships on the banks of the Ure, Wharfe, Swale and their tributaries.

The Chester scheme is, of course, much larger than any of those last mentioned, as 1,100 B.H.P. of plant is installed. The proposal received most careful consideration at the hands of both Mr. Britton and Mr. Hurtzig; and although it is too early to say anything about actual results, there seems to be little doubt that the venture will turn out to be a profitable one to the Corporation.

Australian Trade.

We have received from the Secretary of the Australian Association of British Manufacturers and their Representatives, in Melbourne, a printed sheet giving an outline of Australian trade in the year 1912. The figures given show the trade of the United Kingdom, Germany, and the United States, with Australia, and have been compiled by H.M. Trade Commissioner in Melbourne. The total imports into Australia (including bullion and specie) in 1912 amounted to £78,158,600, an increase of about £11,300,000, as compared with 1911. As showing the rapid growth of Australia as a buying market during the last few years, it is interesting to note that the imports in 1912 showed an increase of about £27,000,000, or well over 50 per cent., as compared with the imports in 1909.

A portion of the trade of Australia, however, consists of goods which, for natural reasons, the United Kingdom is unable to supply. According to calculations made by H.M. Trade Commissioner, the value of goods of this class which may fairly be deducted from the total in order to arrive at our share of the competitive imports was, in 1902, £15,009,110. The items thus eliminated consist of such goods as oils, ores, rice, foodstuffs, &c., and the balance of goods in which we are naturally capable of competing was £61,230,761, as compared with £52,295,529 in 1911 and £40,417,636 in 1909.

It is satisfactory to find that after a slight relapse in 1911 our share of the trade has advanced in 1912. In the latter year, the imports from the United Kingdom amounted to £38,317,485 (62·58 per cent. of the total), as compared with £32,140,488 (61·45 per cent. of the total) in 1911. While the proportion from the United Kingdom in 1912, compared with that in 1909 decreased by 1 per cent., yet in value our trade increased by £12,600,000, double the combined increases made in their trade by Germany and the United States, and more than £4,250,000 in excess of the increase in the imports from the whole of the rest of the world.

The second part of the statement now before us shows the imports into Australia of the chief classes of goods. The imports of manufactured metals amounted in value to £12,213,692, of which we took £8,303,040 or 68 per cent., to Germany's 12·5 per cent. and United States' 15 per cent. In machinery, the total imports were £4 771,397, of which our share was £2,510,052 or 52·61 per cent., as compared with Germany's 5·9 per cent. and United States' 31·6 per cent. It is obvious, therefore, that the United States is the competitor most to be feared in these lines and particularly in machinery. A good deal of her success had been due to very efficient selling methods, which, however, are now being more and more adopted by our own firms with beneficial results. Turning to the 1911 figures in the metals and machinery trade, we find that a large increase has taken place in the British share of the trade. Even where there is an increase in German and American trade, the increase is small, and in some branches there are actual decreases. The following figures are of interest as showing our share of the trade of each State in manufactured metals and machinery, and therefore our relative strength or weakness in the different parts of the Commonwealth :—

	U.K. share of total trade in— Manufactured metals.	Machinery.
New South Wales	65·4	48 9
Victoria	66·4	47·1
Queensland	71·2	61·8
South Australia	74·4	47·2
West Australia...	70·5	73·6
Tasmania	71·0	66·0

While we appreciate the usefulness of the figures now before us we should, from our own point of view, like to see them drawn up in greater detail to show more clearly what is happening in the electrical trades. Nevertheless, even in this general way it is interesting to follow the course of events in such an important market as Australia, and we hope that the Australian Association of British Manufacturers will continue to circulate the annual figures. We understand that the Association, which was founded by Mr. Hamilton Wickes when he was Trade Commissioner in Melbourne, is doing valuable work in other directions in the

interests of British trade, and we commend it to the notice of our manufacturers who are in any way interested in the Australian market.

Lead.

The market, since we last referred to the matter, has passed through another of its phases of weakness, which again was followed by renewed vigour, but as has been remarked in previous articles, it really seems as if the apex of the movement had been reached some time ago, when the price went to close upon £24 a ton. The recent weakness was the outcome of private cables from Mexico announcing that the resumption of shipments from the big smelter at Torreon was impending. This news leaked out somehow, and there was a certain amount of realising on the strength of what was regarded as a most important alteration in the position, but the news proved in the end to be premature, and in sober fact no lead has yet been shipped from the smelter named, while later developments make it more uncertain than ever when things will settle down to an extent sufficient to enable a start to be made with industrial operations. The Torreon smelter indeed has been the scene of sanguinary fighting again. It was in the occupation of the Federal troops, but was betrayed into the hands of the rebels, who swept through it with the rifle and bayonet, and they, in their turn, are being pressed by a large body of Federal soldiers, and in the impending struggle much damage to the plant may be done. Hitherto the rebel forces have not gone in for the destruction of private property, contenting themselves with taking whatever they required in the shape of supplies, and paying for them in paper money, which may or may not be useless. At any rate, the fresh trouble at Torreon sets back the clock again as far as the re-entry into the European market of Mexican lead is concerned. The news naturally had a stiffening effect upon prices, but the main cause of the temporary sharp advance in the price of immediate delivery, was the covering of the extensive bear account. The bears have been looking so long for the collapse of the Mexican fighting, and the resumption of normal industrial conditions there, that they refuse to cover their open commitments till the very last moment. This was the case on this occasion again, and under the pressure prices rose sharply. There has been quite a good demand for lead for export, one or two considerable lines being booked by South America, while the Russian market has been a continual buyer of fairly large quantities, and even yet there seems to be business to be done for this market. The Far East is also taking a good deal of material direct from Australia, and this tends to keep lead out of the London market. Consumers in Great Britain are undeniably short of lead and within the last few days one or two of the largest cable people have been literally begging for even 25 tons to keep their plants going. There is not the slightest doubt that the position of lead is actually very strong, but these are not times for the opening up of bull commitments on anything like an elaborate scale. There is a feeling of distrust about, and this is acting as a marked restraining influence upon enterprise in all directions, and lead is not likely to escape from the common experience. At the present price and with indications on nearly all sides of a trade recession being in progress, consumers are not likely to operate in advance of their known needs. Hence the stocks which they are holding in their yards are very small, probably less than for many years, and this is a factor which, were outside considerations less uniformly unfavourable, might count for a very great deal, but as it is the predominant note is pessimism. As with copper, all intrinsic conditions are disregarded, but some of the leading dealers and brokers are very confident, and point out that export contracts are behindhand owing to the inadequacy of supplies, while important electrical consumers are begging for metal. It is pointed out, too, in one prominent quarter that lead can hardly become plentiful under existing circumstances. The world's output has only increased 3½ per cent. in the last 10 years, while the consumption for electrical purposes has increased enormously.

ELECTRIC COOKING FOR THE SMALLER CONSUMER.

[COMMUNICATED.]

At present the consumer having an income of between £200 and £300 a year finds that electrical cooking is rather beyond his means. This type of consumer is so numerous, and is generally so prompt in meeting his accounts, that on those grounds alone he is well worth cultivating. There is, however, another very important point to consider—the question of load factor. At the moment, any engineer having a fair number of cookers on his mains will assert that the addition of the cooking load has not increased his winter lighting peak; he can also bring forward load curves to prove this point. Now it seems to be quite lost sight of by many cooking enthusiasts, that the possible cooking load, even amongst the wealthier classes, has not yet been tapped to any extent; true, the output has increased on this account quite respectably, but a cooker for any size of family takes a good deal of current, so that it does not require many large ovens on the mains to increase the output. The state of affairs at present is somewhat as follows:—Several people have cookers in use, but it will be found that they are few enough to make it fairly certain that as one oven goes off another comes on. This is due to the fact that the times of dining, and, therefore, the times of preparation of the food vary considerably. With comparatively few of the late-dining class using ovens it is easy to see how the total load demanded by the cookers will not badly affect the load factor. When, however, the use of the electric cooker becomes general amongst this class, as it shortly will owing to its many advantages, it will be found in every locality that there is a time which may be described as the general dining time for that district, and quite 80 per cent. of the people concerned will be dining about that hour. This load, if of any magnitude, is bound to affect the peak at lighting times in winter. A large increase in this cooking load would mean the installation of additional generating plant to supply very low-priced units on top of the winter lighting peak.

If the smaller consumer can be persuaded to adopt electric cooking, then the fact that this class of consumer invariably dines in the middle of the day, coupled with further advantage that in the aggregate he will afford a much greater load than the former class, will result in the mid-day cooking load balancing to a great extent the cooking load which will come on during the lighting peak. A further advantage to be obtained from this consumer is that a good deal of his cooking will be done during the hours when the industrial motor-load is shut down for dinner time.

The chief cause tending to keep this consumer off the mains at present is almost solely the cost. It is freely admitted that this particular class of the community have much heavier calls on their incomes than any other class. No increase of cost for their heating or cooking can be entertained if there is not an equivalent cash saving in other directions. The advantages of electric cooking over all other methods as regards comfort, health, and even the less wastage in cooking joints will be unavailing to secure consumers from this class if the actual bills to be met are heavier than at present.

In a household known to the writer, the charges for lighting and cooking are as follows:—Gas for lighting and cooking, at 2s 6d. per thousand, £3 6s. In addition to this there is a charge of 2s. 9d. per quarter for the rent of the stove, which will cook the meals for a family of six; and a meter rent of 1s. per quarter. The cost of coal for warming rooms and heating bath and lavatory water is about £4 10s. net, coal costing 15s. per ton delivered. This latter item, however, is at the present time not under discussion.

The house is let at £23 a year and rated at £17; thus with a tariff on the Norwich system, of 10 per cent. and a halfpenny per unit, such a consumer could use 768 units a year for the same cost as he now pays for gas. As the saving in meat wastage in the house under consideration would amount to about 25s. a year out of a present annual expenditure of £15 on butcher's meat, we have by this

means a saving which will allow the consumer to use another 600 units a year. The total number of units used will then be as follows: 1,368 for both lighting and cooking of which 100 units will be for lighting. The total available for cooking is then 1,268 units a year, which is too low to carry out the cooking for a family of six. The only effective remedy which the writer can see for the problem is for the efficiency of the apparatus used to be considerably increased. The capital cost of the utensils must also be brought lower, so that they can be hired out at a charge which will compete with that made by the gas authorities. The price per unit can hardly be lowered at the present time, whilst on the Norwich system the substitution of half-watt lamps (if that were possible), for the present lamps would not reduce the annual cost to a sufficiently low figure to secure the class of consumer indicated. In catering for this class, it must be plainly realised that though the benefits of electrical cooking will be freely admitted, yet the extra cost, at present, cannot possibly be entertained. It may be urged that there will be some saving owing to its being possible to dispense with some amount of paid domestic help; this, however, is not the case, as the cost for domestic help in common with all other expenses must be kept down to the lowest possible; thus, the house is often run by the mother and daughters, and though they would be glad of the extra rest and pleasanter kitchen conditions offered by the use of electrical cooking, yet they are forced to forego them on account of the extra money not being available. Where help is employed, it is often because the family consider certain duties in the house as being beneath their dignity; and in these cases it is obvious that such duties will not be affected by the introduction of electrical cooking.

This class of consumer is a most desirable one for the cooking load; he is also more than ready to use electricity for this purpose if it were not for the present cost being rather higher than for existing methods. The station engineer should make a strong point of urging on the manufacturers, in season and out of season, that they must design a cooking stove which is considerably more efficient than those at present available. With so rapid an extension of electrical cooking amongst the class who dine late, the manufacturer is at present busy, and will not be inclined to listen to demands for a more efficient article, which will probably scrap a good many of his present patterns; but the station engineer must either get a cooker which will allow the smaller consumer to use electricity for cooking, or be content to see the cooking load grow and become concentrated on the worst hours of the winter lighting peak.

The obtaining of the smaller consumer's cooking load will not only increase the profits of the supply company, but will practically wipe out the loss of revenue which will have to be faced when the ½-watt lamp is available in 50-c.p. or lower units. With a good cooking load of the type indicated above, the coming of the ½-watt lamp to those towns using the Norwich system will cause little anxiety.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Sale of Electric Lamps.

We take this opportunity of drawing the attention of dealers in electric lamps to the obviously unfair methods of the wholesalers in supplying private consumers with lamps at the same price, and in some instances even less than supplied as per catalogue price to the trade, less, of course, the usual discount allowed the trade. We have experienced considerable difficulty in instances resembling the following:—

Firms of repute have offered to supply us with their goods at a certain price equal to their catalogue price, less trade discount. They have then followed up by sending a representative into our immediate vicinity, who offers the same goods at the same price as offered us, less a further 5 per cent. for cash, having no regard to their listed prices.

How then can we expect the public to purchase the goods from us when able to deal to greater advantage with the wholesaler? The trade is thereby put on a level, as regards price, with the consumer.

We shall be glad to hear the views of other dealers and to know if they have experienced the same trouble.

The Electrical Accessories Supply Stores.
R. Jenner, *Proprietor.*

Sheerness, *October 10th*, 1913.

An Echo of the Marconi Contract.

I find your issue of September 19th awaiting me here.

Against my statement to you that the War Office Wireless Committee had no relation of any kind whatever to the Marconi contract or to my visits to long-distance wireless stations, and that nobody but yourself had ever thought of attempting to make any connection between the two, you quote a telegram from the *Times* to the effect that on the homeward journey from Vienna the War Office "party would visit the Goldschmidt station near Hanover and the station at Laeken," and you ask "How can he maintain that his visits were totally unrelated to the Committee, of which he was chairman?"

The explanation is perfectly simple, as a little courtesy to my personal statement regarding myself would have enabled you to guess.

The *Times* correspondent was inaccurate upon this point. My colleague of the Committee, and the Army expert who accompanied us, returned straight to London from Vienna, as our work there for the Committee was done; and I proceeded alone to Berlin, Hanover and Brussels, on purely private visits, privately arranged by myself, with which the War Office and the Committee had no more to do than you had. Long-distance wireless was wholly outside the scope of the War Office Committee, and my private visits to, and observations of, these three important long-distance stations—Telefunken at Nauen, Goldschmidt at Eilwese, and "onde unique" at Laeken—were never reported to the Committee, or considered by them for a moment. The two matters, as I assured you, and as you might courteously have believed without further challenge, had absolutely nothing whatever in common.

Second, I told you that I had never said I have "seen every long-distance station in operation," or that I "knew every big station in Europe." Against my denial you quote the necessarily condensed report of the *Times*, and remark, with your customary courtesy: "Let him reconcile this with his other statements—we cannot."

In final reply I send you the official verbatim report of my speech, from Hansard's Parliamentary Debates.

On page 4 you will find the first remark: "I have had the opportunity of seeing *every type of* long-distance wireless station in operation."

On page 2 you will find the second remark: I was criticising Mr. Churchill's statement that "this country has been deprived of advantages in wave-length," &c., and I said: "I believe that I know *the wave-lengths of* every big station in Europe."

This letter concludes the matter, so far as I am concerned. But I will cherish the hope that you will at least have the courtesy to express regret for your repeated misrepresentation of me.

Henry Norman.

Antibes, France, *October 5th*, 1913.

[As we have stated on previous occasions in connection with this matter, we relied upon the *Times* reports for the information upon which we based our allusions to Sir Henry Norman's contributions to the Marconi contract controversy. Sir Henry now, for the first time so far as we know, denies the accuracy of those reports in important respects, and, of course, we accept his statements. We had no desire to misrepresent him, and regret that we were misled by the reports in question into ascribing to him statements that he did not make.

What we objected to was the assumption that minutely examining and taking copious notes of wireless installations, and running one's "own little station," constituted qualifications for posing as an authority on long-distance wireless telegraphy, and in that respect our attitude is unchanged.—Eds. Elec. Rev.]

The Diesel Engine.

I was very much interested in the abstract, contained in your current issue, of Mr. G. S. Taylor's report on the Bray explosion. As we depend entirely on Diesel engines for our output, I am naturally always on the lookout for information which will improve my knowledge of the inner working of these engines. I, therefore, obtained a copy of the full report and studied it carefully, and would strongly recommend every engineer who is responsible for the efficient working of Diesel plant to do the same, as Mr. Taylor has treated the subject in a very exhaustive and excellent manner. In view of the widespread interest in Diesel engines, I may be excused for commenting on some of the details in the report; I do so, of course, not because I have the slightest inclination to criticise the methods which were adopted at Bray when starting up the engine on the occasion reported on, but because if any error of judgment were made on this occasion, others, like myself, no doubt would wish to ascertain all that can be learned of the circumstances causing the explosion, with a view to taking precautionary steps to avoid the possibility of such an occurrence on other Diesel plants. Reverting to Mr. Taylor's report, the following facts are stated therein :—

1. The pressure in the starting vessel was only *slightly above* 350 *lb.*, when the compressed air and oxygen from this was admitted to the engine.

2. The pressure in the blast vessel when charged with the oxygen was 800 lb.

3. The fuel pump and the fuel pipe to the engine were drained of crude oil, and were primed with kerosene oil, prior to starting the engine.

4. The flash point of kerosene is between 70° and 90° F., and of crude oil, about 150° F.

When starting the engine, the following valves were opened :—

(*a*) Valve from blast vessel to fuel valve.
(*b*) Valve from compressor to blast vessel.
(*c*) Valve between blast vessel and pressure gauge, and
(*d*) Starting valve on starting air vessel.

The last-mentioned operation (*d*) set the engine in motion, and after the engine had made about six revolutions, the starting lever on the cylinder head was put into the running position. The report states that the explosion did not occur until some seconds after this lever was operated. It further states that no firing stroke occurred, and that air was leaking badly from one of the cylinder valves with a hissing noise (this is characteristic of a leak past the needle valve); also that the air inlet and exhaust valves were leaky. As the report does not state if the starting valve on the starting vessel was closed before the explosion occurred, one may assume that this valve was not closed.

In two respects the starting of the engine was not carried out in accordance with the instructions issued by the makers of the engine. First, the pressure in the starting vessel was far too low to enable the engine to get under way properly. (The makers recommend a normal pressure of 800 lb., and that no attempt should be made to start the engine when the pressure in the starting vessel is found to be less than 600 lb.) The second operation questioned was the opening of the valve between the blast vessel and the pressure gauge.

The usual procedure is to open this valve when testing the pressure in the blast vessel, and to close it again as soon as the pressure has been read on the gauge. The valve is then kept shut until the engine is firing and is properly under way, and is only opened while the engine is running, when one of the air vessels is being recharged to its normal pressure from the compressor on the engine.

Neither in Mr. Taylor's report, nor in any of the articles I read in the technical Press shortly after the unfortunate occurrence at Bray, did I notice any theory put forward as to what effect an abnormally low pressure in the blast vessel would have on the circumstances causing the explosion. Keeping in view the facts that the pressure in the starting vessel was extremely low, and that the air inlet, fuel, and exhaust valves on the cylinder head were leaking air, it follows naturally that the pressure in the blast vessel would fall very rapidly until, in a matter of seconds only, it became less than the maximum pressure of compression in the cylinder of the engine. Now, under normal conditions of working, the fuel oil is ignited spontaneously at the instant of maximum compression, and this ignition, of course, can occur only when the fuel oil is properly sprayed into the cylinder by the blast pressure. If, however, the blast pressure is too low to force the fuel oil into the cylinder, an excess of oil (in this case, kerosene) would accumulate in the fuel valve seating. The report states that the explosion originated in this latter, and explains very fully how this explosion probably occurred. In the circumstances mentioned, it seems, therefore, perfectly feasible to assume that the resultant vaporised oil was propagated through the blast pipe to the blast vessel at the instant that the needle valve was lifted off its seating by the cam lever.

The conclusion I arrive at is that the explosion was due primarily to an attempt being made to start the engine with an insufficient supply of air in the air vessels, and that if the pressure of air in these vessels had been adequate, probably no explosion would have occurred. This conclusion would appear to be supported by the fact that the same engine was successfully started by means of compressed oxygen only five months previous to the event in question.

Mr. Taylor concludes his report by recommending, *inter alia*, that only competent men or experienced engineers should be employed as attendants on Diesel plants. As this recommendation may prejudice the minds of would-be users of Diesel engines on the score of extra labour charges for skilled employés, I think it is only fair to the makers of these engines to state that this recommendation applies more to small isolated private plants, where probably the one man is responsible for everything in connection with the engine, than to, say, small central stations at which two or more Diesel engines are in use. In the latter case the chief engineer or his assistant keeps careful records of all the valves and other parts of the engine which require regular attention, and sees that these are attended to periodically as recommended by the makers. Any engine driver of average ability would very soon learn how to grind in and clean the valves, &c., but the proper setting of these valves should, in my opinion, be done only by the engineer or his assistant. So far as my own personal experience proves, the actual running of a moderate sized Diesel engine does not require the service of a skilled attendant in central station practice. We have three 3-cylinder Diesel engines operating here, and since these engines were first started 15 months ago, they have been driven by three local men who previously had never even seen a Diesel engine working, and whose experience when appointed had been limited to running small local gas or steam plants. These men were each given a fortnight's instruction in the working of the engines, and each man then continued his duties, and has carried them out for months, without a hitch of any consequence.

P. A. Spalding,
Engineer and Manager.

Electricity Works, Dundalk,
October 6th, 1913.

Ventilation at the Gas Exhibition.

What I would like to know is why, if gas lighting and heating are such useful methods of ventilating, have there been fixed, exclusively for the Gas Exhibition at the White City, 53 (there may be more hidden away) 30-in. electric fans, each capable of exhausting 8,000 cb. ft. per minute.

Now, if it is not necessary to have this installation of fans during the run of other exhibitions, when the ordinary ventilation is good enough, why is it necessary to spend, I assume, at least £2,000, solely for the purpose of ventilating the building, when gas is such a good means of ventilation?

Perhaps it is because there being no white ceilings for

the calcined microbes to stick to, or convenient porous plaster for their charred remains to ooze through, the managers remove the cremated bodies from the building into the pure atmosphere to ooze into the lungs of the passing crowd.

As likely as not "Electric Supply Memoranda" will give the reason. Will you ask him?—because I should like to know.

A. C. Bostel.

Croydon, *October* 15*th*, 1913.

LA MAISON ELECTRIQUE.

FURTHER visits paid to the Ideal Home Exhibition at Olympia more than confirm our first impressions regarding the value of the opportunity which the occasion affords for familiarising hundreds of thousands of people with the domestic uses of electricity by actual demonstration. It is true that the purely electrical stands are not numerous, but there are some excellent examples, well planned, well manned, and in every way creditable representations of electrical applications which are drawing great crowds of middle-class householders, and convincing them that the time is fully ripe for the electrical conversion of their domestic arrangements to take place. From the advance notes published respecting La Maison Electrique, our readers will have gathered that its contents were not to be prosaic or unattractive. Some cold, unimaginative creature has in critical mood suggested that workmen's cottages lighted by electricity would be more appropriate at such an Ideal Exhibition than a magic table. We do not agree. We believe that Monsieur Knap's electric dinner table is just now doing a very useful service to the cause of electricity, and as we have had occasion to offer some criticism of the Electric Supply Publicity Committee in the past, we now come with hurrying feet to offer our congratulations to them upon this part of the display organised in La Maison Electrique. Indeed, we do not limit our congratulations purely to this novel, and, considered from the householder's point of view, impracticable device, for the House is throughout attractive, and, as far as it is possible to make it so in a small compass that must be thronged with people, businesslike.

Of course, in this house electricity is used for everything. In the kitchen, the dining room, the business office, the bathroom and the bedroom, a hundred different applications are to be noted. All the water for the household is heated by electricity, and the revolving hair brush, hat iron, bath towels, and the bath mat are all heated by the same agency. In the business office there is an addressograph, a Burrough's adding-machine, and a Blick letter-sealer. Elsewhere there is an Ozonair apparatus, a "Universal" motor table (G.E.C.) with electric motors for boot polishing, knife cleaning and many other such services, electric irons, and an electric sewing machine. Without mentioning the different departments and their equipments in proper sequence, we may add that hair-drying and curling, cradle-rocking, food-warming for the baby, electrically-drawn curtains for the bedroom, and telephones, all play their part in this ideal home. The electric cooking and heating apparatus is rightly made one of its strongest features. Such apparatus includes the following: A Therol heater (Spagnoletti); a cooking stove (Westminster Electric Supply); a Cooper water heater, a grill and a potato steamer (Purcell & Nobbs); a warming cupboard, coffee percolator and table kettle (Metropolitan Electric Supply); a Bankside water heater (City of London E.L. Co.); a floor pad by Messrs. Holmquist; a Belling fire (Belling & Co.); a radiator and a Pygmy heater (Bastian Co.); a shell radiator (British Electric Equipment Co.); a coffee percolator, toaster, hot-plate and kettle (Townshend's Art Metal Co.); and a glue pot (the Electrical Co.). There are vacuum cleaners by Duncan Watson & Co., the British Vacuum Cleaner Co. and Gillespie & Beales; a table fountain by Messrs. Laing, Wharton; an electric fan (G.E.C.); a tea cabinet by the Afternoon Tea Cabinet Co.; an electric lift to carry meals, &c., to the bedroom, not to mention a fly-catcher and a lavatory set.

The exhibit of Messrs. Rashleigh, Phipps & Co. is the most prominently placed purely electrical one in the Hall, and it is well arranged with a lengthy frontage, allowing a very large number of visitors simultaneously to inspect the manufactures shown. The collection of electric light fittings is very choice and valuable. A special room is set apart for the display of inverted fittings in great variety, including the new "Superlux" system, and the effect here is most pleasing. Near one end of the exhibit an electric fountain is playing, and an electric clock is among the other features catching the public eye. Ozonair apparatus, Osram lamps of all sizes and candle powers, and a motor-driven sewing machine at work, are also shown, but the great attraction, which is undoubtedly doing much educational work, is the businesslike collection of electric heating and cooking apparatus. Demonstrations of egg-boiling and other operations on the breakfast table were in progress on the occasion of one of our visits, while ironers were busy showing the good points of the "Magnet" electric iron. In conversation with Mr. Archer, we were interested to learn that during the past nine months 22,000 of these irons have been sold by the makers mainly for service in this country. Demonstrations are also being given with various cooking apparatus on the Archer-Magnet system. One of these is a new domestic cooker, with air lagging. It has an 8-in. hot plate at the bottom, with two circuits controlled by a circular-pattern switch with high, low and off positions. At the top there is a griller attachment, with open red-hot coils supported on massive insulators. With this apparatus, which is specially arranged for flat use, grilling, cooking and boiling on top of the griller may be effected simultaneously; but we hope to publish further details of this cooker in due course.

"Kingolite" electric candles are in use at many stands in the Hall, including those of Messrs. Waring & Gillow, Rashleigh, Phipps & Co., Coal Consumers' Co, Daniel of Wigmore Street, Harvey Nichols, Edmundson's Electricity Corporation.

Messrs. Edmundson's Electricity Corporation, Ltd., show prominently an automatic, self-regulating plant for country house and other installations. They also have showrooms as part of the stand, where electric light fittings and cooking and heating appliances are displayed. The Dowsing Radiant Heat Co., Ltd., who, at many exhibitions, make a proud showing of their popular lines, which are always sure to receive a good deal of attention from the general public, display their luminous and non-luminous radiators, electric cooking apparatus, electro-medical appliances, electric light baths and so forth. The Linolite Co. exhibit their Woodhouse steel casing, "Tubolite" and other specialities.

Vacuum cleaners are to be seen in several parts of the building. The Electric Appliances Co., of Glasgow, show their "Imperial" vacuum suction cleaner, electric vibrators, &c.

The British Vacuum Cleaner Co., Ltd., have a large exhibit of British vacuum cleaners, ranging from the "Brivac" vacuum sweeper to a large stationary cleaner for central installation purposes in private houses, hotels, theatres, &c. For the first time there is shown a new electric cleaner (Model "F F."), which will sell at a moderate price. It is claimed that the machine is most efficient, while the weight is only 11 lb., so that it can be carried about by any servant easily, and can be rested anywhere, as on a staircase, while the stairs are being cleaned. The electrical cleaners include both fan and pump types.

Messrs. Magic Appliances, Ltd., show their new "Magic" suction cleaner, which was described in our issue of September 26th, and represents a great advance in efficiency and reliability compared with previous designs.

LARGE ELECTRIC KITCHENS.

THE great developments in the generation and utilisation of electrical energy during recent years, and the important reductions in the price at which it is sold, have led to the extensive use of electric cooking appliances of all kinds, and there have been established a number of all-electric kitchens in many hotels, restaurants, sanatoriums, steamships, &c. Apart from the great hygienic and economic merits possessed by electric cookers under all circumstances, and too well known to need recapitulation, the little space occupied by electrical equipment is often of great importance—particularly in city buildings and on boardship. In large manufacturing works, electric kitchens offer an ideal means of catering for the staff, and the energy consumed generally effects a very appreciable improvement in the load-factor of the total works demand.

In the Siemens-Schuckert Co.'s cable works near Berlin, an electric kitchen capable of providing for 200—300 persons was erected in 1911, the equipment including:—Eight saucepans of 31 quarts capacity, and consuming 4·2 KW. each; eight 13-quart, 2·6 KW. saucepans, and one of 5·3 quarts capacity (1·5 KW.); 10 pans totalling 16·6 KW. demand; one 2·6-quart kettle (1 KW.); one copper kettle and one coffee urn each of 31 quarts capacity; and one combination containing two roasting ovens, and two hot chambers (15 KW.). The maximum demand possible is 93 KW., but the average lies between 20 and 40 KW.

During one month (August) it was found that the average energy consumption per meal (of ½ pint soup, 6¼ oz. meat, 5½ oz. potatoes, 2½ oz. other vegetables, 0·075 pint milk, and 0·42 pint coffee) was 0·394 KW.-hour. With energy at ½d. per unit, electric cooking saved 10 per cent. as compared with the gas cookers used in the old cable works, but even with current at 1d. or more per unit, the higher cost of electric cooking is far outweighed by the incidental advantages secured.

An even more interesting case is that of the Norddeutsche Lloyd Co., who lately "electrified" the kitchen in their Bremen headquarters. For the supply of the lamps and lifts, &c., in the building, a private electricity station was already in operation, and as

the day load on this equipment was very small, the energy for cooking could be provided at from 0·2 to 0·3d. per unit (the cost of the fuel consumed).

The kitchen space is extremely limited, and before electric cookers were installed the conditions were almost unbearable in summer. Meals have to be cooked for 500 employés, who dine in three groups at one hour intervals. The electrical equipment installed includes : Five saucepans and five steamers, each of 44 quarts capacity and 6·5-KW. consumption ; five 17·5-quart saucepans (3 KW. each), two of 13 quarts (2·6 KW.), and two of 9 quarts (2 KW.) capacity ; four 14-in. steel pans (2·4 KW. each) ; three 70-quart kettles (8 KW.) ; two 44-quart copper kettles (5·5 KW. each) ; one combination containing four 30 × 18 × 11 in. roasting ovens (28 KW.) ; two hot cupboards each with four divisions (4 KW. each) ; three hot plates each with two heats (4 KW. each) ; two hot tubes for the warm water tank (6 KW. each). The maximum possible demand is 194 KW., and the average 40·60 KW.

The equipment is so arranged that minimum hindrance occurs between the various cooks. In the centre of the kitchen a light concrete cooking table (fig. 1) is erected which is covered with glazed

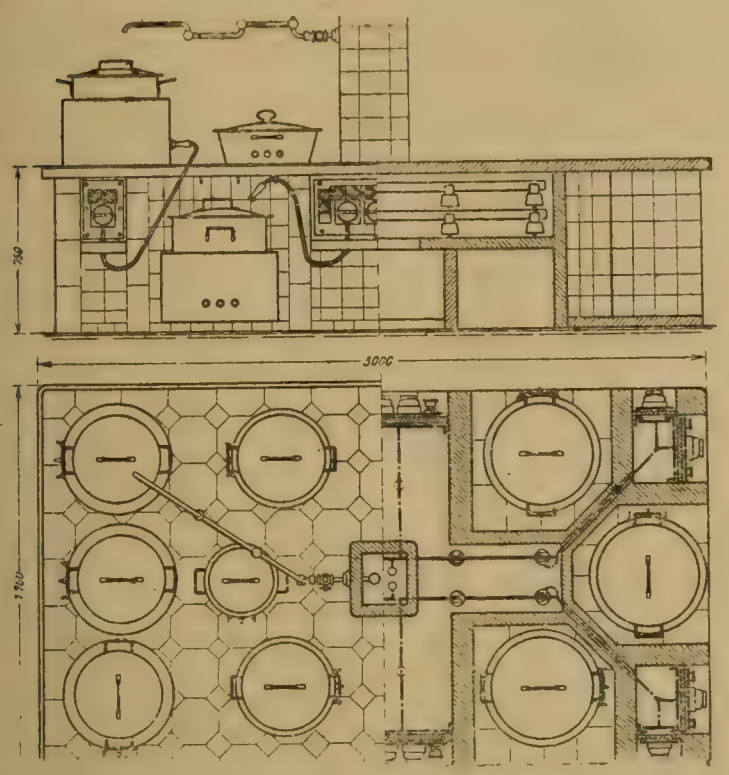


Fig. 1.—Elevation and Plan of Cooking Table.

tiles. Beneath the table are recesses for the accommodation of utensils not in use, and also the necessary fuse and switchgear, and distributing bus-bars. The supply mains are brought down a tiled duct, which also accommodates the hot water delivery pipe (terminating in a jointed discharge pipe). Twenty-six connecting points are provided on this table—14 for the large saucepans, fish kettles and pans, and 12 for the smaller utensils. Current is switched on or off plugs by switches mounted near the point at which the plugs are to be used ; when idle, the plug flex is hung over hooks beneath the table.

The saucepans or boilers are double walled, nickel plated and provided with side and bottom heating elements as in fig 2. The

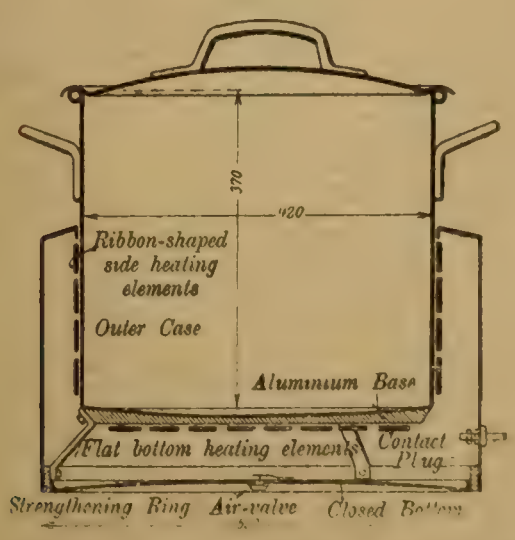


Fig. 2.—Saucepan with Bottom and Side Heating.

heaters are of pure nickel, or 20 per cent. nickel plated, and the vessels being in one piece, there are no joints to melt should they be allowed to boil dry. It is a difficult problem how to attach the bottom heating elements to thin-walled utensils. If soft solder be used the joint is liable to melt, and if the attaching screws are hard soldered, distortion of the bottom generally occurs quite apart from other difficulties encountered. Certain other arrangements which have been tried are subject to the objection that expansion is likely to cause defective thermal contact. In the Prometheus system, an aluminium plate is fitted to the bottom of the vessel (as in fig. 2). This plate is turned flat in order to make good thermal contact with the flat heating elements, which are attached to it by easily removable studs. Owing to its high conductivity, the aluminium hot plate distributes heat evenly over the bottom of the vessel. The side heating elements are clamped in place by small tightening screws, and the nickel plated outer shell is provided with a collar (soldered to the cooking utensil), and at the bottom is stiffened by a stout galvanised iron ring. To the latter are screwed struts, which are bolted on to the aluminium block, and which carry the greater part of the weight of the vessel and its contents. The bottom plate closing in the heater space is soldered to the iron supporting ring, and in it is a small air valve designed to prevent excessive air pressure in the space between the walls of the complete boiler. The various heating elements are connected in series-parallel and, according to the switch setting employed, 6·5, 3·7, 2·8, or 1·7 KW. may be expended in each 44-quart saucepan. The lowest heat (all elements in series), is employed to complete cooking after boiling point has been reached (55 minutes from cold, using full heat).

The stewing pans are constructed in a similar manner, the inner vessel being, however, of plain steel and heating being from the bottom alone. The large oval fish kettle has a 4-mm. bottom to which the 2-mm. side plates are riveted and soldered. The aluminium bottom plate is no longer required, owing to the considerable thickness of the steel bottom and the less importance of uniform heating of the latter. The heating elements are attached by hard soldered bolts, and the power consumption is 8, 5, 3 or 2 KW. (70 minutes to boiling point from cold when full). As in the potato-steamer, a perforated nickel loose floor rests on suitable legs, and is provided with hooks for removal.

Fig. 3 shows the construction of the roasting ovens ; each compartment has 5-mm. side plates welded to 10-mm. floor and top plates, the advantage of this construction being that it is impossible for steam or other vapours to penetrate to the heating elements. Each oven unit can be removed complete with its heating elements by the withdrawal of a few screws. Heaters are attached above and below each chamber by studs which do not, however, penetrate the top and bottom plates. Each under-element requires 4 KW. ; each upper one 3 KW. and 2/3 or 1/3 full heat can be employed as

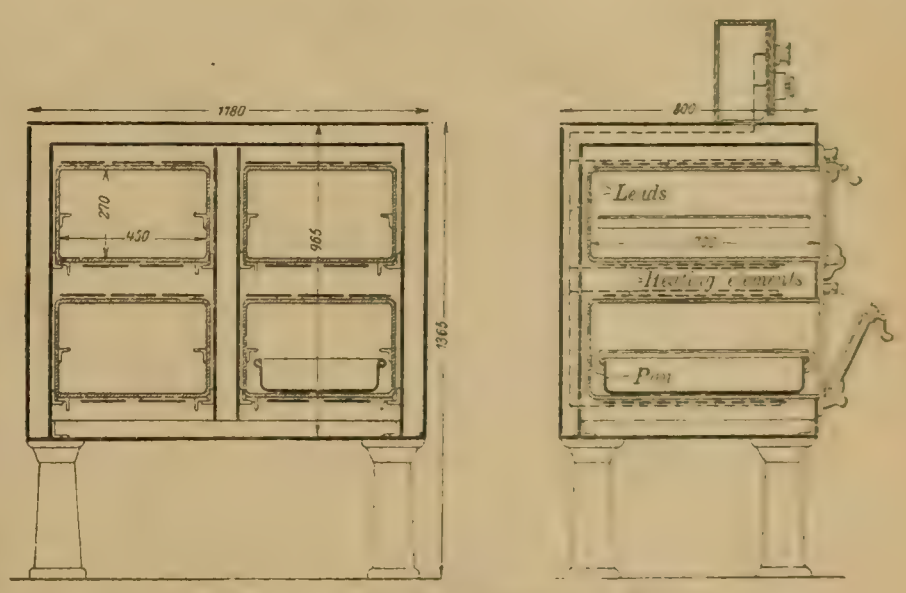


Fig. 3.—Electric Roosting Ovens.

required. On full heat, the oven can be brought to 240° C. in about 30 minutes : thereafter, the lowest heat suffices, and according to the class of cooking in hand, either the upper or the lower elements are most heated. The balanced doors can be left more or less open to permit the escape of steam, &c. The main shell is white enamelled and the attachments are nickel-plated. Four sets of four switches are mounted on a switchboard above the oven, as shown, and thence bare bus-bars are carried between the double walls to the various heating elements.

The hot cupboards (for crockery and cooked food, &c.) are provided with enclosed heating elements beneath the shelves (which are readily removed. Each section requires 1 KW. (max.), and heating is regulable in three stages ; 100° C. can be reached from cold in 40 minutes on full heat.

For the preparation of sauces and small quantities of special dishes, three double hot plates are provided. Each consumes 2 KW., and is heated by six silundum rods mounted beneath a slotted grid.

Two 44-quart (5·5 KW. regulable) copper kettles are mounted in a window recess, and from them boiling water is led into a coffee infuser. The prepared coffee is kept hot for as long as may be necessary by electric heat.

A 220-gallon tank erected above the kitchen supplies all the hot water required for cooking and washing purposes, at 60°-80° C. This is provided with a worm, and the original coal-fired circulating heating system is now replaced by two 6-KW. electric circulator hot tubes mounted immediately below the ceiling, and rendering available for other purposes the space occupied by the original coal-fired boilers.

The entire replacement of the original equipment was effected during the Easter holidays (Friday to Monday inclusive) this year. The kitchen staff quickly became accustomed to the electrical apparatus, and no hitch in the working of this important department has since been experienced.—*Elek. Zeitschrift.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

London-Made Electric Fittings.

We recently paid a brief visit to the premises in Whitfield Street, just off Tottenham Court Road, of Messrs. Abercrombie & Son. Our mission was to see in the showrooms at No. 36 some of the designs of Adam style electric fittings and metal work that were being produced in the workshops at No. 34, but we had not thought to stumble upon a mine of such interest and value as we found in the different rooms, and especially in one apartment on the top floor, where the work of skilled craftsmen of other days remains as a legacy in the business. Here, as far as possible, are classified the very large collection of actual models dating back, in some cases, nearly a couple of centuries. The Abercrombie business began its operations in the year 1720, and its record for choice work is visible on every hand. The fact that in 1794 the company first supplied the Brothers Adam with some of their original work is distinctly

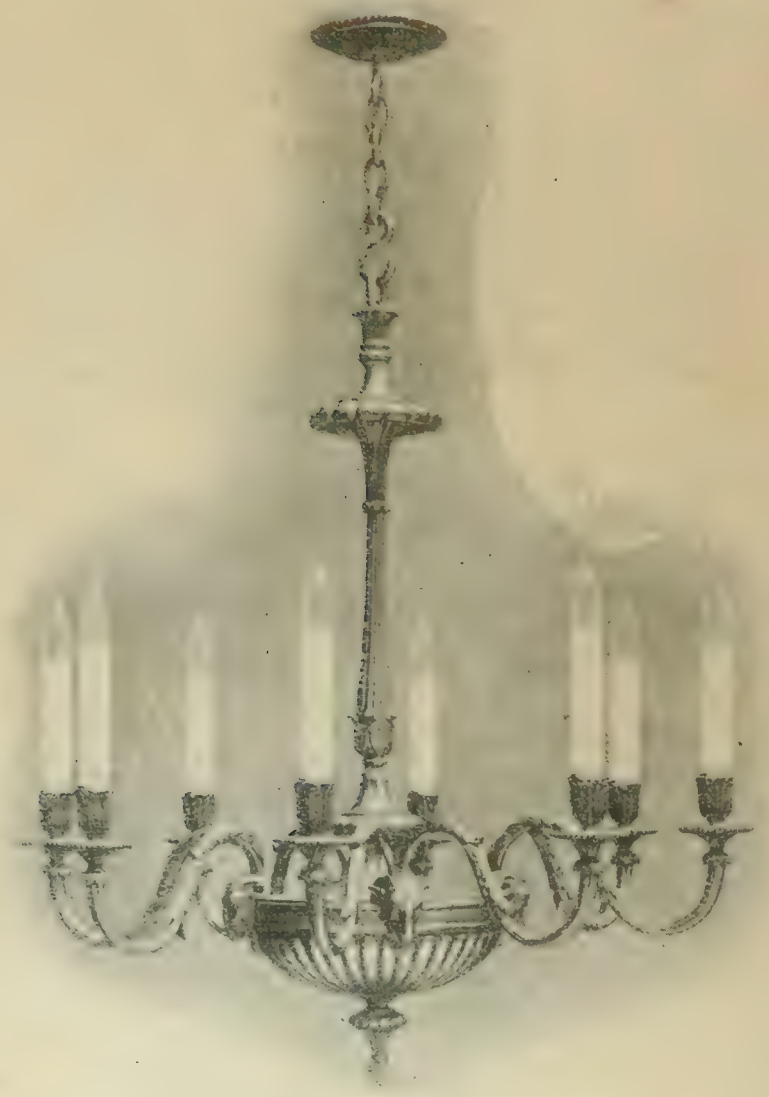
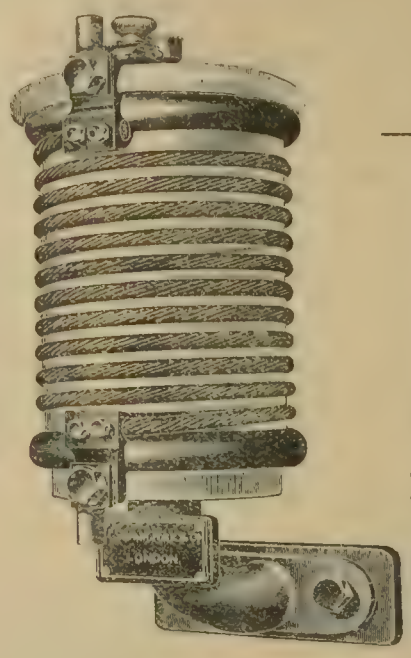


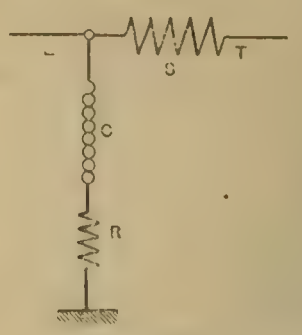
Fig. 1.—An Abercrombie Candle Fitting.

interesting. The premises are divided off into several departments, door furniture, cabinet handles, &c., predominating in one showroom, while in another are displayed a number of Adams electric light fittings, and this design being specially suited to candle-lighting, most of the specimens shown are fitted with the latest form of Lux electric candle with metal-filament lamps. Mr. A. A. Barron took over the business entirely some three years ago, though his connection with the firm of Abercrombie & Son dates further back than that. All the work shown is cast, and a strong feature is made of high-class chasing. The whole of the firm's business is done through the trade, and contracting, supply, and other firms take their clients to Whitfield Street to make their selection. Modestly away in one corner of the showroom we observed a new patent ventilator, invented by Mr. Barron, by means of which ventilators can be opened at a distance by electric control, but of this we shall publish particulars later.

New Low-Tension Arrester.

Messrs. Isenthal & Co., of Denzil Works, Neasden, N.W., have introduced a new type of electrolytic lightning arrester for circuits below 600 volts, which cannot be adequately protected by spark gaps owing to the narrowness of the gaps that would be necessary. In the new device, the principle of the aluminium arrester is retained, but the voltage which is applied to the film of oxide is reduced to one or two volts, the charging current is reduced to a minimum, and the arrester may be kept permanently on an A.C. line without heating up, and without the interposition of gaps in the circuit. These advantages are obtained by making the electrode in the form of a chain, of which each link is electrically separated by two oxide films from the next link, the total resistance of the chain being therefore very high. The chain, which is about one metre in length, is threaded through a cork-screw channel in the mass of a porcelain insulator, which is filled with the electrolyte—a mixture of pure glycerine and water. The chain thus occupies the minimum space, and cannot become entangled. On an outer insulator is wound in a spiral groove a tinned copper cable, which





L, line; S, choker; C, chain; R, resistance; T, to transformer.

Fig. 3.—Connections of Arrester.

Fig. 2.—New Low-Tension Arrester.

forms a choking coil. The apparatus is very compact, and can be mounted in the open; it weighs 13¾ lb. for currents up to 50 amperes. Fig. 2 shows the exterior of the device, and fig. 3 the connections.

Tower Wagon for South Shields.

By the courtesy of Mr. W. T. Robson, general manager and engineer of the South Shields Corporation Tramways, we are enabled to show the accompanying illustration of the tower wagon

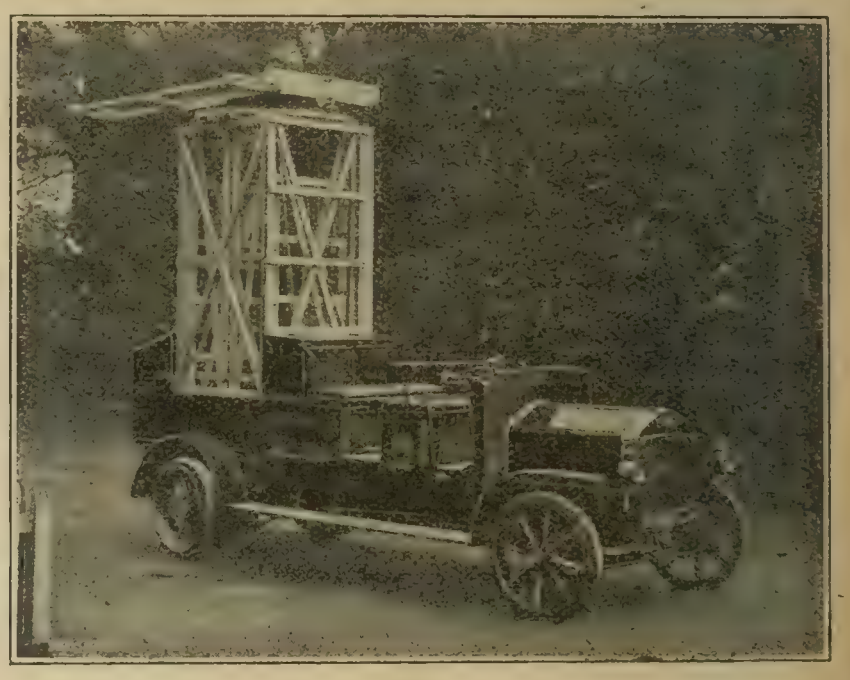


Fig. 4.—Tower Wagon for South Shields.

recently purchased by that undertaking. The chassis is a 32-H.P. Albion, and the body was built by Messrs. Rawlinson & Son, of Blackburn.

Electric Clock Movements.

Mr. C. H. Davies, of 1, Nursery View Villas, Whitton, Middlesex, recently took out a patent for improvements in electric clock movements, which is of considerable interest. There are numerous spring-driven clocks of excellent quality, which the owners would willingly convert to electric drive if a simple method of conversion



Fig. 5.—Section of Spring Drum.

were available, without discarding the bulk of the clockwork, and such a method is provided by Mr. Davies's invention, though it is not restricted to this purpose.

A difficulty met with in electrically winding clock springs is that of overwinding. Mr. Davies uses a small motor of very simple construction, geared by worm and wheel to the drum containing the spring; but instead of attaching the outer end of the spring to the internal wall of the spring drum, he leaves it free. The

pressure of the spring against the drum is amply sufficient to drive the clock train, and if the speed of the motor exceeds that necessary to keep the spring wound, the spring simply slips inside the drum, acting as a friction clutch. The gear can easily be applied to existing clocks, or can be used to drive the first, second or third wheel of a clock movement. The little inductor motor takes 0·01 watt, and can be supplied with energy from dry cells. On this system the pendulum or balance wheel is left entirely free to perform its duty of regulating the speed of the clock movement, having no electrical contacts to make.

W. & G. Electric Novelties.

Messrs. Ward & Goldstone, of Sampson Works, Salford, Manchester, who have long been known as manufacturers of a large variety of electrical accessories for lighting and power and various other purposes, have in their newly-issued catalogue of electrical novelties included a host of things in which the electrical supplies or shop counter man is interested. Massage apparatus, medical coils, electrodes, vacuum tubes, wireless telegraph sets, Morse writing apparatus, alarm clocks, pocket and hand lamps, accumulators, miniature and other metal-filament lamps, electric motors, electric horns and electric fountains—these we mention merely for the purpose of indicating the general scope of the catalogue

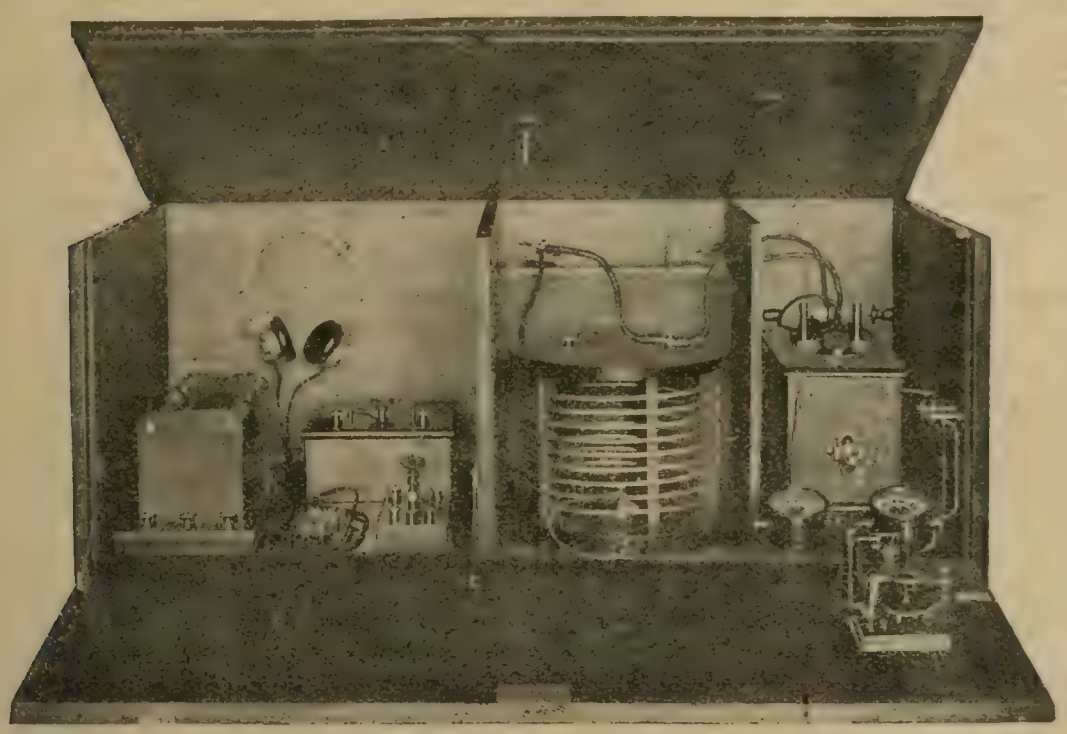


Fig. 6—W. & G. Wireless Receiving Station.

(70 pages), but there are many sundries, ranging from a complete wireless receiving and transmitting station, to toy electric light fittings for children's doll's-houses. We select for illustration here (fig. 6) one of their wireless receiving stations, which is made at a popular price, under Marconi licence. In fig. 7 we show the "Voltalsie" self-regulating electric cycle lamp, which gives an



Fig. 7.—Electric Cycle Lamp.

equally brilliant light at walking or racing speed. It has an 8-volt metal-filament lamp. The same lamp is also made suitable for motor-cycle service. The arrangement is driven by a small rubber-tired wheel which works on the rim of the cycle, and adapts itself automatically to any unevenness of the rim. By touching a lever the generator can be put in and out of contact as desired.

Brass Nut Cover.

Messrs. Robert Bowran & Co., Ltd., of 4, St. Nicholas' Buildings, Newcastle-on-Tyne, has sent us samples of the "Nesbitt" nut-cover, a stamped brass box which fits closely over a steel nut, and protects it from corrosion. The device is intended to secure the same result as a brass box nut, but whereas the latter is in most cases too expensive to be used, the "Nesbitt" cover costs but a trifle, and is easily applied. The steel nut is first treated with boiled oil, tallow, or other protective coating, and the cover is then immediately applied; as it covers the end of the bolt as well as the nut, it protects the thread from corrosion, so that the nut will not rust to the bolt, but can be removed with ease after any lapse of time.

Witton-Kramer Pedestal Grinder.

For grinding castings, for sharpening tools, and a host of other similar purposes, the self-contained electric pedestal grinder is of the greatest utility in a busy engineering shop. A tool of this description is now being manufactured in quantities by the Witton-Kramer Electric Tool and Hoist Co. (for whom the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., are the sole selling agents). It consists of a 2-h.p. totally enclosed motor, with bearings of extra length and spindle of large diameter extended at either side to carry grinding wheels. The spindle is solid, and is not an ordinary motor spindle with extension pieces driven in. The motor, which may be of either the three-phase or continuous-current pattern, is controlled by a small ironclad switch, which is conveniently accommodated inside the pedestal, and can be operated through an aperture in the casting. The wheels are effectively protected by means of sheet-steel guards. Tool rests are provided which are adjustable in several directions. The machines are designed on very substantial lines, to enable them to withstand rough treatment.

New Continuity Fittings.

Messrs. The Steel Tubes and Conduits Co., of Alice Street Works, Keighley, have put on the market a series of patent grip

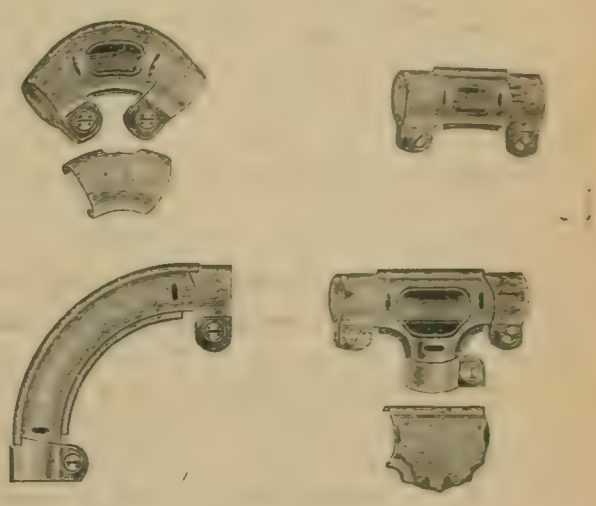


Fig. 8.—"Stacc" Steel Continuity Fittings.

fittings called the "Stacc" system, which are specially adapted for use with plain light-gauge conduits or tubes, it being claimed that an exceptionally high percentage of conductivity is obtained. Independent tests show the average conductivity of a T-joint to be over 80 per cent.; tests of an elbow similarly show 77 per cent. The fittings grip the tube all round, without cuts or loose pieces, and, being made of steel, they have a smooth interior, which cannot damage the cable like castings. Fig. 8 shows some examples of the fittings.

The "L B" Steam Trap.

Messrs. Ferguson Superheaters, Ltd., of 11, Queen Victoria Street, London, E.C., are introducing a steam trap for which special advantages are claimed. The trap consists of a copper or brass tube A, fig. 9, with a valve at one end fixed to a frame B. The inlet end of the tube is formed with a V-shaped projection C, which butts against the frame B. To the valve end of the tube an adjustable inextensible rod D is attached, this rod being connected to the frame by a thumb-screw E. When steam enters the tube this expands, and, being restrained by this rod D, the end of the frame is forced down until it engages with the top of the valve spindle and closes the valve. When the condensed water enters, the tube contracts and

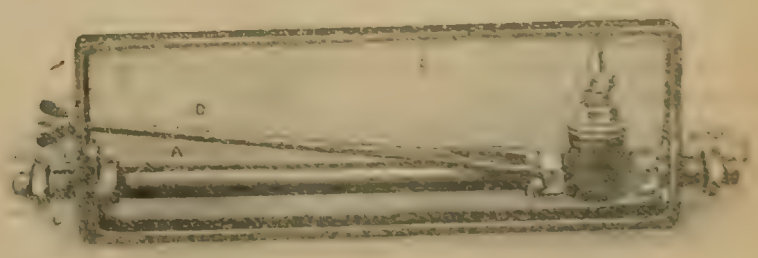


Fig. 9.—"L. B." Steam Trap.

raises the valve, and the water is discharged. The valve is easy of access, and can be taken out and examined in a few minutes. It is entirely water sealed, the sensitive action closing the valve before the whole of the water escapes, and thus diminishing the objectionable feature of valve cutting. In the "L B" trap there is no strain on the tube, as in types where the tube is fixed at one end. The trap will work in any position, requires no bolting down, and will discharge the water to a limited height. There are no internal working parts or internal springs which are liable to corrosion, and when in operation all the movements can be observed, every part being in view. It can be applied as a regulator for controlling the steam supply to feed-water heaters, calorifiers, jacketed pans, &c.

LEGAL.

Electric Wiring Prices.

On October 9th, in the West London County Court, Harraway Bros., electricians, 146, High Street, Kensington, sued Cicograni Smart, hairdresser, 142, High Street, Kensington, for £11 5s., for work done and materials supplied.

Plaintiffs' Counsel said that the defendant had had a new shaving saloon 12 ft. square × 8 ft. added to his present premises, and he asked the plaintiffs to run the electric light into the place from the main rooms. Nothing was said about the costs, and when the work was completed and the account presented, the defendant agreed all the items except two, which amounted to £4 15s.

Plaintiff said that he was not asked as to the price of the work, and completed it in record time, 56 hours. The charges were reasonable.

His Honour: Was there any contract?—Plaintiff: No.

His Honour: You say Mr. Smart asked you to do some electrical work, electric lamps and pushes?—Plaintiff: Yes, and when I sent in the bill it was not disputed, except two items.

His Honour: Does he say that you have over-charged him?—Plaintiff: Yes, he says the £4 15s. should be about £1 or £1 2s.

After further hearing of the case, H. Bonner, electrical engineer, said he had looked at the work, and thought 15s. enough for each light, and 5s. for each plug. The lights and plugs were placed on opposite sides of the room, and they might have been placed on the same side and so have saved a good deal of wiring.

His Honour gave judgment for the defendant, with costs.

La Plata Electric Tramways Co.'s Action.

[*Claim for* £10,000 *against Auditors.*]

In the Court of Appeal on Tuesday, Lord Justices Vaughan Williams, Buckley and Kennedy had before them a case involving a claim of £10,000 damages brought by La Plata Electric Tramways Co., Ltd, of Moorgate Street, E.C., against Mr. Thomas Benjamin Davis Fowler, of Clifton, Bristol, and Mr. V. G. G. Scroggie and Mr. T. E. C. Fowler, both of Buenos Ayres. The matter came before their Lordships on an appeal by the defendant Scroggie from an order of Mr. Justice Scrutton, in chambers, refusing to set aside a writ which Mr. Justice Bankes, on an *ex parte* application, had directed should be served upon the appellant out of the jurisdiction, in the Argentine.

Mr. Hugo Young, K.C., who (with Mr. E. G. Kimber) appeared in support of the appeal, said that the three defendants were partners in a firm of auditors in the Argentine. The firm carried on business entirely in that country, while the work of auditing the plaintiff company's books, in respect of which the present action was brought, was performed out there. In 1909 Mr. T. B. D. Fowler retired, and ceased to take an active part in the business of the firm, taking up his residence permanently at Clifton. There was, however, some question as to whether the dissolution of partnership was properly carried out, so that it was possible in point of law that the retired partner might be liable as a partner. The plaintiff company alleging that it had been defrauded to a very large extent by one of its own officials, brought the action against the defendants as auditors of the company's books, claiming £10,000 damages. The company contended that had the auditors exercised due care, the fraud might have been prevented. Having issued the writ in the action, the company served it upon Mr. T. B. D. Fowler, at Clifton, and then applied to Mr. Justice Bankes *ex parte* for leave to serve it upon the other defendants out of the jurisdiction.

Lord Justice Kennedy: You admit that the circumstances were such that Mr. T. B. D. Fowler could be sued for the acts of his partners?

Mr. Hugo Young: Yes. Continuing, counsel said that Mr. Justice Bankes upon reading an affidavit in support of the application, gave leave to serve the other partners out of the jurisdiction. His (counsel's) submission was that the affidavit upon which the leave was granted, omitted to set out all the material facts, and that had all such facts been stated, it would have been apparent that the cause of action arose in the Argentine Republic, that the decision of the case must depend upon the law of that country, and that the action could be more conveniently tried there.

In reply to the Court, Mr. Hugo Young explained that the present appeal was against the refusal of Mr. Justice Scrutton to set aside an order for service so far as Mr. Scroggie was concerned. As to Mr. T. E. C. Fowler, a question had arisen as to whether he was a British subject, and the application, so far as it referred to him, was at present standing over.

Mr. Holman Gregory, K.C., in opposition, pointed out that the registered offices of the plaintiff company were in London, as also was the directorate, and that one of the defendants was permanently resident in England. There was an affidavit to the effect that a trial in England would be cheaper and more expeditious than in the Argentine; and so far as convenience was concerned, all that it would be necessary to produce were the books of the plaintiff company.

Lord Justice Vaughan Williams said that, in his opinion, the appeal failed. He based his judgment on the proposition that there was not sufficient evidence that there would be any increased expense or inconvenience by reason of the trial taking place in England.

Lords Justices Buckley and Kennedy concurred, and the appeal was dismissed with costs.

BUSINESS NOTES.

Consular Notes.—France.—Writing on the subject of the electrochemical and electrometallurgical industries of his district, the British Consul at Lyons states that the year 1912 was unmarked by any noteworthy development or new departure in those industries which, however, continue to expand hand in hand with the ever-growing utilisation of water power, on which they depend. The manufacture of nitrides from bauxite, by the Seopeck process, has, contrary to expectation, not yet passed out of the experimental stage, and it is, indeed, no secret that the series of costly experiments which have been carried on for the last two or three years at the works of the controlling combination of aluminium companies close to St. Jean de Maurienne, in the Valley of the Arc (Mont Cenis road), have not been covered with the success that was anticipated, difficulties having been encountered in arriving at the high temperatures in the electric furnace necessary for the process. The Consul understands that a rival system requiring lower temperature has been invented, and will probably be exploited by another combination. The production of cyanamide—nitrates obtained from the atmosphere by means of the electric furnace—is being carried on at Notre Dame de Briancau (Isère), but on a very modest scale, very far below that of the great Swedish works at Alby. The output of the various branches of these industries in the district in 1912 is estimated as follows:—

	Tons.	£
Aluminium	9,000	594,000
Ferrosilicium...	30,000	204,000
Ferrochrome and ferromanganese ...	15,000	270,000
Calcium carbide	20,000	200,000
Carbide of silicium	1,500	54,000

An interesting development in the electrometallurgical industry is announced in the shape of the formation of a company for the production of zinc in the electric furnace by a process invented by two Frenchmen. A similar method of production is already being worked in Norway, but in France zinc ore has hitherto been treated to processes heated with coal, and owing to the heavy cost of the carriage of this fuel, of which at least three tons are required for every ton of ore, smelting has been confined to coal-bearing districts which, with the exception of Silesia, where the two minerals are found close together, are for the most part far from the deposits of zinc. The carriage of ore to the coalfields, though less costly than the transport of coal to the zinc mines, throws a heavy burden on the industry, and, moreover, necessitates the preliminary treatment of the crude ore at the mines by washing, in order that the percentage of metal contained in the ore to be transported may be as high as possible. As a result of these unfavourable conditions, the French zinc mines have hitherto been comparatively neglected, the cost of the carriage of the ore to the smelting works, even after the preliminary washing, being prohibitive at the present price of the metal; but the employment of water-power, which exists in abundance in close proximity to the zinc mines in the Pyrenees, will, it is believed, create an entirely new situation. Not only will the cost of the preliminary washing of the ore and its conveyance to distant smelting works be thus completely done away with, but it is claimed that production will be rendered more economical by the use of the electric furnace instead of coal, both in respect of the price of the actual power and the installation and upkeep of plant; while the cost of labour, which has hitherto been a factor of some importance, by reason of the special skill required to work the existing system of extraction, will be very considerably diminished owing to the simplicity of the electric process and the small number of hands needed to work it. Preliminary experiments having been successfully carried out by the syndicate controlling the patents of the new electric process in works at Arudy (Basses-Pyrénées) and Ugines (Haute-Savoie), the rights have been acquired by a company with a capital of £160,000, which has bought falls at Arrens (Hautes-Pyrénées), capable of generating 7,000 H.P., which will be conveyed to smelting works situated at Argelès within easy distance of all the principal zinc deposits in the district (Pierrefitte, Chèze, Arrens, Arre and Anglas), producing from 16,000 to 18,000 tons of ore yearly, which, it is calculated, could be doubled under more favourable conditions of transport, &c. The works at Argelès will, however, not be ready for two years, and the company, in order not to lose time, has meanwhile rented some existing works in Savoy having rights over water-power of 1,500 H.P., and conveniently situated for receiving ore for treatment. It is proposed to devote these works chiefly to the production of white zinc, for which there is a big demand in France, now that white lead is forbidden.

Sicily.—The Consul at Catania reports that the Societa Elettrica della Sicilia Orientale have practically completed their works and now produce about 9,000 H.P., partly disposed of.

Corea.—The Consul in Corea reports that there are at present 3,705 miles of telegraphic lines in that country, with 391 telegraph offices. There are also 2,172 miles of telephone lines outside of the cities, telephone subscribers numbering 8,290.

Japan.—A company, with the title the Japan Electric Furnace Industrial Co., has recently started a factory at Shimo Shibakawa, in the prefecture of Shiznoka, for the electrical production of phosphorus. The establishment is the first of the kind, and is being run on plans adopted as the result of suggestions made by the Industrial Investigation Bureau of the Japanese Department of Agriculture and Commerce, the work being carried out under the guidance of an expert from that Bureau.

Germany.—It is announced that the syndicate of German high-tension cable manufacturers have decided on the establishment of a joint sales office in Berlin.

The Erdmann Rogalski Magnet Zunderfabrik Gesellschaft is the name of a new company which has just been formed in Berlin, with a capital of £7,000, to introduce a new electromagnetic ignition system for motor-cars.

Catalogues and Lists.—Messrs. Musgrave & Co., Ltd., 35, Maddox Street, London, W.—Postal card illustrating their "Ulster" induced draught fans.

The Anglo Engineering Co., Ltd., 35, Kirby Street, Hatton Garden, London, E.C.—Twenty-page catalogue, containing illustrations and abridged specification of their electric lifts, lift controllers, warehouse hoists, &c.

Mr. E. J. Hill, 26, Stanton Road, Wimbledon, London, S.W.—Circular relating to the advertising service that he is prepared to render. Mr. Hill was formerly advertising manager for the Foster Engineering Co., Ltd., and among other firms for whom he is now acting, are the British Electric Transformer Co., Ltd., Peebles and Co., Ltd. (gas engineers), Edinburgh, and Simms Motor Units, Ltd.

Messrs. Mavor & Coulson, Ltd., 47, King Street, Mile End, Glasgow.—No. 7 Yellow Book (112 pages), containing a reprint of the firm's data cards, issued during the last seven years, with reference to the performance of Pick-Quick coal-cutters in seams of different thicknesses. The machines included are mostly electrically driven.

The "Acme" Arc Lamp and Engineering Co., 77, Fortress Road, Kentish Town, London, N.W.—Twelve-page catalogue, giving illustrations, descriptive particulars and prices of the "Acme" arc lamps and metal-filament lamps; a second pamphlet gives similar information relating to the "Acme" flame arc lamp.

Messrs. Veritys Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 754 is a 30-page pamphlet, entitled "Aston Portable Electricity." A full collection appear of different types of pocket electric lamps, small and large torches, police or service lamps, accumulator hand lanterns, miners' lamps, travelling and inspection lamps. Other contents include some electric novelties, also batteries and accumulators for the lamps referred to above. Prices are clearly shown in all cases.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—We have received a copy of the "Mazda House News," the new house journal of the B.T.H. Co., the purpose of which is to "give information on Mazda House matters and to stimulate electric lighting business." It contains in the course of its 20 pages a number of articles which the electrical contractor and tradesman will find of interest, including a list, with illustrations, of publicity literature which is available. Those who desire to receive the "News" regularly should communicate with the company's publicity department, as above.

Mr. George Wilkinson, Beech Mount, Harrogate.—Pamphlet containing illustration and particulars of the new "Losles" automatic electric water heater.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—List of electric motors in stock on October 1st.

Messrs. Landis & Gyr, Ltd., 28, Denman Street, London, S.E.—Illustrated leaflet, describing their two-rate meter, with hand control and self-contained switch.

Bankruptcy Proceedings.—W. R. Wedge, Albion Place, lately carrying on business as an electrical engineer, at the Arcade, Northampton.—At the Northampton Bankruptcy Court on Monday, before the Registrar (Mr. T. M. Percival), bankrupt appeared for his first public examination. The statement of affairs showed liabilities expected to rank £167, assets estimated to produce £77, leaving a deficiency of £90. Debtor was closely questioned by the Official Receiver with regard to his book debts. Regarding debtor's first statement of affairs, the Official Receiver said it was obviously inaccurate, and he stopped debtor from swearing to it. He had a sleeping partner who had advanced £60, and his (debtor's) tools were worth about £35. There was a loss in carrying on the business of £145, for which he could not account. Adjourned until November 11th.

Herbert William Wilson, consulting engineer, West Derby, Lanc.—First meeting October 20th; public examination, November 3rd; both at Liverpool.

An Austrian Lamp Co.—According to a Vienna report to the *Financial News*, under the auspices of the Bank of Austrian Lands (Oesterreichische Länderbank), of Vienna, the formation of the Incandescent Lamp Co. Watt, in Vienna, has taken place, the initial capital being fixed at 2,000,000 kronen.

Theatre Lighting.—With reference to our recent paragraph on Osrams at the London Opera House, the contractors for the supply of Osram lamps in this instance were the British Economical Lamp Co., of 9, Old Bailey, E.C.

"Cantie" Switches.—An advertisement has been appearing in our pages in which Messrs. Marsh, Son & Co., Ltd., are offering "Cantie" switches for sale owing to their business being wound up. Our readers are, of course, aware that the reference to winding up does not apply to the "Cantie" Switch Co., Ltd., of Nottingham, who are the sole manufacturers of these switches, the word "Cantie" being their trade mark.

Liquidation.—Cheap Power Supply and Engineering Co., Ltd.—This company is winding-up voluntarily with Mr. W. T. Green, 33, Lloyd Street, Manchester, as liquidator. A meeting of creditors is called for October 22nd at 77, Fountain Street, Manchester.

Book Notices.—The October issue of the *Faraday House Journal* contains an article by Mr. F. T. Chapman on the Amsler Planimeter, biographical sketches of Mr. G. Scott Ram, Mr. Bernard Sankey, and Mr. G. H. E. Vivian, and an account of high-tension transmission of electrical energy by Mr. E. Fries-Smith. The Wolseley Tool and Motor-Car, Ltd., has been added to the list of firms associated with the Institution.

"Gas Works Directory and Statistics, 1913-1914." London: Hazell, Watson & Viney, Ltd. Price 10s. 6d. net.

"Science Abstracts." Sections A and B. Vol. XVI, Part 9. September 29th, 1913. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Transactions* of the University of Toronto Engineering Society." September, 1913. Toronto: The Society.

"*Journal* of the United States Artillery." Vol. XL, No. 2. September-October, 1913. Fort Monroe, Va.: The Coast Artillery School Press.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXV, No. 10. October, 1913. New York: The Society. Price 35 c.

"Melting Points of the Refractory Elements," by G. K. Burgess and R. G. Waltenberg; "The Silver Voltameter," Part III, by E. B. Rosa, G. W. Vinal, and A. S. McDaniel. Washington: Government Printing Office.

"Annales des Postes, Télégraphes et Téléphones." September, 1913. Paris: A. Dumas. Price 10 fr.

"Recherches Experimentales sur le Coupage des Fers et Aciers par les Chalumeaux à Jet d'Oxygène." By R. Amédéo. Paris: Union de la Soudure Autogène. Price 3 fr.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. September, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 7. July, 1913. Paris: Gauthier-Villars. Price 5 fr.

Trade Announcements.—The Midland Electric Manufacturing Co., Ltd., of Stafford Works, Rea Street South, Birmingham, announce that Messrs. S. T. Pemberton & Co. have now ceased to represent their interests in the Midland Counties, and pending fresh arrangements inquiries should be sent direct to the head office, as above.

The Electrical Supplies Co. have commenced business at 4, Cheapside, E.C., as wholesale dealers in electrical apparatus. They desire to receive catalogues from manufacturers, with factor's discounts, &c.

Mr. T. G. Poole announces that having severed his connection with Mr. Mabbs as from October 1st, he has taken premises at 16, John Dalton Street, Manchester, where he will trade as T. G. Poole & Co. as a wholesale electrical supplier, and will hold large stocks of switches, lamps, carbons, &c.

Messrs. Guest & Co., of the Great Cornbow Works, Halesowen, have added to their business an electrical engineering department, with Mr. G. H. N. Reay as engineer and manager.

Messrs. Haseltine, Lake & Co., chartered patent agents, ask that all communications for them should be addressed to 28, Southamptom Buildings, Chancery Lane, W.C. Though they have been in these offices for the last six months, letters are still incorrectly addressed.

Fire.—A fire has occurred in a sawmill at the premises of Messrs. S. Bill & Co., Ltd., manufacturers of electrical accessories, 146, Queen's Road, Aston, Birmingham. The roof was seriously damaged, and we understand that, in consequence, the department affected will be stopped for a week or two.

Swiss Imports of Electrical Machinery.—The value of the foreign electrical machinery imported into Switzerland last year amounted to £59,160, as compared with only £40,640 in 1911. How largely the trade is in German hands may be judged from the fact that Germany's share of the 1912 total was no less than £54,440.

Lamp Works in the Argentine.—The *Review of the River Plate* publishes the following:—"J. Reviriego, an Argentine citizen, has applied to Congress for a temporary privilege to establish a metallic-filament electric lamp factory. He asks for freedom of duties on the necessary machinery to the value of $50,000, and also on the raw material which is not to be found in the country. We strongly recommend representatives of incandescent lamp manufacturers to take the necessary steps to protect their patent rights and also their trade marks, if they have not already done so."

LIGHTING and POWER NOTES.

Accrington.—Public Lighting and Plant Extensions.—A Committee of the Corporation has decided to try the experiment of lighting Green Haworth district with electricity.

By invitation of Ald. E. Higham, chairman of the Electricity Committee, the members of the T.C. visited the electricity works last week. Ald. Higham gave a detailed explanation of the working of the gas plant, as compared with the steam plant, and said that as the whole plant was now fully occupied it was absolutely necessary to move at once to increase it. The Committee, he said, had

already instructed the borough engineer to get out plans and estimates for utilising the engine house to its full extent, and it was decided that the electrical engineer should prepare plans and estimates for the extension of the gas-making plant and engines, for the duplication of the present installation.

Argentine.—There is a movement on foot in Azul to form a co-operative electric light company. The contract for the public lighting held by the Cia. de Eléctricidad de la Provincia de Buenos Ayres shortly expires, and it is not yet known if it will be renewed. The Commissioner is consulting with the leading inhabitants on the subject.—*Review of the River Plate.*

Ayrshire.—Prov. Order.—The C.C. has received an intimation from the Ayr T.C. that it is promoting a prov. order for the supply of electricity in the districts of Prestwick and Alloway. The Law Committee has recommended the C.C. not to consent to the application.

Bangor.—The City Council has agreed to an increase of 2d. per unit in the price of electricity for lighting purposes. Alderman Bayne reported that improvements in electric lamps had led to a reduction of 20 per cent. in the consumption of energy, and the E.L. Committee considered it necessary to increase the price.

Bournemouth.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of £1,600 for lighting by electricity the Undercliff Drive and the West Undercliff Parade. The work is to be put in hand with as little delay as possible.

Bradwell (Staffs.).—Hospital Lighting.—It has been decided to have the extensions to Bradwell Hospital, to be carried out at a cost of £7,500, lighted by electricity instead of by oil.

Bulkington.—Prov. Order.—The Midland Electric Light and Power Co., Ltd., is applying to the B. of T. for a prov. order in the area of the U.D.C. Powers for supplying the district are already possessed by the Leicestershire and Warwickshire Electric Power Co., Ltd.

Banbridge (Ulster).—Having failed to obtain a prov. order, the Council has decided to advertise for tenders for a three years' contract for lighting the public streets by gas or electricity. In case the tender accepted is for lighting by electricity, the contractor is to have the right to supply current for private consumption.

Burnham (Somerset).—A special meeting of the U.D.C. was held to meet Dr. J. A Purvis, who is responsible for the electric light scheme. Dr. Purvis withdrew by letter a communication to the effect that unless the capital required were reduced by about £1,000, by using overhead wires instead of underground mains, the company could not be floated. A second communication stated that the shares required had been taken, the company would be floated, and the original scheme of underground mains would stand. The scheme would therefore go on as before, the Council having expressed its agreement.

Carnarvon.—In reply to correspondence between the T.C. and the National Electric Construction Co., the latter states that it has up to date lost £7,000 on the working of the undertaking. Early last month the company circularised its customers to the effect that the price of current for lighting would be increased from 5d. to 6d. per unit after the 25th ult. The Electricity Committee of the Corporation then instructed the town clerk to write to the company reminding it of a statement that it would not be likely to increase the price beyond 5d. per unit. In reply, the company's manager stated that had the conditions remained the same as they were in 1904, the price would not have been raised. The company had lost up to date £7,000 after paying the sinking fund and interest instalments. It was as much in the interests of the Corporation as of the company that every attempt should be made to put the undertaking into a position to earn a profit to cover at least the capital charges. The Council at its meeting received a recommendation from the Electricity Committee that the company be informed that the increase in the price was against the best interests of the undertaking, which contention derived support from the managing director's statement in 1904, that if the undertaking would not pay with electricity at 5d. per unit, it certainly would not pay at 6d. A proposal was made that a committee be appointed to inquire into the relations of the Corporation and the company, but this was defeated, and the Committee's report was adopted.

Connah's Quay.—The U.D.C. has accepted an offer made by Mr. Leigh to inspect the district and report upon a scheme for electric light for the town at a fee of three guineas.

Crowle.—Public Lighting.—The U.D.C. has decided to ascertain from small towns where electricity is used for public lighting, particulars of the cost, &c. This is in response to an offer from a firm at Bradford to advise the Council on the question.

Dover.—The Electricity Committee of the T.C., on October 7th, received a communication from the South-Eastern Electric Power Co., stating that it was considering the question of supplying the neighbouring towns, works, &c., with electricity in bulk, and would be glad to include Dover in the scheme. It expressed the opinion that it would be able to supply current at such a price as would obviate any deficiency in running the undertaking, and also to the advantage of consumers. It was stated that the company had got a small plant for its own use at Tilmanstone, near Dover. The chairman said that the engineer had better find out when the company would be able to give the suggested supply. The engineer said they would have to make considerable alterations before they could take three-phase current at 50 periods. The company would bring current to the town at 11,000 volts, and the Council would have to transform it to 2,000 volts. It would mean an expenditure at the works of £4,500, and he should like to have independent advice. The Committee deferred further consideration of the question, so that the engineer could get fuller particulars from the company.

Durham.—A Colliery Power Scheme.—It may be remembered that in 1907 the Durham Collieries Electric Power Co. arranged with the Newcastle-upon-Tyne Electric Supply Co. and the associated companies to operate and maintain the Philadelphia power station, increasing the capacity from 6,000 KW. to 10,000 KW. The Philadelphia station has now been purchased by the Lambton and Hetton Collieries, Ltd., and the colliery company is removing five of the turbines and installing three A.E.G. machines, each of 6,000 KW. capacity, at '75 power-factor, running at 2,400 R.P.M. It is anticipated that the thermal efficiency of the station, when operating these new sets, will be at least as favourable as at any other station operating under similar conditions, the steam consumption figures guaranteed being exceptionally low. An interesting feature of this scheme is that an arrangement has been entered into with the Newcastle-upon-Tyne Electric Supply Co., whereby it is to supply the labour for the operation of the station and also to provide a stand-by supply to the colliery company from the network of cables at Philadelphia. Hitherto, the Lambton and Hetton Collieries, Ltd., have purchased the power for their important group of collieries from the Durham Collieries Electric Power Co., and in order to ensure greater reliability the stand-by required at the station is to be provided from the network of the Newcastle-upon-Tyne Electric Supply Co. and its associated companies, instead of putting down additional spare plant at the Philadelphia station. The boiler plant is to be completely re-arranged and enlarged, but the contracts for this work have not yet been placed. The new arrangement will come into force in January, 1915.

Eastbourne.—The T.C. has decided to purchase a steam coal wagon, at a cost of £550, for the use of the electricity department.

The Guardians have decided to install electric light in the infirmary.

Eastleigh.—Proposed Electricity Supply.—The Electricity Sub-Committee of the Southampton T.C. has informed the U.D.C. that it will be willing, on obtaining a prov. order, to include Eastleigh and Bishopstoke in the area of supply, and that subject to the maximum supply prices clause, &c., the price of current would be a flat-rate of 4d. per unit for private and shop lighting; for power, 10 per cent. above the existing rates at Southampton; and for heating and cooking 1d. per unit, and provided that the public lighting was converted to electricity in all the streets along which the mains would be laid, the charge for public lighting would remain as at present.

Falkirk.—The Callander Coal Co. is equipping the new colliery at Slamannan with up-to-date electrical machinery for coal-cutting and pumping.

Glasgow.—Bailie Smith and Mr. Lackie, the city electrical engineer, have returned from their tour in Canada and the States, and will report to the Corporation in due course. It is said that both gentlemen were impressed with the much greater use that is made of electricity on the other side of the Atlantic.

Gelligaer.—Prov. Order.—The District Council has decided to apply for a prov. order for lighting the wards of Bedlinog and Fochriw with electricity.

Harwich.—The T.C. has raised a loan of £3,370 for the electrification of the pumping station.

Hebburn-on-Tyne. — The Cable Question.—At a meeting of the U.D.C., on the 13st inst., the General Purposes Committee reported that the clerk had again written to the Northern Counties Electricity Supply Co., Ltd., in regard to the condition of the cables in the district and the further fusings that had taken place, and had received a reply setting out the advantages that would be derived from the change-over to the A.C. system, and stating that when the change-over had been made, the supply in the district would be much improved, and that the unfortunate occurrences complained of would cease. A letter had also been received from the B. of T., to the effect that the Board proposed to hold a general inquiry as soon as possible, in regard to the particular method of laying cables in Hebburn and certain other districts, and that experiments were being made on samples of bitumen used in these districts. The Council decided to employ an expert to inspect the mains, and to report to the Council, and, if necessary, to attend the inquiry in London.

Herstmonceux (Sussex).—Electric Cooking *ad lib.*—A supply of electricity for cooking at this village has been provided by Mr. C. W. Von Roemer, who undertakes to fit an electric stove in any house in the parish free, and to supply current at 1½d. per unit. The offer has been liberally accepted.

Holmfirth.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £8,000, for the purpose of generating and distributing electricity.

Hull.—Prov. Order.—The City Council sanctioned on the 9th inst. an application to the L.G.B. for a prov. order to supply electricity to the village of Sutton.

Knaresborough. — Hydro-Electric Scheme. — The U.D.C. has had under consideration the question of erecting plant for the supply of electricity to the old town, and at the last meeting of the Council approval was given to a scheme which proposed to utilise the waters of the Nidd. The Council owns a mill and dam at the foot of Castle Hill, and it is suggested that the necessary outlay should be made on these premises, and the machinery installed.

Leeds.—The Roundhay E.L. Purchase.—At the last meeting of the City Council consideration was given to a recommendation of the Finance Committee that the Corporation should purchase the Roundhay and District Electric Lighting Co. for £17,000, but, after some discussion, it was resolved to refer the matter back to Committee. The reason for this decision was that several members of the Council objected to the large amount of money it was proposed to pay for a concern which, it was stated, had only commenced paying dividends four or five years ago, and since then had only averaged 1 per cent. The price proposed to be paid worked out at £137 per £100 value of the company's stock, and it was stated that the lamps would have to be replaced, and that the great bulk of the mains were useless.

Lincoln.—L.G.B. Inquiry.—An inquiry was held on October 9th into the application of the T.C. for a loan of £10,850 for a refuse destructor. There was no opposition.

Liverpool.—A preliminary report on electric supply in the city, states that there are about 9,700 consumers connected to the supply mains, compared with 8,938 a year ago, and the supply during the current year shows an increase of over 12 per cent. on the quantity supplied during the corresponding period of last year, being an increased output of 3,000,000 units for the eight months, as against 2,200,000 units for the previous 12 months. During this year the demand for electrical energy for power purposes has been most satisfactory, as applications have been received for the supply to over 3,500 H.P., and in several cases an alternating-current three-phase supply is to be given through a sub-station provided on the consumer's premises. The increased revenue for the six months ending June over the corresponding period of last year was about £10,000. Out of the profits of the business, the sum of £707,330 has been set aside towards repayment of capital, and £300,000 to reserve against depreciation and other contingencies. In addition to this, £235,000 has been allotted to the relief of rates, the contribution to this object for the current year being over £30,000.

To assist small power users to adopt electrical energy, motors are supplied on the hire-purchase system, and to encourage the use of electrical energy for domestic and other purposes, suitable apparatus for heating and cooking is supplied on the same system.

The electric lighting of the Liverpool Exhibition has been carried out by the department, and the exhibit in conjunction with the electrical contractors of the City, is expected to produce beneficial results, as the demonstrations given in connection with cooking and heating have created great interest in the use of electricity for these purposes.

The reconstruction of the Lister Drive No. 1 power station is making satisfactory progress, and it is hoped to have the water-tube boilers, which are to replace the Lancashire boilers, under steam in the early days of next month. There are also on order two 6,000-KW. turbo-alternator sets which are not due for delivery until the middle of next year. The reconstruction of the Pumpfields power station is now in hand, and three rotary converters are expected to be in service before the close of the year.

Llandudno.—The Pier Co. has decided to proceed with a scheme for the combined heating and ventilation of the Pier Pavilion by electricity.

Loftus.—Public Lighting.—The U.D.C. has decided, subject to an approved agreement, to take a supply of electricity for public lighting from Messrs. Pease and Partners.

London.—Hammersmith.—The E.L. Committee reports having had under consideration the advisability of organising an electrical exhibition in connection with the Council's undertaking, but upon going into details, it thinks that it is extremely doubtful whether the trading returns of an exhibition would be satisfactory unless a much larger sum was expended than the £300 proposed. Under these circumstances the Committee does not propose at present to submit any proposal for organising an exhibition.

Stepney.—Application is being made to the L.C.C. for the advance on loan of £15,000 on account of extensions at the Limehouse generating station.

Loughborough.—L.G.B. Inquiry.—Mr. H. R. Hooper held an inquiry last week into the application of the T.C. for sanction to borrow £14,000 for the extension of generating plant. Mr. Hooper first criticised the method of keeping the accounts, which he contended were misleading and not in conformity with the L.G.B. requirements. The engineer explained that it was intended to install a Ljungström turbine and alternator for H.T. supply, and a rotary converter to link up the new plant with the old, and some discussion ensued with the Inspector as to the advisablity of installing a comparatively new type of turbine in a place like Loughborough, when other well-tried designs were available. It was pointed out that two of these turbines (the construction of which was described in the Elec. Rev. last week) are on order for the Luton Corporation. The Inspector further pointed out that the Council had not followed the recommendation to appoint separate committees for gas and electricity.

Malta.—It is probable that the electric lighting scheme will be extended to the suburban villages of Valetta. Some time ago the Government proposed to extend the electric lighting to most parts of the island, but this scheme was abandoned on the question of cost. The superintendent of the electric lighting department, in his annual report, says after allowing for interest on capital and rent of the central station, the net profit for the year amounted to £6,426, or 8·12 per cent.

Manchester.—A new G.E.C. 100-H.P. three-phase electric motor has recently been installed at the works of Crossley Motors, at Gorton, Manchester; the machine runs at a speed of 750 R.P.M., and transmits its power to the line shafting through nine ropes. A transformer station with switchgear has also been installed, the necessary current being taken from the Corporation supply mains at 400 volts.

New Zealand.—Messrs. J. J. Craig, Ltd., Auckland, are claiming £148,746 from the City Council as compensation for land taken for, and injuriously affected by, the city electric power station.—*British Australasian.*

Norwich.—L.G.B. Inquiry.—On Tuesday, Mr. T. C. Ekin held an inquiry into an application by the T.C. to borrow £25,000 for the purposes of its electricity undertaking. Since the T.C. acquired the undertaking a profit of £51,919 had been realised; of this amount £37,855 had been applied to depreciation. The inspector said the statement was interesting; the only black spot appeared to be a contribution of £1,200 of the profits in reduction of rates in 1909.

Perth.—Opening a three days' exhibition of electrical cooking, heating, and other appliances, Lord Provost Scott remarked that they owed the exhibition very largely to the energy and enthusiasm of Mr. M'Cracken, convener of the Electricity Committee, backed up by the manager. Speaking of the small cost of the articles on view his Lordship reminded the audience of the offer made by the Corporation by way of concessions to those already using electricity for illuminating purposes; it would be a very easy matter to attach the wiring for the purposes of cooking, &c.

Ramsbottom.—Experimental Lighting.—In Bolton Road West six lamps lighted by gas and six lighted by electricity, have been placed in position for experimental purposes.

Redcar.—Prov. Order.—The B. of T. has asked the U.D.C. for its observations regarding the proposed revocation of the E.L. order granted 13 years ago, and later purchased from the Council by the Cleveland and Durham E.P. Co. The Council has replied that it does not wish the Order to be revoked if the company will give an assurance to take action under it within the next two years.

Rushden (Northants).—A Sub-Committee which has had under consideration the question of motive power for the ejector plant has reported, after obtaining estimates, that the cost of installing the various plant would be as follows:—Oil, £78; electric, £72; gas, £45. Having regard to the intermittent use the plant will be put to, the Sub-Committee recommended the adoption of electric power as the most convenient and suitable for the purpose. The cost of current will exceed the cost of gas, but the saving of expense in attendance will more than compensate for this. The U.D.C. has confirmed the recommendation and accepted the tender of the Rushden and District Electric Supply Co., Ltd., for the work.

Sheffield.—Colliery Power Plant.—At their Waleswood Collieries, near Sheffield, Messrs. Skinner & Holford, Ltd., are extending their electrical plant, consisting of two 250-KW. B.T.H. mixed-pressure turbo-generators, by the installation of a 750-KW. mixed-pressure turbo-generator of the same type, whilst a central condensing plant of the barometric jet type, capable of dealing with the exhaust steam from these turbines, is being provided by Messrs. Mirrlees. The turbines will be operated by exhaust steam from the winding engine, compressors, fan engine, &c., and the whole installation when completed will represent a plant of considerable size. It is anticipated that the cost of production of current will not exceed ·15d. per unit after providing for interest and depreciation. The electrical output obtained from this generating plant will be utilised for operating two main rope haulage gears which have recently been installed, each of 350 effective H.P., and for driving the motors in connection with the new Simon-Carves coke-oven plant which has recently been erected at the Waleswood Collieries. The scheme is being carried out under the supervision of Mr. W. C. Mountain, as consulting engineer.

Slaithwaite.—Prov. Order.—Consideration is being given by the U.D.C. to the matter of applying for a prov. order authorising the Council to generate and supply electricity.

Somerby.—The Melton Mowbray R.D.C. has given the local E.L. Co. permission to use overhead lines in the village of Somerby.

South Africa.—In connection with the Wellington (Cape Province) electric light installation which is now in process of erection, the municipality has adopted the system of municipal wiring. Tenders were called for the work, and the contract has

been given at the rate of 19s. per point for slip-joint conduit on the surface, with additions at schedule rates for screwed conduit, concealed work, &c. The lowest tender was 18s. per point.

St. Anne's-on-Sea.—The E.L. Committee has decided that the Lytham Council be informed that the question of a bulk supply of electricity is so involved that only by a personal interview is there any likelihood of a mutual arrangement.

Stretford.—Loan Sanction.—Sanction has been received to the borrowing of £5,000 for distributors and services, and £2,000 for motors.

Sturry (Kent).—Proposed Water Power Scheme.—A public meeting was held on October 8th to discuss the proposed electric light scheme for Sturry, Fordwich, Westbere and Broad Oak. Mr. Colin Campbell, promoter of the scheme, stated that it was proposed to utilise the water-power at a local flour mill, which was at present running to waste. It was decided to have details of the scheme circulated with a view to a local company being formed.

Sunderland. — Electric Pumping Plant.—Messrs. S. P. Austin & Son, Ltd, have decided to remove the existing gas-driven centrifugal pumps at their Wear Dockyard, and replace them by an electrically-driven plant. It is proposed to install two Gwynne centrifugal pumps, running at 410 r.p.m., driven by Westinghouse three-phase slip-ring motors, and these will be capable of pumping from the dock about 7,000 tons of water in 14 hours. The current will be taken from the mains of the Corporation. The work will be carried out under the direction of Mr. W. C. Mountain, consulting engineer.

Towyn and Aberdovey.—The U.D.C. has under consideration a report by a sub-Committee appointed to meet Mr. Haydn Jones, M.P., and arrange terms for an electric lighting scheme for the district.

Tynemouth.—Proposed Loan.—Application is to be made to the L.G.B. for sanction to borrow £3,000 for mains and £500 for services required during the next three years.

Wakefield.—Street Lighting.—The Lighting Committee has decided to light Barnsley Road, from Milnthorpe Green to Newmillerdam, by electricity.

Warrenpoint.—Proposed E.L.—The Urban Council has decided to consult a firm of electrical engineers with a view to having the town lighted by electricity.

Watford.—At the last meeting of the R.D.C. a letter was read from the Aldenham P.C., asking the R.D.C. to urge the Watford U.D.C. to include Aldenham in the area of the proposed prov. order. The consideration of the matter was deferred until the next meeting.

Weston-super-Mare.—Street Lighting.—The U.D.C. proposes to have the Boulevard and Waterloo Street lit by electricity in place of gas, and has asked the E.L. Co. to quote terms for the supply of current.

Whitehaven.—The T.C. has offered to renew for another 10 years, on the same terms as at present, the contract with the B. of G. for the supply of current to the workhouse.

Windsor.—Public Lighting.—The T.C. has accepted the tender of the Windsor Electrical Installation Co., Ltd., to supply 31 three-light metal-filament lamps for public lighting at £14 each per annum for five years at the expiration of the existing contract, which is at £18 per lamp.

Wolverhampton. — L.G.B. Inquiry. — Mr. H. R. Hooper held an inquiry last week respecting an application by the T.C. for sanction to borrow £22,000 for the purposes of the electricity undertaking. The Town Clerk explained that the present application was for the purpose of increasing the equipment of the works, and that £15,000 was for mains extensions, £5,000 for sub-station equipment, and £2,000 for E.H.T. switchgear. It was possible that very shortly another inquiry might have to be held in respect of a further sum of £30,500 for buildings, steam generating plant and other work. Of late several feeders in the town had been considerably overloaded, and the greatest difficulty was experienced in keeping up the voltage in those neighbourhoods. The Council were very anxious to push on with the work affected by the present inquiry, and equally anxious about the other scheme mentioned. The Inspector examined the details supplied, and the inquiry terminated without opposition. The £35,000 scheme includes one 4,000-kw. turbo-alternator, two water-tube boilers, one 1,000-kw. rotary converter, switchgear, &c. In the course of an exhaustive report presenting this scheme to the Corporation, Mr. S. T. Allen, the borough electrical engineer, remarks that the rapidly increasing demand for electricity supply for all purposes is gradually loading up the present generating plant at the Commercial Road Works, and it is very necessary that preparations be made at once to cope with the extra load which it is estimated will be experienced in the winter after next. The total capacity of the generating plant, including all that at the destructor works, and also that part of the old plant at Commercial Road, which is fast becoming obsolete, is 8,200 kw. The estimated maximum load to be provided for next winter is 6,260 kw., which will allow 1,940 kw. of spare plant. It is estimated that during the following winter the maximum load will be at least 7,260 kw., leaving only 940 kw. of spare plant, which would be totally inadequate. On account of the time taken by manufacturers to make and deliver such generating plant as would be required, it is very essential that tenders be invited and orders placed as soon as possible.

In July an Electrical Exhibition was held at the time of the Floral Fête, and advantage was taken of the opportunity to introduce the new domestic tariff for heating and cooking purposes:—15 per cent. of the rateable value and ½d. per unit for all electricity consumed. In addition, a series of lectures and demonstrations in electricity cooking was held daily during the first two weeks in September. We understand from Mr. Allen that the result of these two exhibitions, together with the introduction of the new system of charging, has been to flood the department with a tremendous number of orders, which demonstrates to a marked degree the success of the efforts in popularising electricity for this purpose, and proves again the value of advertising, as without doubt the money expended has been well laid out. The applications for connection for power purposes keep the department very busy, and one of the largest increases in the H.P. connected during any quarter will be recorded for both the June and September quarters. It is interesting to note that in Wolverhampton the number of units sold per head of population is now one of the highest in the kingdom.

Worcester.—At a meeting of the City Council, on Tuesday, the E.L. Committee recommended that certain changes should be made at the Powick station by which they hoped to increase the amount of current generated by water power. Ald. Parker said their output was increasing to a large extent, and at present the water power was useless to cope with it. The chairman of the Committee said the undertaking now had to pay 14s. 2d. per ton for coal, but in 1905 it was 9s. a ton. As they were giving orders for 5,000 tons it was a serious matter. Ald. Walter Caldicott said he now thought they should dredge the river at that point. The value of the work would be worth the expense. He regarded the water power as the saving clause in the electricity undertaking.

Worksop.—Workhouse Lighting.—The Guardians have decided to substitute electricity for gas in the illumination of the workhouse. Mr. Hartland said that while 86 gas lights in the workhouse cost £32 per year, 221 electric lights in the new infirmary only cost £47.

TRAMWAY and RAILWAY NOTES.

Australia.—It is stated in the Press that the Bill authorising the construction of an underground railway and tramways in Sydney, at an estimated cost of £4,800,000, has been thrown out.

Bournemouth.—Tramway Loan.—The T.C. has applied to the B. of T. for a loan of £7,556 for the construction of a double line of tramway between the cemetery and Winton.

Bradford.—The Markets Committee is urging the tramways department to continue and improve the North Park Road service in lieu of withdrawing same. At the last meeting of the T.C., the clerk reported with reference to the terms of the draft lease of the Bingley tramway, that the B. of T. had signified its willingness to endorse its consent on the lease. Tenders are invited for a supply of the chassis required for 28 trolley vehicles. With regard to the purchase of special motors for use on cars between Bradford and Leeds, the Council has decided to obtain 20 Dick, Kerr Standard 40-H.P. motors at £104 each.

Continental Notes.—France.—The Conseil Général of the Department de la Manche, at its last meeting, considered the question of the construction of the second network of local railways, the working of which by electricity has been advocated by the engineer-in-chief in his report. The Commission des Chemins de Fer, after hearing the report, adopted in principle the electrification of the projected network, subject, however, to a detailed and favourable report as to the existence of available waterfalls in the Department. This question is, therefore, to be considered at the next session of the Conseil Général.—*Revue Pratique de l'Electricité.*

A new section of the Metropolitan Electric Railway in Paris—that between Beaugrenelle and Auteuil—has just been completed, bringing up the total length of the lines in operation to 48¾ miles.

Russia.—The Russian State Railway authorities are reported to be preparing plans in respect of a projected electric railway between Moscow and Wosnessensk.

The tramway employés who have been on strike in Moscow returned to work on the 9th inst., and traffic over the system was resumed.

Edinburgh.—The Tramways Committee, after considering a report by the burgh engineer, recommends the Council to extend the tramways to Corstorphine at a cost of £12,500, and to proceed with the scheme for extending the tramways to the Redford and Dreghorn districts.

Greenock.—The Corporation is to obtain a report from its Parliamentary agent on the question of the Greenock and Port Glasgow Tramway Co.'s accounts in relation to the proposal to municipalise the undertaking.

Leicester.—The T.C. has applied to the L.G.B. for a loan of £5,700 for the provision of six new tramcars.

Liverpool.—The Tramways Committee on the 10th inst. agreed to advance the wages of the whole of the outdoor staff, including inspectors, motormen, conductors and shed assistants. The men to receive increases will number 1,800, and the extra cost will exceed £6,000 a year. In a report presented by the Committee, it was stated that the increased revenue for the six months ending June, over the corresponding period of last year was about £10,000.

Manchester.—Mr. J. M. McElroy, general manager, presented a report to the Tramways Committee on Tuesday, showing the results of the last half-year's working. During the period from April to September the mileage run was 9,769,574, an increase of 324,047. The passengers numbered 102,144,962, an increase of 9,926,230. The energy used was 14,673,871 units, compared with 15,400,798 for the corresponding period last year, and the units per car-mile were 1·502, as compared with 1·630. The revenue per car-mile was 11·561d., as compared with 11·369d., and the working expenses per car-mile were 7·036d., as against 7·002d. The total income was £470,754, compared with £447,605, an increase of £23,149; the total working expenses were £286,477, as compared with £275,661, an increase of £10,816; the gross profit was £184,277, as compared with £171,944, an increase of £12,333; the charges for interest, sinking fund, renewals, &c., were £115,176, compared with £112,430, an increase of £2,746; and the net profit was £69,101, as compared with £59,514, an increase of £9,587.

The Tramways Committee intends to seek powers to run omnibuses along roads outside the city where tramways are either owned or leased by the Corporation, or over which the Corporation has running powers.

Newcastle-on-Tyne. — New Tramways. — The City Council will consider at an early date the question of promoting a Bill to acquire powers to extend its tramway system to Forest Hall station, in the Longbenton Council area.

Oldham. — The tramway receipts to date show an increase of over £4,000, as compared with the corresponding period of last year.

Preston.—New Tramways.—The Tramways Committee decided on the 8th inst. to promote a Bill authorising considerable extensions to the tramway system.

Prestwich.—At a special meeting of the District Council a resolution was ratified that the clerk give notice to the Salford Corporation that for the future, the arrangement under which the Council accepts £200 a year in lieu of its share of tramway profits be discontinued, and that the Corporation furnish the Council with a statement of accounts provided for by the lease.

Ramsbottom.—It is stated that the railless trolley vehicles are giving a steady and very satisfactory financial return—one which should ensure that there will be no burden on the rates in consequence of the step taken by the Council.

Southport.—The question of running cars on the railless trolley system is to be investigated, and a sub-committee is to visit Leeds to see the system in operation, and to interview Mr. Hamilton, the tramway manager.

Trafford Park (near Manchester).—At the annual meeting of Trafford Park Estates, Ltd., last week, the chairman referred to the development of the estates, and said the immediate need was tramway connection with Stretford, Urmston, Davyhulme and Patricroft.

York.—At a meeting of the City Council on the 13th inst., a report was submitted by the Tramways Committee that extensions be made to the Hull Road, Heworth and Huntington routes; that the Acomb route be extended to the centre of the village, and that power for all the extensions be obtained by way of a Light Railways Order or private Bill. The Hull Road extension was estimated to cost £18,611; the Heworth route, *viâ* Layerthorpe (trolley 'buses), £2,112; Huntington Road ('buses), £2,272; Acomb extension, £6,560; Hoxley Road extension, £3,192. A service of trolley-'buses from the railway station was also suggested, the estimated cost being £2,900. The proposals were agreed to. It was also decided to purchase premises in Friargate for offices and showrooms, the cost of the building being £4,000.

TELEGRAPH and TELEPHONE NOTES.

Fishguard.—A wireless telegraph station has been erected at Fishguard Harbour, as the outcome of an arrangement under which the Great Western Railway Co. have constructed the building and the G.P.O. has equipped it and will undertake its working. The installation is on the Marconi system, with a radius of 500 miles, the necessary power being obtained from the Great Western Railway generating station at the Harbour. Three of the company's Irish service steamers have also been equipped.

Wireless Commission.—The Scientific Wireless Telegraphy International Commission assembled at Brussels on Wednesday. The British delegate, Mr. Duddell, was elected president. The International Bureau fixed the next meeting for the beginning of next year.

New Cable.—The French Government has lately commenced the laying of a new submarine telegraph cable between Marseilles and Algiers, a distance of about 400 nautical miles. The cable will be laid at a maximum depth of 2,624 yd between Marseilles and the Balearic Islands and 3,171 between the latter point and Algiers.

Marconi Wireless Rescue.—On Saturday morning the news arrived—by wireless, from the ss. *Carmania* via Fishguard—that the ss. *Volturno*, from Rotterdam to Halifax, carrying emigrants, caught fire on the 9th in mid-Atlantic, and being in desperate straits called for help by wireless. The *Carmania* was the nearest to the scene, and putting on full speed arrived on the spot in four hours. During the day nine other vessels arrived and stood by, but owing to the heavy seas it was impossible to take off the passengers and crew until daybreak on Friday. Over 500 lives were saved. The Marconi operators on the *Volturno* remained on duty until the aerial was destroyed. Without the aid of the Marconi wireless installations, in all probability the whole of the passengers and crew would have been lost. Mr. P. B. Maltby, the operator on the *Carmania*, was on duty almost continuously for three days. By exceptional good fortune, the *Carmania* was able to communicate with Fishguard for some hours at a distance of 1,120 miles.

The Committee of the Seamen's Union is about to consult the members as to whether they are prepared to refuse to sail on any ocean-going cargo vessel not fitted with wireless apparatus, on and after May 1st, 1914.

Japan.—The Japanese Government has decided to install 3,000 telephones in Tokio during the current fiscal year.

U.S.A.—Up to July 1st nearly 1,300 amateur wireless operators had been granted licences by the Bureau of Navigation.

Spain.—The Spanish military authorities have just completed a wireless telegraph installation at Melilla, on the Telefunken system.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—November 26th. An electrically-driven storage battery industrial truck (2,000 lb.) for the Randwick workshops of the Government Railways and Tramways Department. Local representation. Specification, &c., from the office of the Electrical Engineer to the Department, 61, Hunter Street, Sydney. A copy may be seen at the Board of Trade C.I. Dept. in London.

March 18th, 1914.—For the P.M.G. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of the specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

Victorian Railways.—November 12th. 17 miles lead-covered impregnated paper-insulated copper cable for track-locking roads. November 19th.—10 tons sulphate of copper for electrical purposes. Specifications may be seen at Board of Trade C.I. Dept. in London. November 12th.—One 60-h.p. electric motor and accessories.—*Australian Mining Standard.*

December 14th.—Two sections switchboard, common-battery multiple. See "Official Notices" to-day.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 26th.

Launceston (Tas.).—November 24th. Two 500-k.v.a. transformers; feeder cable, &c.; h.t. switchboard for sub-station. Specifications from City Electrical Engineer (£1 1s.). (Time extended from October 13th).—*Tenders.*

Hobart (Tas.).—December 1st. Dry cells for the P.M.G. See "Official Notices" to-day.

Belgium.—October 22nd. The municipal authorities of Liége (Annexe de l'Hotel de Ville-Bureau des Adjudications) are inviting tenders for four transformer boxes. Particulars may be obtained from the Service de l'Electricité, 42, Rue Lambert-le-Begue, Liége.

Bradford.—October 18th. Corporation Tramways Department. Miscellaneous electrical and other stores for year ending December 31st, 1914. Tenders to Town Clerk.

Brymbo (near Wrexham).—October 20th. Parish Council. Incandescent electric lighting of the streets. Overhead system. 40 lamps. See "Official Notices" October 10th.

Bulgaria.—November 17th. Machinery required for a central electric generating station at the "Pernik" State coal mine. The estimated value of the contract is 200,000 fr. (£8,000), and includes three water-tube boilers, two double-expansion horizontal engines of 250 h.p. each, two three-phase dynamos, switchboards, transformers, &c., and a centrifugal pump of 500 litres per minute capacity driven by electric motor. Deposit £400; local representation. Some documents relating to the matter may be seen at the Board of Trade C.I. Dept. in London,

Canada.—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

Cardiff.—October 17th. Corporation. Passenger tickets and ticket punches for trams. See "Official Notices" October 3rd.

China.—SHANGHAI.—October 17th. Extra-H.T. pilot cable, &c., for the Council. See "Official Notices" October 3rd.

Dublin.—November 1st. G.N. Railway Co. (Ireland). One year's supply of stores, including a number of electric and telegraph supplies. See "Official Notices" October 10th.

Dumfries.—The Dumfries County Council invites tenders for electric lighting, telephones, electric clocks, and other electrical works and heating installation at the new County Buildings. Mr. W. Arnot, Electrical Engineer, 163, Hope Street, Glasgow.

Eastry (Kent).—Lighting the hospital for the B. of G. T. Steed Bayly, High Street, Deal.

Glamorgan.—The County Council desires to negotiate for the construction and working of five miles of light railway from Ynysforgan to Pontardawe. See "Official Notices" October 10th.

London.—BERMONDSEY.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

Manchester.—October 21st. Tramways Committee:—(*a*) Permanent way special track work; (*b*) permanent way points, tongues and hardened steel centres; (*c*) granite setts. Mr. J. M. McElroy, general manager.

October 29th.—One storage battery, battery booster and switchboard, for the Corporation. See "Official Notices" to-day.

Motherwell.—October 23rd. Electric lighting works in connection with extensions to the County Hospital. Deposit of £1 (returnable). Mr. W. E. Whyte, District Clerk, District Offices, Hamilton.

New Zealand.—DUNEDIN CITY COUNCIL.—Nov. 12th. Supply meters, maximum demand indicators and insulated cable and bare wire, for a period of two years. Specifications from the electrical engineer.—*New Zealand Shipping and Commerce.*

According to an advertisement in an engineering contemporary, the Auckland Harbour Board want tenders for slipway electric hauling machinery for hauling a vessel of 600 tons dead weight. Messrs. W. & A. McArthur, Ltd., of 18 and 19, Silk Street, London, E.C., are agents for the Board.

Rathmines and Rathgar.—November 4th. The Council. One 400-KW. generating set (high-speed engine direct coupled to two D.C. dynamos in tandem). See "Official Notices" to-day.

Rhyl.—November 19th. One 160-KW. Diesel engine set, for U.D.C. See "Official Notices" to-day.

Spain.—November 18th. The Harbour Works authorities at Valencia are inviting tenders for an installation of electric lighting at the port.

VALENZA.—December 29th. Tenders are invited for the installation of electric cranes and the electric light at the port of Valenza. Provisional deposit, 2,000 pesetas. Particulars, Dunta de Obras Publicas del Porto, Valenza.

Thakeham (Sussex).—Private telephone installation between the workhouse and Storrington (about one mile), for the B. of G. Percy Ayling, Clerk, Storrington, Pulborough.

West Hartlepool.—October 27th. Corporation. Five car trucks. See "Official Notices" to-day.

CLOSED.

Australia.—*Tenders* announces the following placing of contracts:—

P.M.G.'s Department, Queensland.—

12,000 leads for Meidinger main battery.—B.I. and Helsby Cables, Ltd.
20,000 zincs, Leclanché.—I.R., G.P. and Telegraph Works Co., Ltd.

Victorian Railways Department.—

75-H.P. totally-enclosed D.C. motors for underground haulage, £300 each; contact panels, £12 10s. each; controllers with resistances, £55 15s. each.—Australian General Electric Co.
140-H.P., 415-volt, three-phase induction motor, with control, £278.—Australian General Electric Co.

Victorian Public Works Department.—

One motor F.E.P. 18, with flexible coupling for electrical installation.—I.R., G.P. and Telegraph Works Co., Ltd.

WYCHEPROOF (VIC.).—

The tenders of Messrs. R. Hornsby & Sons, Ltd., have been accepted for two suction gas engines for electric lighting plants at Wycheproof and Sea Lake.

SYDNEY.—The E.L. Committee of the Municipal Council has accepted tenders as under:—

Contact and suspension gears.—Lawrence & Hanson, Ltd., £257.
Prepayment meters.—Standard Waygood, Ltd., for Ferranti meters, £321.
Recording meters.—Australian General Electric Co., for D.C. voltmeters, £143; A.C. voltmeters, £319; and A.C. ammeters, £202.
Fibre conduit.—Haes & Eggers, Ltd., 30,000 yards of 4-in. fibre conduit, £2,625.
Bitumen.—W. G. Watson & Co., Ltd., 100 tons, £695.

The *British Australasian* says:—Orders have been placed, without calling for tenders, in London for plant and machinery for the Government electric power station. The order was placed on the advice of Messrs. Merz & McLellan, the cost to be £188,251.

Bradford.—The following tenders have been accepted by the City Council for supplies to the tramways department:—

Tangyes, Ltd.—Armature winding machine, £88; wheel-turning lathe, £808.
Leeds Engineering and Hydraulic Co., Ltd.—Two sets hydraulic jacks, £230.
Jas. Keith & Blackman Co., Ltd.—Smiths' hearths (two single and one double), £81.
Carrick & Ritchie.—Travelling crane, £535.

Canada.—According to the *Canadian Engineer* the Imperial Wire and Cable Co., Ltd., has received the following contracts:—

City of Ottawa.—47,000 ft. paper-insulated lead-covered cable, and 1,100 ft. steel taped cable, both insulated for 3,300 volts.
Toronto Hydro-Electric System.—Approximately 22,000 ft. of paper-insulated lead-covered underground cable.
City of Winnipeg.—12,000 ft. of ditto.

The *Canadian Electrical News* states that the same company has received an order for lead-covered paper-insulated underground cable for the city of Calgary; also that Brantford, Ont., has ordered the following:—

152 ornamental cast-iron standards.—Ornamental Lighting Pole Co.
151 magnetite lamps, including cut-outs and regulators.—Canadian General Electric Co.
Two 750-K.V.A. transformers.—Canadian Crocker-Wheeler Co.
Recording instruments.—Canadian Westinghouse Co.
High and low-tension switch and control equipment for sub-station.—Canadian General Electric Co.

Cardiff.—The E.L. and Tramways Committee has accepted the tender of Messrs. Fraser & Chalmers for a turbo-generator for Roath power station, at £6,345, and that of the British Westinghouse Co. for a 1,000-KW. rotary converter for Hayes sub-station, at £1,955.

East Ham.—The tender of Messrs. T. Moy, Ltd., has been accepted by the T.C. for 100 tons of 1¼-in. Kirkby nutty slack to the electricity station, at 15s. 6d. per ton.

Fareham.—The U.D.C. has accepted the tender of the Anglo-American Oil Co., Ltd., for a six months' supply of oil for the electricity works, at £4 1s. 10d. per ton.

Harwich.—The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for the installation of electric fire alarms in the Borough. The cost is estimated at £230.

Hazel Grove.—The U.D.C. has accepted the tender of Messrs. Shaw & Co., of Stockport, for electric fire alarms.

Leeds.—The City Council has accepted the tender of Messrs. Appleyard Bros. for the erection of transformer chambers as follows:—Elder Road, £277; Westover Street, £189; and Viaduct Tannery, £130.

London.—L.C.C.—The Highways Committee accepted tenders as under for the purchase and removal of old tramway materials:—

1. Old materials in connection with the reconstruction of the King Street and Goldhawk Road tramways and the Hammersmith loop line:—
   (*a*) 320 tons of rails.—P. & W. MacLellan, Ltd.
   (*b*) 48 tons of fishplates, tiebars, &c.—G. Cohen, Sons & Co.
   (*c*) 10,000 sq. yd. of Jarrah wood paving blocks.—J. W. Pullen.
2. Old materials at the County wharf for a period of 12 months:—
   (*a*) 700 tons of steel rails.—S. Menzel.
   (*b*) 100 tons of steel points and crossings.—G. Cohen, Sons & Co.
   (*c*) 400 tons of steel fishplates, cuttings from rails and short pieces of rail.—S. Menzel.
   (*d*) 300 tons of iron (cast).—C. A. Robinson & Co.
3. Old material at the Central car repair depôt for 12 months:—Iron and steel heavy scrap, steel turnings and borings, and steel car tyres.—D. McCall & Co.

The Highways Committee has accepted the tender of Messrs. Kerridge & Shaw for the provision of foundations required in connection with the substitution of turbines for the existing reciprocating engines at the Greenwich generating station.

The following tenders were received for the H.T. switchgear, &c., for Greenwich generating station:—

Bertram Thomas (incomplete tender)	£10,823
British Westinghouse Co., Ltd. (accepted)	17,915
British Thomson-Houston Co.	20,112
Siemens Bros. Dynamo Works	20,674
Ferranti, Ltd.	22,304
Johnson & Phillips, Ltd.	22,886
A. Reyrolle & Co., Ltd.	24,351

Estimate of chief officer of tramways, £18,000.

The firm are to be allowed to sublet the following portions of the work:—(1) To Johnson & Phillips, Ltd., cables; (2) to the British Thomson-Houston Co., Ltd., coupler switches and regulators; (3) to the Morgan Crucible Co., Ltd., carbon resistances; and (4) to Everett, Edgcumbe & Co., Ltd., relays.

The following tenders have also been accepted:—

Condensing water pipes, &c., in the bed of the Thames at Greenwich generating station.—J. Cochrane & Sons, Ltd.
Steam pipes and fittings for Greenwich extensions.—Rodney Foundry Co., Ltd.

During the recess Messrs. Williams & Bach asked to be released from their contract of March last, for the wiring of the Camberwell and Cressy Road carsheds at £2,140, and the next lowest tender, that of Electrical Installations, Ltd., at £2,146 was accepted. The tender of H. L. Holloway for foundations for rotary converters at Shoreditch sub-station, and provision of additional workshop accommodation at £1,535 was accepted.

The tender of the British Westinghouse Co. has been accepted for the supply of 13 reactance coils and two steel valve chests required in connection with the provision of protective devices, &c., for the existing Greenwich plant, at £5,943.

A 20-ton weighbridge for the Belvedere Road depôt is being purchased from Messrs. Ashworth, Son & Co., Ltd., at £148, less £12 for the old weighbridge to be removed.

The tender of the National Rail and Tramway Appliances Co., Ltd., for five hydraulic jacks at £35 10s. each, for the tramway department, has been accepted.

The tender of the Carborundum Co., Ltd., for rail grinding blocks for the tramway department for one year, at 4s. 6d. per block, has been accepted.

STEPNEY.—The B.C. Electricity Committee received the following tenders for 25 street disconnecting boxes :—

	Price each.
Universal Electrical Manufacturing Co.	£4 19 0
Henley's Telegraph Works Co., Ltd.	6 0 0
B.I. and Helsby Cable Co.	6 5 0
J. Every	8 5 0
Reason Manufacturing Co., Ltd.	8 17 6
	(less 2½ per cent.)
Johnson & Phillips	9 10 0

HAMMERSMITH.—The Electricity Committee has received the following tenders for the supply of high and low-tension underground electric cables for 12 months, of the following sizes :—High-tension, ·25, ·1, ·05 ; low-tension, ·3, ·2, ·15, ·1, ·08, ·05, ·025, $\frac{7}{.2}$ twin.

	Per drum of each size.
J. Littauer (Kabelfabrik A.G.)	£650
R. R. Todd	743
Standard Cable Co.	807
A.E.G. Co., Ltd.	810
Western Electric Co., Ltd. (recommended)	825
Pirelli, Ltd.	839
General Electric Co., Ltd.	836
Siemens Bros., Ltd.	838
Johnson & Phillips	848
General Cable Manufacturing Co., Ltd.	848
W. T. Henley's Telegraph Works	849
General Cable Manufacturing Co., Ltd.	876
British Ins. and H. Cables	878
Electrical Engineering and Equipment Co.	906
W. T. Glover & Co.	914
Union Cable Co.	915
Callender's Cable and Construction Co., Ltd.	1,039

For the supply of high-tension switch panels, the estimated number required for the ensuing 12 months is 24. The tenders were :—

	Per panel.
Switchgear & Cowans, Ltd. (recommended)	£9 11 8
Edison & Swan Electric Light Co.	9 15 0
Spagnoletti	11 5 0
Ferranti	15 0 0
Electric Construction Co.	16 16 0
Johnson & Phillips	17 0 0
General Electric Co., Ltd.	17 12 0
Electrical Engineering and Equipment Co.	19 0 0
Thomas	19 5 0
Siemens Bros.	21 10 0
British Westinghouse Co.	21 10 0
Reyrolle & Co.	22 15 0
Eckstein, Heap & Co.	24 10 0
Voigt & Haeffner	28 10 0
Laing, Wharton, Ltd.	52 0 0
Do. do. (alternative)	48 0 0

For the supply of one 125-B.H.P. A.C. motor, for Messrs. Gwynnes :—

Fuller Electric Manufacturing Co.	£268
Brush Electrical Engineering Co.	294
City Electrical Co.	295
General Electric Co. (recommended)	324
Phœnix Dynamo Manufacturing Co.	325
Electric Construction Co.	328
T. Harding Churton & Co.	328
British Westinghouse Co.	330
Vickers, Ltd.	353
Campbell & Isherwood	458
Geipel & Co.	310

The Committee reports that it has had under consideration the tenders for the construction of coal-handling and storage plant, but is not yet able to submit any recommendation thereon.

Melton Mowbray.—The U.D.C. has accepted the revised plans of Messrs. Dawson & Manfield for the construction of a refuse destructor on the site of the old sewage works. The estimated cost is £2,150.

Newport (Mon.).—The T.C. is recommended to accept the tender of Messrs. Heenan & Froude for a refuse destructor, at £7,967.

The Electricity and Tramways Committee of the T.C. has accepted the tender of Messrs. James & Emanuel for 2,000 tons of coal ; that of Messrs. Partridge, Jones & Co. for 3,000 tons ; and that of the United National Collieries for 1,000 tons.

Orsett (Essex).—The B. of G. has accepted the tender of the New Telephone Co. for installing electric bells in the new workhouse premises at £53.

Oxford.—For installing the electric light at the Y.M.C.A. buildings the tender of Messrs. Hill, Upton & Co. has been accepted.

Ramsbottom.—The Traction Committee has accepted the following tenders :—

Polack Tyre and Rubber Co., Ltd., Manchester, for tires for cars for 12 months.
Rawlinson, for a tower wagon.

Shanghai.—The following tenders were received by the Municipal Council for the extensions at Riverside power station :—

BOILERS.

Howden Boiler Co.	£13,102	20 weeks
Babcock & Wilcox, Ltd. (accepted)	14,563	2 in 16 weeks 2 in 22 weeks
Niclausse Boiler Co.	15,650	32 weeks
Clarke, Chapman & Co.	16,1[illegible]	26 weeks

TURBO-ALTERNATORS.—COMPLETE TENDERS.

Name of firm.	Price. £	Speed. R.P.M.	Delivery weeks.	Full-load steam. lb.	Vacuum %
Allgemeine Elektricitats Gesellschaft (accepted)	22,310	3,000	28 30	12·6	93
Maschinenfabrik Oerlikon	22,975	3,000	36 41	13·29	92
Brown-Boveri	25,134	3,000	17 52	13·6	92
Willans-Siemens	25,328	3,000	40 50	14·05	94·3
Maschinenfabrik Oerlikon	26,113	1,500	36 41	13·23	92
Turbo-Electric	27,087	1,500	42 56	13·2	93
A.E.G.	28,260	1,500	18 22	12·6	93
Escher Wyss-Siemens	28,499	1,500	—	13·3	91
Belliss-General Electric Co.	28,566	1,500	52 61	—	—
Dick, Kerr & Co.	29,037	1,500	80 88	13·7	93·5
Brown Boveri	29,834	1,500	17 31	13·6	92
Willans-Siemens	30,364	1,500	44,52	13·1	93·5
C. A. Parsons & Co.†	30,862	1,500	52	12·9	93·3
Belliss-Siemens	31,588	1,500	52 61	13·1	94
British Westinghouse Co.	31,845	1,500	36 40	13·2	93·35
Brush Co.	32,014	1,500	52 65	14·1	93·3
C. A. Parsons & Co.	32,600	1,500	52	12·8	93·3
British Thomson-Houston	32,699	1,500	54	13·7	93·3

* Add £200 for testing at full load.
† Small condenser.

PART TENDERS.

Name of firm.	Price. £	Speed. R.P.M.	Delivery weeks.	Full-load steam.	Vacuum %
Howden-Brown Boveri*	25,032	1,500	40/44	12·8 lb.	93·3
Fraser & Chalmers†	16,170	3,000	—	14·0 lb.	92·5
Fraser & Chalmers†	21,245	1,500	—	13·3 lb.	92·5

* Omits condensing plant value £7,000. † Omits condenser spares and other matters.

CONDENSING PLANT.

Name of firm.	Price. £	Cooling surface. Sq. feet.	Delivery. weeks.
Worthington Pump Co.	6,727	12,000	26
Rees Roturbo Co.	7,463	12,000	30
Isaac Storey & Co.	7,210	12,000	28
Allen Son & Co.	7,509	12,000	22
Mirrlees Watson Co.	7,547	12,000	38

Torquay.—The T.C. has entered into contracts with Messrs. Whiteway & Ball and Renwick, Wilton & Co. for 3,000 tons of Featherstone washed peas and 1,500 tons of Cowper 1-in. nuts, respectively, for the electricity works.

Wakefield.—The Electricity Committee has decided to obtain a Babcock & Wilcox boiler, superheater and stoker, at £2,410 ; a Belliss & Morcom steam turbine, alternator, condensing plant, &c., at £7,703 ; and sub-station switchgear, at £1,471.

Walsall.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £25 12s. 6d., for an additional electric motor for the Council's boiler house.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 17th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, October 17th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Motor-driven Machinery," by Mr. W. A. Toppin.

Manchester Electro-Harmonic Society.—Friday, October 17th. At 7.45 p.m. At Albion Hotel. First concert.

Association of Mining Electrical Engineers (West of Scotland Branch). Saturday, October 18th. At 4.30 p.m. At Royal Technical College, Glasgow. Opening meeting.

National Association of Colliery Managers (Kent Branch) and Association of Mining Electrical Engineers (London Branch).—Saturday, October 18th. At 3 p.m. At Hotel Metropole, Dover. Joint meeting. Paper on "Large Prime Movers and Boilers for Power Houses," by Mr. E. Kilburn Scott.

Institution of Electrical Engineers (Newcastle Section).—Monday, October 20th. At 7.30 p.m. At Armstrong College, Newcastle. Inaugural address by Mr. C. Vernier.

Thursday, October 23rd.—At 7 p.m. At the Lit. and Phil., Middlesbrough. First meeting of the Tees Side members. Address by Mr. Vernier.

Institute of Marine Engineers.—Monday, October 20th. At 8 p.m. Paper on "The Gyroscope and Gyroscopic Action in Engineering Practice," by Mr. T. R. Thomas.

Society of Chemical Industry (Newcastle Section).—Monday, October 20th. At 8 p.m. At the Chemical Theatre of Armstrong College. First of five lectures on "Utilisation of Fuel," by Prof. J. W. Cobb, B.Sc.

Junior Institution of Engineers.—Monday, October 20th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Modern By-Product Coking," by Mr. G. S. Cooper, B.Sc.

Friday, October 24th.—At 39, Victoria Street, S.W. Paper on "Mechanical Advertising and Similar Appliances," by Mr. H. W. Sewell.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, October 21st. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow.

Chemical Society.—Thursday, October 23rd. At 8.30 p.m. At Burlington House, Piccadilly, W. Ladenburg Memorial Lecture, by Prof. F. S. Kipping, D.Sc.

Physical Society of London.—Friday, October 24th. At 5 p.m. At the Imperial College of Science, Imperial Institute Road, South Kensington, S.W. Papers on "The Ice Calorimeter," by Mr. Ezer Griffiths, B.Sc. ; "An Electrostatic Oscillograph," by Messrs. H. Ho and S. Koto.

Institution of Mechanical Engineers.—Friday, October 24th. At 8 p.m. Paper on "Modern Flour Milling Machinery," by Mr. R. B. Creak.

Manchester Association of Engineers.—Saturday, October 25th. At "Masonic Room," Grand Hotel, Aytoun Street, Manchester. Paper on "Engineering Workshop Organisation," by Mr. Hans Renold.

NOTES.

"F" Rays.—The word "ray" is a power to conjure with, and since the application of the letter "X" to a certain kind of ray, it has become the fashion to designate new rays by letters of the alphabet. What "F" stands for, we do not know; but we can make a shrewd guess as to what it ought to stand for in the case of the "rays" now being exploited by Signor Giulio Ulivi, their reputed author. Hitherto we have ignored the matter as unworthy of notice, but the prominence given to it in the columns of the daily Press renders it desirable that we should refer to it. We read that the inventor is now negotiating with the Italian Government, and threatens to come to England with the rays if Italy won't have them. To save time and space, we may say at once that most of the statements regarding the alleged rays that we have seen are purely nonsensical. The inventor is reported to have said that when he directed the rays upon a gas-meter, it exploded. If his other claims are on a par with this one—and they seem to be of a similar nature—they are utter piffle. We apologise to our readers for mentioning the matter.

Late Legal.—Evershed & Vignoles *v.* Paul.—In the Chancery Division, Mr. Justice Neville had before him on Wednesday, October 15th, this action, by which the plaintiffs sought to restrain an alleged infringement of their trade-mark "Megger," and from a general passing off of the defendant's goods as and for the goods of the plaintiffs by the use by the defendant of the word "Omega."

Mr. Walter, K.C., and Mr. Sebastian were counsel for the plaintiffs, and the defendant, Mr. Robert W. Paul, was represented by Mr. Colefax, K.C., and Mr. Beyfus.

In opening the case, Mr. Walter said that the plaintiffs were the well-known electrical apparatus manufacturers carrying on business at Acton Lane, Chiswick, and for their measurement instruments they had obtained a great reputation. They had been carrying on business for a long time making various electrical instruments, and, amongst others, they made an instrument for calculating resistances in electric installations—an instrument for detecting leakages. Prior to 1903 it was known as an ohmmeter, but in that year the plaintiffs, being desirous of having a distinctive trade-mark, Mr. Vignoles invented a horrible word which, like a good many horrible words, became popular. The plaintiffs registered the word "Megger," as their trade mark, it was applied to these instruments for determining leakage, and "Megger" soon became usual to denote these particular instruments. They had a very large sale and were bought by all sorts of people. Counsel said he was astonished at the various classes of persons who purchased these instruments. They included those connected with the electrical industry, drapers, ironmongers, timber merchants, cement merchants and salt merchants. The instrument was asked for by these people as the Megger, but they spelt it in all sorts of ways—Mega, Megga, Meger, Megar and Meggar. In 1911 the defendant commenced to manufacture these things, and he put them on the market, advertised them and exhibited them at the Electrical Exhibition at Olympia, as Harris's low-reading ohmmeter and Harris's portable ohmmeter. In 1912, however, he proceeded to christen his instrument the "Omega," the plaintiffs complained, and though at first he expressed his intention of calling it "Paul's Insulometer," he afterwards refused to abandon the use of the word Omega. In the electrical trade people would perhaps not confuse the Omega instrument for the plaintiffs' Megger, but with the outside public, Counsel contended, the words were so nearly alike as to lead to confusion and constitute an infringement of the plaintiffs' trade mark.

Mr. E. B. Vignoles, a director of the plaintiff company and business manager, gave evidence in support of their case. This class of instrument, he said, was to be found at almost every electric station, and besides a large demand from shippers for supplying orders abroad, a large number of people who had electric installations bought them. The plaintiffs' instrument was usually asked for as a Megger. Their sales were now between 1,200 and 1,500 a year, and were steadily increasing.

Counsel, in cross-examination, put to the witness a number of cases in which the word Omega was used in connection with electrical instruments.

Mr. Astbury took objection on the ground that the only defence pleaded was that the word Omega did not so nearly resemble the word Megger as to be calculated to deceive.

Mr. Colefax submitted that he had a right on that question to tender evidence as to the frequent use of the Omega either as a word or in the form of the Greek symbol. Mr. Justice Neville thought the evidence important, and would either adjourn the case then or hear it out so far as he could, reserving to Mr. Astbury the right to have an adjournment for the purpose of considering the evidence.

After consultation with his client, Mr. Astbury said he had seen the evidence Mr. Colefax intended to produce as to the use of the word Omega, and he did not feel justified in advising his client to go on with the action. Under the circumstances, he would consent to the action being dismissed, but inasmuch as this evidence could not have been adduced without amendment of the pleadings, he submitted the action should be dismissed without costs. There was evidence that Omega had been used in connection with test instruments prior to 1901, but the plaintiffs knew nothing about it, and had they done so the action might never have been brought.

Mr. Colefax submitted that the action should be dismissed with the usual consequences that, had the action gone on, he should have contended that in any event Omega was not a colourable imitation of the plaintiffs' trade mark.

His Lordship said it was difficult to determine what should be done as to costs. He thought, however, justice would be done if he dismissed the action with costs, but gave a direction to the taxing master that the defendants were not to be allowed any costs of witnesses who would have been called to speak to the use of the word "Omega."

Subsequently counsel stated that the parties had been able to arrange an order, and his Lordship made the order in the terms agreed.

B.E.A.M.A. Annual Dinner.—The annual dinner of the Association will take place on Wednesday, January 21st, 1914. Lord Ampthill will preside.

The Late Dr. Diesel.—A daily Press report says that a body was found in the Scheldt on Saturday, and some articles on the body have been recognised by the son of the late Dr. Diesel as being the property of his father. A Berlin dispatch states that Dr. Diesel's family is left entirely without means and in the greatest need.

A Munich dispatch to the newspapers says that at a meeting of creditors held there, it was shown that Dr. Diesel's financial collapse was due to extensive and unlucky speculation in real estate and house property, which followed upon his failure in a costly lawsuit. It is understood that the inventor's admirers purpose raising a pension fund on behalf of the widow.

Appointments Vacant.—Chief assistant electrical engineer for Tunbridge Wells (£170); assistant sales manager for Sunderland Corporation (£200); consumers' clerk for Greenock Corporation; assistant telegraph engineers for Government of Federated Malay States (salary, £360: duty allowance, £75).

Automatic Train Control.—A system of controlling trains, known as the "Detroit," has recently been tested with successful results on the Canadian Pacific Railway. Visual and audible signals are given in the driver's cab, and are repeated to the train dispatcher; the speed of the train is automatically reduced when it passes a "caution" signal, and the brakes are put on if it over-runs a danger signal. The derangement of any part of the mechanism puts the signals to danger. High-frequency alternating currents in wires laid alongside of the track, with receiving apparatus on the locomotive, are employed, so that the system evidently resembles the Railophone system which was successfully demonstrated in this country in 1911 and last year, and the Prentice system, which we described on August 29th last.

The Kelvin Memorial at Glasgow.—A statue of Lord Kelvin in Kelvingrove Park, Glasgow, was unveiled on 8th inst. by Mr. Birrell, Lord Rector of the University. After giving a brief sketch of the celebrated scientist's career, including the years spent at Cambridge, and especially the very lengthy period during which he held the Professorship of Natural Philosophy at Glasgow, Mr. Birrell performed the ceremony, and afterwards he and Sir J. Stirling Maxwell were presented with the freedom of the city. At the luncheon which followed, Mr. Balfour delivered an interesting address in proposing "The Memory of Lord Kelvin." A message of appreciation from Lady Kelvin was communicated. Mr. Balfour referred to the life and work of Kelvin as showing the close connection between theory and practice. He also declared that the fame of Kelvin did not depend upon statues. It rested upon the sure foundation of the gratitude with which posterity would regard achievements which had never been surpassed in the annals of physical science.

A Model Exhibition.—During the past week an exhibition devoted to "model engineering" has been in progress at the Horticultural Hall, under the auspices of Messrs. Percival Marshall & Co., proprietors of *The Model Engineer*. In a different sense the exhibition is a model one, for apparently it was ready at the appointed time, and it is packed full of interest to the rising generation of engineers—who, it is to be hoped, will ever continue to be model engineers—as well as to many of their elders. Wireless telegraphy is very fully represented, exhibits having been organised by Messrs. A. W. Gamage, Ltd., the British Telegraph Instrument Co., Ltd., the Static Scientific Co., and the Synchronome Co., Ltd., while the British School of Telegraphy, Ltd., had a good show. Electrical apparatus of various kinds were exhibited on many of the stands, and numerous examples of amateur work, showing a high standard of merit, were entered for the model-making competitions.

Underground Mail Tubes.—The Electric Carrier Co., of New York, has given a demonstration of a new device for carrying heavy mail sacks in underground tubes, and will shortly submit proposals to the British Post Office for the adoption of its system in London. The new system consists of a steel tube, 36 in. in diameter, through which run steel cylindrical cars, weighing about 1,200 lb. These are propelled by a magnetic push or pull, without wheel traction. The cars are centrally controlled, and one man operates them by a system of push-buttons. The whereabouts of the cars in the tube is indicated by signal lights. The inventors claim that the cars differ from any others in that they have practically no mechanism attached, and can be sent through the tube at a 15-second headway at a speed, on a level stretch, of from 100 to 200 miles an hour. The cost of the system is estimated at £10,000 per mile, and the cost of maintenance only 5 per cent. of the total investment.—*Daily Telegraph.*

(*Continued on page* 623.)

THE CHESTER HYDRO-ELECTRIC PLANT.

The ancient city of Chester and its pleasant river are probably well known to a considerable number of our readers, few of whom, however, would be likely to suspect any direct connection between its old-time associations and one of the most modern of its institutions—the Corporation Electrical Department.

Yet in this, as in other cases, the unexpected has happened, for the stone weir, with which visitors to the town who have crossed the Dee Bridge will be familiar, and which it is recorded was constructed in Norman times by Hugh Lupus, Earl of Chester (A.D. 1070-1101) for the working of corn mills and for fishery purposes, has now through the instrumentality of Mr. S. E. Britton, the city electrical engineer, been turned to very good account by the Corporation for the production of electrical energy.

Indeed, the civic history of Chester, for which space is naturally lacking here, hinges to an almost remarkable extent on the weir constructed by Hugh Lupus, which through nine centuries formed a source of power not only for corn milling at the Dee Mills, but also between A.D. 1600 and 1700, for the pumping of the water supply of the city, and more latterly (1896-1897) for sewage pumping, by means of a water turbine and pump, this installation, however, having now given place to a modern electrically-driven plant.

Flour milling at the Dee Mills appears to have been a hazardous industry, as numerous fires are recorded, and it was after a fire in 1895 that the mills, four in number, were acquired by the Corporation, and finally discarded for milling purposes three years later. In 1910 it was decided to remove the buildings, and it was then that Mr. Britton took up the question of utilising the available power for generating electricity.

The scheme which he submitted to the Electricity Committee of the Corporation was a particularly attractive one, both from a commercial and layman's point of view, as it showed that the annual surplus would recoup the capital expenditure in five years; the scheme was finally submitted to Mr. A. C. Hurtzig, who fully agreed with Mr. Britton's proposals.



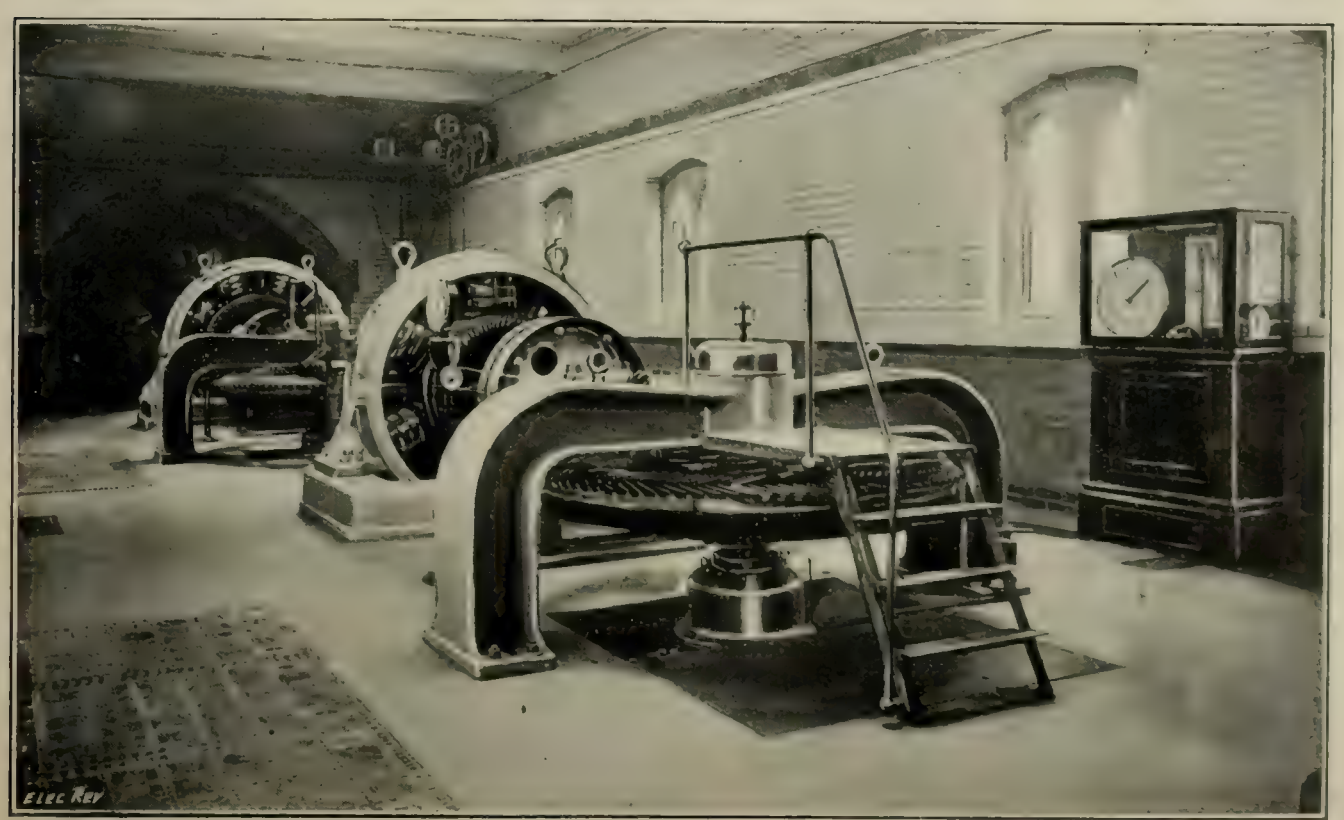
The New Hydro-Electric Power House, Chester.



Reinforced Concrete Construction; Turbine Pits.

The Electricity Committee has undertaken that in the working of the installation the water from the river above the weir shall not be lowered more than 6 in. below the mean height of the weir. By agreeing to this level all interests in the river will be in a better position than frequently occurred in the days of the working of the Old Dee Mills.

The scheme is a unique one, being situated at a place on the river affected by tidal waters, and special consideration had to be given to the influence of the latter upon the plant; to obtain the best results it was necessary to adopt specially-designed turbines and dynamos capable of working efficiently over a wide range of speeds, resulting in the overall efficiency at all times being considerably higher than the usual practice of constant-speed plant.



Interior, Showing the Electrical Plant, Gearing, &c.

It is calculated from the level of the flow

that the average cb. ft. per min. of fresh-water flow at different months of the year is as follows : December, 300,000 ; January, February and March, 100,000 ; April, May, October and November, 50,000 ; June, July, August and September, 20,000 ; and the lowest dry weather flow is about 10,000 c.f.m. The effect of the above varying flow is to give the following average head in feet :— December, 4·5 ; January, February and March, 6·25 ; April, May, October and November, 7·5 ; June, July, August and September, 8·75.



The Old Dee Mills, which occupied the Site of the New Works.

The weir is placed diagonally across the river at the east side of the Old Dee Bridge and forms a channel to conduct the water to the site of the power house. As the water approaches the latter, it passes through a strainer rack and sluice gates.

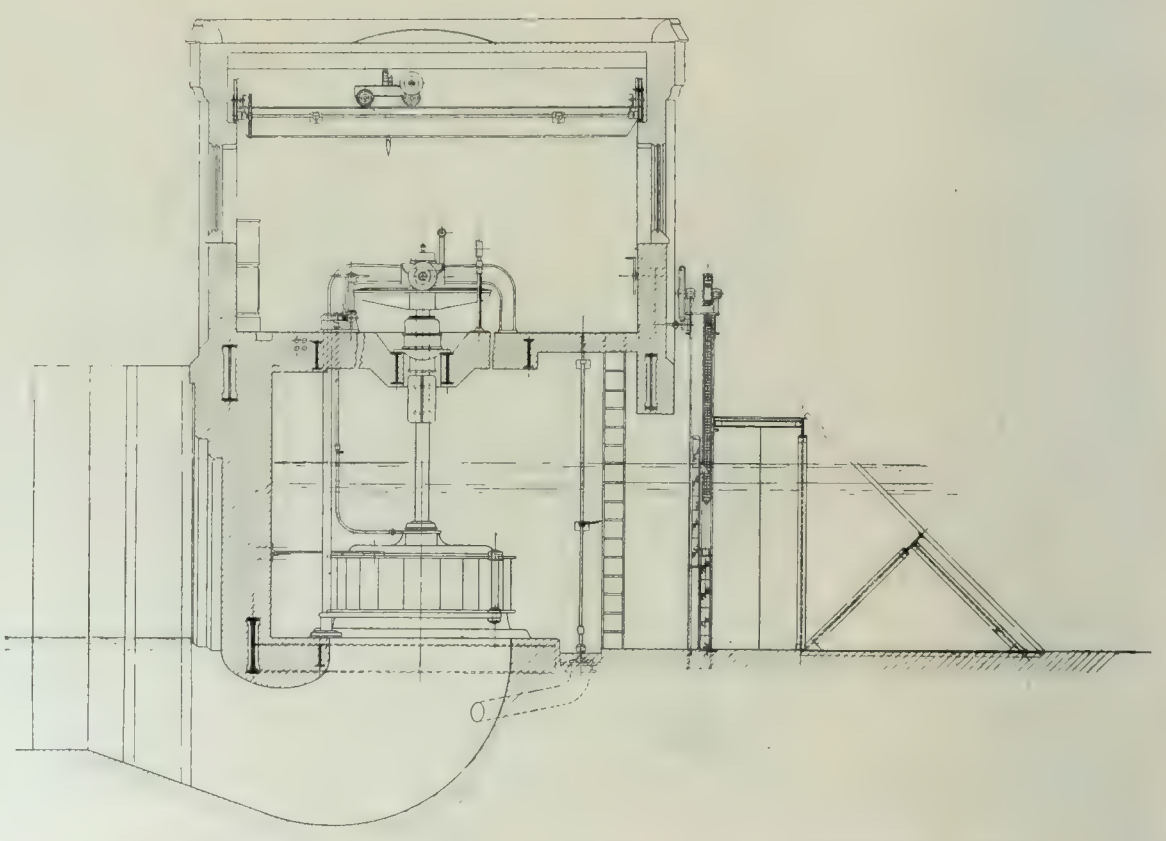
The power house, 89 ft. long × 24 ft. 6 in. wide, and measured from the bottom of the head race, 36 ft. high, is mainly constructed of steel and concrete, faced externally with sandstone rock and lined with glazed brick. The under-water work forming the head race, the three turbine pits, and the tail race is of concrete and steel. On the external face of the down stream side of the turbine pits are placed three cut waters and gothic arches ; these and the filling-in of sandstone harmonise with the adjoining bridge. The retaining wall between the bridge and the power house and 121 ft. of river wall beyond the power house has been entirely rebuilt in ashlar with sandstone taken from the foundations of the old mills.

Three turbines are installed, of the vertical shaft Francis type, specially designed by Messrs. James Gordon & Co., for working under a head of water varying from 1 to 9 ft. ; two turbines are designed for dealing with 30,000 c.f.m. under an actual working head of 9 ft., and are capable of developing 415 B.H.P. at a speed of 50 R.P.M., while the other is designed for dealing with 22,000 c.f.m. under similar conditions, and is capable of developing 305 B.H.P. at 55 R.P.M.

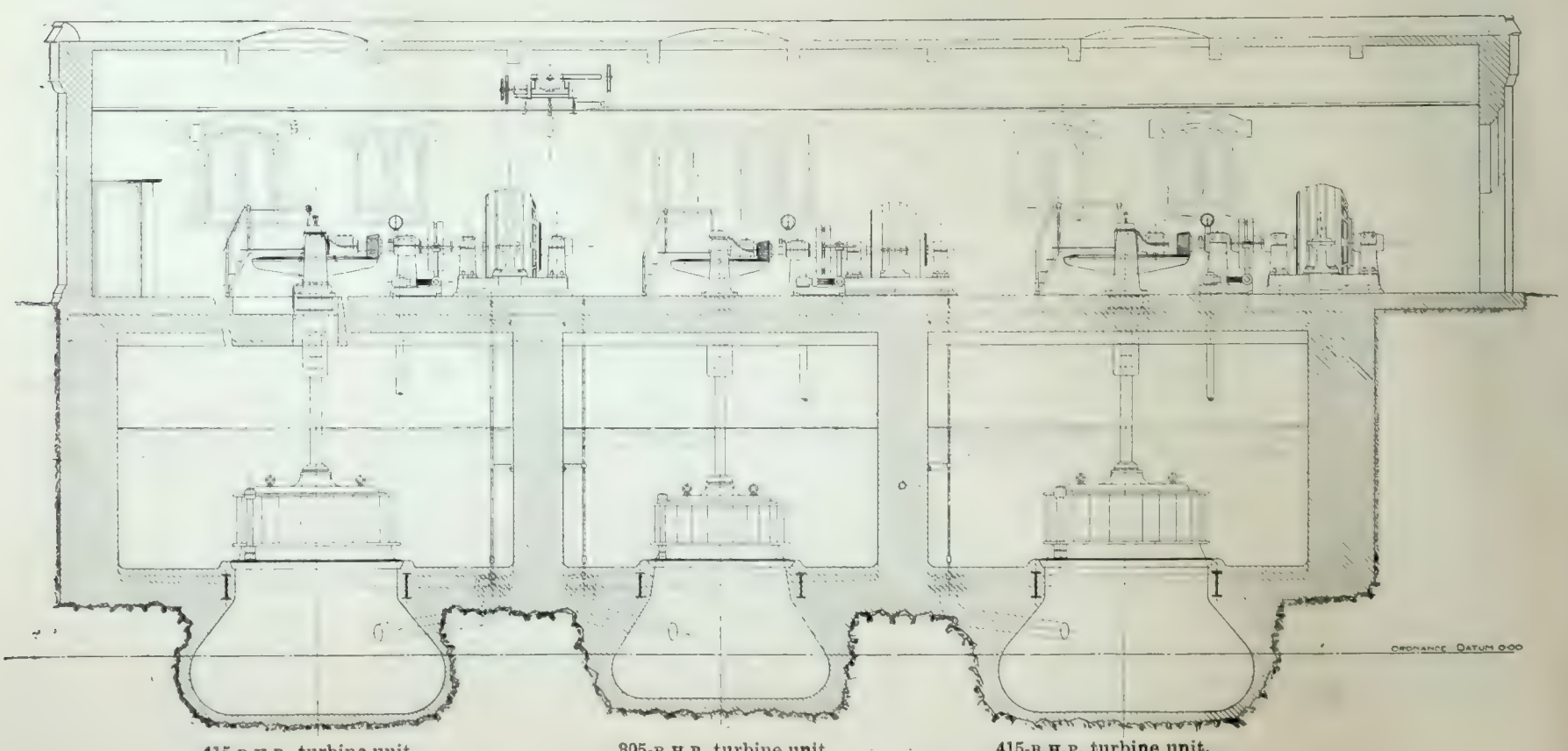
The turbine runners are constructed with buckets of forged steel plate securely cast into a centre boss and surrounding ring of cast-iron ; the guide casing is of cast-iron, also the guide blades, which are bushed with gun-metal and mounted on steel spindles ; the closing edges of the guide vanes are ground to ensure a close water-tight pit when closed, and the vanes are coupled by links and shafting to the hand regulating gear.

Each turbine is provided with a set of hand-operating gate gear mounted on the generator floor, including an indicator to show the position of the guide gates.

The revolving weight of the turbine shaft, runners and bevel gear is supported by a specially designed collar suspension bearing, fitted at the upper end of the vertical shaft on the generator floor ; the thrust rings of the suspension bearing are submerged in oil, which is kept in circulation by an arrangement of grooves and oil hobs.



Sectional View, Showing Arrangement of Hydro-Electric Unit.



415-B.H.P. turbine unit. 305-B.H.P. turbine unit. 415-B.H.P. turbine unit.

Longitudinal Section through the New Hydro-Electric Power House, Chester.

Each turbine is provided with a tachometer, and a handsome head and speed gauge is installed. This gauge records on a large daily chart the available head of water, and also indicates the head under which the turbines are working and the correct speed at which the turbines should be working.

A wrought-iron strainer rack is provided across the full width of the head race, and to facilitate cleaning it, a platform is placed at a level which is well above headwater.

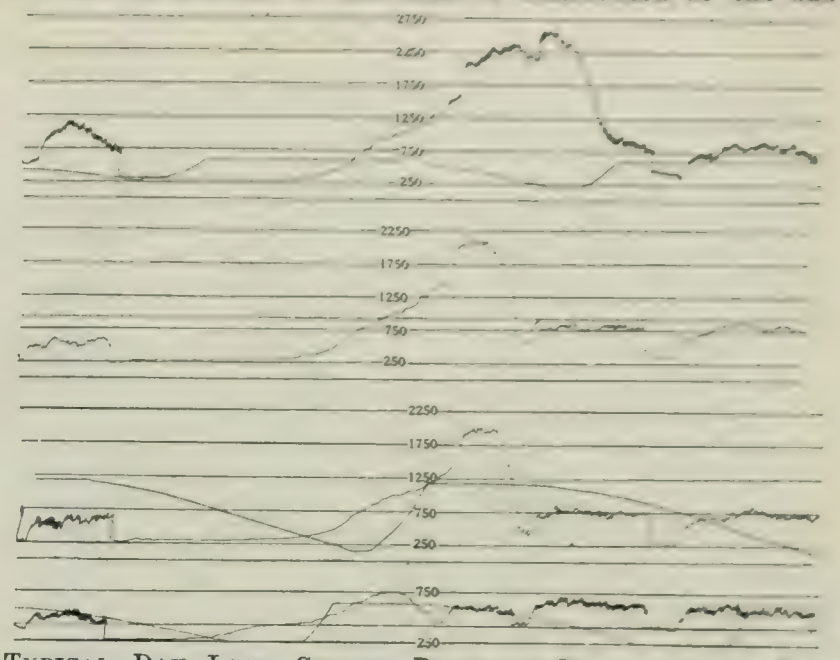
There are three complete sets of sluice gates, each consisting of two gates of the double lifting type, with a double set of headgear, operated inside the power house by one man.

The turbines are coupled through machine-cut steel helical bevel gear and flexible couplings to shunt-wound interpole generators, constructed by the Lancashire Dynamo and Motor Co. The two large generators, each have an output of 225 KW., at a speed varying between 143 and 285 R.P.M., while the output of the smaller generator is 185 KW., at any speed between 167 and 300 R.P.M.; the pressure is 440-500 volts.

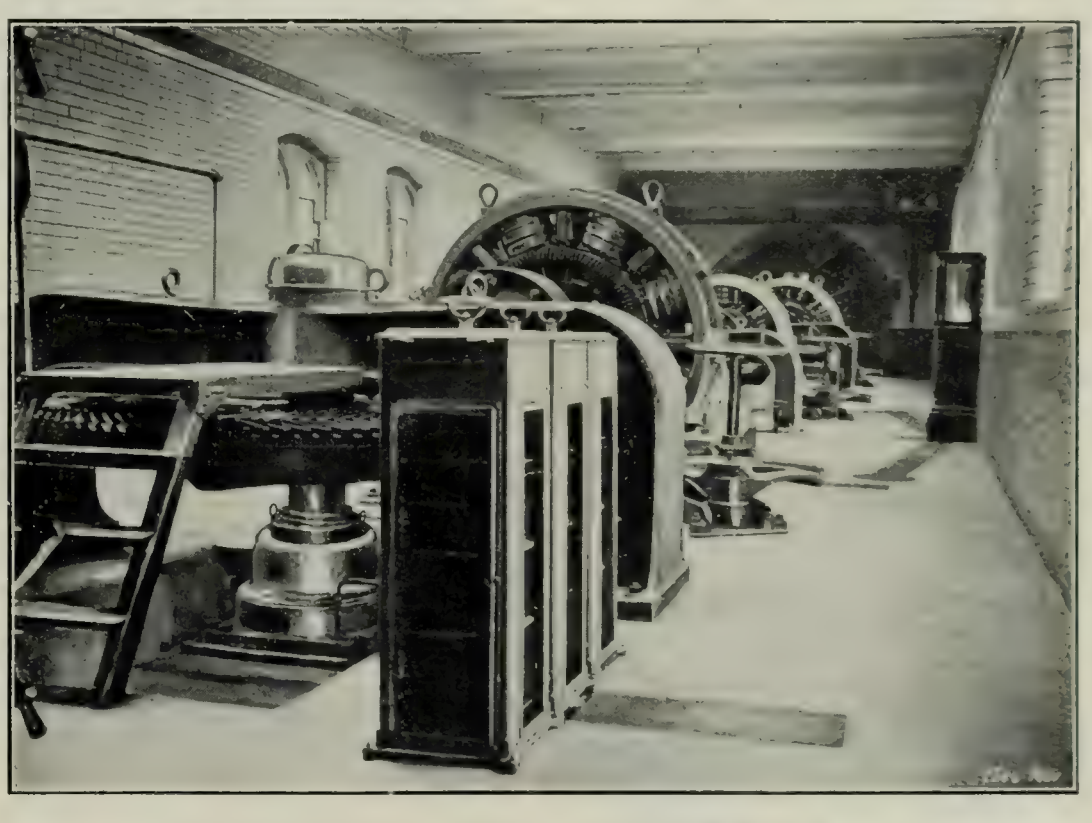
Although the normal maximum speed of either machine is, approximately, 300 R.P.M., the armatures are specially constructed so that they may be safely run at 500 R.P.M., without fear of damage. The higher speed is given when the load is instantaneously thrown off the turbine as, for instance, in the event of the generator circuit-breaker operating.

Special attention has been paid to the insulation throughout the machines, so that it may withstand the action of damp atmosphere.

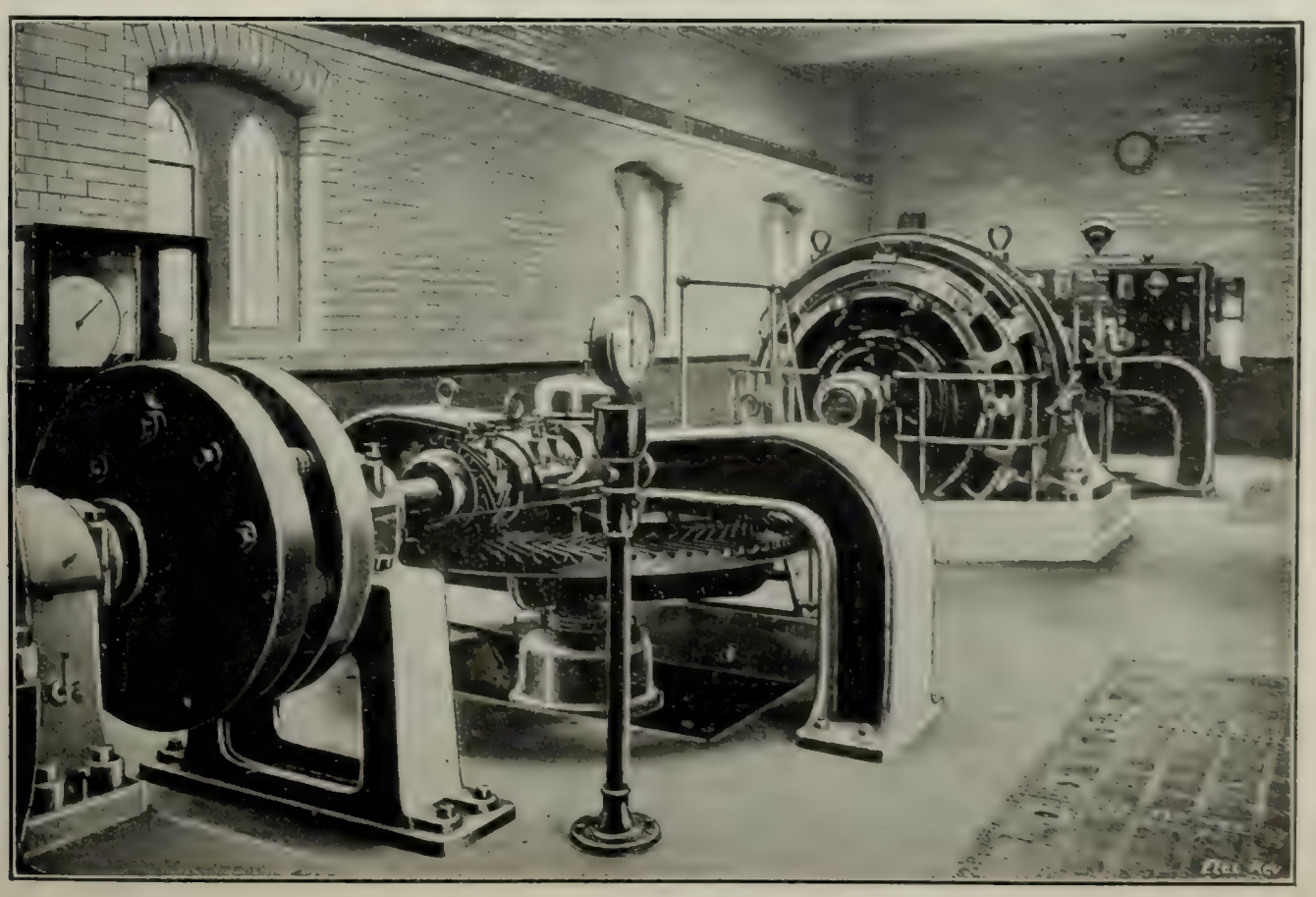
The generators are controlled from a Crompton switchboard erected at one end of the power house, consisting of three enamelled slate panels on which is mounted the usual apparatus for the control of direct-current generating plant. The current generated is conveyed by three lead-sheathed and steel-armoured cables, laid direct in the ground, to a substation at the Cross. As much of the current as is required to meet the demand of that area is distributed at the sub-



Typical Day Load Curves Between December and June of Steam Station, with Estimated Hydro-Electric Output on those Dates Superposed (Dotted Line).



Generating Plant, Chester Hydro-Electric Works.



Arrangement of Flexible Coupling, Citroen Gearing for Generator Drive.

station, the balance is sent to the steam generating works at New Crane Street, where it passes through a reversible booster, and is either sent out to other areas of supply, or stored in a battery in readiness for the next peak load.

The arrangement of plant provides flexibility and economical running under the varying conditions of flow and head, as one unit will deal with the dry weather flow, two with the average flow and three with the wet weather flow and low heads. It is estimated that the installation will yield about 1,250,000 units per annum at a cost including capital charges of rather less than ·3d. per unit.

The scheme includes several interesting constructional features, which we are unfortunately unable to do more than indicate, viz., the suspension bearing for the turbine runners, &c., carrying a weight of about 6½ tons; the adjustable ball thrust bearing in proximity to the Citroen gear for giving minute adjustments to the latter; the flexible coupling—a speciality of Messrs. Gordon—in which an endless rope interwound between the projecting pins of the two halves

of the couplings, gives the required flexibility not only in the direction of rotation but also for end play, the latter a source of considerable wear with other similar types of coupling, which the rope feature is said to overcome ; also the sluice gates, constructed in two parts, the lower one of which opens



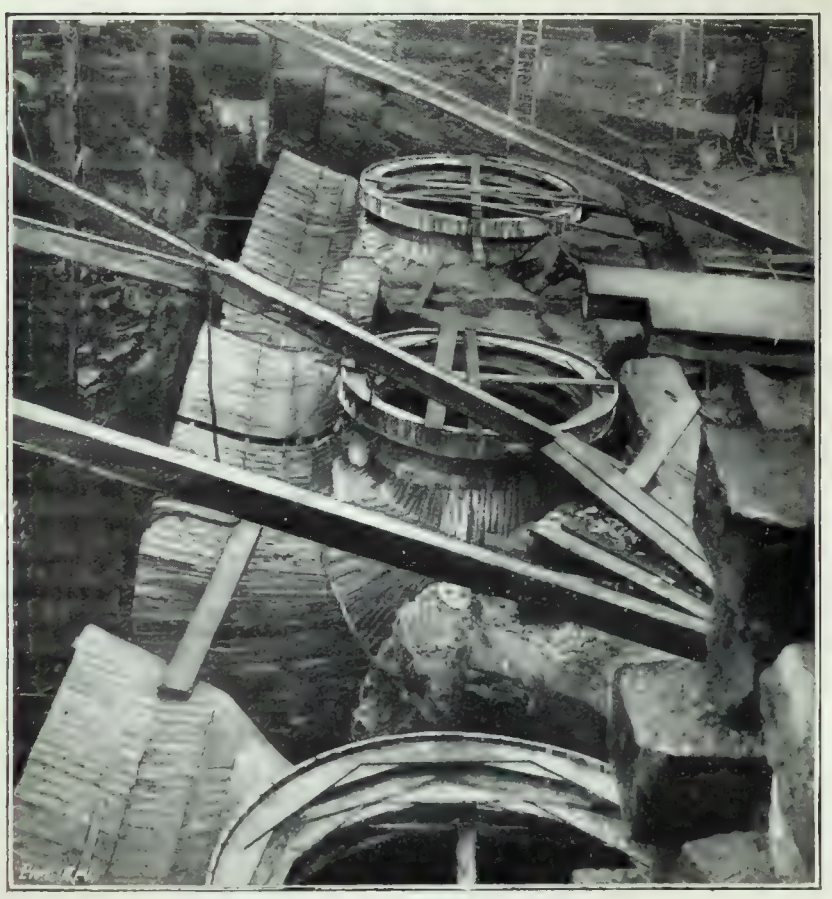
Removing the Old Foundations.

to the full extent before the upper one is lifted, the arrangement being such that one man can operate the double sluice gate.

In Mr. Hurtzig's report, he estimated that Mr. Britton's scheme would cost some £12,500, allowing over 10 per cent. for contingencies, and basing capital charges upon local experience, these were estimated at £858 per annum, which together with £334 for labour and management, and £134 for repairs and maintenance, gave a total annual charge of £1,326.

Mr. Britton estimated that 1,021,490 units could be usefully generated during a year, but this estimate was exceeded by Mr. J. S. Wilson, who, in an appendix to Mr. Hurtzig's report, came to the conclusion that 1,273,400 units per annum was a safe production figure.

However, taking Mr. Britton's figure of 1,021,490 units



Wooden Formers for Turbine Draft Tubes.

at 1d. per unit, an income of £4,257 results ; and as the total working cost per annum as mentioned above, only amounts to £1,326, the surplus or profit should amount to £2,931.

In view of the promising nature of these estimates, the actual results obtained from the working of the plant, which is to be officially opened on Monday next, will be awaited with great interest.

The principal contractors were Messrs. James Gordon and



The Strainer Rack and Sluice Gates.

Co., of London, who constructed the building, strainer rack, sluice gates, turbines, gears, shafting, flexible couplings and travelling crane ; the Lancashire Dynamo and Motor Co., who supplied the generators ; and Messrs. Crompton & Co., who constructed the switchboard.

In conclusion, we congratulate Mr. S. E. Britton, the city electrical engineer, not only on having originated a somewhat novel scheme of considerable pecuniary value to the town, but also on having carried it to an apparently successful stage of operation. We are indebted to Mr. Britton for his assistance in connection with this article.

Electric Traction Abroad.—In a review of electric traction abroad, great progress, says the *Revue Pratique de l'Electricité*, has been made in the driving of trains by electricity in Germany, Italy, Austria, Sweden and Russia. The Prussian State railways have organised services on several lines. In 1906 the Berlin suburban line to Gross Lichterfeld was electrified (direct current) ; four years later the trial line from Niederschönwerde to Spindlersfeld, also the Blankenese-Hamburg to Ohlsdorf single-phase line were organised. A satisfactory result being shown, the Prussian Administration decided, in 1909, to electrify the Magdeburg-Halle-Leipzig section (154 km.) ; that from Laubau to Königzelt, in Silesia (129 km.) ; and a stretch of 145 km. in the Riesengebirge. In order to ensure uniformity in the equipment and the locomotives and to train the staff, the Dessau to Bitterfeld line was opened in 1911. The complete service from Magdeburg to Leipzig will be in operation in 1914. The State Railway Administration of Prussia owns 95 locomotives and 145 motor-carriages on the single-phase system. Working results on the Blankenese-Ohlsdorf line began to show satisfactory figures from the third year (1910) of operation viz., 1½ per cent. in 1910, 3½ per cent. in 1911, and 4 per cent. in 1912 on the capital disbursed ; the mileage run on the Dessau-Bitterfeld line was 30,000 to 40,000 km. The Prussian Government has laid before the Landtag a scheme to electrify the Berlin suburban railways, consisting of 400 km. of double track, 27 km. of single track, and 125 km. of auxiliary lines. The capital required will be 123,000,000 fr., 75,000,000 of which will be for rolling stock. The trains will be made up of 13 coaches, drawn by two or three motor-cars, an arrangement allowing the use of existing rolling stock. The principal section of the Stadtbahn is 13½ km. in length ; it will be served by 32 trains per hour in both directions which may be increased to 40. Electric working should be started in 1914, as, the electrification is being hastened, owing to the insufficiency of the steam service. The Prussian Administration has chosen the single-phase system owing to the satisfactory results shown on the Blankenese-Ohlsdorf line, where long trains of 300 tons weight are being run ; the construction of sub-stations is, moreover, dispensed with. The State Administrations of Prussia, Bavaria, and of the Grand Duchy of Baden have officially adopted the same system

NOTES.

(*Continued from page* 618.)

University College, Dundee.—On Monday the new engineering department was opened by Sir A. B. W. Kennedy. We shall recur to the matter in a later issue.

The "Tynemount."—The electric motor ship, *Tynemount*, has recently undergone satisfactory trials and is now nearly ready to sail on her maiden voyage.

Institution and Lecture Notes.—A meeting of the Electrical Section of the Newcastle-on-Tyne and Gateshead Chamber of Commerce was held on the 13th inst. in the Mayor's Chamber, Newcastle. Mr. C. S. Vesey Brown presiding. Mr. W. C. Mountain was elected chairman of the section for the ensuing year, and it was decided to discuss the question of tariffs for cooking, heating and lighting purposes, at a special meeting on October 27th. A report was presented to the meeting which stated, *inter alia*, that the desirability of having a uniform tariff for heating and cooking had been discussed. The committee agreed that it was almost impossible to obtain a uniform tariff, but considered that some principle might be generally agreed upon. The engineers of the various municipalities had been circularised, asking for opinions on the point, which was receiving the attention of the committee.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. G. C. I. STUART, of the staff of the Manchester Corporation Electricity Works, Stuart Street, and formerly resident engineer at the Brakpan power station of the Victoria Falls and Transvaal Power Co., Ltd., South Africa, has been appointed power station superintendent of the Central Argentine Railway, Ltd., Buenos Ayres.

The salary of MR. E. ROTHWELL, electrical engineer at the Rochdale Workhouse, is to be increased from £130 to £150 per annum with emoluments, which amount to £26 per year.

MR. L. LEE, chief meter inspector of the Watford undertaking, has resigned his appointment. MR. V. A. WOODLAND, at present assistant meter inspector, has been promoted to fill the vacancy, and applications are invited for an assistant and for two junior shift engineers, owing to the appointment of the present senior shift engineer (MR. G. A. AYRE) as third assistant engineer, and the junior shift engineer (MR. ELLIS) as shift engineer.

The Stafford T.C. has appointed MR. W. H. ROBBINS to succeed Mr. Mead as electrical engineer.

The Whitehaven T.C. has received 180 applications for the post of electrical engineer in succession to MR. SANKEY.

MR. JACKSON, canvasser to the Corporation electricity department at Cheltenham, has resigned in order to take up another appointment.

The Hereford T.C. has increased the salary of MR. G. H. WATSON, assistant engineer at the electricity works, from £117 to £130 per annum.

MR. ROBERT WILKINSON, shift engineer at South Shields Corporation electricity works, has been presented with a suit case by the staff and employés, upon the occasion of his leaving to join the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., at Trafford Park.

Tramway Officials.—MR. J. R. TAYLOR, of Ashton-under-Lyme Corporation Tramways, has been appointed chief clerk of the Walsall tramways at £130 a year, rising by annual increments of £10, to £160. Mr. F. Walton was formerly appointed to this position, but withdrew his application.

General.—On Friday morning last, when the pressure of the week was somewhat relaxed, the generally very tranquil offices of the ELECTRICAL REVIEW resounded with a hearty singing of the chorus "For He's a Jolly Good Fellow." For a few moments the members of all departments of the office staff on Ludgate Hill "downed tools" in order to give their cordial good wishes to MR. W. G. WICKEN on his retirement from the position of manager of the composing department, after 30 years' exemplary service with Messrs. H. Alabaster, Gatehouse & Co. Advantage was taken of the opportunity to present Mr. Wicken with a well-filled cigar cabinet, suitably inscribed. The presentation was made by Mr. E. S. Middleton (advertisement manager), after a brief address, signed by every member of the staff, had been read and presented by Mr. Albert Bridge (news editor). Every employé of the firm who could possibly manage it was present, but the days being more strenuous than they used to be, the advertisement travellers, Messrs. Osborne Pearston, H. Porter-Cox and H. G. Crabb (Electrical Directory department), were only able to be present in the spirit. Those assembled included Mr. A. H. Allen, M.I.E.E. (assistant editor), Mr. J. Osborn (publishing department), Messrs. W. B. Warwick and E. H. Howard (photographic and engraving department), Mr. P. J. Haskell (accountancy and advertisement department), &c. Mr. B. A. Tapp (sub-editor) had not yet returned from holidays. A pleasing and perhaps somewhat unusual circumstance was the lengthy service with the journal of so many of those present, seven having continued for more than 20 years, though still in the hey-day of youth. The spirit of a common interest, engendered by the friendly relations that have always existed between the principals and staff, is reflected in this record. In addition to the staff's good wishes, Mr. Wicken has also received the personal recognition of the proprietors (Messrs. H. Alabaster, Gatehouse & Co.), ensuring him of freedom from anxiety in his well-earned retirement. Mr. Wicken is succeeded by his son, MR. W. H. WICKEN, who has been connected with the department for many years.

On the occasion of the visit of the King and Queen to the London Coliseum last week, in aid of the French Hospital in London and the Charing Cross Hospital, among those who had the honour of being presented to their Majesties was MR. GEORGE VERITY (vice-chairman of the Charing Cross Hospital).

MR. LEWIS E. BURR, of the Woods Motor Vehicle Co., Chicago, has been elected president of the American Electric Vehicle Manufacturers' Association.

A Canadian Exchange states that MR. A. T. GOWARD, Victoria manager of the B.C. Electric Railway Co., recently left for England, where he will spend several months, and will discuss with the directors matters pertaining to the company's undertakings in Victoria and immediate vicinity.

The same contemporary states that MR. H. W. CURLING recently arrived in Canada to assume the position of managing director of the Canadian Electric Co. Mr. Curling was recently in South Africa, where for over three years he has been directing the operations of a London electrical company.

MR. W. BRAGG, of the machine shop staff of Messrs. Willans and Robinson, Ltd., electrical engineers, of Rugby, is leaving to set up in business for himself at Coventry, and his colleagues have presented him with a watch. MR. A. JOBEY, of the same department, is leaving to take up an appointment at Glasgow, and he has been presented with a travelling trunk, with a gold bracelet for his wife.

The staff at the Sheerness Dockyard electric power station have presented a set of carvers and pickle fork in case to MR. ARTHUR SHRUBSALL on his marriage.

MR. ROBERT ONIONS, the general manager of Messrs. Richard Hornsby & Sons, Ltd., of Stockport, who has been with that firm for a period of over 23 years, has now left them to become works manager to Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, Stockport. A meeting of some 300 of Messrs. Hornsby's employés was held to bid him "good-bye," and a presentation, consisting of a silver rose bowl and a set of vases, was made by Mr. Bellamy, one of the directors of the firm, who referred to the good relations which had always existed between Mr. Onions and the directors, their appreciation of Mr. Onions' services, and their good wishes to him in his new appointment.

MR. EDWARD J. NALLY is accepting the appointment of vice-president and general manager of the Marconi Wireless Telegraph Co., of America. Mr. Nally has been for more than 35 years connected with the telegraph business, starting as a messenger boy with the Western Union Telegraph Co. He recently resigned as vice-president and general manager of the Postal Telegraph and Cable Co., after a service of nearly 25 years. His telegraph experience and reputation are expected to be especially valuable to the company in connection with the trans-Atlantic and trans-Pacific telegraph service which it is expected will be opened to the general public by the close of the present year.

MR. T. GRAY, who has been connected with the Electric Construction Co., at Bushbury, for 21 years, has just left to fill an important position in Chelmsford, and last week he was presented with a gold watch from the turning and fitting shops. Mr. and Mrs. Gray were the recipients of two umbrellas; and from his more immediate colleagues, Mr. Gray received a massive cigarette case.

MR. C. E. HUNTER, director of the Edison & Swan U.E.L. Co., Ltd., has been appointed to the board of the Altrincham Electric Supply, Ltd.

MR. H. W. ERBY this week severs his connection with Messrs. Williams & Bach, 9, Hanover Street, W., having resigned his position as manager of the electrical department.

MR. J. J. CHISWELL, late sales manager of the Brimsdown Lamp Works, Ltd., and previously for some years manager of the supplies department of the Brush Electrical Engineering Co., Ltd., has now entered into his new offices at Craven House, Kingsway. Mr. Chiswell has been established as an "electrical purchasing agent" since the beginning of the year, trading as Chiswell & Co., and is acting for several important Colonial firms. He would be glad to receive lists from manufacturers interested in the over-seas trade, particularly Canada, Australia and India.

Obituary.—MR. J. H. CAWTHRA.—News was received in South Shields on the 11th inst. of the death in South Africa of Mr. J. H. Cawthra, formerly borough electrical engineer at South Shields. It was stated that death was the result of a motor accident, but no details were then to hand. Mr. Cawthra commenced his association with electrical engineering in the North of England, when, after the completion of his apprenticeship, he entered the service of Messrs. J. H. Holmes & Co. Here he acquired experience in the construction and erection of electric generating plant. Later he became connected with the Newcastle-on-Tyne Electric Supply Co. Subsequently he served as a marine engineer, and in 1893 he gave up this work and received an appointment under a Yorkshire electrical company. He afterwards became chief assistant electrical engineer at the Leeds Corporation electricity works, and subsequently held a similar position under the Swansea Corporation. In 1901 he was appointed to South Shields leaving there two years ago to take up an appointment under the Victoria Falls Power Co., South Africa.

MR. J. GROVER.—The death is reported of Mr. John Grover, of Heather Bank. The deceased, who was 78 years of age, established the Hindhead E.L. Co.

NEW COMPANIES REGISTERED.

Watson, Marsh & Co. (Hampstead), Ltd. (131,523).—This company was registered on October 9th, with a capital of £500 in £1 shares, to carry on the business of designers, manufacturers, exporters and importers of, and dealers in, electric light and other electrical apparatus, conduits, ynamo machines, lamps, fittings and accessories, &c. The subscribers (with one share each) are:—J. B. Marsh, 6, Hovedean Road, Cricklewood, N.W., electrical engineer; M. Cohen, 25, Brindesbury Road, N.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are M. Cohen, J. B. Marsh and G. H. Marsh (all permanent). Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Newman & Co., Ltd. (131,537).—This company was registered on October 10th, with a capital of £1,000 in £1 shares, to carry on the business of electrical engineers, manufacturers of electro-plated and other metal goods, and bottles and other glass articles, &c., and to adopt an agreement with H. F. Morriss, W. Hamblett, and W. Knowles. The subscribers (with one share each) are:—W. Knowles, Alcesten Road, Wallington, incorporated accountant; H. F. Morriss, 143, Lower Road, Rotherhithe, S.E., metal merchant. Private company. The number of directors is not to be less than two or more than three: the first are W. Knowles, H. F. Morriss, and W. Hamblett (all permanent); qualification, £200. Registered office, 39, Old Paradise Street, Lambeth, S.E.

Cold Light (Dussaud Processes), Ltd. (131,482).—This company was registered on October 8th, with a capital of £18,000 in 16,000 ordinary shares of £1 each, and 40,000 deferred shares of 1s. each, to carry on the business of manufacturers of, and dealers in, electric and other lighting, and cinematograph apparatus and lamps, electricians, engineers, &c. The subscribers (with one share each) are:—L. Schloss, 3, Rangoon Street, E.C., merchant; E. A. Myer, 46-7, London Wall, E.C., solicitor. Private company. The number of directors is not to be less than three or more than ten; the first are J. H. Osborne, L. Schloss, E. A. Myer and Maria F. E. Cogni (permanent, subject to holding 500 ordinary shares), A. Leresche and C. F. Dussaud; qualification of ordinary directors, 100 ordinary shares. Registered office, 46-47, London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Radium Electro-Emanation Co., Ltd.—Particulars of £3,000 debentures, created September 18th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,750. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Continental Electricity Co., Ltd. (57,088).—Return dated July 18th (filed September 5th), 1913. Capital £20,000 in 1,000 ord. and 1,000 pref. shares of £10 each. 1,000 pref. and 998 ord. shares taken up. £16,380 paid on 790 pref. and 848 ord. £3,600 considered as paid on 210 pref. and 150 ord. Mortgages and charges: Nil.

Electrical Oil Refining Co., Ltd. (43,126).—Return dated August 6th, 1913. Capital, £5,000 in £1 shares. 4,375 shares taken up. £1 per share called up on 882. £882 paid. £3,493 considered as paid. Mortgages and charges; Nil.

Exchange Telegraph Co., Ltd. (6,152). — Return dated August 13th, 1913. Capital at date of return, £246,250 in 8,125 "A" and 16,500 "B" shares of £10 each. 8,023 "A" and 16,200 "B" shares taken up (exclusive of 102 "A" shares forfeited). £9 per share called up on 6 000 "A," and £1 per share on 2,023 "A." £56,023 paid. £179,000 considered as paid, being £10 per share on 16,200 "B" and £8 per share on 2,125 "A" shares. Mortgages and charges: Nil. Since the date of the above return, resolutions adopted with a view to reducing the "A" nominal capital to £96,430 in 8,023 "A" shares of £10 each, and 16,200 "B" shares of £1 each, by cancelling 102 "A" shares forfeited, by cancelling capital lost or unrepresented by available assets to the extent of £9 per share on 16,200 "B" shares, and by cancelling 300 "B" shares which have not been issued.

Frinton-on-Sea Electric Light and Power Co., Ltd. (70,689).—Return dated May 22nd, 1913. Capital, £10.000 in £1 shares (7,300 pref.) 1,376 ord. and 5,125 pref. shares taken up. £6,501 paid. Mortgages and charges: £6,457.

General Electric Co., Ltd. (67.307).—Return dated July 24th, 1913. Capital, £800,000 in £10 shares (40.000 pref.). 40.000 pref. and 40.000 ord. shares taken up. £10 per share called up on 33,000 pref. and 15.000 ord. £479,976 paid, leaving £24 in arrears. Mortgages and charges: £200,000.

Electrical Co., Ltd. (36,819).—Return dated May 9th, 1913. Capital, £100,000 in £5 shares. All shares taken up. £2 12s. 6d. per share called up on 17,000 and £2 on 3,000. £50,625 paid. £9,000 (£3 per share) considered as paid on 3,000. Mortgages and charges: Nil.

Electric and General Investment Co., Ltd. (31,506).—Return dated July 8th, 1913. Capital, £201,500 in 20,000 ord. and 19,900 pref. shares of £5 each, and 40,000 def. shares of 1s. each. All shares taken up. £1 per share called up on the ord., and £5 on the pref., and 1s. on the def. £121,500 paid. Mortgages and charges: £29,570 10s.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full (*a*) on September 15th, 1913, of debenture dated February 9th, 1904, securing £100; and (*b*) on September 17th, 1913, of debenture dated January 3rd, 1911, securing £150, has been filed.

Issue on September 24th, 1913, of £250 debentures, part of a series of which particulars have already been filed.

La Plata Electric Tramways Co., Ltd.—Trust deed dated September 10th, 1913, (supplemental to trust deeds of May 26th, 1909, and January 31st, 1912), to secure £100,000 5 per cent. first mortgage debenture stock ranking *pari passu* with £30,000 and £70,000 like stock created under the deeds of 1909 and 1912 respectively. Property charged (specifically): Concessions, lands, tramways, buildings, &c., specified in the second schedule to the principal trust deed. (As a floating security): The company's undertaking and other assets, present and future, including uncalled capital. Holders: River Plate Trust, Loan and Agency Co., Ltd., 52, Moorgate Street, E.C.

Henley's (South Africa) Telegraph Works, Ltd. (77,781).—Return dated August 1st, 1913. Capital, £2,000 in £1 shares. 2,000 shares taken up. £2,000 paid. Mortgages and charges: Nil.

Clarke, Steavenson & Co., Ltd. (57,821).—Return dated August 25th, 1913. Capital, £3.000 in £1 shares. All shares taken up. £1 per share called up on 1,400 and 15s. per share on 1,600. £2,600 paid. Mortgages and charges: £500.

Malaga Electricity Co., Ltd. (48,076).—Return dated July 22nd, 1913. Capital, £57,000 in 10,000 ord. shares of £5 each and 7,000 def. shares of £1 each. All shares taken up. £5 per share called up on 10,000 shares. £50,000 paid. £7,000 considered as paid on 7,000 shares. Mortgages and charges: £34,131.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Return dated September 18th, 1913. Capital, £50,000 in £5 shares. All shares taken up. £50,000 considered as paid. Mortgages and charges Nil.

British Empire Lighting and Construction Co., Ltd.—Mortgage dated September 26th, 1913, to secure £700, charged on gas works, mains, meters, plant, &c., at Swinehead, Lincs., and goodwill of the said gas works. Holder: M. J. Johnson, Swinehead, near Boston, Lincs.

Nairobi Electric Power and Lighting Co., Ltd.—Particulars of £3 000 debs., created September 10th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £19,000. Property charged: The company's undertaking and assets, present and future, except a certain contract. No trustees. A memorandum of satisfaction in full on September 10th, 1913, of debs. of various dates from 1908 to 1913, securing £17,000, has also been notified.

Varley Magnet Co., Ltd.—Issue on October 1st, 1913, of £500 debentures, part of a series of which particulars have already been filed.

Reno, Ltd. (117,987).—Return dated September 12th, 1913. Capital, £5,000 in £1 shares (1,000 pref.); 800 pref. and 4,000 ord. shares taken up; £4,800 considered as paid. Mortgages and charges: Nil.

Rural Electricity Supply Co., Ltd. (107,281).—Return dated July 14th, 1913. Capital, £10,000 in 9,500 pref. shares of £1 each and 10,000 defd. shares of 1s. each; 1,856 pref. and 4,713 defd. shares taken up; £1 per share called up on 2,661 pref. and 1s. per share on 4,713 defd.; £2,302 8s. paid, including £112 16s. 3d. paid on 205 shares forfeited; £107 1s. 3d. remains in arrears. Mortgages and charges: £300.

Tubes, Ltd. (91,224)—Return dated July 2nd, 1913. Capital, £100,000 in £1 shares. All shares taken up. £1 per share called up on 82,859. £82,859 paid. £17,141 considered as paid on 17,141. Mortgages and charges: Nil.

Sheerness and District Electric Power and Traction Co., Ltd. (65,749).—Return dated June 30th, 1913. Capital, £75,000 in £10 shares (2,500 pref.). 5,000 ord. and 2,473 pref. shares taken up. £10 per share called up. £74,730 paid. Mortgages and charges: £23,327.

Spensers, Ltd.—Particulars of £3,000 second debentures, created September 5th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Cleveland and Durham Electric Power, Ltd.—A memorandum of satisfaction in full on October 4th, 1913, of charge contained in an agreement dated May 29th, 1912 (supplemental to an agreement dated January 13th, 1911), securing £31,600, or such other sum as might be payable under the terms of the said agreement of May 29th, 1912, has been filed.

CITY NOTES.

Ferranti, Ltd.

THE directors' report for the year to June 30th, 1913, shows that the profit on trading for the year was £59,599, and, after crediting discounts, interest and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, income-tax, bad debts, directors' and trustees' fees, and expenses of issue of five-year notes, there remains a balance of £28,142, which has been applied as follows:—Interest on prior lien debenture, £402; interest on first mortgage debenture stock, £4,850; interest on five-year notes, £1,094; interest on bank loans, £1,799; depreciation reserve account, £10,000; leaving a balance of £9,996; which, together with the amount at credit at June 30th, 1912 (£12,456), makes £22,452. Of this, £22,000 has been carried to the general reserve account, leaving to be carried forward £452. The results for the year again show an improvement over those for the previous year. A further £10,000 has been added to depreciation reserve, increasing the amount to £56,350, and the directors have deemed it advisable to carry £22,000 to the credit of a general reserve account. An issue of 6 per cent. five-year notes has been made, and the balance of the prior lien debentures has been redeemed. By the operation of the sinking fund, £4,000 of the first mortgage debentures have been redeemed, and the loan on second mortgage debentures has been reduced. Mr. S. Z. de Ferranti and Mr. Arthur Whittaker offer themselves for re-election as directors. Mr. R. W. Cooper was elected a director during the year.

The meeting is to be held in London on October 24th.

Auckland Electric Tramways Co., Ltd.

THE annual meeting of this company was held on Thursday last week at the Electrical Federation Offices, Kingsway W.C., Mr. C. C. Tegetmeier presiding.

The CHAIRMAN first expressed the satisfaction felt by his colleagues and himself in being able to present a statement of accounts which showed in such a high degree a continuance of the progress that had characterised the business of the company since the commencement of their undertaking. The traffic receipts last year amounted to £257,591, which was £28,449, or 12 per cent. more than in the preceding year. They had become accustomed to seeing their traffic receipts increase year by year, but although the route mileage worked last year was only slightly in excess of that of the previous year, the result showed a greater proportionate increase than they had ever had in any one year over its immediate predecessor. Dealing with the balance-sheet, the share capital stood at £500,000. During the year they made an issue of £50,000 in preference shares, and those shares were offered to the shareholders at par *pro rata* to their holdings, and with the exception of a very small number, were all taken up. Those which were not taken up were disposed of at a premium. There were also issued during the year £25,000 in debenture stock, and, on the other hand, in accordance with the provision of the trust deed, debenture stock to the amount of £4,487 was redeemed. The renewals and depreciation account at the beginning of the year stood at £71,007. That account was created out of revenue for the purpose of providing for future expenditure upon renewals and reconstruction, as distinct from current expenditure upon repairs and maintenance. As he had stated at previous meetings, the time

was approaching when they would have to meet a considerable expenditure for the reconstruction of the permanent way. Last year extensive renewals and reconstruction were carried out, and the expenditure amounted to £34,844. This had been charged to the renewals account. For the next few years the expenditure would continue heavy, although not, perhaps, to the same extent as last year. They had made arrangements for the purchase of adjoining property which would enable them to enlarge their power station and provide additional plant. They had already placed an order for an additional 1,000-KW. set, which they expected to have installed during the ensuing 12 months. The development of the traffic had also necessitated considerable capital expenditure in doubling the track in several places, and with comparatively slight exceptions, the whole of their track was now doubled. Also they had spent a good deal of money in connection with the new repairing works. From the nature of the capital expenditure to which he had referred, it would be seen that only to a slight extent could it have been directly productive of profit during the year in which it had been spent, and they could look for material benefit from it in the future, not only in increased receipts, but in the greater efficiency of the service and the greater economy in working expenses. In view of future capital requirements they proposed to make an issue of £100,000 ordinary shares. They proposed to adopt the same course with regard to the issue of those shares as they had done on former occasions, and to offer them to the shareholders *pro rata* to their holdings at par, the *pro rata* proportion being one new share to every five old shares. Referring to the revenue account, he said that their total receipts amounted to £261,713, which was £29,362 more than in the preceding year. The continuous growth of their traffic receipts was quite remarkable, and afforded clear evidence of the prosperity which Auckland had been enjoying, and which there was every indication it would continue to enjoy. To carry, as they did last year, 40,000,000 of passengers from a community of the size of Auckland, which was approximately an average of the whole of the population on every day throughout the year, was exceptional, and the upward movement was still continuing. During the first three months of their present year, they had carried more than half-a-million more passengers, and taken over £3,000 more in traffic receipts than in the corresponding three months of last year. The interim dividend on the ordinary shares was paid in May last, and required £10,208: they now proposed a final dividend of 1s. per share, making 1s. 7d. for the year. That would require a further £17,500, and leave £8,782 to be carried forward, as against £8,267 brought in. The reserves they had established with the additions of the carry forward, made a total of £172,444, which was 17 per cent. of the total paid-up shares and debenture capital, including the £100,000 of new capital proposed to be issued. The chairman concluded by moving the adoption of the report and accounts.

Mr. C. Shirreff Hilton seconded the motion, which was carried unanimously.

An extraordinary meeting was subsequently held, and the proposal to increase the capital from £500,000 to £600,000 by the creation of 100,000 new ordinary shares of £1 each, was approved.

Metalite, Ltd.

Mr. W. Stewart presided on Monday at Salisbury House, E.C., over an extraordinary general meeting of the shareholders of the above company, for the purpose of considering a resolution for the voluntary winding up and reconstruction of the company. There was a large attendance of shareholders.

The Chairman said that before commencing to deal with the scheme of reconstruction, which, together with his co-directors, he had had prepared, he very much regretted to have to inform them that on September 21st Mr. Metcalf died, and they had thus lost the valued advice of one who had been the moving spirit during the whole of the company's existence. He was formerly managing director of the company from the date of its formation for some time, and although he afterwards vacated the position, yet he was jointly responsible for the carrying out of the company's trade, and he was the only director who had been connected with the company since its formation. For that reason they had been looking mainly to him to give the meeting a history of the company's work and the details of the present position. He (the chairman) joined the board in July, 1911, and consequently could not say very much of what occurred prior to that time, but he found that all the first directors, with the exception of Mr. Metcalf, had resigned, and that the chief work which then lay before them was to get the work at the Derby factory properly going, and to clear up a number of liabilities which had been accumulating gradually. For that purpose, and also to get further working capital, it was necessary to make a debenture issue which, for the most part, was subscribed by his colleagues and himself, and they also made large cash advances which, he might add, had not been repaid, nor had any of them had any interest thereon. However, matters were progressing fairly satisfactorily. A ready market existed for the company's products, and the only thing required to make the undertaking a success was an increased output, which was gradually increasing week by week, and they had hoped shortly to have turned the corner, when the present trouble was precipitated by the owners of the first mortgage on the company's assets putting in a Receiver in February of this year. This naturally interfered with the uphill task which they were concentrating their efforts upon, and so, during the intervening period, they had been earnestly considering the best steps to take in the company's interest, primarily with a view to helping the shareholders, and incidentally the debenture-holders. As a result of their deliberations they had had a scheme prepared for reconstruction based on a contract, which he would have read to the meeting.

The Secretary pointed out that the document would take a quarter of an hour to read, and it was decided that it should lie on the table and that the secretary should read the scheme as printed in the directors' circular, viz.:—

"The proposed scheme of reconstruction, which, after lengthy deliberations, your directors consider most desirable, is as follows:—

"The proposed new company is to have a nominal capital of £85,000, divided into:

£16,500 being 16,500 £1 profit participating cumulative preference shares bearing prior 7 per cent. dividend and then ranking equally with the ordinary shares for additional dividend.

£21,250 being 85,000 5s. ordinary shares to be issued as fully-paid to the series debenture-holders and loan creditors.

£47,250 being 189,000 5s. ordinary shares to be issued as 3s. 6d. paid up to the existing shareholders in the old company.

Total £85,000

"The existing shareholders will, therefore, have a preferential right to apply for the last-mentioned shares, which will carry an unpaid liability of 1s. 6d. per share, providing a sum of £14,175

Issue of 15,000 7 per cent. cumulative preference shares 15,000

£29,175

"Which will be allocated to:—

First mortgagees' principal interest and costs of receivership (say)	4,500	
Second mortgagees' principal interest and costs (say)	1,350	
Third debenture	2,500	
Preferential and trade creditors and costs of reconstruction (say)	3,000	
Balance of consideration for the exclusive British licence under Boran Patent (No. 9,941, of 1912)	1,000	12,350
Leaving in hand for working capital (estimated)		£16,825."

The Chairman said that, personally, he had no doubt if they were prepared to adopt the resolution which he would move, that success would yet come to the company, which was in possession of a factory fully equipped with the most modern machinery and plant requisite for the manufacture of metal filaments and metal-filament lamps, and which had the exclusive British licence to manufacture and sell the Boran lamp. As regarded the management, that was entirely in their hands, as the directors of the new company would have to be elected by the shareholders—as to two directors by the preference shareholders, one director by the fully-paid shareholders, and two directors by the partly-paid shareholders. He should like to say a few words with reference to the vendors' outstanding calls. As they would remember, the vendor companies—the Bryant Trading Syndicate and the International Filaments, Ltd., paid for somewhere about 120,000 shares. Of these they had gradually placed a large number, and on these the whole of the calls had been paid. In addition, the vending companies had paid further amounts, and actually there were now outstanding only about one-third of the original liability. Although they had repeatedly pressed for the payment of the balance, the vendor companies found they were unable to pay off the sum at present, and, so far as the directors could see, were not likely to be in a position to do so, at any rate for some considerable time. Under those circumstances, it seemed grossly unfair that the company should retain the benefit of voting at that meeting, and for the large vote which they held in virtue of their fully-paid shares which they held as distinct from the shares with unpaid calls, prevent the passing of the resolution, and thus deprive the other shareholders of the benefits which would accrue to them under the scheme. Seeing that it was hopeless to endeavour to collect the calls, the directors made the proposition to the vendor companies, and it had been agreed that, in consideration of the vendor companies refraining from voting at the meeting, they should be released from their liability, which, after all, so far as their company was concerned, really made no tangible difference. He moved:—

That it is desirable to reconstruct the company and accordingly that the company be wound up voluntarily, and that Gordon Stuart Clarke, of 10, Pancras Lane, in the City of London, be and he is hereby appointed liquidator for the purposes of such winding up, and that the draft agreement submitted to this meeting and expressed to be made between this company and its liquidator of the first part, the London City and Midland Bank of the second part, Herbert Samuel Golding and James McDougall of the third part, William Plato Oulton of the fourth part, R. C. J. Goodrich of the fifth part, Bryant Trading Syndicate, Ltd., of the sixth part, International Filaments, Ltd., of the seventh part, the Derby Lamp Works, Ltd., of the eighth part, and the same is hereby approved, and the said liquidator be and he is hereby authorised pursuant to Sec. 192 of the Companies' (Consolidation) Act, 1908, to enter into an agreement with the said Derby Lamp Works, Ltd. (when incorporated), in the terms of the said draft and to carry the same into effect.

Mr. Bentley, in seconding the motion, said the chairman told them he joined the board in 1911. He (the speaker) was asked to join the board in 1912, and since joining the board, he might say it had been one continual drain on his resources. He had put upwards of £8,000 into the company's trading, and therefore they would quite appreciate that to him it was essential that the company, if possible, should be floated into a prosperous condition. The matter was entirely in the shareholders' hands. They, as directors, courted the fullest publicity. During the 18 months that he had been connected with the company he had paid all his own expenses coming up to the board meetings. He had continually put his

hand into his pocket, and up to the present had not received £1 out of the company. That was the position in which he stood, and so he thought he was as great a sufferer as anyone there.

Mr. Porch asked who Mr. Clarke, the liquidator, was, and if he were a chartered accountant.

The Chairman said he was not a chartered accountant, but was a qualified accountant.

Mr. Porch moved as an amendment that Mr. Gosling, chartered accountant, be appointed liquidator. He said he understood Mr. Clarke was only a clerk.

Mr. Gilbert seconded the amendment.

A Shareholder pointed out that there were two sides to the question. His experience was that if they got into the hands of a chartered accountant, it was a costly matter. In this case they had a young man prepared to come in and, under the guidance of the board, liquidate the company.

Another Shareholder pointed out that they were losing sight of the material point. It was not a question of the liquidation, but of the scheme. It seemed that the directors had put a large amount of money into the company, and if the shareholders were going to squabble over the scheme, they were going to throw their money away.

Mr. Porch said he would seriously suggest that it would be far better for the directors to have an independent liquidator.

The Chairman said that in anything Mr. Clarke would do, he would be properly supervised by the directors.

The amendment was then put to the meeting, and defeated.

A Shareholder asked what was the position of the shareholders who did not wish to continue in the new company?

The Chairman said that would be dealt with by the liquidator in the usual way.

A Shareholder pointed out that there was a well-defined course under which shareholders were dealt with under a reconstruction scheme. It was carried out in a very simple manner.

Mr. Odell asked what was the minimum amount of subscribed capital on which the board would go on?

The Chairman: That will be absolutely at the discretion of the new company.

Mr. Odell: It seems to me everything is put at the discretion of the liquidator.

The Secretary said it would be at the discretion of the directors of the new company. The directors were to be nominated in a certain way as stated by the chairman.

Mr. Odell asked if it was not possible that some of them would pay up the further call, and then find the whole thing fizzle out, and no more be heard of it?

The Secretary said of course a prospectus would be prepared and issued in the usual way, and the shareholders would apply for new shares on the basis of that. That would set out everything provided for under the Companies Act.

Mr. Odell said they knew the metal lamp never had a chance. They had heard talk of grave irregularities, and they knew they had never had enough capital. If the Bryant Syndicate and the International Filaments, Ltd., paid up what they owed, there would be a chance.

Mr. Raphael asked if that was not a question of being wise after the event. If the directors had known what they knew now, probably they would not be in the position in which they now found themselves. He did not think it was a matter about which the meeting should concern itself.

Mr. Odell said he thought it was. The directors knew perfectly well that they never had enough money to make the thing a success.

Mr. Raphael: That is passing a vote of censure on the directors.

Mr. Odell said that at a meeting at Derby two shareholders made themselves very nasty and threatened proceedings against the board. He had reason to suppose that arrangements were made with these gentlemen afterwards to withdraw the proceedings, and he would like to know if he was right. Were any proceedings pending, or had any proceedings been taken and withdrawn?

The Chairman: No action whatever has taken place.

Mr. Odell: Was any settlement made with Mr. Rossendalt?

The Secretary: No.

The Chairman: You raised the point at a meeting, and I gave you an emphatic denial. No arrangement has been made with him.

A Shareholder asked if the Boran lamp had been proved or was it only an experimental lamp.

The Chairman said he believed the Boran lamp had passed the stage of experiment. It was an accomplished fact.

The Shareholder: Has it been placed on the market?

The Chairman said the factory had been closed since February 5th, and no lamps had been made.

Another Shareholder asked if the new company was being floated simply to exonerate the directors from all blame or liability, or whatever they liked to call it, or was it simply with the idea that everything would be better when the company was formed?

Mr. Bentley said the new company was being formed simply because the old company had no capital and could not carry on the business. They had a factory up to date in every respect at Derby, and an extensive market, but no money.

The Shareholder: Then sell it.

Mr. Bentley said if the resolution was passed the matter would be in the hands of the new directors; they could either sell or carry on the business, but until the resolution was carried nothing could be done, because everything was at a standstill for lack of capital.

A Shareholder said he wanted to know whether there was any liability attaching to the present directors if the new company was formed.

Mr. Raphael said that if the directors had done anything for which they were amenable they did not get rid of their liability by the course which they suggested should be adopted now. The new company would have the right to inquire into the whole action of the old company, and if the directors had done any wrong they must pay the usual penalty for it. It occurred to him that the only possible method of getting anything out of the assets of the company was by the meeting adopting the resolution. The directors of the new company would be the persons who would have the direction of the liquidator. The liquidator would be merely the conduit pipe for the purpose of transferring the assets of the company to the new company. The only hope of getting anything out of the company was by the reconstruction scheme. He was not in a position to state it definitely, but he had been told that negotiations were on foot with the debenture-holders of the company for the purpose of their surrendering their debentures with a view to taking shares in a new concern. If that were so it would be very materially to the benefit of the shareholders, and therefore he thought their time would be better served by passing the resolution and getting to business as soon as they could.

At this stage a Shareholder asked that the contract document should be read, and the secretary accordingly read it.

Mr. Odell asked if any actual cash had been paid to the company by the Bryant Trading Syndicate and the International Filaments, Ltd., during the last 18 months, and, if so, how much.

The Chairman said Mr. Odell knew there was an action for winding up. He did not remember the date of the action.

Mr. Odell said it was 12 months ago.

The Chairman said he thought that killed the goose absolutely, a proceeding in which Mr. Odell took a considerable part.

Mr. Odell said that he did, and he thought that had it been successful they might have got something. He would propose as an amendment that the company be wound up compulsorily. He thought if they did that the Receiver would press the vendor companies. They simply wanted the money owing by those concerns, and then they could go ahead.

The amendment was seconded, but the chairman said he could not accept it.

A lady Shareholder said that in April, 1912, she received a letter in which it was stated:—"The company, apart from the present business, will this year show gigantic strides, and shareholders will consult their own interests in refusing to sell their holdings at less than par, there being every possibility that the shares will be readily marketable at a substantial premium."

The Secretary: Who is that signed by?

The lady Shareholder said it was signed by a person named Nunn. She and her sister-in-law held 600 shares bought with their hard-earned savings. They had that letter, which made them feel very pleased, and now they were going to lose all.

Another Shareholder said that in March last he received a letter from Wood Green asking him to sell his shares.

Mr. Raphael said such circulars were being constantly sent out by those who were trying to make a market in shares. It was a practice which everyone in the City knew extremely well. He understood that the company was in no way responsible for the circulars.

Several Shareholders asked what the position would be of the shareholders who did not come in.

Mr. Raphael said that what the scheme meant was that they were going to cut down their capital to a large extent, and shareholders were at liberty to take up shares of the value of 5s., on which 3s. 6d. would be paid. If they did not choose to pay up the 1s. 6d., then their shares were put on one side and sold for what they would fetch. The last paragraph in the circular showed how the directors were to be elected.

The resolution was then carried by 25 votes to 4.

Hurst, Nelson & Co., Ltd.—The directors' report shows, after deduction of all charges, a gross profit of £61,057. After deducting income-tax and interest, depreciation and balance of formation expenses, the directors recommend payment of arrears of dividend on preference at the rate of 6 per cent. per annum for the year ended May 15th, 1913, less tax, £11,300; dividend at rate of 6 per cent. on preference from May 15th to November 11th, 1913, less tax, £5,650; to reserve an equal amount to provide for payment of a half-year's dividend on May 15th next, £5,650; to special reserve fund for security of dividend on preference share capital, £10,000; in payment on November 11th, 1913, of dividend on ordinary at rate of 5s. per share, free of tax, £3,000; leaving to be carried forward £2,257.—*Financial News.*

Prospectus.—*Newcastle-upon-Tyne Electric Supply Co., Ltd.*—The list was to close on Tuesday in an issue of £400,000 5 per cent. second mortgage debenture stock. The proceeds will be utilised in repaying the company's floating indebtedness, in meeting the expenditure in respect of the extensions of the Dunston generating station, for prospective developments and extensions, and for other purposes.

Oriental Telephone and Electric Co., Ltd.—Interim dividends are announced of 3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 4 per cent. on the ordinary shares, free of income-tax. Warrants will be posted on 31st inst.

Continental.—Germany.—The Rheydt Kabelfabrik Gesellschaft, of Rheydt, reports a net profit of £84,911 for the last financial year, as against only £60,158 in the preceding 12 months. The dividend is being increased from 8 to 12 per cent.

Dick, Kerr & Co., Ltd.

The annual meeting was held on Thursday, October 9th, at the Cannon Street Hotel, E.C., under the chairmanship of Mr. C. T. Cayley.

In moving the adoption of the report (see Elec. Rev., p. 550), the Chairman said he was glad to be able that year to meet the shareholders with a better showing of results than was the case last year, although, perhaps, it went without saying that they were not yet in the position in which they would all like to be. He made no prophecy last year, and preferred not to do so now. In a business such as theirs with interests in many varied branches and all over the world, he would be a bold man who predicted results in advance, especially in view of the labour, financial and political complications existing at the present time. In the balance-sheet they would have found some charges. They would see that the item of "capital expenditure" at the works, including "goodwill and patents," showed a reduction of over £7,000, which represented the amount by which the depreciation exceeded the additional capital expenditure for the year. No doubt they would regard this as a satisfactory feature in the accounts, and he might say that, although they had been obliged to face a considerable diminution in their profits in recent times, the directors had consistently adhered to what they believed to be a sound and conservative policy in regard to depreciation at the works. Then the "stocks in hand and work in progress," which referred only to the manufacturing side of the business, showed an increase of £31,000 over last year. This was the high watermark on this account in the history of the company, and although it locked up more of their capital from a financial point of view, it might be regarded as a favourable sign in other respects. Taking the "Debtors' bills receivable," and the outstanding balances on contracts together, they found that these assets had increased to the extent of £71,753 as compared with last year. The only other assets calling for explanation were "Sundry investments," which were nearly £28,000 less than last year. This was accounted for by the sale of certain securities, and by the writing down of the book value of the investments by the amount of the special reserve of £16,000, as explained in the report. This reduction was also to a large extent set off by the increase in the amount of cash balances. Turning to the liabilities side of the balance-sheet, the only change of importance was the "Loan from bankers £100,000." In order to arrive at an explanation they must, first of all, look at the other floating liabilities, and they would see that the creditors, bills payable and loans (other than banker's loans) showed an increase of about £12,500 on last year, as against the increase of £71,753 which he had already alluded to in the corresponding assets on the other side, viz, debtors, bills receivable and contract balances. There was, therefore, a net increase of assets over liabilities on these accounts of nearly £60,000, and then they had to take into consideration the increase in the value of stocks and work in progress, viz., £31.000. There were, of course, other fluctuations, such as the reduction in the amount of the debenture stock, which were being gradually redeemed, but he thought they would see that the banker's loan was accounted for by the increase in the amount of capital they had been called upon to provide in the shape of increased stocks and increased debtors. The demand for extra working capital was the result of expansion in their manufacturing branches. He knew of no branch of the heavy engineering trades in which the custom in respect to payments was so severe. To begin with, progress through the shops averaged at least 12 months, and in addition they had often from two to three months expended in shipment to destination, and the custom of the trade was that the first payment was made upon delivery at destination. They were endeavouring with some success to get a modification of this and other onerous conditions.

Mr. R. H. Prestwich seconded the motion.

Mr. J. B. Concannon congratulated the board on the progress made during the year, and he thought some stress might be laid on the statement of the auditors as to the ample depreciation which had been made with respect to the plant and machinery.

Mr. A. L. Ashwell pointed out that whilst they had been told there was more work in hand they had not had any indication as to when they might expect a dividend.

The Chairman, in reply, said nearly a half of the ordinary stock was held by the directors, and they naturally regretted that there was no dividend. The profits had been increased by hard work to nearly £30,000 that year, and if the ordinary shareholders would exercise patience the board hoped that some day they would pay a dividend.

The report was adopted.

In replying to a vote of thanks, the Chairman mentioned that it was very doubtful if the company would be able to do a great deal of business with the United States, as the American tariff was still something like 30 per cent. against them.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended September 30th, 1913, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on November 1st.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax, payable on and after the 31st inst., making a total distribution of 4 per cent. for the half-year ended September 30th.

Zurich Bank for Electrical Enterprises.

The general survey which is usually given in the annual reports of the Bank für Elektrische Unternehmungen, which is an investment and underwriting company, is very brief for the year 1912-13. After referring to the wars in Tripoli and in the Balkans, which caused great reserve to be shown in business, the report states that the increased dearness of money was also reflected in the large decline in the share quotations of electrical undertakings. The constantly growing use of electricity for lighting and trade purposes brought about an almost general advance in revenue and the surpluses realised by the enterprises associated with the bank were higher in most cases than those in the preceding year. Apart from individual branches, the manufacturing trades scarcely experienced any ill-effects from the disturbed political conditions, and in certain countries an improvement took place. It cannot at present be foreseen whether these favourable circumstances will continue. During the year the share capital of the bank was raised by the issue of £600,000 in new shares at the price of 150 per cent., the premium realised being devoted to the reserve funds and to depreciation, particularly in the case of new investments. The accounts show the following results for the two years:—

	1912-13.	1911-12.
Share capital	£3,000,000	£2,400,000
Loan capital	2,630,000	2,660,000
Gross receipts	461,000	411,000
Net profits and balance forward ...	283,000	258,000
Dividend	270,000	240,000
,, per cent.	10	10

The value of the shares held, and of advances made on current account, have largely increased during the year, but the payments on underwriting transactions slightly declined, as compared with 1911-12. A detailed list of the securities is given, and it is mentioned that in order to prevent future surprises, owing to possible fluctuations in the quotations, all the share investments are entered in the balance-sheet at the nominal value or less. The report also enumerates the new investments made in 1912-13, and the underwriting transactions, including the formation of a special company for the carrying out of the concession for a high level and underground railway between Stamboul and Pera, Constantinople.

Quebec Railway, Light, Heat and Power Co., Ltd.—At the annual meeting held in Montreal on September 9th, the directors reported that for the fiscal year ended June 30th, 1913, the gross earnings from operation were $1,524,200, as compared with $1,415,825 in 1912, an increase of $108,375. After adding miscellaneous income of $236,881, the total revenue from all sources was $1,761,082, an increase of $150,672. The operating and maintenance expenses were $895,180, against $734,925, an increase of $160,255. The fixed charges and taxes of all kinds amounted to $792,100, leaving a net surplus of $73,801, which, added to that of last year, leaves a total surplus to date of $147,341. The sum of $27,641 was received from the Dominion of Canada on account of subsidies. This sum has been applied to the cancellation of $30,000 bonds according to the trust agreements. The properties and plants of the company and its various subsidiary companies have been maintained in the same high state of efficiency as heretofore, as evidence of which there was expended during the year on maintenance account, $91,500.

Cleveland and Durham Electric Power, Ltd.—The directors' report for the year ended June 30th, 1913, states that during the year the capital expenditure on works has amounted to £12,396. The gross profit amounts to £33,225, as compared with £25,784 for the previous year, an improvement of £7,440. After providing for debenture and other interest, there remains a net profit of £14,225 (as compared with £6,720 last year), which, together with £3,589 brought forward, gives an available balance of £17,814. The directors propose payment of a dividend of 4 per cent. on the preference shares (£13,348), transferring to depreciation and renewals account £2,000, and carrying forward £2,466. The connections to the system at June 30th, 1913, aggregated 55,133 H.P., an increase of 6,704 H.P. connected during the year. A further 15,000 H.P. has been arranged for.—*Financial Times.*

Argentina.—The Argentine Railway Co. having obtained control of the Hydro-Electric Co., of Tucuman, by the purchase of 8,000 shares of $100 gold each, have taken over the management of the company. The board of directors which hitherto existed in Buenos Ayres having resigned, Mr. R. Stuart has been appointed interventor of the company in Tucuman.—*Review of the River Plate.*

Cuba Submarine Telegraph Co.—An interim dividend for the six months ended June 30th at the rate of 6 per cent. per annum, free of tax, on the ordinary shares is announced.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared an interim dividend of 4 per cent., less income-tax, on the ordinary shares for the half-year ended June 30th last.

Humphrey Pump Co., Ltd.—The statutory meeting of this company was held on October 9th, Mr. E. Mond presiding.

German Electrical Companies.

The directors of the *Kabelwerk Rheydt A.G. of Rheydt*, after making ample provision for depreciation, recommend the payment of a dividend of 12 per cent. for 1912-13, this comparing with 8 per cent. in the preceding year.

The *Brandenburg Carbid und Elektrizitätswerke A.G., of Berlin*, reports that a further favourable development took place in 1912-13, both in regard to the production of carbide and the supply of electrical energy; and the gross profits rose from £19,000 in 1911-12 to £23,000 last year. After making provision for depreciation the net profits are returned at £10,000, as compared with £7,900. It is proposed to pay a dividend of 5 per cent., as against 4 per cent. in 1911-12.

The *Elektrizitäts A.G. (late H. Poge), of Chemnitz*, reports that business was very active throughout the year 1912-13 and the works were fully employed. As gross profits the accounts show the sum of £105,000, as contrasted with £59,000 in 1911-12, the turnover having increased by £450,000. After meeting general expenses, &c., and placing £19,000 to depreciation as against £15,000, there remain net profits of £15,900, as compared with £15,600. A dividend of 7½ per cent. has been declared, this being the same rate as in 1911-12.

The report of the *Deutsche Gluhlampen Fabrik A.G., of Plauen*, states that in consequence of changes in the workmen, the high prices of raw materials, and the depression in prices caused by large competitors, the sale prices of the company's glow lamps in 1912-13 declined below the cost of production. The loss of £19,000 reported a year ago had considerably increased, and in January, 1913, the share capital was reduced in order to cover the loss and provide further funds, the latter being augmented by the advance of £10,000 by a group of shareholders. The future prospects are regarded favourably as a larger stock of orders is on hand, although further working capital has now to be raised.

The *Wolfram Lampen A.G., of Augsburg*, earned gross profits of £130,000 in 1912-13, as compared with £89,000 in the previous year, and the net profits amounted to £7,900, as against a loss of £26,000 in 1911-12. As a result of this loss the share capital was reduced from £150,000 to £30,000 in the past year, the book profit thereby realised being applied to the extinction of the deficit and to writing down the value of plant, machinery and patents. At the same time an issue of £30,000 in preference shares were made, and a total of £23,000 was subscribed. It is now intended to pay a dividend of 6 per cent. on the preference shares, leaving £6,200 to be carried forward.

The *Oerlikon Co.*—The report of the Maschinenfabrik Oerlikon, of Zurich, states that the department for general electrical machinery and transformers was fully employed during the whole of 1912-13, and the apparatus department was also exceptionally well occupied, both for individual apparatus and for complete switchboard installations. The special drives for the textile industry continued to enjoy great favour, and in the department for lifting plant and electro-mechanical plant, the record turnover effected in 1911-12 was considerably surpassed in the past year, whilst a larger volume of business was also transacted in turbine machinery. In the electric railway branch the year was one of great development, both in respect of the carrying out of the work which was commenced in 1911-12, and in relation to new orders. The business in shunting and workshop locomotives experienced a large expansion. During the year the company delivered the locomotives for the Engadine line of the Rhatian railway and the locomotives for the Lotschberg line of the Berne Alpine Railway Co. The sales companies abroad, in which the company is interested, yielded satisfactory results with one exception, which incurred a loss in consequence of a failure. An understanding had been reached with the Société Suisse d'Entreprises Techniques of Constantinople, whereby this company undertakes to represent the Zurich firm. The accounts show net profits of £43,000 for 1912-13, as compared with £21,000 in the previous year, and a dividend of 7 per cent. has been declared on the ordinary share capital of £320,000, this rate contrasting with 5 per cent. in 1911-12.

Argentina.—The annual general meeting of shareholders of the Compania Tramways Eléctricos del Sud was held on the 11th ult., when the report and balance-sheet to June 30th were approved. Profits amounted to $202,979.56, out of which the shareholders received a dividend of 6 per cent.—*Review of the River Plate.*

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent. on the issued capital stock.

STOCKS AND SHARES.

Tuesday Evening.

Many people expect to see a rise in the Bank Rate at the end of this week, and the possibility of a 6 per cent. minimum before Christmas is canvassed with a good deal of interest. The pessimist says: "Why not take the bull by the horns, and discuss the chances of an 8 per cent. Bank Rate?" But more sober-minded men declare even now that, with a moderate amount of good luck, the Bank may be able to keep the money market steady on a 5 per cent. basis for the rest of the twelvemonth.

This dearness of money is the prevailing factor in Stock Exchange markets for the time being. It had the effect of depressing prices during the arrangement of the carry-over on Monday; it has the further negative effect of causing people to put money on deposit with their bankers, instead of using it for investment in Stock Exchange channels. Other disquieting considerations are the unsettlement in Brazil and the *coup d'état* in Mexico, both of which have played their parts in putting down prices in some of the markets with which we deal.

The dreadful experience of the *Volturno* shows once more how invaluable is wireless telegraphy when a disaster happens at sea, but this time there was no such result in the Marconi market as followed the tragedy of the *Titanic*.

The Central London non-assented stocks have fallen heavily, the drop amounting to as much as 10½ points in the case of the Ordinary, 5½ in the Preferred, and 13½ in the Deferred. The assented stocks have given way a little. The slump in the non-assented issues is due to the partial approximation of the stocks to the same level as the assented, with reference to the yield. It was, of course, absurd that the Deferred, which received 2 per cent. last year, should be standing at a price at which the return worked out at £2 12s. on the money, while on the Deferred-assented the yield came to £4 18s. 9d.; and that there was certain to be some sort of adjustment of values in this direction has been clear for some time past. The only wonder is that it did not happen months ago, and that it has not been carried further.

Metropolitans fell 1½ and Districts 1, thanks to the stiffness of money and to the emphatic refusal of the public to take any interest in the Home Railway stocks for the time being. The carry-over charges on Underground Electrics were rather lighter than those on other Home Rails, but this did not prevent a fall of a point in the company's 6 per cent. Income bonds, which have eased off to 90 sellers.

The English Electricity Supply group moves irregularly. City of London Ordinary shares at 16¼ are ¾ down, but the Preference have risen 5s. to 12¾. The drop in the Ordinary came about as the result of the general depression in other markets, which caused some of the holders to get out of their "City Lights" in sheer disgust with the outlook for all the markets. County Preferences hardened with Cities, but Westminster Preference fell ⅛, and the Company's Ordinary shares are weak at 8⅝, being a fall of 7s. 6d. It will be noticed that the yield on Westminsters at the present price comes to £5 12s. 8d. per cent.

Vancouver Power new 4¼ per cent. Debenture stock was left in the hands of underwriters to the tune of 70 per cent. The price dropped to 3 discount, rallying to 2 discount. This means about 86 for the fully-paid scrip. The security, as set forth in the prospectus, is excellent.

The extraordinary events in Mexico at the end of last week took everybody by surprise, and most of the securities connected with the country felt the shock. Railway descriptions suffered most, but there are falls in the Common shares and bonds of the Mexico Tramways and the Mexican Light and Power Companies. The market naturally tends to become more and more restricted, but it can be confidently relied upon that the buyer will not find it difficult to get hold of stock. The Mexico Tramways Company has declared its usual dividend of 7 per cent. per annum; this did not, however, save its securities from fresh declines.

Brazilian Tractions slumped at one time to 88, but have recovered to 90, leaving them with a fall of 2 points on the week. Nearly everything connected with Brazil is depressed, from Brazilian Government bonds downwards. The flatness has extended to Rio Tramways and Sao Paulo Tramways bonds, the falls in which range from 1½ to 4½ points, the latter drop occurring in Rio Second Mortgage bonds. This state of affairs has been brought about, as noticed before, by the fears regarding the rubber industry and the condition of Brazil generally. The Minister of Finance has drawn attention to the necessity for retrenchment, but, on the other hand, the coffee crop is seeking to make up some of the falling-off caused to the revenue by the rubber crisis, the upshot of which nobody is able to forecast with any degree of accuracy.

Plantation rubber shares are in a bad case, benefiting nothing from the difficulties of the Brazilian producers, while all the panaceas which are put forward for the protection of the industry in the Middle East prove powerless to prevent prices from slipping back. It is to be observed that the fall in the price of rubber appears to have done the larger consumers little good, with the exception of the man who buys motor tires. The companies which are interested as consumers of rubber are unchanged so far as their prices are concerned. In the list of Manufacturing shares quoted overleaf, the only changes are a fall of $\frac{1}{16}$ in Babcock & Wilcox, and a rise of $\frac{1}{32}$ in British Aluminium, neither of which can be attributed in any way to the vagaries of rubber. Shawinigan Water has been flat, shedding 3½ points; and Electric Light and Power of Cochabamba at 91½ is 2½ down. Calcutta Electric Ordinary hardened to 7½, this being one of the few rises that have taken place during the present week.

The Telegraph market is dull, like the rest. Various falls have occurred in the cable companies' stocks, the decline extending to Debenture and pre-Ordinary issues. The Direct United States Cable Company has declared a second interim dividend of 2s. per share, making 4 per cent. in respect of the half-year; the shares remain steady at 6⅞. Anglo-American Telegraph eased off after its recent firmness. American Telephone and Telegraph Convertible bonds fell a point to 102, while the 4½ per cent. issue shed 6 on Tuesday, which took back the price to 100½. Orientals are better. The preliminary opening of the Panama Canal has had no effect upon prices, not even West India and Panama shares responding to the mighty upheaval brought about by President Wilson's touching a button at Washington.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 14th.	Rise + or Fall −	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	£	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	£	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	£	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	£	4½	4½	4⅜ — 4⅝	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	£	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	£	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	15¾ — 16¼	— ¾	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12¼ — 13¼	+ ½	4 10 7
Do. 5 % Deb.	Stock	5	5	115 — 119	+1	4 4 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord. ..	10	6	5†	11¾ — 12½	..	4 18 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅝	+ ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 104½	— ½	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	£	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	£	6	6	4⅜ — 4⅝ xd	..	6 3 1
Do. 5 % Cum. Pref.	£	5	5	4⅜ — 4⅝ xd	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	£	9	..	7¾ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	£	8	8†	7½ — 8	..	5 0 9
Do. 4 % Deb.	Stock	4	4	90 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 6
London Electric, Ord.	8	2½	..	1⅛ — 1⅜	..	4 14 7
Do. 6 % Pref.	£	6	6	4⅞ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	+1	4 6 0
Metropolitan	£	4	4†	3⅛ — 3⅝	..	5 8 3
Do. 4½ % Cum. Pref.	£	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	90 — 93	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10¼	..	5 11 7
Oxford	£	7	6†	6⅞ — 7⅛	..	5 9 10
St. James' and Pall Mall, Ord.	£	10	10†	9 — 9½	..	5 5 3
Do. 7 % Pref.	£	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2¾ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7●	1⅛ — 1⅜	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96 xd	−1	4 13 9
Urban, Ord.	£3	Nil	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	£	3	..	2¼ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86 xd	..	5 4 8
Westminster, Ord.	£	10	10†	8⅝ — 9⅛	— ⅛	5 12 8
Do. 4½ % Cum. Pref.	£	4½	4½	1⅛ — 1⅜	— ⅛	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	£	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	£	8½	..	7¼ — 7⅜	+ ⅛	5 9 8
Do. 5 % Pref.	£	5	5	4⅞ — 5⅛	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7†	110 —115	..	6 1 9
Do. 7 % Pref.	$100	7	7	117 — 122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — ⅞	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93 xd	..	5 7 6
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90½ — 92½	− 2½	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/16 — 5/8	..	Nil
Do. 6 % Pref.	1	6	..	9/16 — 5/8	..	10 13 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	£	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	77 — 81	..	6 3 5
Mexican Lt. & Power, Common	$100	4	4	60 — 65	−2½	6 3 1
Do. 7 % Cum. Pref.	$100	7	7	94 — 99	−1	7 1 5
Do. 5 % 1st Mort. Gold Bds.		5	5	87½ — 90½	−2½	5 10 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	74 — 78	−3	6 8 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	73 — 76	..	6 11 7
Montreal, Lt., H. and Power ..	$100	9	10†	217 —227	..	4 8 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	..	4 9 1
Shawinigan Water, Capital ..	$100	6½	6†	135 —139	—3½	4 6 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	⅝ — ¾	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	126 —128 xd	—4	6 5 0
Do. Collat. Trust	$1000	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph ..	Stock	8	8	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105½ —106½	— ½	5 12 8
Do. Def.	Do.	30/-	..	28½ — 29¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80 — 82	—1½	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	14⅜ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	£	4	4	8½ — 8⅝ xd	..	5 6 8
Do. 10 % Cum. Pref.	£	10	..	6⅝ — 7¼ xd	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅝ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	128½ —131½	..	5 6 5
Do. 8½ % Pref. Stock	Do.	8½	3½	75½ — 77½	..	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	96½ — 98½	— ½	4 1 3
Eastern Extension	10	7	7	12⅜ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	94 — 96	—1	4 3 4
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	8 18 10
Globe Telegraph and Trust ..	10	6	6†	11 — 11½ xd	..	5 4 4
Do. 8 % Pref.	10	8	8	11⅞ — 12⅜	— ⅛	4 17 0
Great Northern Telegraph ..	10	20	5†	80 — 82	— ⅜	6 5 0
Indo-European Telegraph ..	25	15	..	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	8 13/16 — 8 15/16	..	5 1 6
Do. 3 % Cum. Partic. Pref.	1	17	..	8⅜ — 8½	..	5 4 7
Monte Video Telephone, Ord. ..	1	6	6	1 5/16 — 1 7/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	93 — 96	—1½	4 10 6
Oriental Telep. and Elec. ..	1	10	..	1 13/16 — 1 15/16	— 1/16	5 3 3
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1¾	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	98 — 103	..	9 17 6
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/8	..	4 3 4
Do. 4 % Debs., 1 to £500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2½ — 2¾	..	4 11 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10⅜	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9⅝	..	6 3 1
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12¾ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 14th.	Rise + or Fall —	Present Yield p.o.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3 1/2 — 3 5/8	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75 xd	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12½ — 14½	..	..
Do. Do. Deferred ..	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	50 — 53	..	5 13 2
Do. 5 % Perp. Deb. ..	100	5	5	91 — 94	−1	5 6 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	61 — 66	−10½	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	−1	5 0 0
Do. Pref.	100	4	4	70 — 75	−6½	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	−13½	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	−1	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 8
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾ xd	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71 xd	..	6 6 9
sle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 3/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord. ..	1	..	..	¼ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 9/16	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	73 — 78	..	5 15 5

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 14th.	Rise + or Fall —	Present Yield p.o.
	*					£ s. d.
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol. ..	100	1⅝	1½†	44 — 44½	−1½	3 13 0
Do. Surplus Lands	100	2⅜	2⅜†	59 — 61	..	4 10 2
Do. 8½ % Deb.	100	8½	8½	83 — 85	..	4 2 4
Do. 8½ % Pref.	100	8½	8½	78 — 80	..	4 7 6
Do. 8½ % Con. Pref.	100	8½	8½	76 — 78	−1	4 9 9
Metropolitan District Ord. ..	100	Nil	..	32¾ — 33¼	−1	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 8½ % Gtd.	100	8½	8½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89 xd	..	5 12 0
Potteries, Ord.	1	3½	..	9/32 — 13/32	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	110 —112	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	−1	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	8⅜ — 8⅝	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	91⅝ — 93⅝	+ ½	4 5 7
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	5	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	89 — 91	−2	6 11 1
Brisbane Trams Invt., Ord. ..	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	121 —124	..	6 9 1
Do. Pref. Ord.	100	6	6	109 —113	..	5 6 2
Do. 5 % Pref.	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	89 — 92	..	4 12 5
Calcutta Trams, Ord.	5	7½	6†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	11/16 — 13/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	− ⅛	4 13 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	2	..	1 — 28	−7	..

La Plata Elec. Trms, Ord. ..	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4⅝d.	6	⅞ — 1 xd	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4¾ — 4⅝	+ ⅛	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	..	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7	87½ — 89½	−2	7 16 5
Do. Gen. Con. 5 % Bonds ..	..	5	5	89⅜ — 91½	— ½	5 8 8
Do. 6 % Bonds	100	6	6	92 — 94	— ⅛	6 7 8
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5 7/8 — 6 1/8	..	7 18 10
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	−2	4 19 6
Do. 5 % Mort. Bonds ..	100	5	5	88½ — 90½	−4½	5 10 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 103	−1½	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90 xd	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5	..	7 0 0
Do. 6 % Pref.	5	5	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	2½ — 25/32	..	7 18 4
Babcock & Wilcox	1	16	..	3 — 3⅛	− 1/16	5 2 3
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord. ..	1	..	..	1 — 1⅛	+ 1/32	..
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B I. & Helsby Cables	5	10	..	8½ — 8¾ xd	..	5 14 3
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb...	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92¾ — 95¾	..	4 14 0
British Westinghouse, Pref. ..	5	Nil	..	15/16 — 1⅛	..	Nil
Do. Deb...	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103 xd	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —8/-	..	Nil
Do. Pref.	1	..	..	8/- —8 6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	..	11 — 11¾	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 13/16 — 3 15/16	..	5 1 7
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	1/8 — 1 3/8	..	..
Do. Pref.	1	6	6	¾ — ⅞	..	6 17 2
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1 3/8	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb. ..	100	5	5	63 — 68 xd	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb...	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	6	6	9½ — 10½	..	5 14 8
Do. Deb...	100	4	4	87 — 92 xd	..	4 7 11
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb...	100	4½	4½	101—103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13¼ — 14¼	..	5 5 3
Do. Pref.	10	5	5	9⅝ — 10⅜	..	4 18 9
Telegraph Construction.. ..	12	20	5†	37 — 39	..	6 8 1
Do. Deb...	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4% 1st Mort. Deb.	100	4	4	55 — 60	..	6 18 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

SWEDISH EXPORTS OF ELECTRICAL GOODS.

The following statistics of the exports of electrical and similar goods from Sweden in 1911 are very interesting as revealing a continuance of the development of the Swedish manufacturing position; figures for 1910 are given for purposes of comparison, and notes of increases or decreases have been added; it will be noted that Sweden's capacity for exporting to markets in which we compete is rapidly extending, both as to the quantity exported and as to the range of markets:—

	1910. Kronor.	1911. Kronor.	Inc. or dec. Kronor.
Electric incandescent lamps.—			
To Finland	31,000	29,000	— 2,000
„ Russia	106,000	41,000	— 65,000
„ Denmark	33,000	44,000	+ 11,000
„ Germany	47,000	44,000	— 3,000
„ Great Britain	22,000	15,000	— 7,000
„ Argentina	26,000	—	— 26,000
„ Other countries ...	16,000	24,000	+ 8,000
Total ...	281,000	197,000	— 84,000
Dynamos and parts thereof.—			
To Norway	564,000	837,000	+ 273,000
„ Finland	149,000	171,000	+ 22,000
„ Russia	53,000	88,000	+ 35,000
„ Germany	39,000	98,000	+ 59,000
„ Great Britain	93,000	79,000	— 14,000
„ Spain	63,000	119,000	+ 56,000
„ Australia	113,000	47,000	— 66,000
„ Canada	127,000	294,000	+ 167,000
„ Other countries ...	32,000	123,000	+ 91,000
Total ...	1,233,000	1,856,000	+ 623,000
Electric motors and parts thereof.—			
To Norway	302,000	618,000	+ 316,000
„ Finland	27,000	58,000	+ 31,000
„ Denmark	61,000	30,000	— 31,000
„ Great Britain	119,000	174,000	+ 55,000
„ Spain	20,000	12,000	— 8,000
„ Brazil	29,000	—	— 29,000
„ Argentina	77,000	18,000	— 59,000
„ Other countries ...	37,000	133,000	+ 96,000
Total ...	672,000	1,043,000	+ 371,000
Transformers and parts thereof.—			
To Norway	75,000	260,000	+ 185,000
„ Russia	15,000	—	— 15,000
„ Denmark	33,000	—	— 33,000
„ Spain	—	96,000	+ 96,000
„ Australia	37,000	63,000	+ 26,000
„ Canada	200,000	124,000	— 76,000
„ Mexico	19,000	—	— 19,000
„ Other countries ...	13,000	12,000	— 1,000
Total ...	392,000	555,000	+ 163,000
Telephone instruments.—			
To Norway	77,000	46,000	— 31,000
„ Finland	279,000	514,000	+ 235,000
„ Russia	1,372,000	1,231,000	— 141,000
„ Denmark	224,000	132,000	— 92,000
„ Holland	160,000	349,000	+ 189,000
„ Great Britain	1,933,000	1,688,000	— 245,000
„ Mexico	116,000	155,000	+ 39,000
„ British S. Africa ...	—	199,000	+ 199,000
„ Other countries ...	54,000	721,000	+ 667,000
Total ...	4,215,000	5,035,000	+ 820,000
Petroleum and benzine motors.—			
To Norway	477,000	884,000	+ 407,000
„ Finland	244,000	249,000	+ 5,000
„ Russia	2,527,000	2,308,000	— 219,000
„ Denmark	206,000	133,000	— 73,000
„ Germany	461,000	652,000	+ 191,000
„ Holland	292,000	206,000	— 86,000
„ Great Britain	190,000	291,000	+ 101,000
„ Italy	150,000	103,000	— 47,000
„ Austria	346,000	291,000	— 55,000
„ Other countries ...	283,000	1,034,000	+ 751,000
Total ...	5,176,000	6,151,000	+ 975,000
Turbines.—			
To Finland	41,000	12,000	— 29,000
„ Great Britain	72,000	104,000	+ 32,000
„ Canada	236,000	111,000	— 125,000
„ Japan	—	118,000	+ 118,000
„ Other countries ...	31,000	179,000	+ 148,000
Total ...	380,000	524,000	+ 144,000
Cranes, &c.—			
To Finland	58,000	44,000	— 14,000
„ Russia	186,000	91,000	— 95,000
„ Other countries ...	66,000	63,000	— 3,000
Total ...	310,000	198,000	— 112,000
Copper wire covered with textile threads.—			
To Russia	207,000	350,000	+ 143,000
„ Denmark	131,000	63,000	— 68,000
„ Great Britain	96,000	190,000	+ 94,000
„ Other countries ...	22,000	40,000	+ 18,000
Total ...	456,000	643,000	+ 187,000
Steam engines.—			
To Russia	365,000	493,000	+ 128,000
„ Denmark	26,000	27,000	+ 1,000
„ Argentina	23,000	—	— 23,000
„ Other countries ...	39,000	101,000	+ 62,000
Total ...	453,000	621,000	+ 168,000
Steam turbines.—			
To Russia	171,000	184,000	+ 13,000
„ Finland	38,000	29,000	— 9,000
„ Holland	35,000	11,000	— 24,000
„ Other countries ...	19,000	30,000	+ 11,000
Total ...	263,000	254,000	— 9,000

Krona = 1s. 1½d.

Arc and Spark Wireless Systems.—Users of continuous oscillations in radio-telegraphy claim that these waves are less absorbed in passing over the surface of the earth than are damped wave trains produced by spark sending. Attempts to verify this claim experimentally have shown no appreciable difference in absorption over moderate distances. In order to extend these experiments over greater distances, a 30-KW. arc operated by 500-volt D C. was installed in the high-power station at Arlington, Virginia, and the results obtained were communicated by Dr. L. W. Austin, in a recent issue of the *Journal* of the Washington Academy of Sciences. As these results have been much quoted in connection with the British Imperial system, it may be of interest to indicate their nature.

Comparisons were made, at a wave length of 4,100 m., between the current received at St. Augustine, Florida:—(*a*) When sending on the arc system with 47-53 amps. current in the aerial. (*b*) When sending from a 500-cycle spark 100-120 amps. in the antenna.

The distance between the two stations was 530 nautical miles. The received currents were measured by the calibrated detector galvanometer method, and it was found that they were directly proportional to the radiation currents at Arlington within 10 per cent., *i.e.*, at this distance there was no evidence of a difference in the absorption. This agrees with the results reported by Dr. Austin in March, 1912 (and mentioned by Mr. Marconi in his recent evidence), concerning the relative ground absorption for damped and undamped oscillations over a distance of 30 miles. From these experiments, Dr. Austin concluded that within the limits of the errors of observation, the ground absorption for that particular part of the country was the same in the case of both undamped and moderately damped oscillations.

The Arlington results were verified by the shunted telephone method using a slipping-contact detector at New Orleans, and also at Key West, both places being approximately 900 miles from Washington. The receiving apparatus was next placed on the *Arkansas*, and taken to Colon, 1,800 nautical miles from Arlington. There the receiving apparatus was taken to the naval radio-telegraphic station, and during two days' tests the arc signals were heard by day and night, whereas the spark signals were heard only after dark. These observations indicate that at 1,800 miles the continuous waves showed a smaller degree of absorption than the damped waves, but since the tests were made at a season (late in December) when exceptional days occur which might differently affect the two systems of operation, an additional series of observations was made during the recent voyage of the *Salem* to Gibraltar and back. In verification of the Colon experiments, it was found that for distances over 1,400 miles the arc (as judged by day-time reception) was equal to, or somewhat better, than the spark, notwithstanding the fact that the spark radiation current at Arlington was considerably more than twice as great as the corresponding arc current. Messages were continuously received by both arc and spark in the day-time up to 2,100 miles. Several times day signals were heard at greater distances, the arc being uniformly louder. Night signals were heard all the way to Gibraltar.

THE BRITISH ASSOCIATION.—V.

A New Method of Starting Mercury-Vapour Apparatus.

By John S. Anderson.

(*Section A. Abstract.*)

In the best types of mercury-vapour lamps and rectifiers at present on the market, the arc is started by tilting the lamp or rectifier, either by hand or automatically. This tilting arrangement is very often inconvenient. This is found to be especially the case when one is dealing with lamps used for scientific purposes. For example, in carrying out experiments on the Zeeman effect a mercury-vapour arc lamp is extremely suitable. But the difficulty arises from the fact that the lamp must be placed between the poles of an electromagnet, the distance between the poles being usually so small that any tilting apparatus that may be employed interferes with the proper mounting of the lamp.

Mr. G. B. Burnside and the author have overcome this difficulty by constructing a lamp which may be fixed in position between the poles of an electromagnet, or in any other suitable position, and then started without having to be tilted. This is brought about by the employment of a heating arrangement near one of the electrodes, preferably the negative electrode. The lamp tube is provided with a small vessel near this electrode, the vessel having a re-entrant portion or recess in which a heating element is placed. The part of the tube immediately above this small vessel and its recess is constricted. The heating element may conveniently consist of a small coil of platinum wire wound round a suitable support; it may be placed in the recess of the small vessel or removed at will, without interfering with the vacuum of the lamp. The heating coil of wire is connected in series or in shunt, in the latter case being provided with an automatic cut-out. An external resistance is placed in series with the lamp. Before starting, the small vessel is full of mercury, which forms a continuous connection inside the tube between the positive and negative electrodes. When the electrical current is switched on, the heating coil becomes incandescent, and the heat given off by the wire goes to raising the temperature of the vessel and its contained mercury, there being no appreciable loss by radiation into the surrounding air. Very little heat is required, because the first bubble of mercury vapour formed rises to the constricted portion of the lamp and is there caught, thus breaking the continuity of the mercury inside the lamp and starting the arc. Owing to the resistance of the mercury vapour, which is formed once the arc is started, the current is cut down to the value required for running the lamp. The platinum wire of the heating element can be made of such a thickness, and the external resistance can be so adjusted, that the wire does not emit heat when the lamp is working, but becomes incandescent when the lamp is started, the action being quite automatic.

Trade Unions and Co-partnership.

By John B. C. Kershaw.

(*Section F. Abstract.*)

The author in this paper discussed the statistics of the co-partnership movement in the light of the facts and figures given in the latest Government report on profit-sharing and labour co-partnership in the United Kingdom, and then dealt with the causes of past failures, more especially with the objections of the trade unions and their leaders to all extensions of the movement beyond its present limited field of application. The author's proposals for overcoming trade-union hostility were :—

1. Perfect freedom for all workers to join their respective unions if so inclined.

2. Recognition of trade-union rates of pay as a basis of the co-partnership scheme.

3. Election of selected labour leaders in each industry and locality as directors of large firms or companies.

The objections that might be raised to these proposals—by critics from both sides—were discussed in some detail, and the author expressed the opinion that the wave of unrest which is still troubling the industrial world in all countries will only be calmed and give place to more harmonious co-operation between capital and labour, when the manual workers are given a larger share of the profits of industry and a greater stake than they now possess in the welfare and prosperity of their country.

Co-partnership, in the author's opinion, is the most simple and effective means for bringing about this change in the organisation of our industries, and at the same time preserve that efficiency of financial and technical control, without which no industry can succeed in these modern days. Past failures in the attempts to run industries entirely by working men for the workers' own benefit have proved the need for a closer co-operation between *Capital, Brains and Labour*. There are three essentials required for the successful conduct of modern manufacturing industries: (1) A plentiful and cheap supply of capital; (2) a plentiful supply of skilled and contented labour; (3) skilled technical and business management which can take instant advantage of all opportunities offered for improving the manufacture, and of extending the market for the finished goods.

The co-partnership principle is the one which offers the best chance of attaining these three conditions of success, and if trade-union hostility to the principle could be disarmed, the movement would extend with amazing rapidity.

The Nomenclature and Definitions of Magnetic and Electrical Quantities.

Report of the Committee.

(*Section A. Abstract.*)

The report consists of a discussion on the present nomenclature and definitions of electrical and magnetic quantities, together with various alterations that have been proposed at times, and some new suggestions.

The names of several quantities in electrical and magnetic science are at present in a much confused state, several synonyms being employed, and these are in some cases inconsistent with one another. A definite and simple name for each conception is highly desirable.

The allotment of special names for units is a matter requiring very great care and examination of past experience in the popular acceptance of units. There is no doubt that a name helps people. At the same time, it is not in general desirable to create separate names for the units of quantities closely related to one another.

That a consistent and homogeneous system of symbols for the important units is a great convenience, will be generally agreed. The International Electrotechnical Commission has agreed upon a few symbols, and has made some important suggestions, that are under consideration and trial. These are quoted at length, and the bearing of these proposals on a general scheme is considered in detail in the report. The substance of the report does not lend itself to abstracting.

The Radio-Elements and the Periodic Law.

By Frederick Soddy, M.A., F.R.S.

(*Section B. Abstract.*)

During the present year, 1913, the general law governing the passage through the periodic table of the elements in process of radio-active change has been discovered. As the result it is possible to write the three disintegration series of uranium, thorium and actinium across the periodic table, so that each member falls into its proper place in the case of the 27 members the chemistry of which is known.

The chemical analysis of matter is thus not an ultimate one. It has appeared ultimate hitherto, on account of the impossibility of distinguishing between elements which are chemically identical and non-separable unless these are in process of change the one into the other. But in that part of the periodic table in which the evolution of the elements is still proceeding, each place is seen to be occupied not by one element, but on the average, for the places occupied at all, by no fewer than four, the atomic weights of which vary over as much as eight units. It is impossible to believe that the same may not be true for the rest of the table, and that each known element may be a group of non-separable elements occupying the same place, the atomic weight not being a real constant, but a mean value, of much less fundamental interest than has been hitherto supposed. Although these advances show that matter is even more complex than chemical analysis alone has been able to reveal, they indicate at the same time that the problem of atomic constitution may be more simple than has been supposed from the lack of simple numerical relations between the atomic weights.

Effect of Atmospheric Conditions on the Strength of Wireless Signals received at Liverpool.

By Prof. E. W. Marchant, D.Sc.

(*Section G. Abstract.*)

Measurements have been made over a considerable period of time, but those described herein deal mainly with observations during the month of July. The most accurate observations have been obtained with signals sent out by the observatory at the Eiffel Tower at 10.45 a.m. and 11.45 p.m. The method adopted in the earlier tests was to use a "Perikon" detector in series with a galvanometer and telephones, the measurement of strength being made by the cumulative deflection due to a series of known signals. This method was not found satisfactory with the Paris signals for which the antenna current used was known, and in the later tests an Einthoven string galvanometer has been employed by which the strength of signal for each individual spark at Paris could be observed to within ± 5 per cent. The results obtained show that there is a maximum variation from 0·6 to 1·3 in the strength of the signals received on different days in the same month; the average strength of signal being assumed to be 1·1, and that the current received on a fine, clear night is about 1·7 times as strong as that received in the day time.

Although no certain relationship can yet be regarded as established between the strength of a signal and the weather conditions at the sending and receiving stations, so far observation has shown that rain in Paris always corresponds with a diminution in strength of received signal. In one case, with a wind of 6 metres per second velocity, blowing in a N.W. direction, the signal-strength fell to half its normal value. The most favourable condition for signalling appears to be a cloudy sky at both sending and receiving stations, the signals being weaker when the sky is clear or covered with light clouds. Rain at the receiving station appears to have a comparatively small influence on the strength of the received signals.

The result of a set of special signals sent from the Eiffel Tower on the evening of Saturday, July 26th, 1913 (by the courteous arrangement of Comm. Ferrié), at intervals of 30 minutes, between 7 and 10 p.m. (which includes the time of sunset), shows that the increase in strength of night signals occurs just after sunset, there being an abrupt increase in strength of about 70 per cent. This change is quite sudden, there being comparatively little alteration n signal-strength until the sun has set and no perceptible increase n strength afterwards. There appears to be some evidence that signals are slightly stronger just after sunset than during normal night conditions.

Atmospheric Refraction and Absorption in Wireless Telegraphy.

By W. H. Eccles, D.Sc.

(*Section G. Abstract.*)

It seems to be agreed among the mathematicians who have worked at the subject that wireless telegraph signals could not be transmitted a quarter way round the globe by means of diffraction. According to some numerical results of J. W. Nicholson, a station rated at more than a million kilowatts would be required for communication with Buenos Ayres if diffraction alone were utilised. These calculations have all been made on the supposition that the earth is a perfect electrical conductor, and that the medium surrounding it is electrically homogeneous; but these conditions are by no means fulfilled, and it has been suggested that the transmission of signals to great distances is successful either because the earth is not a perfect conductor or because the air is not a perfect dielectric.

At night signals may travel to remarkable distances whatever their wave-length, and this suggests reflection rather than refraction; in the day signals of great wave-length travel best, which suggests refraction. The hypothesis introduced by the author, which attempts to account for this, is based on the assumption that the sun's rays ionise the atmosphere in such a way that the concentration of ions increases gradually as we ascend in the atmosphere. In this event, a ray started horizontally, say, will pursue a curved path with its concavity towards the earth; and thus, if the ionisation is great enough, an electric ray may follow and overtake the curvature of the earth.

The fundamental theorem is that the velocity of electric waves through a gas is increased by the presence of ions of molecular size in the gas. The velocity of long electromagnetic waves will thus exceed the velocity of light in an ionised medium. It may be remarked that if space is, as suggested by Schuster, in some degree conductive, long electric waves should travel faster than light waves from the sun to the earth.

Calculations indicate that if a suitable mathematical law of variation of refractive index could be assigned, the fall of intensity of signals with distance might be accounted for numerically without any absorption whatsoever. Something rather less extreme than this is, however, to be looked for, since formulæ that have been deduced for the absorption in highly ionised air prove that some absorption is to be expected in the case of rays traversing the higher levels of the atmosphere.

Short Heat Tests of Electrical Machines.

By W. R. Cooper, M.A., B.Sc.

(*Section G. Abstract.*)

Tests of dynamo-electric machinery are generally carried out extending over six hours in order to determine the maximum temperature rise. Suggestions have been made that such tests might be considerably shortened by assuming that the curve of temperature rise is a logarithmic curve. The author gives a brief account of the methods that have been proposed, and points out that the "thermal time constant," on which the behaviour of a body in heating and cooling largely depends, should be found most easily, and under less complex conditions, from the cooling curve. In order to test the applicability of the various methods, tests were made upon a 5-KW. motor-driven dynamo. The curves of temperature rise were found to be fairly logarithmic. The usual method of running a machine on test is to run on constant output with constant voltage, which necessitates increasing the input to the field coils as their resistance rises. A truly logarithmic curve can only be expected if the input of heat is at a constant rate, so that a better result would be expected if a machine were tested with constant input to the field coils, the output of the machine being constant but at varying voltage. Actually this method of testing was not found to give an improved result. Graphical methods appear to give better results than formulæ, as the latter are very sensitive to such errors in the data. In any case only certain portions of the temperature rise curve should be used, and any formulæ depending on the initial rate of temperature rise should be avoided, as this is difficult of exact determination. The curve of cooling has certain advantages; only a small portion of it seems suitable for graphically determining the thermal time constant, but this quantity can be derived much more readily by the time taken for a certain percentage drop of temperature rise. In the results given there is better agreement between the values found for the thermal time constant than for the maximum temperature rise. It is suggested that a fair approximation to the maximum temperature rise can often be obtained by testing for a time equal to, say, 1¼ times the thermal time constant, deducing the value of this constant from the cooling curve, and thence the maximum temperature rise from the heating curve.

A New Method of Sealing Electrical Conductors through Glass.

By John S. Anderson.

(*Section A. Abstract.*)

While experimenting with a new method of starting mercury-vapour apparatus Mr. G B. Burnside and the author experienced great difficulty at first in obtaining a satisfactory method of sealing the electrical conductors through the glass of the lamps with which the experiments were carried out. Mr. Burnside, however, solved the difficulty by devising a simple method whereby platinum wires may be sealed through Jena glass; according to the same method other conductors, such as copper wires, may be sealed through ordinary glass.

The method consists essentially in fusing the metal and glass together in the usual way and then immersing the seal, after it has cooled to about a red heat, in a bath of oil or fat. Each immersion lasts about two or three seconds. The seal is immersed a little further in the cooling medium at each successive immersion until it is completely cooled.

For currents up to 15 amperes solid conductors may be employed, but for larger currents it is found advisable to make use of tubular conductors, which may be quite easily sealed through glass according to Mr. Burnside's method.

In preliminary experiments copper wires 1·5 mm. in diameter were successfully sealed through German glass, and platinum wires of 1 mm. diameter were sealed through Jena and other glasses. A copper tube, capable of carrying a current of 100 amperes, was sealed through German glass. Platinum wires were sealed through Jena glass in mercury vapour lamps, and the seals were found to be air-tight after a period of over eight months, although they had from time to time been subjected to the heat of the lamps when burning.

The chief advantages of this method of sealing electrical conductors through glass are as follows: (1) The process of obtaining seals is much simpler than any at present in use; (2) for incandescent electric lamps and all kinds of vacuum tubes, with the exception of mercury-vapour apparatus, copper or other high conductivity metal may be used as the conducting material; (3) in the case of mercury-vapour apparatus a minimum quantity of platinum is used in the tubular form of conductor for large electrical currents, because the tubular shell may be filled in with copper, subsequent to the sealing process; (4) conductors of very much greater cross-section than it has hitherto been possible to employ may be sealed through glass; (5) the one process is applicable to all kinds of glasses.

The Chemistry of the Radio-Elements.

By Alexander Fleck, B.Sc.

(*Section B. Abstract.*)

Since last year's meeting at Dundee, when the chemistry of three short-lived radio-elements was described, the study has been continued, and the chemical nature of 11 additional radio-elements has been worked out experimentally. In each of these cases, with the one exception of Uranium-X_2, the chemistry of the substance may be summed up by saying that it has properties identical in all respects with those of some already known element.

The results of the work show that:—

1. Uranium-X and radio-actinium are chemically identical with thorium.
2. Mesothorium-2 is chemically identical with actinium.
3. Radium-A is chemically identical with polonium.
4. Radium-C, thorium-C, actinium-C, and radium-E are chemically identical with bismuth.
5. Radium-B, thorium-B, and actinium-B are chemically identical with lead.
6. Thorium-D and actinium-D are chemically identical with thallium.

In the cases in which the inseparable elements are common elements these latter have all atomic weights above 200, and occupy one or other of the last 12 places of the periodic table.

A Magnetic Susceptibility Meter.

By W. H. F. Murdoch.

(*Section A. Abstract.*)

The author uses a unipolar method of testing, with the addition of a circular coil in series with the magnetising solenoid. This coil acts upon the magnetometer needle which is lying in a neutral field of force, so that the tangent of the resulting deflection due to the magnetic material plus coil is strictly proportional to magnetic susceptibility.

A mirror may be used to read the deflections, and in this case susceptibility = deflection × constant.

It follows that such an instrument with tangent scale and pointer can be graduated so as to read directly the value of the susceptibility coefficient in C.G.S. units. To fix the value of H the current is measured and the values are multiplied by a constant.

The theory of the instrument was given, and an example of its use for testing iron, together with a diagram of connections and curve of results.

The various corrections were also briefly discussed.

ANTIPODEAN VIEWS.

A Resume of the Impressions of an Englishman Visiting Australia and of an Australian Visiting Europe.

A fortunate consequence of twentieth century ease of travel is that engineers of the present day are able, in increasing numbers, to take advantage of the facilities which they and their predecessors have created, and, by visits to distant countries, to extend their knowledge by actual observation of conditions, practice and results therein. There can be no doubt that travel is of the utmost importance to the technical man, whatever his profession, not only in respect of the experience and knowledge which he himself gains, but also in respect of the assistance which he is thereby enabled to give to his employers—whether private or municipal—and to his colleagues. The advantages accruing to a firm which sends a competent member of its staff abroad or on a world-tour are obvious, and innumerable instances might be quoted in which municipal or State engineers have, during such travels, gained information which has been applied to the public benefit. The engineer who travels as the representative of a technical society, or who carries letters of introduction from a public body, naturally finds many avenues open to him which are closed to the representative of a private firm, but, whether travelling as a public or private person, he cannot fail to acquire a mass of invaluable data and to broaden his outlook upon the problems with which he is called upon to deal in his regular employment. The impressions gathered by such a traveller form the best substitute for actual travel, and as such, and because we cannot all be globe-trotters, they deserve wide publicity and careful study.

At the present moment we are in the unusual position of receiving simultaneously Mr. Justus Eck's account of his tour in Australia, and a collection of engineering notes compiled by Mr. E. H. W. Westwood (hon. sec. Victorian Institute of Electrical Engineers), during his recent visit to Europe.* Both gentlemen have many interesting things to say, and in the following paragraphs we reproduce the most striking of their opinions and criticisms. To quote Mr. Eck, with over 600 central public electric generating stations, all within the compass of an afternoon's journey, the home-staying engineer is apt to consider there is little or nothing to be learned in a visit to Australasia, with its 200 stations, many of the smallest conceivable size, widely isolated, and the whole of them supported by a total population which is less than that of London. Local conditions, however, vary enormously in different parts of the world—not only in actual physical respects, but also in the general conditions and manners of life and in administrative equipments and methods—and these conditions and their consequences it is desirable to study, particularly since it often happens that practice which has arisen naturally and of necessity in a certain district offers considerable advantages in other cases where it would never evolve naturally. Again, the combinations and permutations of natural and artificial conditions in various parts of the world often produce a demand for unusual types and ranges of apparatus, and full appreciation of the justification for this demand can only be had by actual acquaintance with the conditions producing it.

Generally speaking, the managing engineer in Australia and other "new" countries has a freer hand in the design and execution of his work than has his *confrère* in this country, and Mr. Westwood is of opinion that many English and Continental engineers would starve in private practice in Australia owing to the communities there being too small to permit of specialisation to any great extent. Now that the engineering department of the Melbourne University is in working order, the prospects for higher technical education are distinctly brighter so far as Victoria is concerned. Mr. Westwood regrets that "two essential parts in the training of almost all engineers at home"—the use of the slide rule and a knowledge of technical German—are much neglected in Australia. We fear that a knowledge of German is none too common a qualification among technical men in this country.

Although every State in the Commonwealth has its own idiosyncrasies, Mr. Eck finds existant among its electrical engineers a freemasonry which is all for the good of the industry and which helps greatly in the dissemination of knowledge and experience. He quotes numerous illustrations of the fact that Australia is able to supply most of her needs from her own talent, and he dwells at some length on the state of technical societies in the Commonwealth. For the Victorian Institution of Electrical Engineers, Mr. Eck has nothing but praise, and he expresses the somewhat heretical—but, we believe, quite justifiable—opinion that this Society will do well to preserve its independent existence, at least so far as concerns the British I.E.E. Standing alone, the Victorian Institution will be best able to adapt itself promptly to the requirements within the area of its influence. In some of the other States of the Commonwealth, affairs are less satisfactory; plenty of talent is available, but powerful electrical societies have yet to be organised. It is likely that some of the scattered honorary local secretaries now representing the British I.E.E. in various parts of the Commonwealth will ultimately become the promoters of strong local independent bodies.

In connection with office organisation and manufacturing methods in this country, Mr. Westwood comments favourably upon the systematic working adopted in the offices of large British firms, but states that automatic machinery is not used either on the Continent or in England to anything like the extent he had expected. Automatic features chiefly predominated in purely mechanical works (such as chain, pump and automobile manufactories). A well-known Glasgow firm, which appears to be much ahead of its competitors in this respect, had sent two members of its staff on a four months' tour through the States to study and purchase the latest forms of automatic machines.

Without much encouragement in the way of propaganda, the general public in Australia has shown a remarkable avidity to absorb all the electrical supply available, but it is surprising when one realises how much more important electric supply is in the Commonwealth and the Dominion than at home, to find such vast areas as North Sydney without current, and the suburbs of most of the big cities with no, or insufficient, electrical supply. According to Mr. Eck, the reason is that the growth of Australian cities has been unprecedented, and the land, due largely to the nationalisation of the railways, has wanted facilities in the way of quick and suitable tram service. Thus, the necessity of living on the fringe, if not actually in the city, has resulted, and districts planned as small adjacent townships have become suburban, or integral, sections of the city. The Government of New South Wales has proved the only authority capable of handling the parochial prejudices which even now stand in the way of realisation of the Greater Sydney scheme. Perhaps, on the same ground, the Government will take over the electric supply of the enormous areas north and south of Port Jackson.

There seems to have been in the past little confidence among many engineers in charge of Australian central stations in the future of electricity, and this, together with the rapid increase in demand which has actually occurred, has resulted in many stations operating with no adequate margin of plant capacity, and, of course, without means of borrowing supply from a neighbouring undertaking. Recently a serious effort has been made to adopt standard supply pressures and frequencies, Wellington (N.Z.) being now almost the only important town with an abnormal supply frequency (80 cycles). Isolated plants in mines, &c., seem to have absorbed all the freak plant.

Fans, heaters, cookers, domestic motors, &c., will be used in large quantities as soon as more current and livelier propaganda are universally available. Already current is frequently as cheap as in this country, and both as regards actual price, and in comparison with the local charges for gas, the consumer gets good value for his money.

* For the original text of these communications, reference should be made to the *Australian Mining Standard and Electrical Record*, page 429, *et seq.*, and the *Proceedings* of the Victorian I.E.E., page 9, *et seq.*, 1913.

The moderate price of current, the high wages of domestic servants, and the trying summer temperatures, have created a good demand for electric heaters and irons wherever sufficient current supply has been available. It is, perhaps, partly due to the land being so closely related in climate to the United States, and so conveniently situated with regard to North America, that American types of apparatus are in such evidence. European apparatus is, however, available, and one Melbourne firm is doing good business in the manufacture of electric heating apparatus.

Many good showrooms have been established, that in Melbourne being particularly fine (largely owing, be it noted, to information gained by Mr. H. R. Harper on his recent round-the-world tour). As in this country, the gas interests realise the importance of electricity as a competitor, and "though the electric showrooms are good, the gas ones seem better and *more publicly placed*" (the italics are our own). A well-organised and worked showroom is undoubtedly an expense, but it creates constant interest in electricity, and affords a means of combating directly any misrepresentations made by gas advocates.

Mr. Westwood states that, having seen the general state of wiring in Australia, India, Africa and Europe, he believes the Australian wiring to be as good as, or better than, that which he saw in England, and he considers Continental wiring to be the last word in bad work.

The overhead distribution system common in Australian towns offers inestimable advantages in supplying growing areas, particularly in suburban districts, where houses are small and plots large. The cheapness of the line construction and the ease of adding to or altering the feeders are wholly to the advantage of consumers, and Mr. Eck reports great improvements in verandah construction; it now only needs a good effort to standardise on a verandah which will carry and conceal feeder cables and provide suspension supports for overhead trolley wires and positions for arc lamps for street and window illumination. Large shops are at present often lighted after closing hours by arc lamps hung under the verandahs, and the design of the latter is often such as to bring the lamps unpleasantly low.

In discussing English switchgear, Mr. Westwood comments upon the great confusion prevailing in this country between "English" and "Continental" practice. He says that England is the dumping ground for American and German switchgear, and "English practice is to take either country's standard lines, and that greatly dependent on the idosyncrasy of the engineer-in-chief." Mr. Eck states that the cardinal failing of the Australian in purchasing a low-priced instead of a cheap article leads to much inferior workmanship, poor economy, and improper or insufficient switching arrangements, particularly in the lighting field.

Standard ratings for machines are not fixed, and probably (says Mr. Eck) never will be. The British Engineering Committee Standards are applicable to the southern parts of the Continent but are not suitable for Queensland and the northern parts. Rules, regulations and specifications for electrical plant, apparatus and installations, have been codified by the engineers of the Fire Underwriters' Boards in the various States, but the administration of them differs considerably, and apparatus permitted in one district is often prohibited in another with insufficient time notice to importers to enable them to utilise stocks already ordered, and in some cases in course of delivery. This is a real hardship to traders, and is a state of affairs which should be remedied forthwith.

For organisation, design and good construction, Mr. Westwood saw little to equal the Adelaide tramways, and Mr. Eck also comments upon the high development of electric traction on street railways in Australia. The geographical position of the sub-Continent has brought it under the influence of both British and American practice, hence work of the most diverse character is to be seen. With the exception of Melbourne and, to a less extent, Sydney and Brisbane, most cities have no suburban lines and stations, or have failed to develop these for the convenience of passengers, and this has naturally resulted in the development of good tramway services in all the large and many smaller towns. Generally speaking, the systems have been laid out to attract passengers, and have proved very successful in operation. Mr. Westwood speaks very favourably of the performance and prospects of railless trolley 'buses in this country, but in discussing his (Mr. Westwood's) paper, Mr. Noel Murray urged that from the public's point of view, a trackless could not be compared with a track system, since the laying of rails gave a guarantee to settlers on the route that the service would continue. This view, though worth recording, appears to be fallacious; one of the chief claims made for trackless trolley vehicles is that they make it possible to give travel facilities to a new district long before track-cars could be afforded, and yet involve no expenditure which does not go towards the trolley tram system ultimately to be established, and the development (by aid of the trackless vehicles then liberated) of further new districts.

In Melbourne, Mr. H. R. Harper is performing pioneer work in the field of storage battery traction for commercial and private vehicles.

The electrification of the Melbourne surburban railway lines is to be carried out under the guidance of Mr. Chas. Merz, and it is hoped that complete electrification of the tramways, and numerous improvements in the terminal manipulation of rolling stock and traffic, will soon be effected in this city. The stupendous underground railway scheme proposed in Sydney, involves far greater engineering difficulties than were encountered in the construction of the London tubes, but the project must eventually be carried out since an overhead railway is inconceivable, and the north and south traffic across the city must continue to increase by leaps and bounds. Branch and even main line electrification is likely to become an accomplished fact in New Zealand at an early date, and the vast water power available in the Dominion foreshadows almost unlimited developments in the utilisation of electrical energy for agricultural, industrial, and domestic purposes.

Naturally, Mr. Westwood was impressed by the impetus given to electrical supply in Europe by the perfection of metallic-filament lamps, and he comments favourably on the recent progress made in the construction of magazine and enclosed flame arcs, and on the great amount of research work still being carried out in this field, particularly in Germany.

The electric lighting of streets in Australia is steadily being taken over by electricity works, but though modern and efficient installations are provided in many towns, others are still characterised by very deficient lighting arrangements, even in the main thoroughfares. Too much dependence is often placed on the illumination derived from shops, with the result that after 10 p.m., and on Sundays, practical darkness prevails unless the moon shines. "The straight wide streets of Australian towns are well adapted to arc lighting, and the agreeable after-dark temperatures call for the above state of affairs to be remedied, so that citizens may find their streets agreeable and safe to use at night."

In shop lighting, the striving after concealed lights is obvious, but poor results are generally obtained. Only a medium degree of illumination is generally produced, and the many reflections of the "concealed" lights produce as much glare and distraction as though the lamps were bare and at eye level.

The splendid sunlight of Australia and the North Island of New Zealand demand good interior daytime illumination, which the use of verandahs renders difficult of achievement from daylight. Good electric lighting is, therefore, necessary, and to about twice the intensities adopted as standard in England, where the artificial illumination is in contrast with street lighting and not with brilliant daylight. With such intensities, the question of maintenance costs, as well as absence from glare, have to be carefully studied. The best shops are adopting indirect lighting, in most cases by arc lamps burning pure carbons and giving colour-true rendering of the fabrics and materials displayed. In small establishments where colour-truth is not of so great importance and where the restricted size of the room prohibits arc lamp lighting, indirect lighting by metal-filament lamps is being adopted, and there is no doubt that before long the American indirect and diffused lighting systems will appear and be adopted.

Australia is ahead of England in adopting automatic telephone exchanges, and the apparatus installed is good in

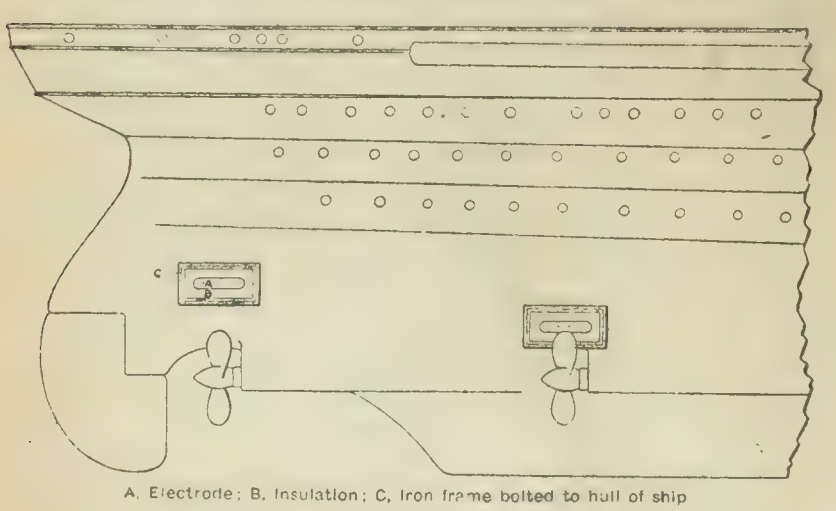
design, both as regards materials and strength. As in most countries, the subscriber's apparatus is very diverse in type and method of operation. The hand-combination instrument is still in use and, in common with many other telephone users, Mr. Eck laments the day when this convenient set gave place, in this country, to the heavy pedestal transmitter with no speaking key and a separate receiver. In the field of wireless telegraphy, Australia is showing progressive independence by manufacturing large quantities of wireless apparatus, notably in Sydney, under Father Shaw's patents.

In conclusion, Mr. Eck notes the generally superior education and intellectual equipment of members of the electrical fraternity, and predicts a permanently successful future for electrical engineers in Australasia.

THE ELECTRICAL PROTECTION OF SHIPS' HULLS.

It is recognised pretty extensively among marine engineers that corrosion of the exterior of ships' hulls is very largely an electrolytic question. The couple formed by the junction of two dissimilar metals and the presence of sea water is quite sufficient to set up an extensive pitting action, which, unless checked, may have very serious results. Recently an adaptation has been made of a process which has given excellent results in connection with the protection of steam boilers, condensers, &c., and which, in a good many installations both on land and at sea, of important size, is replacing the older method of attaching in the interior of the boiler plates of zinc which are electro-positive as related to iron or steel. This method is known as the Cumberland process, and has been developed by the Cumberland Syndicate.

The principle on which this depends is as follows :—The iron anodes, suitably insulated, are immersed in the water contained in or surrounding the metallic vessel which has to be protected, and a measured amount of electricity is supplied to each anode. The regulation of the current is effected by a separate resistance coil in series with each anode which, with the resistances, are insulated from the parts to be protected, and the plate is connected by wire to the positive pole of a source of electricity supply, while the metallic parts of the vessel to be protected are connected to the negative pole of the supply source. The current, therefore,

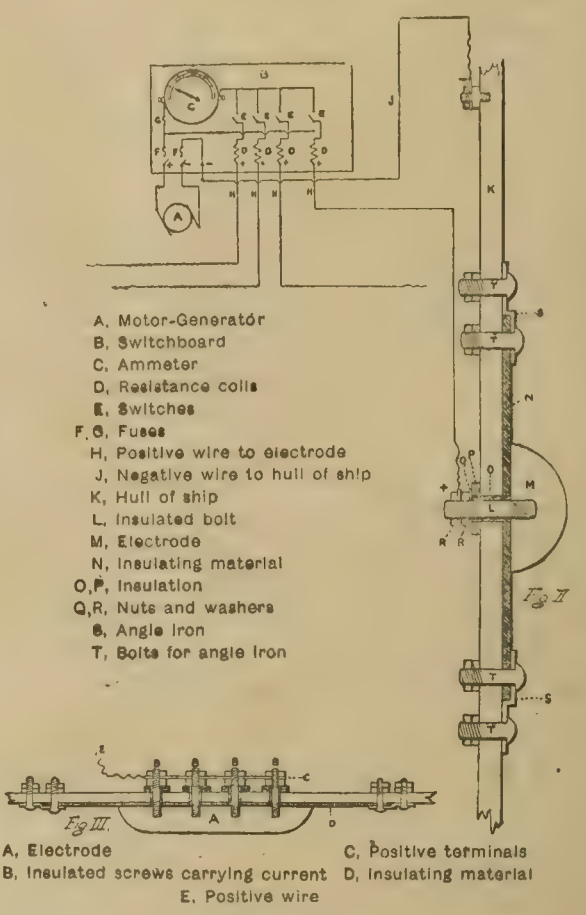


A, Electrode; B, Insulation; C, Iron frame bolted to hull of ship

Fig. 1.

passes from the positive pole of the generator to the anodes, through the water which is decomposed by the current, and enters the metal comprising the vessel to be protected, returning thence to the negative pole of the generator. In this way the destructive agencies of the water are directed away from the metal of the vessel to the iron anode which is attacked, oxide of iron being formed, while the negative vessel suffers no change, the only perceptible result being in the case of a strong current, the formation of bubbles of hydrogen. The life of an anode depends on its weight, and also on the amount of current consumed, and as iron is a cheap metal, and one which can easily be replaced, the method is commercially sound.

Fig. 1 illustrates the method of adjustment of the electrodes. It will be seen that the plate A is surrounded by insulation B interposed between the electrode and the iron frame C, which is bolted to the hull of the ship. This will be seen more clearly from figs. 2 and 3, the latter showing the use of insulated screws carrying current, and the insulating material, while fig. 2 shows the complete electric circuit. A is the motor-generator, the motor being fed from the electric light and power mains of the ship, while the generator is capable of giving a pressure of from 6 to 10 volts, direct current. By suitably varying the resistance B in series with each anode, a distribution of current can be effected giving the best overall protection throughout the parts of the ship likely to be effected by the electrolytic action of sea water.



Figs. 2 and 3.

This is a comparatively new development, but the Cumberland process applied to steam boilers and condensers has met with such distinct success that some of the largest vessels are now equipped in this way. Among these may be mentioned the vessels of the White Star and Cunard Companies, such as the *Mauritania*, *Luisitania*, *Laurentic* and *Celtic*, while important electric power houses such as those of the New York and Brooklyn Edison Companies, the City and South London Railway, &c., have installed the process for the protection of their steam raising and utilising plant. It will probably not be long before some such process as the above, applied to the protection of ships' hulls, is regarded not as a novelty but as a necessity.

REMINISCENCES OF THE MISTY PAST.

By G. A. Nussbaum.

When, in the latter part of the seventies, the Jablochkoff candle and various arc lamps had given such a great impetus to electric lighting, the rush of all sorts and conditions of men to the new industry was simply amazing, at least, it was so in France. On a smaller scale, it must have been something like the Californian gold fever. Tremendous fortunes were to be realised by inventors, the gasworks were to be put on the scrap-heap, and there was a panic amongst the shareholders.

I had just come to Paris after some years of hydraulic engineering in the provinces, and joined a consulting engineer. Many of my friends were going over to the new industry, and I was urged to do the same. However, as I

had interesting work on hand, I did not feel inclined to change saddles until the new industry had settled down into a steady groove; heretic that I was, I even held on to some gas shares I had bought a few years previously. But fate lay in wait for me; one morning a friend, afflicted with a considerable fortune, called on me and explained that he had commenced financing a new electric lamp which was to put the Jablochkoff and other burners in the shade, and he wanted me to enter the new concern to look after his interests. His carriage being at the door, I was bundled into it, and we drove to the heights of Montmartre, where a small laboratory and workshop had been installed in the "Passage Cotin." He introduced me to the inventor and a staff of very intelligent looking young men. The "marvellous" invention was the little slide-lamp, which, in 1882, lighted one of the courts at the Crystal Palace Exhibition. I told my friend that I was not competent to judge the value of the invention, and urged him to take advice of a first-class electrician before sinking more money in the affair, but the electrical fever held him in its grip. I had to leave my post and enter the undertaking, and had to improve my knowledge as best I could. At that period there were no men who had more than an elementary smattering of electric lighting. The theory on the construction of dynamos, motors, and lamps, was very hazy, even among the high priests of the profession; it was guess-work with us and most other manufacturers of those days. But all the same, what a merry hopeful time it was: we were all to become millionaires, and were discounting our future riches heavily. I remember an enthusiastic young electrician who used to pawn all his belongings each time he thought he had made a marvellous discovery, in order to give a decent christening to his invention; and what christenings they were!—no wonder few babies survived the ordeal. I wonder whether anyone still remembers some of the free lances of those days, le père Lontin, whose machines can still be found in some of the early text-books, de Meritens, the staunch champion of Magnetos *versus* Dynamos, some of whose huge magnetos were, I believe, installed for a time in one of the English lighthouses, and many other types.

Besides the slide-lamp we made various other apparatus, "*le brûleur à quatre charbons*," for instance, an arc lamp in the shape of an inverted pyramid, each electrode being formed by two flat carbon rods with electromagnets near the points to keep down the arc. An almost identical burner was re-invented many years afterwards, and used as a soldering lamp.

Every Thursday we had great receptions at our laboratory, when we made a series of public experiments, and frequently we had a very aristocratic audience. I remember having seen quite a string of carriages from the Faubourg St. Germain at the entrance of the little "Passage Colin"; people took a lively interest in electrical experiments in those days. The late M. Hospitalier was a frequent visitor at our laboratory, and so were the Comte du Moncel, the electrician; Comte Dumas, the chemist; Léon Gambetta, Rochefort and other celebrities, who came from time to time. People who knew the fierce pamphleteer only by his vitriolic outbursts in the Press have no idea what a charming conversationalist he could be when he chose.

The "clou" of our show was the melting of metals and minerals by means of the four-carbon burner; some attempts at welding and making steel castings from scrap iron were also made. One day a dainty little Marquise, doubting the possibility of melting one of her precious stones, handed in a ring (I forget what kind); it was soon reduced to a lump, stone and gold, to the great delight of the pretty owner. Great amusement was always caused by forming chains and giving electric shocks to our guests.

Sometimes we had visitors of a very different social standing—for instance, one Thursday evening there swaggered in a small band of "rôdeurs-de-barrières" (or Apachés, as they are now called), at their head a notorious scoundrel, known by the name of "La Terreur de Montmartre." The word was immediately passed that the beauties were to be got in a chain, which we did. Well, I have never witnessed such a rapid transformation as that of these ruffians. When released, they sneaked out a flabby, ghastly looking gang, with not an atom of bounce left in them; perhaps the shocks we had administered to them were not exactly of a mild kind. But there is a sequel to this incident. Years afterwards I was looking over some works, when, to my amazement, I saw my friend, "La Terreur de Montmartre," amongst the workmen. He evidently recognised me at once, smiled and doffed his cap. The manager told me that he was one of the steadiest and best mannered men on the premises, and my friend, the "terreur," dated his conversion from the day of his electrification at our laboratory. Now, here is a hint for the Home Secretary!

In 1883 the concern was made into a limited company, with works at Courbevoie, near Paris. There, several types of dynamos, motors and arc lamps were turned out, also an incandescent lamp for low voltages, the lighting body of which was composed of thin, straight carbon rods forming a triangle, cemented at the apex with carbon paste. As far as I know, all these creations, together with the company, are dead and buried long since. It was at the Courbevoie works that Mr. Charles Brown, of the well-known Swiss firm, Brown, Boveri & Co., took his first lessons in armature winding.

At the first Paris Electrical Exhibition in 1881, we made a pretty brave show, and received a gold medal for our arc lamps. But I must confess that the award was principally due to a long pole, kept in a corner, which was vigorously handled whenever the lamp-carbons came together or kept too far apart. Scouts were posted in various corners of the Exhibition to signal the approach of committee-members; then there was a wild rush for the poles, and the lamps were well shaken so that they might burn brightly for half an hour. Yes, arc lamps of those days required a considerable amount of coaxing, and all the manufacturers were more or less in the same boat.

One of the most amusing features of the Exhibition was the stand of the famous "bougie J.," invention of the late Prof. J., which was supposed to have solved the problem of division of light. In big letters, it was announced that 40 of these burners could be lighted by a single H.P. A number of these unfortunate candles were fitted on a large panel; before this edifying tableau the boss of the show was executing a continual "pas seul" in the frantic endeavour to keep his blinking lamps burning, correcting them with a stick like so many naughty children.

After the closing hour, we proceeded to a small restaurant behind the Exhibition, where we compared notes, and the fun waxed fast and furious until the small hours of the morning. Gas engineers were sometimes lured to this den and metaphorically tarred and feathered. Kind-hearted Wilfrid de Fonvielle, editor of the *Electricité*, frequently presided over these meetings.

Ah, me, where is that "barty" now? Vanished into the "Ewigkeit" most of them, where no doubt they are occupied with greasing lightning and superintending thunderstorms generally.

The "free lance" with his Fata Morgana always moving in front of him, has long departed, to make room for the steady plodding man, chock-full of science, as Captain Cuttle has it.

The electrical industry is developing on magnificent lines with ever-widening horizons, but the glamour of its "Vie de Bohème" has departed for ever; peace to its ashes!

Standardisation of Electric Lamps for Motor-Cars.—The Accessories Committee of the Society of Motor Manufacturers and Traders is following the example of the American Society of Automobile Engineers in endeavouring to bring about some degree of standardisation in electric lamps for use in connection with the electric lighting of motor-cars. A Sub-Committee was appointed to go thoroughly into the matter, and a joint meeting has been held with representatives of the lamp manufacturers. The various points dealt with in the discussion were (1) voltage, with regard to which the view was expressed that there should not be more than two standards. (2) Candle-powers.—The general opinion was that three standards were sufficient for head lights, and three others for side and tail lights. With regard to bulbs [illegible] considered that the 33 mm. and 55 mm. sizes were the [illegible]. (3) Filament.—The kind known as "Helical Spark" appe[illegible] to be preferable, whilst the position of the filament was decided according to the size of bulb. (4) Caps.—The small bayonet cap was agreed to be preferable for side and rear lamps, but with regard to head lights the maximum candle-power to which it was practicable, might, it was considered, somewhat depend on the holder.

ELECTRIC CONTROLLERS FOR HAULAGE SERVICE IN COAL MINES.

The control gear illustrated and described below has been specially designed to comply with the revised Home Office Regulations which came into force in June, 1912, governing the use of electricity in mines.

Rule 15 of the regulations applies to those parts of the mine where inflammable gas, although not normally present, may, nevertheless, occur in quantities sufficient to be dangerous.

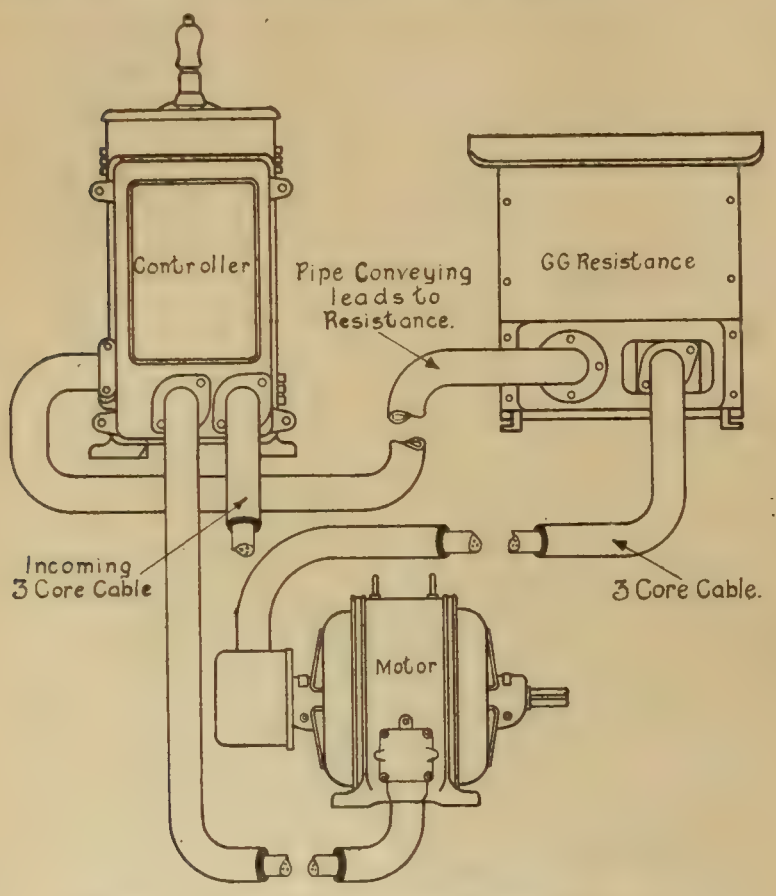


Fig. 1.—Arrangement of Pipework, &c.

In mines where the voltage exceeds low pressure (250 volts) it is now compulsory to arrange the wiring of the control apparatus and motors so that a continuous metallic casing is obtained for all cables throughout the mine; it is therefore necessary when installing control apparatus where Rule 15 applies so to devise this apparatus as to prevent open sparking.

It would be unnecessarily expensive to use controllers designed to comply with Rule 15 in those parts of the mine where this rule does not apply; for this reason the British Thomson-Houston Co., Ltd., have standardised two types of mining controllers in



Fig. 2.—Exterior of Controller.

The arrangement for obtaining continuous metallic covering for the cables connected between motors, controllers and resistances is shown in fig. 1, for A.C. slip-ring motors; a simpler arrangement suffices for D.C. motors, the pipe connecting the rotor slip-rings to the rheostat being omitted. The frames of the controllers and resistances are provided with clamps for the pipes enclosing the single-core cables, and for the armouring of the three-core cables. The inlet for the pipe enclosing cables connected to the resistance is at the side of the frame, and the inlets for the cables for connecting to main switch and motor are at the back of the frame.

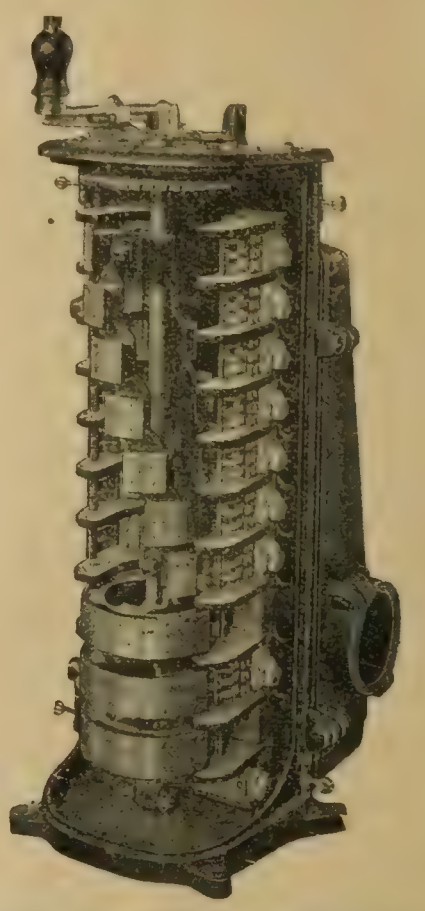


Fig. 3.—Interior Mechanism of Controller.

Controllers for use where Rule 15 does not apply are of the vertical type, as shown in figs. 2 and 3; they have strong cast-iron frames and wrought-iron covers, and are operated by means of crank handles.

The frames of controllers for use with three-phase slip-ring motors are supplied in two forms: One suitable for all cables to be run in pipes, three pipes being required; the other for the rotor resistance cables only to be run in a pipe, the line and stator connections being made by means of three-core armoured cable, and two sets of clamps being provided on the frame for clamping the armouring to the frame.

For D.C. motors, the standard controller frames are arranged for connecting to three pipes: One for the incoming line cables; one for cables connecting the controller fingers to the resistance; and one for the cables connecting the controller fingers to the motor armature and field terminals.

Controllers for use where Rule 15 applies are built with strong

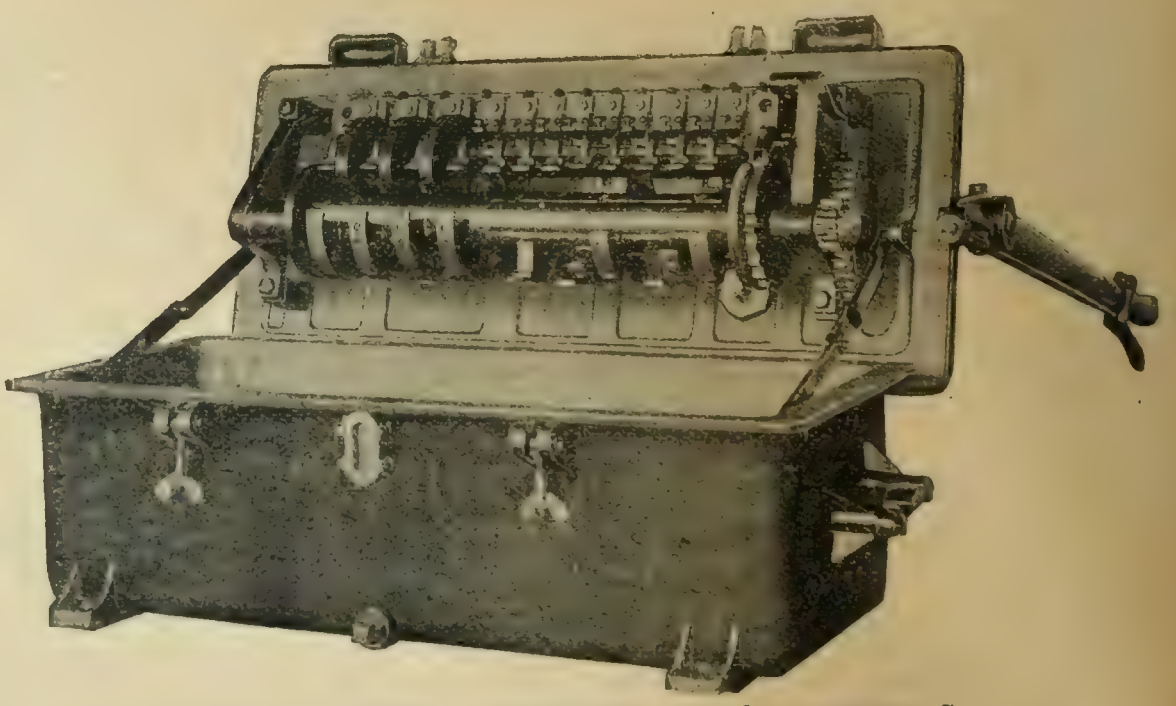


Fig. 4.—Horizontal Type of Controller with Oil-immersed Contacts.

capacities up to 250 H.P. and line voltages up to 3,000 for A.C. motors, and in capacities up to 100 H.P. and line voltages up to 600 for D.C. motors.

Direct current is still used in some of the older mines, but the motors used do not exceed 100 H.P. in size.

cast-iron cases, having wide machined flanges between the box and the cover, and as an additional precaution against open sparking, all contacts on which arcing may take place are oil-immersed. These oil-immersed controllers are of the horizontal type, this form being the most convenient for inspecting the working parts.

Controllers up to and including 100 H.P. have the moving and fixed contacts supported from the under side of the cover, so that they are at once accessible for inspection and renewals when the cover is lifted. Figs. 4 and 5 show controllers of this type.

For capacities above 100 H.P. the controllers are designed so that the cylinder in each case is supported from a fixed frame, the oil tank being lowered from the frame when it is required to inspect the contacts. A tank-lowering device is provided with each controller, so that the tank when full of oil can be lowered with ease. The frame consists of a box-shaped casting mounted on four pipe supports. The frame also forms a terminal box for enclosing the terminals, which are mounted on studs passing through porcelain insulators fixed in the frame. The cylinder and finger bases are mounted below and supported from this frame, each finger base being connected to the under side of one of the terminal studs. Wide machined faces on the lower surface of the frame and the upper surface of the oil tank ensure that danger due to open sparking cannot result, should the correct oil level not be maintained. Fig. 6 shows a controller of this type suitable for a 250-H.P. 3,000-volt slip-ring motor.

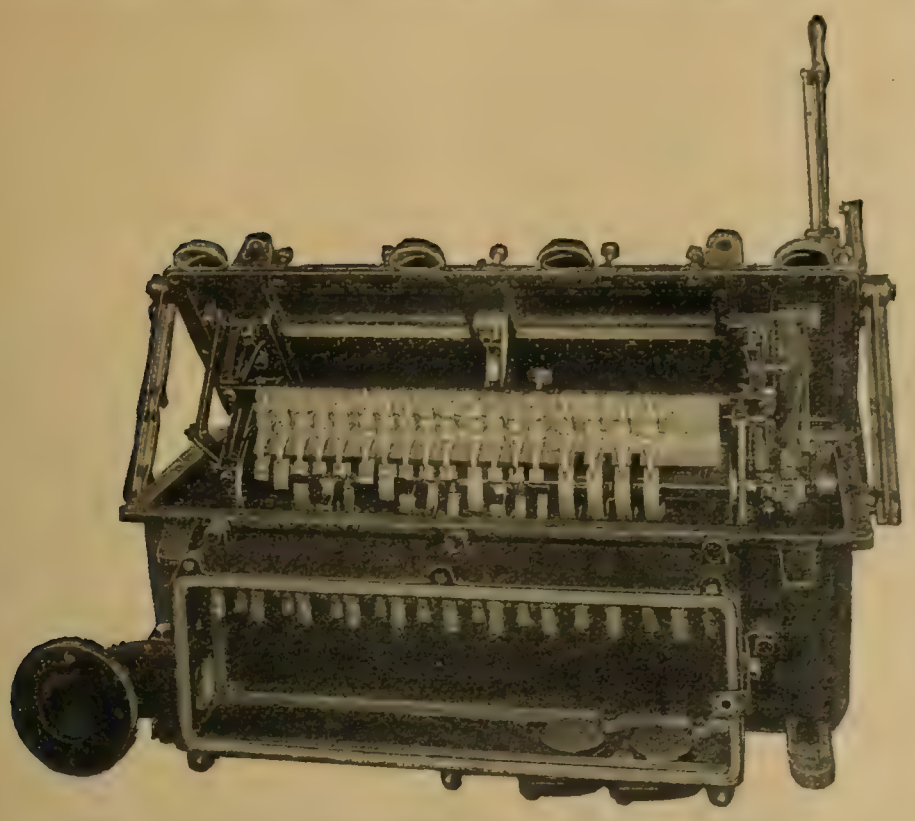


FIG. 5.—HORIZONTAL CONTROLLER, SHOWING ACCESS TO CONNECTIONS.

In all of the controllers described above, the working parts can be inspected without disconnecting any cables. Many types of oil-immersed controllers in use in mines in the past were of the vertical type, the contacts of which could only be seen by disconnecting the cables and lifting the controller bodily from the tank, a process involving considerable time and difficulty.

Oil-immersed controllers for large currents have in general been found to wear more at the arcing tips than air-break controllers working under the same service conditions. The latest types of 150-H.P. and 250-H.P. controllers built by the British Thomson-Houston Co., Ltd., overcome this trouble, and save the expense of frequent renewals to finger and segment arcing tips.

The resistances for use with the controllers described are constructed from the British Thomson-Houston standard air-cooled type C G units, consisting of iron grids insulated from their supports by mica, and grouped together to form resistance-boxes. The resistance-boxes are in turn assembled in three forms of frames, depending on the service and number of units required.

Fig. 7 shows a typical resistance for use with a British Thomson-Houston mining controller.

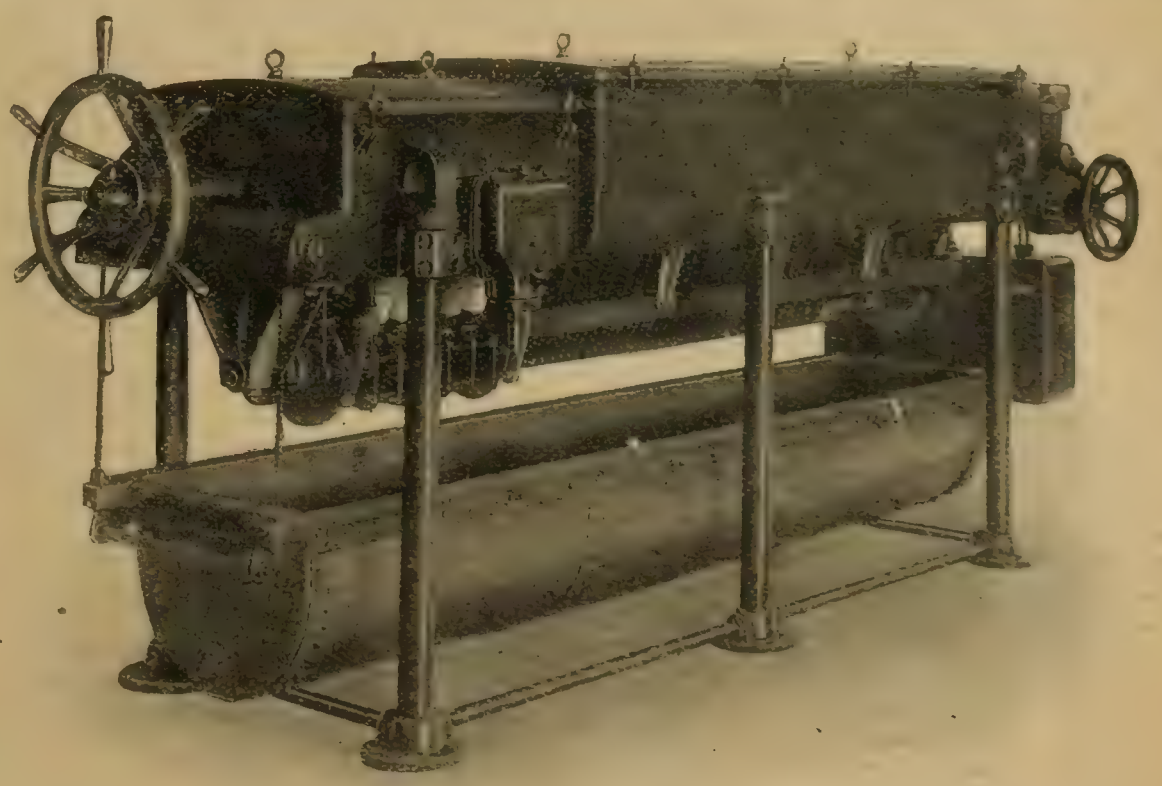


FIG. 6.—LARGE CONTROLLER WITH OIL-IMMERSED CONTACTS.

Paper Cables.—MESSRS. THE MACINTOSH CABLE CO., LTD., who are financially controlled by the well-known firm of Chas. Macintosh & Co., Ltd., of Manchester, have recently commenced the manufacture of paper cables at their new works in Liverpool, erected specially for this purpose. The company are in a position to quote for, and supply, all classes of paper-insulated cables. Messrs. Gillespie & Beales, of Amberley House, Norfolk Street, Strand, W.C., have been appointed the company's sole selling representatives for the south of England.

Lead.—In their report dated October 11th, MESSRS. JAMES FORSTER & CO. state:—"Closing prices last week were £20 7s. 6d. September, £20 October, £19 December and £18 12s. 6d. January. Early this week the 'bears' had a 'merry' time, selling freely for October and forward positions. October was done down to £19 12s. 6d, December £18 12s. 6d. and January £18 5s. These operations were apparently based on reports of improvement in the Mexican position, which, by the way, is scarcely borne out by the latest news, and the belief that supplies from that country would be shortly forthcoming. However, actual facts soon put a different face on the market. On Wednesday September lead was offered at £20 2s. 6d., and on Thursday £20 15s. was paid for this delivery, 'bears' coming into the open only to find that holders had little lead available. In justice to home dealers, it may be said that the 'bears' are chiefly Continental. The actual position is that at no time this year has lead been so urgently required. Important electrical consumers are begging for the metal, and contracts for export are behind-hand, owing to supplies being so inadequate. The export demand continues unabated, and on the top of all is a 'bear' squeeze. Yesterday, September lead was still wanted with £20 15s. paid. There were buyers at £20 5s. for October delivery; £19 2s. 6d. was paid for November and £18 15s. for December. We should, perhaps, explain that September lead is deliverable up to October 15th. Closing prices are:—£20 12s. 6d. prompt, £20 5s. buyers October delivery, £20 sellers October shipment, £19 5s. November, £18 17s. 6d. December and £18 7s. 6d. January. Consumers should ignore fluctuations in the market, and provide for their requirements in due time. That lead can become plentiful under existing circumstances is scarcely to be expected. The total production of the world has only increased 3 to 5 % in the last 10 years, while the consumption for electrical purposes has increased enormously during the same period. This is quite sufficient to account for the prevailing scarcity and absence of stocks. English lead, £21."



FIG. 7.—GRID RESISTANCE.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,864. "Illuminated signs." V. von Vangel. September 29th.

21,891. "Marine cableways." T. S. Miller. September 29th. (Complete.)

21,901. "Electric water heaters or geysers." L. M. Waterhouse and Simplex Conduits, Ltd. September 29th. (Complete.)

21,918. "Telegraphic apparatus." A. A. C. Swinton. September 29th.

21,921. "Telephone exchange systems." D. H. Kennedy and J. W. Turner. September 29th.

21,924. "Electric tail-lamp with emergency globe for use on motor-cars and other vehicles." H. Atkinson. September 29th.

21,931. "Selecting device for electric bells and the like." W. E. Muntz. September 29th.

21,959. "Coil bobbin for primary-current coils of meters, measuring instruments or the like." Allgemeine Elektricitats-Ges. (Convention date, November 28th, 1912, Germany.) September 29th. (Complete.)

21,965. "Indicators, annunciators and the like." Sterling Telephone and Electric Co., Ltd. (Telephon-Fabrik Akt. Ges. vorm. J. Berliner Austria.) September 29th. (Complete.)

21,997. "Electrically-heated hot-air syringes used in the practice of dental surgery." G. F. Gadd and Western Dental Manufacturing Co., Ltd. September 30th.

22,023. "Method of and means for mounting electrical resistances or filaments on to supports for electric apparatus such as heaters and lamps." C. O. Bastian. September 30th.

22,024. "Electric glow-lamps or/and the method of manufacturing and operating the same." C. O. Bastian. September 30th.

22,035. "Construction of electric lampholders." A. A. Price. September 30th.

22,091. "Electric vehicle transmission." W. R. Cooper. October 1st.

22,093. "Metallic-filament lamps." H. Bleske and E. Schulze. (Convention date, October 3rd, 1912, Germany.) October 1st. (Complete.)

22,146. "Apparatus for high-speed telegraphy." J. Gell. October 1st.

22,149. "Dynamo-electric machines provided with commutators." H. Mensforth. October 1st.

22,157. "Telephone transmitting apparatus." A. H. Foote. October 1st. (Complete.)

22,176. "Brush or like sliding contacts for high-frequency electrical apparatus." A. S. Sörensen. October 2nd. (Complete.)

22,198. "Connecting-up of electric cables or conductors and the protection of their exposed ends and terminals." St. Helens Cable and Rubber Co., Ltd., and J. C. White. October 2nd.

22,220. "Electro-magnetic relays for use in connection with wireless telegraphy installations and for other purposes." A. B. Williams and W. A. Solomon. October 2nd.

22,222. "Manufacture of carbon electrodes for electric arc lamps." F. Lewis. (Convention date, July 2nd, 1913, Germany.) October 2nd. (Complete.)

22,223. "Manufacture of carbon-electrodes for electric arc lamps." C. Conradty (firm of). (Convention date, July 2nd, 1913, Germany.) October 2nd. (Complete.)

22,224. "Electro-pneumatic air-brake systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 2nd.

22,228. "Generator of electricity for automobiles forming a combined source of ignition and illumination." A. Sanchez and C. Baradat. October 2nd. (Complete.)

22,235. "Construction of electric fans of the oscillating or revolving type." S. G. Leach. October 2nd.

22,260. "Electric vulcaniser for tires." R. K. Hearn. October 3rd.

22,273. "Electrically-operated switches." B. Thomas and E. Thomas. October 3rd.

22,274. "Electrically-operated switches." B. Thomas and E. Thomas. October 3rd.

22,275. "Electrical rheostats." B. Thomas and E. Thomas. October 3rd.

22,319. "Arc-light carbons." H. Ayrton. October 3rd.

22,331. "Electric glow lamps or/and the methods of, manufacturing and operating the same." C. O. Bastian. October 3rd.

22,348. "Method of and apparatus for the control of electrical plant." H. J. Read and W. J. Branson. October 3rd.

22,358. "Manufacture of a material suitable for electrical insulation and other purposes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (Divided application on 8,417, 1913, April 9th.) October 3rd.

22,359. "Electrical baking-apparatus." W. P. Perry. October 4th.

22,390. "Systems and methods of control for electric motors." N. W. Storer. (Convention date, October 5th, 1912, United States.) October 4th. (Complete.)

22,394. "Alternating-current transformers." D. K. Morris and Morris and Lister, Ltd. October 4th.

22,405. "Lamp annunciators for telephone switchboards." Western Electric Co., Ltd., G. H. Nash and B. B. Grace. October 4th. (Complete.)

22,406. "Telephone hand sets." Western Electric Co., Ltd., G. H. Nash and B. B. Grace. October 4th.

22,420. "Electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 4th.

22,421. "Resinous condensation products." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (Addition to 24,254, 1912.) October 4th.

22,425. "Holders for incandescent electric lamps." H. Russell. October 4th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Field-Magnets of Electric Turbo-generators. A. Rolfe. 14,056. June 17th.

Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 18,478. August 12th. (August 14th, 1911.)

Electrical Accumulators. C. de Sedneff. 18,571. August 13th.

Flexible Metallic Clip for Attaching and Detaching Shades, Shade-holders, Advertisements, Decorations, Protectors and the Like to or from Electric, Gas, Oil or Vapour Lamps, or other Devices that may be Used for the Purpose of Illumination. F. Parks. 20,805. September 12th.

Apparatus for the Electrical Treatment of Gases and Vapours. W. T. Hoofnagle. 20,950. September 13th.

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co.) 21,263. September 18th.

Telephonic Receivers. A. Marr. 21,664. September 24th.

Branch Boxes for Electric Conductors. J. Kramer. 23,750. October 17th.

Electromagnetic Suspension Devices. B. Graemiger. 24,541. October 26th. (July 3rd, 1912. Addition to No. 24,499 of 1912.)

Switches for Use in Connection with the Electric Lighting Systems of Automobiles. B. Brooks and W. Holt. 25,420. November 6th.

Automatic Electric Circuit-breaking Arrangements. E. C. Möller. 27,530. November 29th. (Divided application on No. 6,990 of 1912, September 21st.)

1913.

Ozonizers. J. C. A. Henderson. 1,156. January 17th.

Connections for Continuous Electric Current Generators. Fried. Krupp. Akt.-Ges. 1,407. January 17th. (March 1st, 1912.)

Construction of Incandescence Electric Lamps. O. Schaller. 1,804. January 22nd. (August 23rd, 1912.)

Process of, and Apparatus for, Producing Ozone. J. Steynis. 3,769. February 13th. (February 13th, 1912.)

Automatic Electric Switches. H. C. E. Boutard. 5,546. March 5th. (March 6th, 1912.)

Apparatus for Photographically Recording Electrical Measurements and for like Purposes. Siemens & Halske Akt. Ges. 8,240. April 8th. (April 10th, 1912.)

Registering Circuits for Automatic Telephone Exchanges. Siemens and Halske Akt. Ges. 9,168. April 18th. (April 18th, 1912.)

Audible Signals for use in Determining Temperature. A. McNab. 9,695. April 24th. (April 25th, 1912.)

Fly-Wheel Storage Arrangements such as used in the Electrical Driving of Hauling or Winding Machinery. Siemens-Schuckertwerke Ges. 11,007. May 9th. (May 10th, 1912.)

Individual Telephone Mouthpieces. C. S. Warren. 11,198. May 13th.

Electrolysis of Aqueous Solution. Ges. für Chemische Industrie in Basel. 11,872. May 21st. (December 9th, 1912.)

Automatic Ships' Telegraph Alarms. J. A. Sullivan. 11,972. May 22nd.

Inductance Coils for Telephone or other Circuits. Siemens & Halske Akt.-Ges. 12,265. May 29th. (May 29th, 1912.)

Dynamo-electric Machines. Siemens-Schuckertwerke Ges. 14,390. June 21st. (June 22nd, 1912.)

Electric Switches. Siemens-Schuckertwerke Ges. 16,454. July 17th. (June 7th, 1913.)

The Position in Canada.—A correspondent writing from Ottawa, Canada, under date September 16th, comments as follows upon the present position of affairs:—"There is scarcely anything doing in the way of electrical progress in our western cities. They have run the length of their rope, and are now at a full stop. Some of the cities now have difficulty in finding money to maintain existing works. Calgary, Saskatoon, Edmonton, Moose Jaw, Regina, Prince Albert, and several other towns, are doing nothing in the way of civic improvements. Times are bad, and all the summer hundreds of men have been walking the streets in those towns unable to obtain work. Saskatoon, a town but eight years old, spent, in 1912, something like two million dollars in civic improvements. Now she has no money to spend on improvements, and finds it difficult to finds money for maintenance. These towns started to run before learning to walk; now they can neither run nor walk. These Western towns tried, and succeeded in a large measure, to become full-fledged cities all at once—to have the improvements of cities a century old, in four or five years. The towns mentioned all now have their asphalt street pavements, their wires in conduits underground, their Whiteway lights, their incinerator, street cars, modern railway termini, up-to-date power plants; all the waterfalls in proximity to these Western cities have been harnessed and utilised for both power and light.

"Some of these improvements are, as might be expected, in an incomplete state, and the difficulty in procuring money this summer leaves the vast work unfinished.

"Winnipeg is doing little improvement work just now. This city worked in the millions. Three million-dollar contracts have been quite common in the past five years. There are no million-dollar contracts given out by the city this year.

"Still these towns are perfectly solvent, and their large expenditure in the past five years may be justified on the plea of the indispensability of modern improvements, particularly for new and fast growing towns, for encouragement of growth. The money stringency this season is a blessing in disguise for these Western towns. It effectually stops their mad career of improvements. They will now have time to consider and look out upon their mushroom-built landscape with a good crop this year of 200,000,000 bushels of wheat and a big crop of oats and barley. Our Western cities will soon be handling lots of money. The good harvest of this year is a grand thing for the West even sentimentally, because it will have the effect of causing European money-lenders to retain confidence in Western securities. Western municipal securities are all right, and with another good crop next year, the West will again come into its own. Another good crop in 1914 is, however, necessary in order that the West may regain the confidence of the world of finance."

The Shops Act.—The Southport Corporation has made a closing order which embraces those carrying on business as electricians, and under which shops must be closed at 8.30 on Mondays, 1 on Tuesdays, 8.30 on Wednesdays and Thursdays, 10 on Fridays, and 11 on Saturdays.

THE

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DEPARTMENTAL DECISIONS.

A CASE of the utmost importance to those who have to do with Government Departments was decided last week by the Court of Appeal. It primarily concerned the Local Government Board; but the decision is of such a nature that it must necessarily affect the dealings of the Board of Trade and other Government Departments.

It has been the fashion in recent years for the Legislature to withdraw all recent Acts of Parliament from the jurisdiction of the Courts. A new tribunal for the settlement of difficulties is frequently set up; but if not, it is declared that disputes "shall be settled by some one or other of the existing Government Departments." This form of inquiry may or may not be acceptable to the public; but so far as Officialdom is concerned, it has the advantage of secrecy. The case decided last week bids fair to raise the curtain to some extent.

The material facts were short and simple. A house was declared unfit for human habitation by an inspector appointed under the Housing and Town Planning Act. This was after two public inquiries, at which the householder gave evidence. The inspector made a report to the local authority who, in their turn, made the closing order.

Thereupon the house-owner appealed, as he was entitled to do, to the Local Government Board. Before his appeal came on for hearing, however, he was informed that the matter had been considered by the Board or some person properly appointed, who, acting on the information in the report of the inspector, had decided to dismiss the appeal and confirm the order. The householder took exception to this and took certain legal steps, as a result of which the Court of Appeal has quashed the order. Lord Justice Vaughan Williams pointed out in effect that the procedure adopted by the Local Government Board was contrary to natural justice.

Lord Justice Buckley said:—

I am opposed to the growing tendency of Government Departments to regard as privileged reports made to them on matters which affect the rights of the individual . . . . . I am strongly of opinion that the appellant was entitled before such an order was made to be put in possession of the facts alleged against him on which the Local Government Board acted, and was entitled to an opportunity of upsetting them if he could. If the appellant had a right to be heard on appeal to the Local Government Board—he certainly has the right to appeal—it is no answer to say that he has been heard before the Inspector. I think the appeal must succeed on that ground, and the closing order be quashed. A decision of a Government Department is like the judgment of a Court. Not only must the proceedings be openly conducted, but the Judge cannot give judgment with closed doors.

It is true that Lord Justice Hamilton dissented from the rest of the Court, but we cannot refrain from expressing our satisfaction at the result of the proceedings to date.

The practice of the Local Government Board is similar to that of other Government Departments, to each of which quasi-judicial functions are constantly being assigned by new Acts of Parliament.

For our part, we hope that this decision will be borne in mind by the Board of Trade when exercising its jurisdiction under the Electric Lighting Acts. An appeal lies to that Board in certain cases. Thus, as our readers are aware, where the exercise of powers under the Electric Lighting Act involves placing works in streets, notices have to be given to the local authority and the Postmaster-General. The local authority or the Postmaster may disapprove of the proposed works, and if the undertakers wish to go further their remedy is to appeal to the Board of Trade. An appeal is also allowed to the Board of Trade where there is a dispute between an undertaker and a consumer as to a requisition made by a consumer.

Again, the Board of Trade Regulations provide by Paragraph B (4) that the system and frequency of the supply shall be maintained subject, as respects frequency, to a variation not exceeding $2\frac{1}{2}$ per cent. above or below the declared frequency, and shall not be altered or departed from except by consent of the Board of Trade, and upon such terms and conditions as the Board of Trade may impose. To mention in detail the matters with regard to which the Board has power to give or withhold consent would be beyond the limits of our space. Suffice it that consent may be required for the breaking-up of private streets; the construction of the generating stations; overhead wires; supply for traction purposes; transfer of rights of purchase. Finally, to mention a power but recently conferred upon the Board, Sec. 6 of the Electric Lighting Act, 1909, makes provision for the supply of electricity from area A to premises within area B, subject to the consent of the undertakers in area A. "Provided that, if, in the opinion of the Board of Trade, any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given."

We have said enough to show the extent to which those interested in the supply of electricity are subject to the jurisdiction of the Board of Trade. And there is no appeal. In the instance last cited the Board may declare that consent has been unreasonably withheld, but no one other than a few clerks in a Government office ever knows why. The judgment in the matter may be perfectly capricious, but it is absolutely final!

It is for this reason that the electrical world will be glad to see the ruling of the Court of Appeal as regards the Local Government Board applied to other Government departments. Too great has been the tendency in recent years to subject large questions which closely concern the public to hole-and-corner official inquiry. A matter of enormous moment to a large body of shareholders or ratepayers may be subjected to the decision of a third-rate official who is sheltered for all time behind the magic name "Board of Trade," and whose reasons, however wise or foolish, are never submitted to the ordeal of public opinion.

Quantitative and Qualitative Heating.

Much error creeps into matters of engineering and manufacture from the failure to perceive that the utility of heat is not to be measured by temperature alone or by calories alone. Nobody will deny that in producing electricity by means of coal-generated power only a very small fraction of the calorific capacity of the coal can be ultimately reproduced as heat by using electricity as the go-between. That this is not due to any fault in electricity is plain to be seen from the high coefficient of conversion of water power into electrically-generated heat. Briefly, the conversion of mechanical energy into electricity is a process of high efficiency, and so is the process of turning electrical energy into heat energy; but to convert heat into work is a process of low efficiency. Yet there are small operations demanding heat, which can be carried out by electrical means with commercial economy even in competition with heat generated direct from fuel.

An example of this is the cooking of food. To cook food it is necessary to heat it to a certain fairly high temperature. Assume this to be 150° F. above atmospheric temperature, and that the food to be dealt with weighs 7 lb. Assume this mass even to be as water in possessing a specific heat of unity, then it will require 1,050 units of heat to raise the food to the desired temperature. This is equal to the heat in $\frac{1}{14}$th of a lb. of good coal. Electrically it is equal to about 0·3 KW.-hour or to about 1 lb. of coal burned in the power-producing boiler. But by means of careful heat insulation the electrically generated heat has been so conserved that it has become possible to conduct cooking operations with much less heat than is *ordinarily used* by direct fuel cookery. There is great difficulty in burning solid fuel in such small quantities as will enable the same economy to be secured. Gaseous fuel labours under the necessity of maintaining a constant stream of hot gases.

The electric cooker aims to attain to a high temperature, and not to lose heat by convection, conduction or radiation—all which losses are unavoidable in other methods.

Makers of steam superheaters have attempted to temper the furnace heat to the superheater pipes by a flood of cold air, which simply means that they waste heat by reducing it below a usable temperature. The correct method is to absorb the surplus heat in some previous useful operation, so that the hot gases may be turned into the superheater at a safe temperature, and after use there, still serve for feed heating. Superheating is a quantitative operation, for it requires much heat, but not at a maximum temperature.

Domestic water heating requires heat in quantity. A 40-gallon hot bath demands at least 20,000 heat units, or, say, 6 units of electricity, costing 18 to 30 lb. of coal. Similarly for heating a house, heat is required in quantity, and must not be confused with the occasional use of an electric heater to take the chill off a small room. The quantitative demands for heat have been badly catered for by solid or gaseous fuels, because it has been the habit to maintain a current of heated air, and only to use a small fraction of the heat by way of radiation, instead of by other means. What is to be borne in mind in questions of heating is the essential difference between degrees and calories, between the process which consists in heating a small quantity of stuff and keeping it hot, and the heating of a large mass of stuff, which must travel away from the locus of heat application. Cooking exemplifies the first, as also should crucible heating, if the above principles received better attention. The second is exemplified in the heating of air or water to be applied to house warming, for the heat is of necessity sent continually to waste by the process of ventilation, and is of such low temperature quality as to be past use as a waste product.

The Future of Municipal Enterprise.

We commend to the study of all of our readers who are interested in the subject of municipal *v.* private ownership, some extracts from a very important report by Sir F. Oppenheimer (H.M. Commercial Attaché for Germany), which appear on another page of this issue.

The co-operative control movement that has been in progress in Germany for some time past has been described in our pages. Changing opinion in that country has brought about a strong feeling in favour of a combined system in which private companies are responsible for the management of electrical undertakings, the municipality participating in the capital and having a voice in the said management. Municipal authorities find that municipal operation is too inelastic to enable it to adapt itself to modern and changing trade and industrial conditions. A score of other reasons are given explaining the desire for a change, and so many of these have been discussed in our pages in relation to British affairs, indeed, are brought into evidence almost weekly in our electric supply and traction news, that we find it difficult to resist the temptation to make a detailed commentary on this report considered from the British standpoint. We will, however, omit the detail at the moment, and confine our attention to main principles.

There are, of course, differences between the conditions, legislative, local, and probably industrial as well, obtaining in the United Kingdom and in Germany, but we cannot feel, democratic as the times appear to be, that the municipal control spirit is going to continue unmodified in perpetuity here. Though the signs are not very pronounced, we believe

the time is not far distant when the inherent weaknesses of public ownership will lead to agitation for a change. We say this not because of antagonism to such a policy, nor because of any predilection we may be assumed to have for private enterprise, and still less with any desire to reflect upon electrical officials personally, but purely for the reason that when the demand for efficiency everywhere, whether in man or machine, is so strong, the weaknesses which are inseparable from a purely municipal system, unless it be under the control of a strong man who knows what is best, and can command it both from the Council and from its employés, must inevitably receive attention.

Everybody will agree that the average councillor is quite incompetent to *control* public gas, electrical and other such undertakings with knowledge. This being so, what exists to-day may be municipal ownership without municipal *control* except that poor sort of authority that a councillor exercises when sheer necessity compels him to vote one way or the other. The technical official and his small committee are the municipal board of directors, but they have to ask approval from the general body of councillors who do not know what they are voting upon. Of course there is, as a general rule, an assurance that the technical official will not go very far wrong technically, because, in a very important sense, he does not stand alone, having at his disposal the experience and opinion of the hundreds of other like officials engaged in other cities and towns. But our present point is that when the Council does actually control it often goes wrong, whereas at other times, by reason of its sheer inability to comprehend, it must blindly follow the leading of its technical official. As matters stand, we, of all men, should not quarrel with the latter course, but it is as well, when the broad principles are under discussion, that the people who comfort themselves with the thought that certain public works are their very own properties should recognise how very small is the measure of control exercised by those whom they elect as their representatives. Sometimes busybody councillors intervene and make big blunders, and technical men ask for more freedom from pettifogging interference. But is it not the system rather than the councillor that is at fault? We should like Sir F. Oppenheimer's report to be made the basis of a calm and dispassionate discussion by quite unbiased men, for a number of the weaknesses summarised therein in relation to the German position have arisen in many places in the United Kingdom. Maybe other observers among our readers may agree with us that the future seems likely to bring about more of that co-operation, financial and otherwise, of British companies and municipalities, toward which Germany seems to be inclining, and of which there is at least one important working example within a few miles of North London. The hostility of municipalities toward companies in some of the big industrial areas has, we believe, almost died out as the problems of electrical development have worked their way home to local minds. In this there is both cause for gratification and a sign of the coming tendency. The lion and the lamb may yet fraternise, and the general public and the capitalist find it to be of benefit to both to co-operate in providing and controlling electrical facilities.

Special Courts for Patent Cases.

In the *Times* of October 12th there appeared a letter from a barrister, in which a plea was urged for the establishment of special Courts for the hearing of patent actions. Many of the old arguments were brought forward in support of the proposal. Under the present system patent cases are tried indiscriminately by the Chancery Judges, and the result is that in patent matters the rule is *quot homines, tot sententiæ!*

The chief objections raised in the letter above-mentioned are that patent cases, being long, interfere with the administration of justice for other litigants. It is urged that if the patent case could be sent to a separate Court, duels between counsel and expert witnesses could be fought out *ad nauseam* without incommoding others of His Majesty's subjects seeking justice in the Courts. Finally, it is pointed out that at present appeals from the decisions of the Comptroller of the Patent Office as to granting patents, &c., are now heard by the Solicitor-General, whose time is so fully occupied otherwise, that very often a year elapses before he can take up the Patent Office business. During this time the applicant has to wait—in doubt whether he will obtain his patent or not.

It is suggested that the jurisdiction of the Solicitor-General might well be transferred to the new Court, where patent cases were a speciality.

To advocate some measure of reform in the present system under which patent and other technical cases are tried is no new thing. The difficulty is to know where and how to begin. The word patent, to adopt the comprehensive phrase of Count Smorltork, "of himself comprises a study of no inconsiderable magnitude." It would require an encyclopædia to enumerate the different scientific questions which may have to be decided in patent cases; and to secure the services of a single man who possessed the necessary knowledge would be almost impossible. Indeed, it is hard to know where to find one well equipped with the faculties of a good patent judge except within the ranks of the legal profession. But, alas! it is not from the ranks of those who specialise in patent cases that the Judges are appointed. They are men who have distinguished themselves at the Chancery Bar. With one notable exception, all the gentlemen raised to the Bench in recent years have had but little experience in patent cases. The exception, of course, is Mr. Justice Astbury; but he had professional claims of a high order, in addition to his practice in patent cases. It will be remembered that an effort has been made to bring certain kinds of patent cases to one Court, or before one Judge. There is one Judge to whom all the cases arising under the Compulsory Working Clause are specially assigned; and in so far as he has been employed in this kind of duty, his work has given satisfaction. An attempt might be made in the required direction by extending his jurisdiction to regular patent cases.

It is essential in these matters to proceed slowly and tentatively. The legal machine appears to the layman to be cumbersome and out of date; but it has been evolved by centuries of experience. If one of its varied movements is disarranged, others must inevitably be affected. If one man were told off to try patent cases he might always give satisfaction to patentees, and but seldom favour infringers, and this through no bias or "cussedness," but from a warp in his judgment. It is no uncommon failing in the judicial mind. Thus there are certain County Court Judges who, when deciding compensation cases, nearly always find for the workman. In the result, the employer keeps away from their Courts. But the "infringer" would have no way of avoiding trial before the Patent Judge. Having regard to this one consideration, it would seem better to distribute the trials of patent cases among many Judges rather than to restrict them to a few.

The "Tynemount."

The new electrically-driven cargo ship *Tynemount*, which we describe and illustrate in this issue, takes us one step further towards the electrical engineer's ideal in marine engineering.

Unfortunately this first British-built electrically-propelled vessel for commercial use falls short of the ideal, in that its deck machinery—cargo winches, steering gear, &c.—is steam driven, and therefore probably no better, if no worse, than the deck equipments of the great majority of cargo vessels, which even marine engineers admit are steam eaters.

While there is no doubt some substantial reason for the arrangement adopted in this case, we may be pardoned for regretting that the examples of the *Selandia*, *Jutlandia*, with their all-electric deck machinery, the *Fauvette*, and of the many large ocean liners which have most extensive deck electrical equipments, have not been followed.

Meanwhile, the behaviour of the *Tynemount* will be watched with close interest by the shipping fraternity, who, once convinced that electric propulsion, whether on the Mavor system, as employed in this case, or on any other, is commercially advantageous, will not be slow to adopt it.

The Drying and Purifying of Insulating Oils.

In spite of the improved chemical and physical properties of modern insulating oils as used in transformers, oil-break switches, lightning arresters, condensers, &c., it is almost impossible to prevent the admixture of water either in transport or in service. Moreover, leakages may occur in the oil tanks or the cooling coils, allowing water to mix with the oil, while another source of deterioration is to be found in the carbonising of oil particles at the contacts.

The presence of water in insulating oils is more dangerous than is usually supposed, it having been proved that even ·005 per cent. "humidity" considerably reduces their insulating properties. This fact was probably first realised by cable makers, who use considerable quantities of oil in the manufacture of paper cables. The oils used in impregnating the paper are, therefore, dried by filtration through a screen of calcium chloride. Oils used for lubricating the cable during its manufacture are also similarly treated, while the vaseline or solidified oil, which plays such an important part in paper cable manufacture, is warmed to give fluidity, and then dried by filtration in the same manner.

An interesting process of oil filtration under pressure is described in *L'Industrie Electrique*. The theory underlying this process is that not only are any solid particles mechanically separated, but all moisture is retained on the filter screens by capillary attraction. A motor-driven pump causes the oil to flow through a fine mesh metal strainer (which arrests all the larger solid particles) into a series of filter chambers. Each chamber consists of a cast-metal plate and a metal frame, on which is stretched absorbent paper. The plates have projections on their surfaces, which support the filter paper and allow the oil to circulate. The whole series are clamped together between two stout end-plates, while an emergency valve is fitted which allows free passage of the oil in case the pressure in the filter becomes so great as to threaten rupture of the papers. This occurs when the oil is so impure as to clog the filter pores.

Filter presses in actual use will deal with 10-15 litres per hour and 45-50 litres per hour. It is recommended that after cleaning, the filter papers be dried in a special form of electric oven. This is a porcelain stove fitted with regulating dampers; the heating elements are metal strips encased in pure mica and enclosed in steel tubes, which fit into bayonet sockets in the oven.

Mr. H. H. Hodgman, in the *General Electric Review*, discusses the necessity for this process, and gives interesting suggestions as to the nature of the samples to be tested before deciding on the filtration. He states that after standing 24 hours the humid and impure oil will be found at the bottom of the tank, and should be extracted for examination by the aid of an improvised pipette. This is a glass tube 1 in. in diameter, but drawn out to one-quarter its original diameter, and long enough to reach the bottom of the tank. The palm of the hand is placed over the larger end, and the tube is passed to the bottom of the tank; on removing the hand the tube fills with the lower strata of oil, and on replacing the hand this sample can be drawn out.

When examining large transformers or other reservoirs of oil, at least 20 litres of oil should be drawn out at first, in order to cause a circulation of the oil through all portions where water of condensation might collect. All tubes and vessels used during the test must be very carefully cleaned and dried, and precautions must be taken against the action of a humid atmosphere while testing.

Before filling a transformer tank, the oil should certainly be filtered, and before placing the transformer in commission, the oil should be allowed to stand several hours; at the end of this period samples should be drawn off as described, and if found "wet," the oil should be drawn off and refiltered.

A SUGGESTION TO THE ELECTRICAL MANUFACTURER.

[COMMUNICATED.]

Manufacturers have long recognised that while it is true that quality speaks for itself, still it is necessary to provide the audience, and the art of advertising has never been so highly developed as at the present time. In the electrical industry especially, progress has been so rapid and improvements so numerous that consumers are, to a great extent, dependent on a vigorous publicity campaign to keep them posted up in the latest applications of electricity.

Many of the larger manufacturers, realising the importance of making their products known, have established publicity departments which issue really valuable information illustrating their products with well-made blocks and giving valuable working data; this is a move in the right direction, but they do not seem to go far enough, and the following experience may perhaps illustrate what the writer means.

A number of lantern slides were required to illustrate the applications of electricity to machine tools for a lecture before an engineering society, so a number of prominent firms who make a special line of this class of work, were asked if they could assist with illustrations, and the response was most gratifying. Not only good reproductions, but photographic prints, were freely placed at the lecturer's disposal, and in addition a great deal of valuable information was supplied which was very useful in the preparation of the paper. What seemed strange was the fact that practically none of these firms had lantern slides of their illustrations; each of them must have had one or two members of their staff who were good photographic workers for the prints sent were splendid specimens of the photographic art, and in many cases each print would cost twice as much as a lantern slide of the same subject. Now, during each year these firms must get many requests for illustrations and information, and on each occasion they would send out prints which are converted into lantern slides. The charge for making a slide from a print amounts to 1s.; for, first of all, a negative must be made, and then a slide is made from it; a second slide would only cost another 6d., for, of course, the negative can be used for making any number of slides. If the firms who send out photos for this purpose were to obtain a lantern slide of each print used, they would form the nucleus of a collection which could be loaned to others, carriage, of course, being paid both ways by the user; but it would pay a firm to lay themselves out to make a complete set of lantern slides of their productions and make it known that these would be loaned to lecturers, to technical schools, and to engineering or scientific societies.

The actual cost of a set of about 40 slides is well within £1. The name of the firm would of course be printed on the slide, so that a larger public would be reached than by means of prints; besides, many slides used in lectures are made by people who are not accustomed to lantern slide work, and they do not do justice to the originals.

One or two small albums filled with prints taken from the same negatives as the slides, and numbered to correspond with them, should be made, and these would be sent to the applicants when selecting slides, thus preventing unsuitable ones from being forwarded. The usual rate for the hire of lantern slides is 6d. per dozen per night, and at this price the scheme could be made self-supporting, an unusual thing in publicity work.

When one considers how a lecture before an engineering society attracts the very people before whom the manufacturer wishes to display his goods, it is surprising that this branch of publicity work has been so long neglected.

Engineering is one of the principal industries of the kingdom; in every large town in manufacturing districts there are engineering schools, engineering or scientific societies, and in almost every case the complaint of secretaries and committees is dearth of papers; here is a chance for manufacturers to step in and help themselves, as well as do a kindness to those who will be, and sometimes are, in a position to benefit them. Let them make up illustrated lectures, which, while they advertise their plant, will still be interesting and instructive to the audience. Subjects for such lectures will readily suggest themselves; for example,

"the making of a dynamo," could be well illustrated by photographs showing the various stages and processes of manufacture, also examples of the firm's work and interesting cases of the applications of the machines.

Throughout the lecture attention could be drawn to the outstanding features of the design, with comparative illustrations showing how other people achieve the same ends. If desired, and if illustrations are available, the evolution of the dynamo can be traced, also emphasising how near to perfection the firm whose goods are shown has brought designs.

The same thing could be done for other electrical apparatus or groups of manufactures, such as switchboard instruments, &c. Another style of lecture, which would appeal not only to students or popular audiences, but also to works managers or publicity departments of supply undertakings, would be a paper on, say, the applications of motors to various industries; a firm of motor manufacturers has unique opportunities for collecting illustrations on such a subject, and as slides accumulate the lecture can be rewritten to deal with special industries, such as "Applications of motors in shipyards," "applications of motors in sugar refineries," "applications of motors in breweries," &c. By adding a popular account of how sugar is refined or how brewing is carried on, the lecture can be made to appeal to a still wider audience.

A third type of lecture to deal with the commercial side of the applications of electricity would be very popular with some audiences; comparative tables, curves and charts taken from recording instruments and diagrams would be interspersed with photographs of machinery and examples of methods of driving.

A lesson could be learnt from photographic material manufacturers who not only prepare popular lectures to advertise their goods, but also send lecturers and demonstrators free of charge to photographic societies all over the country. The fact that such lectures are multiplying is conclusive proof that the promoters are finding that it pays, while the experience of the societies is that these trade lectures are among the best attended meetings of the whole session, for no effort has been spared to make them attractive.

Electrical firms who would follow suit are not called upon to make radical departures from their usual practice. They have all the data necessary, and in most cases they have all the illustrations also; it is merely a question of getting a member of their staff, or even an outside man, to write up a suitable lecture and getting their photographer to make up a set of their photographs in lantern slide form. The electrical papers would probably be willing, like the photographic journals, to publish the names of firms who have illustrated lectures or lantern slides for loan or hire purposes, and thus enable the secretaries of engineering societies to get into touch with those who are willing to help.

When it is known what firms stock slides of their machinery and apparatus, they are sure to receive photographs from their customers showing their plant in operation under various conditions, and the most interesting of these could be secured for publicity purposes.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Batteries for Telephones.

I am a storage battery maker, and frequently quote and obtain orders for batteries for telephone exchanges. Some of the makers of telephones require one to state the internal resistance of the cells offered, and I should very much like to know what difference this makes. I am not a telephone expert, but I am very sceptical as to whether the internal resistance matters a scrap, particularly as some purchasers of telephone batteries do not raise the question.

I beg to hereby give formal notice that if the telephone makers do not enlighten me, I shall regard it as proof that I am right and they are wrong.

E = C R.

Remarkable Motor Records.

Your recent article on the above subject should surely interest all designers, and I think a great many will be at one with the writer of that article when he says "the scepticism, if not the derision of the expert designer," will be aroused. The figures given are of far too scrappy and vague a nature to convince one as to the merits or demerits of the designs. The writer claims the motor's ability to do 120 B.H.P. continuously, and 160 B.H.P. with ease. I challenge that statement, and before accepting it will need considerably more information than has been given, and I think your readers generally will be with me so far.

The figures given show a temperature rise after 3 hours of 56° F. on commutator and 38° F. on armature, with an *input*, not output, mark, of 63 KW., *i.e.*, but 75 B.H.P. at the very highest.

But a machine of this size would not reach its final maximum temperature under 10 hours, and taking the time constant, or rate of increase of temperature, into account, from the figures given its final temperature rise of 75 B.H.P. would be of the nature of 60° F. for the armature.

From the nature of the design, if full advantage be taken of the interpoles, this will be essentially a "copper machine," and the bulk of the losses will be "copper losses," but to keep things favourable, let us assume that copper and iron losses are equal. It will be clear that the accepted rules regarding conservation of energy not having yet been discarded, some losses must take place, and it is pretty well certain that these losses in a machine of the size and speed mentioned will be of the nature of 13 per cent.

Of this we can apportion 7 per cent. to armature C^2R and iron losses. The dimensions given show a cooling surface not exceeding 1,400 sq. in.

We have, therefore, on 80 B.H.P.—normal full load—a loss of 4,200 watts, *i.e.*, 3·0 watts per sq. in., and on 120 B.H.P. 6,800 watts, *i.e.*, 4·9 watts per sq. in., and on 160 B.H.P. 10,600 watts, *i.e.*, 7·6 watts per sq in.

I think a fan to cool this armature would account for a goodly percentage of the input.

The above losses are underestimated, for in a machine of this type the copper losses would be at least twice the iron losses, which makes the position much worse.

Again, the speed being so low, the losses on the commutator are mainly brush C^2R losses, and if on 75 B.H.P. the temperature rise is 56° F. in three hours, I will leave readers to judge of the last state of that commutator, when subjected to 120 B.H.P.—meaning 2½ times the losses—for a long run, or to 160 B.H.P. as claimed.

As regards the brush current density being 50 amperes per sq. in., I have many motors running on an apparent density of 100 amps., ordinary carbon brushes, but it must be remembered that where commutation is perfect, high densities are possible, whereas on bad commutation, an apparent density of 30 amperes, that figure so sacred to consulting engineers, may often mean 200 to 300 amperes per sq. in. at the tip of the brush.

The designer of these machines draws attention to the fact that flux densities are pressed up to a very high value. This agrees with modern practice, but the economical limit is soon reached, owing to the present magnetic materials having limits of quality. Hence, high densities have obviously to be paid for in excitation losses or extra copper. Moreover, too high densities, particularly in the teeth, do not conduce to effective use of the virtues of the interpoles on overloads.

I should be interested, as would I think designers generally, were the writer of the article to substantiate his statements, by amplifying the very meagre data he has given. For instance, why not publish a test sheet, showing time run, temperature rise, rate of increase of temperature and efficiency?

It would be of value to the profession, also, were he to state the material and labour costs in terms of so much per B.H.P., as the statement italicised of "half the cost-price paid" conveys no meaning whatever, inasmuch as there are prices and prices.

Finally, I would say, in my opinion, and I state it with all humility, that until some brilliant discovery comes along,

D

designers have to travel along a well-defined road to get the best result from given material, and the signposts are pretty evident to be :—

1. Ventilation.
2. Better space factors, *i.e.*, improved insulating medium.
3. Correct use of interpoles,

and last, but by no means the least important,

4. Educating consultants and Corporation officials as to safe temperature limits.

That this last is important will, I think, be conceded, when I state that quite recently, Corporation officials have gone so far as to lay down the exact insulation materials and thicknesses to be used, and to prohibit the use of fans for cooling, or axial ventilation through the armature core.

W. Rae Joss.

Harrogate, *October* 13*th*, 1913.

[Unfortunately our correspondent's assumptions are in many respects very wide of the mark; no doubt the designer of the motors will set him right. Meanwhile, the motors are running.—Eds. Elec. Rev.]

Specialisation.

I enclose herewith copies of two letters which we are sending out to the electrical industry, and shall be very much obliged if you will give such prominence to them as you may think fit.

Ferranti, Ltd.
A. B. Anderson, *Managing Director.*

London, *October* 14*th*, 1913.

To Switchboard Makers.

Dear Sirs,—As you will doubtless have seen from the Press we have, after careful and lengthy consideration, decided to no longer undertake switchboard contracts, the reason being briefly that we find our capacity entirely required for the manufacture of our standard catalogue lines, a business which has been increasing for the last two or three years. We may say that one consideration which helped us to this decision was our hope that our large experience in the manufacture of switchboards and switchboard details should ensure for us a very considerable clientèle amongst switchboard manufacturers, for such details as they themselves do not manufacture, in view of the fact that we shall no longer be a competitor for such contracts. Obviously, our withdrawal from this particular field—in which we may claim to have been particularly prominent—must necessarily benefit those remaining in the field, and we therefore feel entitled to hope for special consideration from those with whom we have until recently been in active competition when orders or contracts for detail gear were being placed.

The whole of our principal staff, without exception, in this department are remaining in our employ, and we think it not unlikely, therefore, that our lengthened experience, to which we have before referred, may enable us to be of some assistance generally to switchboard manufacturers.

There is no doubt in the opinion of the writer that a good many manufacturers are prejudicing their chance by expending too much energy upon the manufacture of small sections of their requirements of which they could be easily and profitably relieved by anyone specialising and manufacturing in large quantities. We hope that an appreciation of this consideration may lead to an extension of the movement, of which we believe our action is only the beginning.—We are, dear sirs, yours faithfully,

Ferranti, Ltd.

To Clients.

Dear Sirs,—We very much regret that we are unable to quote for the switchgear to your specification which you have been kind enough to send us.

Owing to the continuous growth of our meter department and the continual demands for more space, caused also by the corresponding growth of various other sections of our manufactures, we are reluctantly compelled to cease undertaking what we describe as heavy switchboard contracts.

During the last two years we have increased our works area by 50 per cent., and our capacity by some 75 per cent., in order to meet the aforesaid growth in our meter department, power and instrument transformers, switchboard instruments, oil switches, knife switches, circuit-breakers, and many other details of switchboard manufacture, as also heating and cooking apparatus. The whole of this detail manufacture we intend to continue.

We are also now selling a new form of compression motor starter which has proved so superior in our opinion to any other form of starter on the market during the course of four years' experimental and test work in our own works, and two years' experience of them in limited numbers amongst customers, that we anticipate a very large business in this starter, and all legitimate developments of the same in the direction of motor control gear, not only for D.C., but for A.C. machinery. Briefly stated, the demands upon our space and capital are now so great in what we might call our catalogue material, that we are, as we regretfully stated at the beginning of this letter, abstaining from tendering for switchboard contracts. Catalogue material, we ought to remind you, includes our line, a rapidly increasing business, in sub-station panels.

In cases where our gear is specially required, such as extensions, we shall, of course, do everything in our power to relieve our customers of any inconvenience resulting from this decision on our part. We believe that this inconvenience with our assistance, may be reduced to a vanishing point in view of the fact that there are several other switchboard manufacturers in this country who will be willing and able to undertake such work as might otherwise be entrusted to us.

If we might for a moment refer to the broader aspect of the question, we may say that we believe that any steps taken in the direction of specialisation and cheaper production must necessarily benefit all manufacturers, and, consequently, the industry as a whole.—Yours faithfully,

Ferranti, Ltd.

An Australian Power Station Contract.

The attention of the Agent-General for Western Australia has been called to the accompanying paragraph on page 616 of your issue of the 17th inst.

The *British Australasian* says :—Orders have been placed, without calling for tenders, in London for plant and machinery for the Government electric power station. The order was placed on the advice of Messrs. Merz & McLellan, the cost to be £188,251.

Inasmuch as tenders for the plant and machinery for the Government electric power station at Perth, Western Australia, were invited by public advertisements in London (in your paper amongst others), the statement is incorrect, and the Agent-General would esteem it a favour if you would cause the necessary correction to be made. The *British Australasian* is being asked to make a similar correction.

On September 3rd last, the Premier of Western Australia (The Hon. J. Scadden) made a statement in the Legislative Assembly of Western Australia in answer to a question regarding tenders for the Perth power house (see extract herewith from the Parliamentary Report), and if an incomplete report of his reply reached London, the cause of the error is accounted for.

Western Australia Parliamentary Debates.

Question—Electric Power Scheme, Plant.

Hon. Frank Wilson asked the Premier: (1) Having reference to the Government electric power scheme, is it a fact that orders have been placed for the plant and machinery in London without tenders being called locally, in the usual manner, for the same? (2) If so, were public tenders called in London or elsewhere? (3) What is the value of orders placed?

The Premier replied: (1) Yes. The provision of the plant and machinery for the Government power station was left almost entirely in the hands of the firm of Merz & McLellan, and, on their advice, and with the concurrence of the Agent-General and myself, when in London, tenders for various reasons were not called locally, the principal reason being the urgency of the matter, and the fact that only a limited number of firms could supply the necessary plant and material. (2) Yes. (3) £188,521.—*Legislative Assembly, Wednesday, September* 3*rd*, 1913.

Ernest E. Salter.

London, S.W., *October* 20*th*, 1913.

The Diesel Engine.

I have read Mr. Spalding's letter, and would like to comment on one or two points raised.

1. The makers certainly recommend a minimum pressure of 600 lb. for starting, but it is quite possible to start a small engine with a much smaller pressure if sufficient "blast" pressure is available to inject the fuel.

2. Opening of the valves of air vessels. The opening of the valve from compressor to blast vessel also opens up to one of the three pressure gauges. The second gauge is only used :—

(*a*) When engine is standing—to ascertain pressure in any of the receivers.

(*b*) When engine is running—to ascertain pressure in starting receivers.

We were accustomed to open this gauge to the starting receiver while starting the engine, so that the loss of starting air could be observed, and this was done at the time of the explosion.

(*c*) Should therefore read valve between starting vessel and gauge.

The air leaking past the cylinder valves was not from the fuel valve. Any leakage here is audible as soon as the valve from blast vessel to fuel valve is opened.

The leakage in question was only noticeable when the engine began to turn.

Mr. Spalding appears to overlook the fact that the Bray engine is a single-cylinder type, and that the blast pressure would not begin to fall until the starting lever was put into the running position, as the fuel valve was not leaking. The pressure would only fall about 10 lb. at each firing stroke. I consider that the blast pressure at the moment of the explosion could not have been less than 770 lb.

As the engine had previously been started up with very low pressure of starting air, and, at another time, with oxygen, one may assume that neither of these alone would cause the explosion. A combination of circumstances, each in itself practically harmless, often gives curious results.

The low starting pressure would result in slow starting speed, and, with a leaky valve, bad compression. This was evidently too low to fire the charge in the engine cylinder, but sufficient to fire the probably much richer mixture of oxygen and paraffin in the fuel valve. The traces of compressor lubricating oil in the blast pipe and receiver might have been harmless without the oxygen. With the oxygen it was disastrous.

The suggestion of a non-return valve in the blast pipe has been made several times. From my experience of the fierceness of the explosion, even along this small pipe, I suggest that such a valve would simply be blown to pieces without hindering the progress of the flame to any appreciable extent.

The driving of Diesel plants requires no more skill than does a modern steam plant, but greater watchfulness on the part of the driver is required. A careless driver will sooner or later lose the compressed air, and where only a single engine is installed this is a very serious matter.

For cleaning and grinding in the valves a careful, more than a clever, man is required, as in a small generating station where only an engineer and assistant engineer are employed, it is quite impossible to spare the time to watch every action of the fitter.

The clearances of the valve levers, however, should certainly be set by an engineer.

D. E. McDonnell.

Bray, *October 18th*, 1913.

Pressure Regulation.

I regret that there has been delay, owing to absence from home, in answering Mr. Allingham's letter on pressure regulation. The plan of separately exciting c.c. turbo-generators by direct-coupled exciters was, I believe, described in the columns of the Review some time ago. The reason for the design is probably as follows :—Should steam and vacuum fail on a compound turbo-generator, the friction of the air in the turbine would bring a load on to the generator, now being driven as a motor by other machines in parallel. A considerable current would thus flow back through the compound coils, which would greatly reduce the field strength, and consequently the generator, acting as a motor with a weak field, would run up to a high and dangerous speed. Where the generator was excited by a direct-coupled exciter, this danger would be obviated, for the exciter would increase its voltage, and thereby strengthen the field of the main generator when the speed was increased, thus limiting the generator speed.

Reverse-current breakers ought to prevent such troubles, but, unfortunately, these have been known to fail at the critical moment.

Replying to Mr. Allingham's query, *re* instability of fields in reversible boosters when operating with heavy currents and weak fields, I have had no trouble in this direction, nor would I expect any, particularly if the fields be laminated. Were the reversible booster to be unstable to the extent of, say, 5 or 6 volts round about the zero point, it would not appreciably affect the working. On the other hand, it is very annoying where one has a mid-wire booster on a generator with a choking coil mid-wire connection, to find that the pressure on one side of the system is 5 or 6 volts higher than the other, and that one cannot rectify the defect, owing the instability of the booster field. I believe that a number of mid-wire boosters have been scrapped for this season; but I cannot help thinking that they would have worked well had the air gap been large enough, and it would have been a further help if the fields had been laminated.

C. Turnbull.

Tynemouth Electricity Works,
October 20th, 1913.

LEGAL.

Prosecution of Colliery Officials: Judgment.

In the Hamilton Sheriff Court on Saturday last, Sheriff Hay Shennan gave judgment in a prosecution at the instance of the Home Office, in which Robert W. Dron and James Dalgleish, the agent and manager respectively of Dalziel and Broomside Colliery, Motherwell, were charged with 12 offences involving defects in the mechanical and electrical equipment of the colliery. The proof was a lengthy one, and keen interest was aroused in mining and electrical circles regarding the issue.

His Lordship has decided that as it has not been proved that Mr. Dron is the agent of the colliery the charges against him must be dismissed. He finds Mr. Dalgleish, the manager, guilty of several contraventions in regard to the mechanical and electrical plant of the colliery. On the whole, however, he regarded the position of the manager as much more favourable in relation to the electricity charges than it was with regard to the other offences libelled. Charge 7 relates to the unprotected condition of four fuses in a distribution box, and if there were defects he could not, he said, hold the manager responsible for these. It was not his duty to inspect the fuses in the distribution box; that was the duty of the electrician. Charge 8 was a much more serious one. It was one of failure to have covered with insulating material certain unarmoured cables, one at six places, one at three places, and two at 25 places each. The evidence in support of this charge was overwhelming. The bare parts of the cable were from 4 in. long downwards. He could not acquit the manager of the responsibility here. His duty of general supervision surely extended to observing the condition of the cables as he passed. Indeed, the manager made the mistake of thinking that on all matters relating to electricity he was absolved from responsibility. The four remaining charges related to matters of detail for which he could not hold the manager responsible. The ninth charge complained that certain cables were found resting on iron nails. They had been properly enough installed, but where the suspending material had given way the cable had been fixed up so as to rest on iron nails. The manager here, his Lordship thought, was justified in assuming that such matters would be attended to by his subordinate officials. He, therefore, could not convict unless it was proved that the manager had seen the improper fastening, and had acquiesced in its continuance. Charge 10 was founded on the fact that the signal wires were found in contact with the cables. Here, again, the original installation was efficient, and the manager was entitled to trust to his officials that it was maintained so. There was no evidence that he himself knew of the defect. Charge 11 related to a matter of small detail, the soldering of an earth conductor into a log, for which he could never hold the manager responsible. It was to be noted that charges 11 and 12 related to the construction of apparatus which was in use before June 1st, 1911. The apparatus satisfied the requirements of the Rules then in force, and the Inspector had not required it to be altered. Accordingly, it was impossible to convict under those charges.

In imposing a fine of £5, with the option of 20 days' imprisonment, Sheriff Shennan said he did not regard the offences as serious, but merely technical. Of course, in a case such as this, where a manager was convicted, a fine would require to be more than it would be for an ordinary miner.

Curious Workmen's Compensation Claim.

Sheriff Shennan, in Hamilton Sheriff Court, has issued his judgment in an important action brought under the Workmen's Compensation Act. The claimants were the widow and family of Wm. Gourlay, puddler, Wishaw, who sought payment of £300 from the Etna Iron and Steel Co., Motherwell, as compensation in respect of Gourlay's death, the contention being that he had been electrically killed on February 3rd, 1913, while employed with the defendants. It was alleged by the claimants that the deceased met his death by coming in contact with a heap of scrap iron which had been charged with electricity from the shears in the works. For the defendants it was contended that on the day of the accident, Gourlay was not in his usual health, and that for the past 15 years he had suffered from fatty degeneration of the heart. They denied that the heap of scrap metal had become charged with electricity. His Lordship, in holding that the claimants were not entitled to compensation, said that the evidence was wholly insufficient to prove that Gourlay suffered from electric shock. It was incredible, he thought, that the shearman, John Smith, should have been working about the shears and the scrap all day without experiencing the slightest shock. Again, on the day following the alleged accident, the police sergeant put on the current and was entirely unable to find any place where an electric shock could be got.

Tramway Passenger's Claim for Dog-Bite.

An action was brought in the Dundee Sheriffs' Court by a woman, who sued the Corporation for £20 for loss and injury sustained by her in respect that while a passenger on a tramcar travelling between Broughty Ferry and Dundee, she was bitten in the face by a dog which had been allowed to travel in the car. Sheriff Neish decided in favour of the Town Council. It was pointed out that according to the tramway by-law, the conductor might allow any person to enter a car with a dog.

Tramway Accident Claim.

In the Court of Session, Edinburgh, last week, the record was closed in an action against the Musselburgh and District Electric Light and Traction Co., Ltd., for £500 damages in respect of the death of a two-year old child. The father of the child attributes the accident to the negligence of the driver of the car, but the defenders deny fault and plead contributory negligence.

Factory Act Prosecution.

At the Huddersfield Borough Police Court on Friday last, the proprietors of the Mirfield Motor Works were summoned for a breach of the Factory Act Regulations, it being alleged that they allowed the use of a portable electric lamp which did not comply with the regulations.

Mr. H. J. Peacock, H.M. Inspector of Factories, Huddersfield, said that on July 24th a workman named Thomas Roxborough received a shock from an electric lamp which he was using, and he subsequently died. Mr. Peacock did not allege that the death was directly attributable to the lamp, but the case was brought as a warning against the use of such a dangerous lamp.

Mr. G. Scott Ram, Electrical Inspector for the Home Office, said the lamp, which he had examined, did not conform with the regulations. The holder was in metallic connection with other metal of the lamp, and there was a brass tube running through the handle, and if there was any leakage in the lamp the metal guard and the brass at the end would become "alive." A man standing on damp ground and holding the lamp would probably receive a shock, and might not be able to let go. There should have been a third wire connected with the earth.

The Magistrate's Clerk (Mr. C. L. W. Nicholson) said he would advise the Justices that the death of the man had nothing to do with that case.

A fine of £5 and costs was imposed.

Tramway Assessment Appeal.

At the Salford Hundred Sessions on Monday, the chairman gave judgment in the rating appeal brought by the Salford Corporation against the Assessment Committee of the Barton-upon-Irwell Union and the overseers of Eccles, heard at the last sessions. He said the Court had decided to treat the tramways in Eccles as an integral part of the whole system, in considering what a hypothetical tenant would look at in dealing with the tramways. Therefore they dismissed the appeal with costs.

Mr. Sutton, on behalf of the appellants, asked the Court to state a case, but the application was declined.

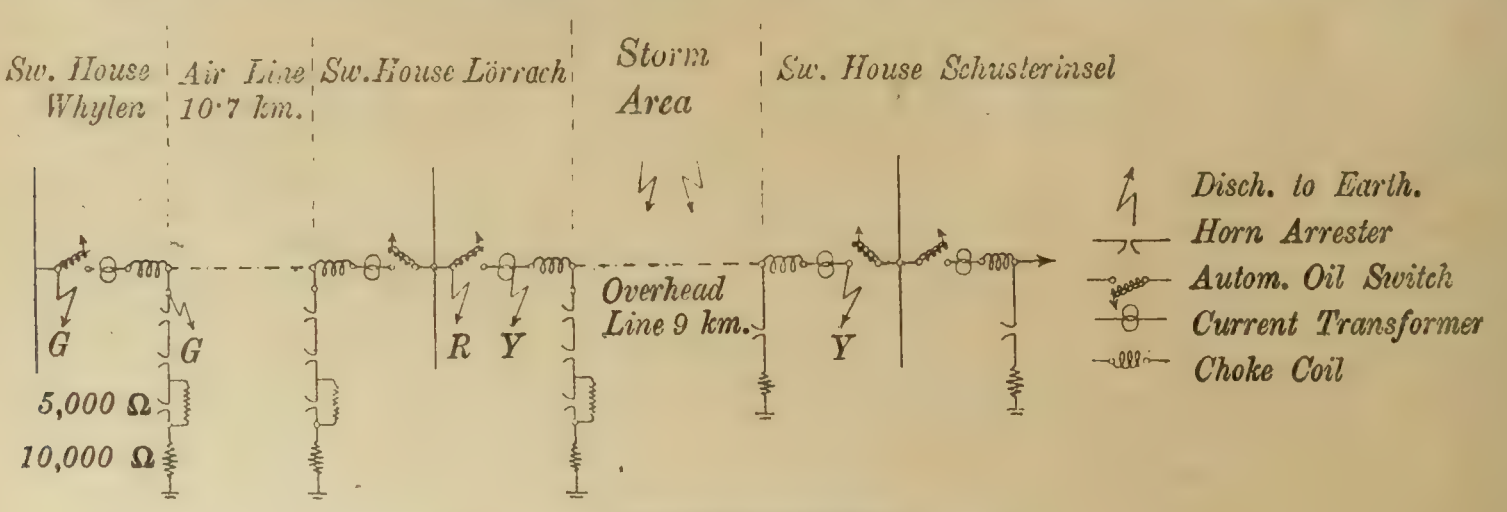
The Chairman remarked that the decision was based on a question of fact, and not of law.

A DISASTROUS OIL-SWITCH FIRE.

A recent report by the Schweizerische Elektrotechnische Verein is concerned with a serious oil-switch fire which occurred last spring in the new power station at Wyhlen. In this installation the switchgear is erected in a separate four-storey building, distant 80 m. from the generator house and occupying a ground space of 66 × 12 m. The ground-floor is occupied by 7,000-volt bus-bars, the first floor by 7,000 and 45,000-volt oil switches; the second floor by 45,000-volt bus-bars, and the third by lightning arresters and the departing transmission lines. The switchgear is designed and erected on the latest principle, a cellular construction being adopted and Duro-plate partitions being employed between the three phases on the 7,000-volt board and between individual phases in the 45,000-volt section. Porcelain insulators are used where conductors penetrate walls The double line 45 000-volt transmission is carried by lattice masts, and an automatic oil switch is connected in each line in the switch house.

On April 24th last, at 4 p.m., there was a thunderstorm in the Wyhlen-Lörrach district, and the 45,000-volt line was struck by lightning. The two line switches in the switch house opened and one exploded, making a loud report and shaking the whole building. The location of this switch was such that access to the seat of the fire, which at once broke out, was delayed for a short time. The conflagration spread with remarkable rapidity, and the dense smoke created hindered operations considerably. Four patent fire extinguishers were emptied against the burning switch without avail, and all endeavours to approach the switch from other directions proving fruitless, nothing could be done till smoke helmets and oxygen apparatus arrived from the Basle fire station. Owing to the intense heating of the chequer plate flooring which meanwhile occurred, it was an hour and a half before the fire could be fought in earnest. Naturally, the whole station was shut down, and the switch house rendered "dead" immediately the switch explosion occurred, and everything possible was done to localise and retard the fire by blocking up windows and doors. The fire was completely subdued about 8.30 p.m. The exploded switch was of the latest A.E.G. 40.000-volt electromagnetically-operated type, the poles being immersed in separate oil chambers, and having two breaks per pole. The stroke was about 190 mm., the effective breaking distance 290 mm.; break, 280 mm. below oil level; distance to earthed metal, 150 mm.

An examination of the switch after the disaster showed that, owing to the shearing of the gear wheel pins in the oil tank winch gear, the red and yellow phase oil boxes had fallen down. The intense heat to which the parts had been subjected had fused



G, R, Y represent the phases.

Disastrous Oil-Switch Fire; Diagram of Connections.

certain pieces together, and fallen masonry had broken other parts; the heat of the arc had melted the upper leads and some of the iron in the switchboard framework in the neighbourhood, while the heat and the force of the explosion of the gases produced by the volatilisation of the oil had together caused serious damage to the reinforced concrete construction in the vicinity. A particularly unpleasant result of the fire was the deposition of an oily soot over practically everything in the switch house.

Examination of the lines showed that discharges to earth had occurred as indicated in the accompanying diagram, and the cause of the switch explosion was undoubtedly the inability of the switch to break the short-circuit current which flowed when all three of the Lörrach lines were shorted to earth by their lightning arresters. At the time of this short-circuit, there were in service seven generators, each of 3,000 K.V.A. maximum capacity and 6,800-7,000-volt terminal P.D. at 107 R.P.M., supplying the line through 6,300/45,000-volt transformers.

The fact that such serious results followed the combustion of a comparatively small quantity of oil (440 gallons in all) is explained by the rapid generation of choking smoke. A few minutes after the outbreak it was impossible to penetrate to any part of the large switch house without smoke helmets, and by the time these arrived the fire had assumed serious dimensions.

It being admitted that, despite careful study of the unfavourable conditions to which oil switches may be subjected in large modern stations, explosions cannot be completely eliminated, attention must be paid to means of removing the oil which then becomes so grave a source of danger. Further improvements are possible in the suspensions of the oil tanks (to prevent the latter being upset) and an emergency draining valve should be fitted, to open in the event of greatly increased pressure in the switch chamber and to permit the oil to flow away.

It is also open to question whether under modern conditions of electricity generation and distribution, the practice of mounting all the main switchgear of the station in one building, however completely the various switch compartments are isolated with regard to each other, must not give place to entirely distinct switch houses for the several generators, transformers and transmission lines. Wholesale failure of supply and damage of apparatus not directly concerned in a breakdown would then be eliminated. In many cases, the generating capacity of stations has been increased without corresponding increase in the capacity of the oil switches

initially installed, and in such cases the installation of quick-acting automatic switches in the bus-bars would limit the generator capacity acting on a short circuit and would much reduce the risk of disaster in the oil switches, which are often loaded almost to the limit of safety under normal operating conditions. Finally, large oil switches, and particularly those which (being designed for extra high tension) employ large quantities of oil, should be erected in compartments provided with openings to the atmosphere for the ready escape of smoke in case of fire. Suitable smoke helmets, easy to fit and use, should be provided near the switch house. The design and use of large oil switches has hardly kept up with recent developments in large central-station design and operation.

SOME NOTES ON GRAPHIC INSTRUMENTS.

By KENELM EDGCUMBE.

(*Paper read before the* Arc Works Engineering Society.)

I hardly think that any apology is necessary for the use of the word "graphic" in the title of this paper. Everyone knows what is meant by a "*graphic* wattmeter," whereas no one knows what is meant by a "*recording* wattmeter." We are all agreed as to what the latter ought to mean, but not even consulting engineers are infallible, with the result that the greatest confusion has arisen through the use of the word "recording" when "integrating" was intended. But I venture to go a step further. The expression a "graphic instrument" is too long, and I am, therefore, proposing to abbreviate it into "grapher." The stoker stokes, the booster boosts; why should not the grapher graph? At any rate, there are many precedents for the suggested innovation.

The expression "graphic wattmeter," &c., has already been taken up in many quarters, and it is to be hoped that the Nomenclature Sub-Committee of the International Electrotechnical Commission, which is now endeavouring to obtain international agreement as regards electrical terms, will see its way to recommend the adoption of the expression "graphic," even if its dignity prevents it going a step further and adopting the "grapher" also.

It will possibly be held by some that a more serious subject for apology lies in the title of the paper which, instead of being "Some Notes on Graphic Instruments," ought to be "Notes on *some* Graphic Instruments" (and those chiefly made by my own firm). If so, I accept the rebuke in all humility.

It may safely be said that in no other country have graphic instruments reached such a high state of development as has been the case in Great Britain. For this satisfactory state of affairs considerable credit must be given, I think, to the Board of Trade who, by their insistence from the first on the keeping of continuous records, have made accurate graphic instruments a necessity.

The most obvious way of constructing such a grapher is to attach a pen to the end of the pointer of an indicating instrument, and so cause it to trace a line on a paper chart which is, in the meantime, being moved steadily forward under it, by means of a clock. The paper chart may conveniently be marked with cross lines to represent hours, and with longitudinal lines, each corresponding to a definite value of current, pressure or other quantity.

One of the first difficulties which besets the designer of such an instrument lies in the disturbing effects of friction between the pen and the paper, and to overcome this the working forces must be made as large as is reasonably possible. The minimum torque which can be regarded as satisfactory depends upon a number of factors, such as the width of the chart, the form of the pen, the length of the pen arm, the nature of the chart and so forth. In this respect, a graphic instrument differs from an indicating one, for, in the latter, the chief criterion is the deflecting force, as compared with the weight of the moving parts, the ratio torque weight representing a sort of frictional "figure of merit" in this respect. With a grapher, on the other hand, pivot friction is of small account compared with that between the pen and the chart. The criterion, in fact, is the restoring force called into play by a definite displacement of the pen arm. In other words, the frictional "figure of merit" in this case is more nearly :—

$$\frac{\text{Force at the pen point corresponding to full deflection.}}{\text{Width of chart.}}$$

If the force is measured in grammes and the width of the chart in cm., the ratio should be not less than 0·05, for satisfactory working, and should preferably be not less than 0·1.

The force in question is equal to the torque of the spring (in gramme-centimetres, say) corresponding to full deflection, divided by the length of the pen arm, consequently the "figure of merit" becomes :—

$$\frac{\text{Controlling torque corresponding to full deflection.}}{\text{Width of chart} \times \text{length of pen arm.}}$$

In the case of instruments having suppressed zeros, if the frictional error (as measured by the distance the pen lags behind the correct reading) is to be no greater than that of the corresponding free zero instrument, a spring of the same strength must be used in each case, but "set up" to the requisite amount. Or, looking at the matter from another point of view (no matter what may be the nature of the control used, so long as the chart is moderately evenly divided), the torque in the above expression may be taken as being the difference between the respective torques at the two ends of the chart. From the above considerations it will be clear that a mere knowledge of the *torque* due to the spring is of little or no value in the case of a grapher, a fact frequently forgotten when comparing one pattern with another.

Graphic instruments may be divided into three main groups, according to the method employed for tracing the record on the chart :—

1. Those in which the pen is attached directly to the measuring instrument, which has sufficient force to render pen friction negligible.

2. Those in which friction is eliminated altogether by keeping the pen out of contact with the paper chart. (The word "pen" is here used in its very broadest sense, seeing that in most cases no ink, and consequently no pen, in the ordinary sense, is employed.)

3. Those instruments in which the pen is in contact with the chart in the ordinary way, but instead of being attached directly to the moving system, is controlled through a relay.

Graphers of the first group, which are by far the most numerous, are dealt with in more detail later.

Of those belonging to the second group, mention may be made of the spark apparatus of Siemens, in which a high-tension spark from an induction coil passes from the pen point through the chart, thereby leaving a trace on the paper. Another grapher belonging to this group is the "inkless" instrument of the author's firm, which has recently been modified in a number of important details. The principle is well known, and consists of an inked ribbon stretched across the chart, against which is a steel point attached to the pointer, being pressed against it at intervals. By this means a series of dots, each one corresponding to the position of the pointer at the moment, constitute the record upon the chart. A momentary current is sent by a master controlling clock, constructed on the Synchronome system, and this current, which only flows for about $\frac{1}{100}$th of a second and amounts to $\frac{1}{2}$ an ampere, is repeated at regular intervals of one or five seconds, according to whether the quantity to be measured is varying rapidly or slowly. These impulses work the tapping mechanism for making the record and also drive forward the paper chart. Moreover, any number of graphers can be connected in series, so that all receive precisely the same number of impulses, with the result that the charts are driven forward in absolute synchronism, thus eliminating all uncertainty as to the timing of any number of instruments on a switchboard, which is often a matter of considerable importance in the event of some disturbance occurring on the system. It is also quite easy so to arrange matters that the switchboard clock and, in fact, all clocks, workmen's time checks and so forth about a works are controlled from the same master clock.

Besides the great advantage of being able to synchronise all the charts in this way, it must be remembered that in the intervals between the impulses the pen arm is absolutely free to move, unimpeded by friction of any sort, except that of the jewelled bearings, so that almost the same precision is possible as can be obtained from the corresponding indicating instrument.

To the third or relay group belong, amongst others, the Callendar instrument, which was one of the earliest to employ this principle, and which has been applied to various zero methods, particularly in connection with pyrometers of the resistance pattern. It has not, so far, been developed as a graphic ammeter, wattmeter, &c.

In this apparatus, the galvanometer pointer deflects between two platinum disks, the deflection causing it to make contact with either one or the other. So soon as this occurs a circuit is closed and a relay acts, which causes the bridge contact to be drawn along

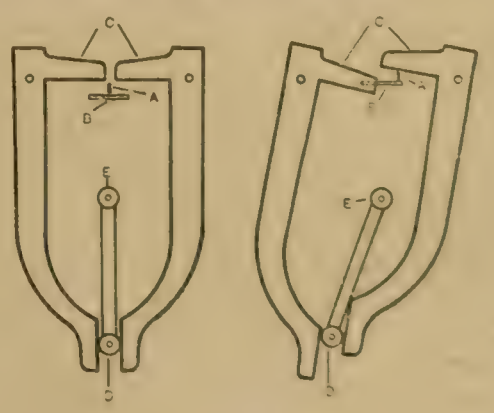


Fig. 1.

by clockwork until balance has been restored and the galvanometer ceases to make contact. The slide wire of the bridge is stretched across the chart and the travelling carriage has fixed to it, besides the contact, an inking pen by means of which a continuous trace of the position of the contact is obtained upon a paper chart which is driven forward by clockwork.

A more recent arrangement is the Olivetti graphic wattmeter, in which the wattmeter pointer closes the circuit of a small motor which draws the pen across the chart, and at the same time introduces a gradually increasing controlling couple tending to oppose the deflecting force of the wattmeter. So soon as these two forces are equal, the circuit is automatically broken, and the pen ceases to move until a further change in the deflecting force again closes one or other of the two relay contacts, and so causes the motor to move the pen forwards or backwards once more.

The latest addition to this group is the mechanical relay arrangement due to Mr. Leeds. The actual device is somewhat complicated, but the underlying principle may be gathered from fig. 1. This instrument, like that of Callendar, is only applicable to zero methods. The galvanometer pointer A is pressed up periodically by means of the plate B, and so long as A is central (that is at zero) it

merely rises and falls in the space between the two levers C C. Should the galvanometer be deflected, however, as shown in the right-hand figure, the plate B, in rising, forces the pointer against the right-hand bell-crank lever C, raising its upper end and forcing the lower end to the left, at the same time carrying the pen D with it. The arm to which D is attached is pivoted at E and is periodically brought back, mechanically, to its vertical position. During the process of being restored to this position it is momentarily geared to the bridge or potentiometer contact which also carries the pen and is, by this means, pulled in one direction or the other across the chart until balance has been restored. When this occurs, the galvanometer pointer comes once more to zero and, consequently, passes freely up and down between the two levers C C. Instead of the above movements being carried out by a clockwork mechanism, a small motor is kept continuously running and, by means of an ingenious form of governor, the speed is maintained so steady that the chart itself can be driven forward by it.

All graphic instruments working on the relay principle necessarily suffer from the disadvantage of being unable to follow rapid fluctuations of load, since even under the most favourable conditions the pen takes quite an appreciable time to travel from one side of the chart to the other, usually not less than a quarter of a minute. They are, therefore, only suitable for recording quantities which change but slowly, such, for example, as furnace temperatures; and even for this purpose they would hardly seem to possess any very marked advantages over the much simpler devices described.

It need hardly be said that one of the most important features of a graphic instrument is the pen, and many are the forms which have been tried. The simplest of these, and one which proved satisfactory for use with graphic barometers and other instruments,

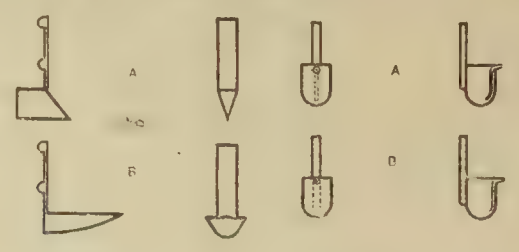


Fig. 2. Fig. 3.

is the spoon pen shown in fig. 2, B. This device has been modified in various ways, with a view to obviating some of its drawbacks, among which may be mentioned the following.

The ink is very liable to dry up, and only a very small quantity can be contained in the pen. There is considerable danger of the ink being thrown out in the event of the pen arm coming violently against one of the limiting stops. Considerable pressure is required between pen and paper to ensure the ink flowing satisfactorily and, owing to the shape of the pen, a comparatively thick line is usually traced. One modification, which has proved satisfactory in practice, is shown in fig. 2, A. It is made up of a single piece of metal, and whilst overcoming most of the objections mentioned above, has the advantage of allowing the filling to be done by squirting the ink in from the back.

The modern tendency, however, is towards the "bucket" form of pen, two useful modifications of which are shown in fig. 3. An

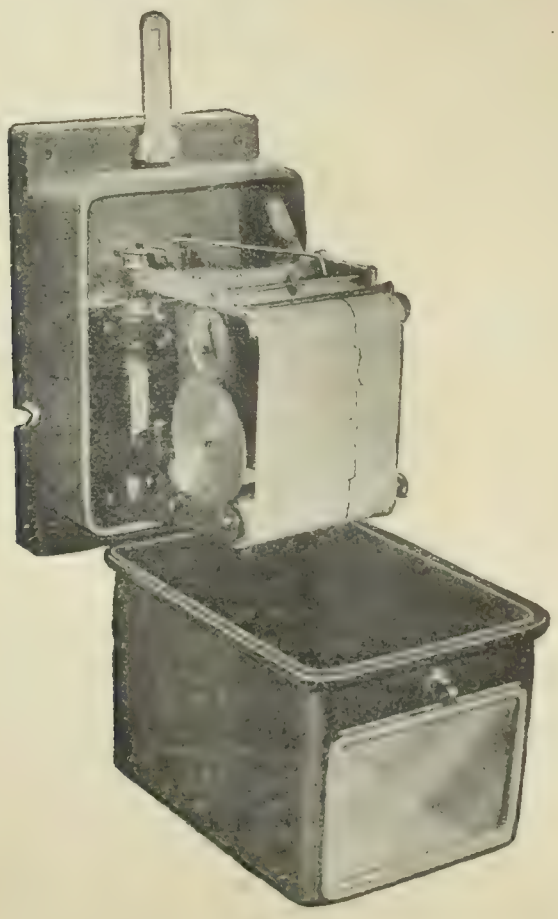


Fig. 4.

obvious drawback to pen A lies in the fine capillary tube which is liable to clog, and is at all times difficult to clean. The other pen B gets over both these difficulties and gives a very satisfactory record.

A source of error which must be carefully guarded against in all graphic instruments of the pen pattern, is the fact that the weight of the pen varies according to the quantity of ink in it, and this variation necessarily affects the indications. The larger the working forces, the less is the disturbance; but when a supply of ink sufficient for a long and variable record is required, the error is difficult to eliminate.

A method which has been used for obviating errors due to this cause consists in a narrow trough fixed parallel to the chart, and into which dips a capillary tube carried at the end of the pen arm and terminating in a fine point pressing against the chart. Whilst this arrangement takes the weight of the ink off the pen arm, it suffers from the disadvantage that the trough collects dust, and that the ink, being exposed, tends to dry up, and thus increases the frictional resistance in a very short time, unless cleaned out at frequent intervals.

The only real solution of this problem, without the use of relays or other complications, would seem to lie in the centrally placed



Fig. 5.

ink reservoir, such as is employed in the "Ink Well" pattern of grapher shown in figs. 4 and 5. The ink is contained in the reservoir A, into the centre of which dips the end of the inking tube B. This tube has a steel cross piece C fixed at right angles to it, resting in the forks D D carried by the moving system. The weight of the inking tube is counterbalanced to such an extent by means of the adjustable weights E, that there is just sufficient pressure between the point and the chart to give satisfactory inking. Owing to the fact that the writing point is on a level with the ink in the reservoir, very little pressure is needed, and frictional errors are reduced to a minimum.

The ink reservoir, which is of considerable capacity, is almost completely closed in, so that the ink neither dries up nor gets dusty, and a sufficient supply is held in the container for at least a month's record, even with an abnormally variable load. The ink reservoir is easily removed for cleaning or refilling, by means of the handle J, and the inking tube can be washed out at any time, should this be necessary, by lifting it out of its supports and holding it under a tap. An oil damper G, held in place by the two

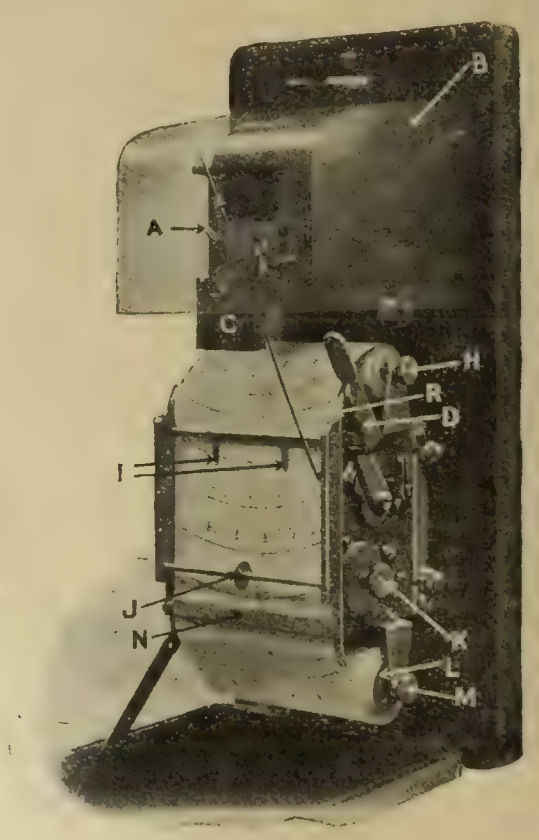


Fig. 6.

milled-headed screws F, serves to impart the requisite amount of dead-beatness to the movement by means of a vane attached to the arm H.

Amongst the advantages of this instrument may be mentioned the following:—Enough ink is carried for at least a month's record, and the chart lasts also for this period, so that, apart from a weekly winding of the clock, no attention whatever is required. The ink is not contained in the pen, and, consequently, as has been pointed out, the question of whether the reservoir is full or empty is without effect on the accuracy. The pressure of the pen on the paper is not appreciably affected by any accidental bending of the pen arm. The electrical movement has a vertical spindle, so that all the weight is carried centrally upon a single jewel, instead of by a horizonal spindle pressing upon the sides of two such jewels. The pen writes on a flat surface, whereby friction is considerably reduced. The writing surface being horizontal, there is no tendency

for the ink to flow down the chart in a kind of river, as is so often seen in the ordinary grapher. The space occupied on the switchboard is only 11½ in. × 7½ in., and is thus considerably less than that taken by other instruments having the same width of chart. The chart, after leaving the inking point, passes down the front of the clock so that not only is an exceptionally long piece of record always visible, but the ink has time to become perfectly dry before being wound up on the lower roller. A direct reading scale is fixed just in front of the inking tube so that a reading can be taken at any time.

Next to the pen in importance comes the method of attaching it to the movement. One of the earliest arrangements, and one which is still used by many makers, is that borrowed from graphic barometers, &c., and consists in a German silver arm having a slight springiness, the pressure on the chart being regulated by a milled head near the point of attachment. One of the disadvantages of this arrangement is that should the arm become even slightly bent, the pressure between the pen and the paper is very seriously altered; and, although adjustable by means of the milled head, it is a very difficult matter for the uninitiated to determine just how much pressure will give the best results. Various forms of hinged pen, some suspended near the top and others near the extremity of the arm, have been tried, but all suffer from the same defect—namely, liability to be seriously deranged by any bending of the arm.

After having tried, and at different times used, all the above forms of pen arm, as well as many others, the author's firm has finally adopted an exceedingly flexible arm fixed rigidly at the top.

The advantages of such flexibility are many. In the first place, owing to its suppleness, it is practically "fool-proof"; and even should it become bent, owing to excess of zeal on the part of the switchboard attendant, the pressure between the pen and the chart is but little affected, since it depends on the tension of a weak, but very much "set up," spring. The arm is also extremely light and strong while, at the same time, very rigid in the direction of motion.

Another matter of importance is the efficient insulation of the pen arm from the movement. In most cases a 1,500-volt test to earth is now specified, and, in exceptional cases, one of 3,000 volts, and it must be remembered that when replacing the charts the hand is almost certain to come in contact with the pen arm, so that its efficient insulation is a necessity, particularly in the case of continuous-current systems, where higher and higher pressures are coming into use, and the movement cannot be insulated from the circuit by current tranformers. In the Everett-Edgcumbe instruments this is ensured by attaching the pen to a solid block of ebonite, which would safely withstand 5,000 volts, moreover, in moving-coil instruments, this block is rigidly clamped to the coil, instead of depending on any form of screw, which is always liable to work loose with the continual banging against the limiting stops, to which graphic instruments are subjected.

Mention must next be made of that most important part of a graphic instrument, namely, the chart driving mechanism or clock. So long as it is merely a question of rotating a chart carrying drum, the problem is not a difficult one. Any strong clock will do the work and can be made to keep fairly good time. Now, however, that continuous band charts have become almost universal for station use, a very much more powerful driving mechanism is essential. When, moreover, it is stipulated that the chart shall wind itself up on a second roller, after passing under the pen, the difficulties become still greater.

Owing to the continually increasing diameter of this roller as the chart winds on to it, the speed of rotation must gradually be reduced so as to keep the peripheral speed always the same, namely, equal to that of the chart. This is usually arranged for by driving the auxiliary roller through a friction clutch which allows the necessary slip to take place. This slip, however, entails the provision of a very much stronger driving force than would otherwise be required, and it is largely due to a failure to recognise this fact that so many unsatisfactory driving mechanisms have been evolved in the past.

In the case of roll charts, a speed of 1 in. per hour will be found suitable for most purposes, while ½ in. per hour is a very useful speed for sheet and disk charts. For special purposes, however, very much higher paper speeds are required, often as high as a foot, or even more, per minute. For speeds exceeding about 12 in. per hour it is usually impossible to use an escapement, and this is replaced by some form of centrifugal governor. In many cases two alternative speeds are called for, and a gear changing arrangement is then provided, usually somewhat on the lines of the change-speed gear of a motor-car. When the high-speed range involves the use of a governor, while the low-speed range has to be regulated by an escapement, the change-over arrangement becomes more complicated owing to the difficulty of preventing the spring from running down while the change-over process is going on.

Closely connected with the clockwork is the chart itself and the method of driving it. In the first place, it is essential that the paper used should have the hardest possible "super-calendered" surface, as otherwise the ink will penetrate into the pores, and not only will a blotchy record be produced, but the ink in the pen will speedily be exhausted.

As regards the best width for the chart, a number of circumstances have to be taken into consideration, but 4 in. seems to have been accepted pretty generally as the most suitable, and attempts to introduce a 6-in. width have not, so far, met with much success.



Fig. 7.



Fig. 8.

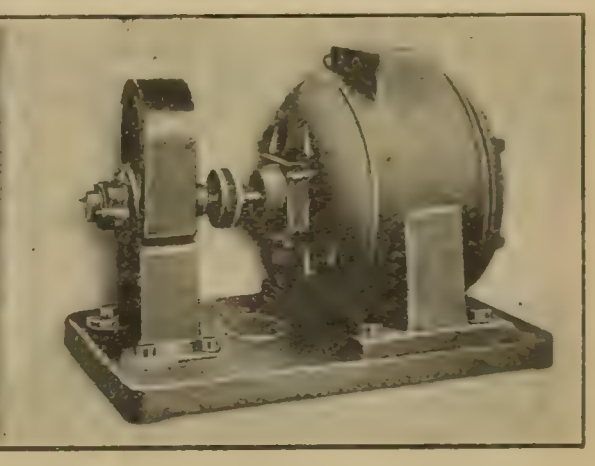


Fig. 9.

It has to be borne in mind in this connection that the same conditions do not apply to the width of chart in a grapher as to the length of scale in an indicating instrument, since in the former case almost the sole feature governing the accuracy is, as has been said, the friction of the pen on the paper, whereas in the latter it is usually the possibility of reading the scale at a distance which counts for most. For this reason, it is useless to increase the width of the chart unless the working force can be increased more than in the same proportion, which is in practice by no means easily done without, at the same time introducing corresponding disadvantages, such as a larger size of instrument, increased power consumption, overheating of shunts or resistances, and so forth. It should further be remembered that in the case of a graphic voltmeter, in which the greatest exactness is usually required, it is an easy matter to suppress the zero and thereby to open out the scale at any desired point. It may be pointed out that with a 4-in. chart the thickness of the recording line usually represents less than ½ per cent., so that there is no difficulty in reading the chart with all the precision desired.

It is sometimes put forward as a recommendation of some instruments, that the charts have rectilinear lines, but it is so seldom that a record has to be planimetered (and this would seem to be the only case in which there was any real gain in replacing the curved lines by straight ones) that it is doubtful whether the extra complication is really justified.

Of the various methods of driving the charts which have been devised from time to time, only two have survived, namely, the pin drive and the friction drive. This is, of course, excepting disk chart and sheet chart instruments, in which the chart is rigidly attached to the clock-work mechanism.

The pin-drive takes two forms. In the one the driving-wheel is provided with needle points which penetrate into the paper and in the other the charts are perforated with a number of small holes along one or both edges, and into these engage short pins fixed in the periphery of the driving wheel. A disadvantage of both these arrangements is that the pins passing into and out of the paper, even when perforated, necessarily introduce a certain amount of resistance to motion which has to be overcome by the clock.

The pin drive with perforated charts is used by the author's firm, in their Inkless Synchronised graphic instruments, already described, in order to ensure the absolute interlocking of the charts of a number of instruments driven by a common control clock. But for those cases in which a separate clock is used to drive the paper of each instrument, thus making it complete in itself, there would appear to be nothing gained by employing the pin wheel, and the friction drive then forms the most convenient arrangement. Fig. 6 shows a typical grapher clock employing a modified form of friction drive, namely, the R R type of Everett, Edgcumbe instrument. A wheel with serrated edge is driven by the clock, and the chart is pressed against it by the jockey wheel J while kept flat by the two springs I. As the chart is unwound from the spool carrier H, and fed under the pen, it is automatically wound up on to the lower roller L. By turning the knob K by hand, the

chart can be moved forwards or backwards for time setting, &c. The spindle carrying this milled knob is driven by the clock and gears into a small pinion which can be seen in the figure. Since it is often difficult to obtain access to the side of the instrument, owing to the restricted space on the switchboard, a winding lever D is provided, which can be actuated from the front.

The daily sheet chart is still frequently called for by those who prefer to have each day's record complete in itself, and in such cases the disk pattern of grapher is coming more and more into use, owing to its compactness and comparatively low cost, as well as to the fact that a complete day's record is always in full view.

Such an instrument is shown in fig. 7, the overall dimensions being only 10½ × 8½ in. Owing to the use of the extremely flexible pen-arm already alluded to, a simple arrangement is possible whereby, when the front is opened for re-charting, the flat arm which can be seen lying under the pen automatically raises the latter from the paper, so as to make both the chart and the pen readily accessible without fear of damage.

In conclusion, allusion may be made to one or two special forms of grapher which have been developed to meet particular requirements. A form of combined graphic ammeter and voltmeter, spoken of as a "feeder log," is often useful. In these instruments, which have charts of extra width (usually 6 in.), two movements are placed side by side, the ampere record covering some two-thirds of the chart, while the volt record occupies the remainder. In this way, a continuous record can be obtained of the current and pressure on, say, a feeder, and from a careful scrutiny of such charts very valuable information is often obtainable as to the origin and ramifications of a disturbance.

Another form of instrument deserving special treatment is the graphic ammeter for insertion in the earth-wire of a three-wire continuous-current system, or in that between the neutral point of a three-phase generator and earth. It is essential, if such an instrument is to be of value, that its range should be comparatively low, usually from 10 to 20 amperes, and if the system mid-point is connected dead to earth, the current flowing on the occurrence of a fault is enormous. It is now becoming more and more the rule in three-phase installations to install a carbon-powder resistance in the earth wire, so as to keep the fault current within limits, but since this current has to be sufficient to trip the breaker on the largest feeder (unless a discriminating arrangement is employed) it is, in any case, very much in excess of that which the grapher is designed to carry. To protect the instrument, an automatic switch is usually installed which short-circuits the terminals of the grapher. Unfortunately, the action of such a switch cannot be instantaneous, and it is found that before it has had time to act the pen is thrown up to the end of the scale and, no matter how carefully designed the limiting stops may be, considerable damage is done.

To overcome this trouble, the author's firm has devised a small auxiliary short circuiting switch, which is almost instantaneous in its action. It has its winding connected in series with the grapher, and immediately the current exceeds a pre-determined value, depending upon the range of the grapher, it short-circuits the latter. By this means the instrument is fully protected until the slower moving main switch has had time to act and cut it out of circuit.

In some cases the limiting resistance is not left continuously in circuit, but is only cut in on the occurrence of a fault, and this auxiliary is then of still greater importance. In either case, directly the main switch has acted and so cut the resistance into circuit, the auxiliary switch opens and the grapher is again free to record the current flowing. The fact that an earth has occurred is shown by the record, and in many cases an auxiliary contact is provided so as to ring a bell or to give some other warning to the attendant that one of the lines has gone to earth.

Another instrument of considerable value at the present time is the speed grapher, or, as it is often called, the "Tachograph." Such instruments are usually constructed on one of two principles, being either mechanically or electrically-operated. In mechanical tachographs, a fly-out governor arrangement, very similar to that of the ordinary tachometer, is employed, and to this a pen is attached.

In the electrical tachograph, a small magneto-generator is coupled to the machine whose speed is to be measured, and has its terminals connected to a graphic voltmeter. Since the E.M.F. generated by such a machine is almost proportional to the speed, the grapher can be scaled to measure speed direct, and has, moreover, the advantage of an evenly divided chart.

Fig. 8 shows the transmitting element of such a combination fitted in a water-tight case for use on boardship. An obvious advantage of the electrical as compared with the mechanical tachograph, is that the receiver can be placed at any distance from the transmitter, and hence from the machine under test, instead of having to be directly belted or geared on to it. Further, almost any number of direct-reading speed indicators or graphers can be worked from the same generator.

The transmitter of a graphic frequency meter is shown in fig. 9. It consists in a small A.C. motor directly coupled to the transmitting magneto-generator. The speed of the motor, and consequently the E.M.F. of the transmitter, is strictly proportional to the frequency, so that the grapher connected up to it can be marked direct in cycles per second. The range of the actual instrument illustrated in fig. 9 is 40 to 70 cycles, and the chart of the grapher connected to it is perfectly evenly divided. By means of such an apparatus a continuous record of frequency can be obtained by an instrument situated either on the switchboard or in the engineer's office and, further, any number of indicators or graphers can be connected in series and placed wherever it may be wished to know the frequency.

ELECTRICALLY-OPERATED ICE PLANT AT CHICHESTER.

During the last few years the advantages attending the use of ice and cold storage plant have become far more widely recognised, and a very considerable demand has arisen in all large towns for a supply of hard, clear, crystal ice, similar to the natural ice imported from Norway.

Owing to improvements which have recently been effected in ice-making plants, this class of ice can now be made and sold at a very low figure. A new field of development is thus opened out for central electric light and power stations, owing to the fact that the demand for ice is greater in the summer months of June, July, August and September.

The average electric supply company has a very heavy peak load during the winter months, and the plant which is installed to deal with this is generally available for other purposes during the summer. By using this power to operate a suitable ice-making plant, the ice can be made and sold at a large profit, and as the power load is levelled up to a large extent, the electrical plant can be operated to much greater advantage.

These facts have recently been prominently brought forward by Mr. Horace Boot (consulting engineer to the Chichester Electric Light and Power Co., Ltd.), and he finally placed the order with the Haslam Foundry and Engineering Co., Ltd., of Derby and London, who have for a large number of years made a speciality of this work, and have recently patented a new system for producing hard clear ice.

The plant, which has been running very satisfactorily for nearly the whole of this season, works on the ammonia compression system, and has been specially designed to work with the smallest amount of attention, which is very essential, as, in order to obtain the most economical results it must, as far as possible, be operated by the supply company's regular staff.

The ammonia compressor is of the "Haslam" enclosed type, which requires practically no attention, as all working parts run in an oil bath. Open air condensers of the interlaced type are fitted, and the pipes, as well as the pipes used in the ice tank and for cooling the cold storage rooms, are all electrically welded in continuous lengths, thus making the loss of ammonia impossible.

The ice tank is fitted with the "Haslam" patent system of air agitation, which keeps the water in the ice cans continually agitated, until the blocks are frozen up solid. The air used for this purpose is compressed and cooled to a low temperature in a a special plant, and owing to the sterilising action of the air on the water, the ice produced is clear and free from impurities. The ice cans are fitted in groups in strong wrought-iron frames, each group being fitted up complete with air pipes and nozzles for supplying the compressed air, these being permanently attached to the cans and connected to the air main by a rubber hose and union, so that it is only necessary to disconnect this one union, and the group of cans can then be lifted by an overhead traveller, dropped in the relief tank, and emptied on a special can tip supplied for the purpose. The ice then passes down an ice shoot either to the ice store or to the loading platform as required.

The cold stores are insulated in the latest manner with cork insulation, the floors being covered with rock asphalt, which is also carried a short way up the sides of the chamber, this giving a waterproof and very efficient insulation.

The cold stores have a capacity of about 6,000 cb. ft.; they are divided into three chambers, one being used for the storage of ice, and the others for general cold storage purposes.

The plant has an output of 1½ tons in 24 hours in 2 cwt. blocks.

In the case of the plant forming the subject of this notice, existing buildings were utilised as far as possible, and the plant was carefully arranged to avoid expensive new construction.

RUBBER.

The position of the crude rubber market has not yet cleared itself, and the future is still very uncertain. The aftermath of the boom has indeed been a huge crop of tares. The position in Brazil remains very perilous, but the determination of the authorities to grapple with it, in so far as in them lies, is shown by the publication of a decree by the Brazilian Government authorising a reduction of 10 per cent. on the duties on rubber exported. This should help the rubber trade of the Amazon Valley, but there is grave reason for fearing that this trade has yet to go through a period of severe depression, for the simple reason that even under the relaxed conditions just put into effect the wild rubber trade cannot hope to live alongside that of the plantations of the Middle East. It costs far more to harvest the crude

rubber in the Amazon Valley than it does to produce that of Malaya and the adjacent territories, and at the moment there are plenty who think that the plantation industry can supply everything that the world wants. This may not be entirely accurate, but certainly the world does not want to pay even to-day's prices for all the rubber, wild and plantation, that is produced. Taking a view, the prospect of the trade should be better ultimately than present conditions demonstrate, for the wild rubber trade is doomed to virtual extinction with the standard grade of plantation at only a trifle over 2s. a lb., and no small part even of the plantation output can be produced at a profit at this figure. There is only one way for the matter to develop, and that is for the wild industry to pass through its crisis. When this is over, the price of rubber will have reached a more remunerative level, and it will be time then to take a fresh view, but for the present matters have yet to adjust themselves, and in the process someone is going to suffer. This someone is first the Brazilian, and next the high cost planter. The reckless way in which people rushed into rubber ventures during the crazy period of the boom is becoming mournfully apparent almost day by day, companies the shares of which were rushed up to premiums of hundreds per cent. now being on the rocks and derelict, not the smallest forethought having been exercised to bring their finances into relation to their responsibilities, and their management being too often of the utterly farcical order. There is a lot of weeding out to be done with regard to the plantation industry before it is purged from its errors, and this even though the industry is really now quite firmly established. These recurring reconstructions and fresh issues of capital are, however, fatal to confidence being restored, and it is little wonder under all the circumstances that the elaborately conceived scheme for the regulation of the selling end of the various plantation companies should have come to grief at any rate in the form proposed. It is stated on good authority that the cost of collecting rubber in Brazil is 3s. a lb., while it is asserted that 2s. 9d. a lb. will not pay for collecting the commoner grades of wild rubber, of which some 30,000 tons a year will be swept out of existence by the continuance of current selling prices, but not even this has been a factor of sufficient importance to induce harmony among the plantation interests. The proposals of the Malacca Co. received a good amount of support from the trade at large, but not enough for the scheme to be pushed forward in face of the aloofness, if not the hostility, of one important group, and the proposals accordingly were dropped. It has been stated publicly that the abstention of this group was due to their asserting that their costs were lower than those of the assenting companies, and possibly this may have had something to do with it, but a new proposal has now been formulated which involves the taking of a poll of shareholders in plantation rubber companies. It remains to be seen if this novel move is actually taken. Whether the individual shareholder is a good and competent judge of the methods by which the rubber trade is to be rehabilitated remains to be seen. In ordinary conditions directors and responsible officials of companies are those upon whose judgment the shareholders rely, but in this case the shareholder is practically to be called in to decide the policy for the directors and the officials, and a queer state of topsy turvydom is thus set up. It is doubtful whether any real good can come out of the proposals, which it must not be forgotten have for their actual objective the raising of the price of rubber. As has been pointed out before, the interference with natural conditions for the purpose of artificially raising prices is always a dangerous thing. The market is even yet anything but settled, and prices may fall further, but consumers would do well to bear in mind that there cannot be any additional very serious depreciation.

The British Fire Prevention Committee.—Last week the Committee's winter session was inaugurated with a series of three high-temperature fire tests, dealing with partitioning materials and with a reinforced concrete floor. There was on view an interesting collection of fire extinguishers which had been under test.

BUSINESS NOTES.

The Shops Acts.—The Blackpool Corporation has decided to make a general closing order, which will include shops in which electrical fittings and supplies are sold, providing that from the Thursday following the second Wednesday in October until December 15th; from January 1st until the Tuesday preceding Easter day; from the Thursday of Easter week until April 30th, shops shall be closed at the following hours:—Monday, Tuesday and Thursday, 7.30; Wednesday, 1 p.m.; Friday, 8 p.m.; and Saturday, 10 p.m.

Lead.—Messrs. James Forster & Co.'s lead report dated October 18th, reads as follows:—"Closing prices last week were £20 5s. October delivery, £20 October shipment, £19 12s. 6d. November, £18 13s. 9d. December, and £18 6s. 3d. January. The market opened on Monday firm with £20 2s. 6d. and £20 paid for October shipment. On Tuesday the Convention agents offered lead rather freely for October shipment and sold down to £19 15s. This rather upset dealers and the same delivery was done down to £19 12s. 6d. Since then we have had a strong market with advancing values and the close is at £20 15s. buyers October delivery, £20 10s., £19 13s. 9d., £19 7s. 6d. and £18 13s. 9d. paid for October, November, December and January respectively. There is no need to emphasise our frequently expressed opinion that we are approaching a time of serious danger as far as lead supplies are concerned. During the last three days, October delivery lead has been repeatedly asked for without finding a seller, and yesterday £20 15s. was bid for this delivery in vain. Important works in the Thames are almost at a standstill for lead and others are approaching this position. The provinces are asking London for prompt or early lead, and the requirements for export for this month are large and, as far as we can judge, will only be partly met. There is, in addition, a considerable 'short' account on this market, particularly on behalf of German speculators, who have sold freely for months past forward lead at considerably below current prices. Altogether there is reason for considerable apprehension as to the immediate future, and Mexican affairs do not tend to lessen it. English lead, £20 15s. to £21."

Ghent Exhibition.—Messrs. Ferranti, Ltd., have been awarded a Grand Prix for their exhibit at Ghent, which included amongst other gear a high-tension three-phase 6,600-volt ironclad motor panel of the totally-enclosed interlocked type. These ironclad panels form one of the lines in which the firm have specialised for some time past, and they now have a complete standard range of such panels for all classes of high-tension work, both for motor control and for feeder distribution. The panels are very fully interlocked; the doors of the panels cannot be opened unless the whole of the accessible gear in the interior is "dead"; the oil switch must be opened before the isolating switches can be closed, and it cannot be closed unless the isolating switches are completely opened or completely closed; the isolating switches cannot be opened unless the oil switch is open, and cannot be closed unless both the oil switch and earth switches are open; the earth switch cannot be opened or closed unless the isolating switches are completely open. One of these panels is on view at the firm's showroom at Central House, Kingsway, where the working of the panel can be shown to anyone who is interested in this class of gear.

Private Arrangements.—Christopher Snowden, electrical and gas engineer, 129, Arundel Street, Portsmouth.—A meeting of the creditors in the above matter was held on Tuesday last week, when a statement of affairs was submitted which had been prepared by Messrs. Oscar Berry & Co., of Portsmouth. This showed liabilities amounting to £252, and net assets £95. It was reported that the debtor started trading at his present premises 12 years ago, and in 1908, being in difficulties, entered into an arrangement under which the creditors were paid 6s. 8d. in the £. The household furniture was claimed by the debtor's wife. Some discussion took place at the meeting, and it was eventually resolved to confirm the deed of assignment executed in favour of Mr. Oscar Berry as trustee, and that the debtor be given 14 days in which to find a composition of 5s. in the £, such composition to be paid within a reasonable time.

The Aluminium Market.—A meeting of the constituents of the International Aluminium Syndicate took place in Paris recently, when it was decided not to make alterations in the minimum prices. For the purpose, however, of securing uniformity in the different countries, it was agreed to fix the minimum also for Germany at 100 fr. per cwt. in place of the rate of 80 marks per cwt. hitherto in operation. The general conditions referring to purity of products, extra prices, &c., experienced no change, and business was thrown open for the ensuing year.

Electrical Production of Metals.—The Electro-Metallurgical Works Co. has been formed at Horrem, near Cologne, for the erection of a large experimental installation for the electrical production of metals on the lands of the Beissel Mine, near Horrem. The share capital amounts to £50,000, and the undertakings interested are the Chemische Fabrik Griesheim Elektron and the Metal Bank and Metallurgical Co., of Frankfort-on-Main.

Book Notices. — *General Directions for the Use of Electric Cooking Stoves.* By Mrs. W. T. A. Cross. London: Lake, Sison & Brown, Ltd. Price 2d — This is a pamphlet giving simple and straightforward instructions in the art of electric cooking; not cooking recipes, in the ordinary sense, but explanations regarding the points of difference between electric and gas cookers, and the right way of using the former to the best advantage. Even without instruction, says the author, very good results will be obtained, but with intelligent management electric cooking will also be found to cost no more than gas cooking. Advice is given regarding the choice of utensils, and clear instructions follow as to the use of the grill, the oven, &c., with the proper temperatures for the various operations. A thermometer is essential if the oven is to be used in the most economical manner. Directions for cleaning the oven are included. The booklet is admirably calculated to guide the user to success, and the only point to which we take exception is the reference on p. 7 to short-circuiting the grill. A grill which is liable to damage in this way is not well adapted for use in the kitchen.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 3, July-September, 1913. London: John Murray. Price 2s. 6d. net.

The Teaching of Electric Light Switching. London: Messrs. A. P. Lundberg & Sons.—In this new edition a number of highly favourable opinions of teachers are quoted, showing that the pamphlet has filled a real want; the outline lectures have been divided into groups; particulars are given of the firm's free examinations and certificates, and their sectionised switch-and-lamp demonstration boards are described. Messrs. Lundberg have undoubtedly brought into merited prominence a branch of electrical fitting which had previously languished in obscurity, and their well-directed efforts towards developing this subject deserve the thanks of both contractors and consumers

Dissolutions and Liquidations. — The Batley Electric Carbonizing Co, Ltd.—A meeting is called for November 20th, at Prudential Buildings, Market Place, Dewsbury, to hear an account of the winding-up from the liquidator, Mr. H. Appleyard.

Saville & Watson, electrical engineers, 8, Bream's Buildings, Chancery Lane, W.C.; Cobham, Surrey; and Cardiff.—Louis Alfred Thomson and Kenneth Walton Neild have dissolved partnership. Mr. L. A. Thomson will attend to the debts and continue the business under the same style at the same address.

The Ridings Arc Lamp Co., Ltd.—This company is winding-up voluntarily, with Mr. F. Rawlinson, 46, Liscard Road, Seacombe, as liquidator. A meeting of creditors has been called for November 6th, at 9, Parr Street, Liverpool.

The District Electric Co., Ltd.—A meeting will be held at 115, Colmore Row, Birmingham, on November 24th, to hear an account of the winding-up from the liquidator, Mr. J. W. Hinks.

The Nevile Engineering Co., Ltd.—A meeting of creditors is called for November 1st, at 9, Foregate Street, Worcester (Mr. G. W. Bull, liquidator). A circular issued by Messrs. A. J. Urwick and C. J. Rafarel expresses regret that it has been decided to wind up, and states that the business is to be offered for sale as a going concern. It is added that there is the nucleus of a good business; £8,000 has been spent on works, plant, &c., the turnover is about £7,000 per annum, and the orders on hand at present amount to about £3,000.

Bankruptcy Proceedings. — Bernard Musgrave, director of a limited company, late of Astley Bridge, Bolton, Lancs.—November 1st is the last day for receipt of proofs for dividend by the trustee, Mr. T. H. Winder, 19, Exchange Street, Bolton.

E. J. Crosier (Crosier, Stephens & Co.), engineer and merchant, Newcastle-on-Tyne.—A fourth and final dividend of 10d. in the £ is payable October 31st. Trustee, Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

Harold W. Lake, patent agent, 7, and 8, Southampton Buildings, London, W.C.—A composition scheme was approved by Mr. Registrar Brougham on 17th inst., under which 7s. 6d. in the £ will be paid to creditors. Debtor lost money in speculating in rubber and rail shares.

Sydney A. M. Rose, 75, Elgin Mansions, London.—Receiving order made on October 16th on a creditor's petition.

Starting Currents of Ferranti Meters.—Messrs. Ferranti, Ltd., have drawn our attention to the performance of a batch of six meters (5 amperes at 200 volts) recently tested at the National Physical Laboratory; four started with 0·015 ampere, or 3 watts, the other two taking 0·02 and 0·03 ampere respectively, so that they would all start with about half the current taken by a single tungsten lamp of the smallest size at present on the market, and most of them with less than one-third of that current. Thus if the ½-watt lamp of 10 c.p. ever becomes an accomplished fact, the Ferranti meter will be able to record its consumption with ease, even when only one lamp is alight. In other respects the calibration curves of these meters are equally satisfactory.

Buckingham Palace Front.—During the night shift work on the reconstruction of the front of Buckingham Palace, Royal Ediswan drawn-wire lamps, were exclusively used to illuminate the scaffolding. On this scaffolding, where work of a heavy nature was continuous night and day, an electric lamp of great strength and brilliance was required. The lamp used carries the Royal Warrant, both to King George V and to Queen Alexandra. The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, have recently secured the following important contracts for the above type lamps:—General Post Office, the British Admiralty, the British L. M. Ericsson Manufacturing Co., and the United River Plate Telephone Co.

Catalogues and Lists.—The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—Price leaflet (6 D) of C.H. lamps fitted with light-transforming reflectors giving normal colour effects.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Pamphlet No. 250 briefly describes, and gives prices of, new competitive lines of electric irons, boiling plates, electric kettles, and a small cooking outfit. Copies will be sent on application.

Messrs. Sir W. H. Bailey & Co., Ltd., Albion Works, Salford.—List No. 2,813 (four pages) gives an illustrated description of the firm's direct contact feed-water heater, grease skimmer and air expeller with automatic control gear (Clausen's patent).

Messrs. Siemens Bros., & Co., Ltd., Woolwich.—Supplement No. 1 to Catalogue 502, is a leaflet giving an illustrated description, with price, of high resistance temperature indicators with pivoted coil and compensating resistance.

The Electrical Co., Ltd., Charing Cross Road, London, W.C.—Folder giving prices and brief particulars of the "A 1" and "F" type Bastian heaters, and the "Pygmy" heater.

Messrs. Cruse Controllable Superheater Co., Manchester.—Twenty-page catalogue, containing a full description of their patent "Integral Units" system of sectional superheaters for B. and W., Stirling, and Lancashire boilers. Many diagrams are given, including a number of sketches showing methods of removing "units," and a loose leaflet gives data from a report of a trial of a Macclesfield plant fitted with the superheater mentioned.

Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, near Stockport.—New edition of their catalogue (No. 70, 32 pages), containing an excellently illustrated description of the Mirrlees-Diesel oil engine, with notes on fuel cost, and an estimate of running costs for 100, 150 and 200-B.H.P. engines for a week of 55 hours. Some pages are devoted to engines for marine purposes, and the engines as employed in emergency electric generating sets for ships. A second publication (No. 71) describes a "Mirrlees-Diesel" oil engine supplied for Kinnaber water-works pumping plant. A third circular gives information relating to the arrangements made by the firm whereunder fuel oils may be tested and analysed in a new and specially-equipped laboratory at a stated scale of charges.

The Schniewindt Electric Co., Staniforth Street, Birmingham.—Leaflet No. 17, particularising and pricing their "Peerless" pipe-cutting pliers and wall-boring tools, intended for the use of electrical contractors, wiremen, &c.

Messrs. Carson & Evans, 3, Fenchurch Buildings, London, E.C.—Folder reprinting the opinions of a number of electrical firms respecting their experience with the use of "Carvanite" insulating material.

Messrs. Electrical Installations, Ltd., 27, Martin's Lane, Cannon Street, E.C.—Folder on "Reducing Administration Charges—How Modern Lighting Methods Affect Business."

Dowsing Radiant Heat Co., Ltd., 105, Great Portland Street, London, W.—Small folder list illustrating a new and cheap type of hot-bar radiator, and a number of luminous types and electric kettles. Prices are given, and space is left for printing in contractors' names.

The International Electric Co., Ltd., 111-115, Salisbury Road, Kilburn, London, N.W.—Supplementary section of their new telephone list (12 pages). It contains illustrations and well-arranged particulars and prices of a number of intercommunication telephones, magneto call wall telephones, railway and mining telephones, railway selective ringing telephones, and "Mercury" and "Neptune" battery calling telephones for railway and marine use.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—12-page supplementary list, D 11 (509), particularising their Simplex enclosed fuses and fuse wire. Several new types are described—including a pattern designed to take the place of the ordinary porcelain fuse carriers on standard distribution boards, having a 2½-in. break. The other types include a re-wireable pattern. It is interesting to mention that in addition to the recognised English standards the company is manufacturing fuses to the National Electrical Code of America.

Trade Announcements.—We are informed by the Edison & Swan United Electric Light Co., Ponder's End, Middlesex, that they have taken a lease of the imposing building at present occupied by the London Shoe Co., at 123-125, Queen Victoria Street, E.C. They will enter into possession shortly, when arrangements will be made for a special entrance from Upper Thames Street, for the counter trade, and other alterations will be carried out which will make the large hall a very fine electrical showroom. In the meantime, the business will, as usual, be carried on at Queen Street and College Hill, a very large stock of Royal Ediswan lamps, electrical fittings and accessories being carried at these showrooms.

Messrs. S. T. Pemberton & Co., 8, Church Street, Colmore Row, Birmingham, announce that although they have resigned the representation in the Midland Counties of the Midland Electric Manufacturing Co., Ltd., they are still interested in the manufacture of high and low-tension switchgear, and invite communications relating to same from their friends.

Mr. Norman Tegetmeier announces that his partnership with Messrs. E. C. Sparkes & Co. has been dissolved and that he has taken offices at 112, High Holborn, W.C. Messrs. Peyton & Peyton, Ltd., of Birmingham, have appointed him sole agent for the sale of their electric light fittings.

The address of the Electrical Supplies Co. is 41, Cheapside, E.C., not 4, as stated in our last issue.

Patent Applications.—An order has been made restoring patent No. 17,216 of 1909 granted to Société L'Air Liquide for an invention for "Improvements relating to the liquefaction of air and the separation of it into its constituents."

Application has been made for restoration of lapsed patent No. 4,198 of 1905 (J. H. Apjohn) for "Improvements in clutches."

Application has been made for the restoration of patent No. 5,522 of 1907 (J. Hawley, Ltd., and A. S. Jones) for "An improved electromagnetic separator drum for grain and similar conveyors."

Canadian Electrical Trade.—We are informed that the Eugene Phillips Electrical Works, of Montreal, purchased outright the entire telephone cable-making branch of the Stromberg-Carlson Telephone Manufacturing Co., of Rochester, New York. All the machinery was moved to Montreal and installed in the new quarter of a million dollar extension to the Phillips plant, which was completed a few weeks ago. The Eugene Phillips Electrical Works have been making telephone cable for about 25 years, but the addition of the Stromberg-Carlson machinery greatly increases their output.

Fire.—Considerable damage was done by fire last week to the stock and premises of Mr. A. Shaw, electrician, Storey Street, Hull.

For Sale.—Sheffield tramways department has for disposal a number of G.E. 52 motors. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Acton.—Year's Working.—Interesting figures relating to the electricity undertaking have been submitted to members of the U.D.C. this week. The statement of accounts for the year ended December 31st last shows the gross profit for the year to be £2,974 and the capital expenditure £96,229. Estimating £1,500 representing loans to the Council which had been repaid, the net capital expenditure was £94,729. The £2,974 represented 3·14 per cent. upon that sum, so that there was no amount due to the Council under Sec. 4 of the Metropolitan Electric Supply Co. (Acton District) Act of 1911. For purposes of comparison, the accountant to the Council has presented a statement showing the income and working costs per unit sold during the past year and during the year 1910-11, the last year of working by the Council. For the latter year the units sold numbered 760,696, at a cost of 3·72d., while last year 1,306,941 units were sold, the cost being only 2·57d.

The report, on being brought to the notice of the Finance Committee last week, drew from Councillor R. Poulton, J.P., the remark that it only proved what a splendid thing the Council had in the electricity undertaking, and how wrong it was to get rid of it. The chairman pointed out that the Council's best advisers told them they could not reduce the cost. Councillor Dunsmore said the statement before the meeting clearly proved, even more than he felt before, that the passing over of the undertaking to the company was an act of consummate folly. The figures were ordered to be entered on the minutes, the chairman remarking that he regarded them as being very satisfactory; and those who took an interest in the concern before it passed out of the Council's hands could not fail to be struck by the great increase in the output and the reduction in the price per unit.

Aldenham.—The P.C. has decided to ask the R.D.C. to waive the formal notices which ought to have been served in July with respect to the application of the Watford U.D.C. for a prov. order for electric light for Aldenham.

Argentina.—Our contemporary the *Review of the River Plate*, in a recent issue, gave some interesting particulars relating to the conduct of public business in the Republic, from which it seems that the Cia. Alemana Transatlantica de Electricidad has for months past been endeavouring to collect the bill of the Moron Municipality for public lighting. The bill, which was originally $37,000, now amounts to $64,000, and the company has been unable to obtain payment of a single cent, in spite of the fact that the Municipality has religiously collected the public lighting tax. The company, finding that all its attempts to collect the bill were without avail, suppressed the public lighting. The T.C. then rescinded the contract existing with the company, in spite of the opinion of the legal advisor of the Provincial Government, who said that such a course of action was impossible. At the same time it granted a concession to a company, with headquarters in the Federal Capital, who offered to donate the sum of $50,000 to the Municipality when the contract with the German company expires. It also offered to reduce the cost per month of arc lamps by $2.50 per lamp and to reduce the price for private lighting by 3 cents per KW., but insisted that the receipts for the public lighting tax should be handed over to it for collection. It is reported that the German Electric Light Co. will institute proceedings against the Municipality.

Barnes.—Electric Van Trial.—The U.D.C. has approved the action of the Public Health Committee in hiring an electrically-propelled dust van for one week at £8. In order to compete with the Gas Co., consumers making reasonable use of exterior arc lamps are to have the whole of their supply at the reduced rate of 3d. per unit, subject to the usual discounts. The Council has refused to sanction an expenditure of £50 for the purpose of advertising the E.L. undertaking.

Barnsley.—On the recommendation of the borough electrical engineer, two automatic stokers are to be purchased at an estimated cost of £300.

Barnstaple (Devon).—The chairman of the Finance Committee recently mentioned that out of £200 provided last half year against a deficiency on the electric light undertaking only £21 had been required, as the demand for current had been good and, coupled with the economy due to the new accumulators, a saving of £179 had been thus effected. A saving of £86 on the estimate for public lighting had also been made, but no further economies in this direction were to be hoped for.

Basingstoke.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of £14,000 for carrying out the electric light scheme.

Bexhill.—Kent Coal Trial.—The Corporation has decided to purchase for experimental use at the electricity works, a quantity of Kent coal at 17s. 9d. per ton.

Birmingham.—It is reported that Messrs. L. G. Mouchel and Partners, representatives for the Hennebique system of reinforced concrete, have, in competition, been selected to design the foundations for the new electric power station at Saltley, and that the work will be proceeded with as soon as quantities are taken out and tenders obtained.

Bispham.—On October 17th the chairman of the Electricity Committee formally started a new 150-H.P. gas engine generating set.

Bitterne.—Street Lighting.—Subject to ratification by a parish meeting, the P.C. has accepted the offer of the Southamptom Electricity Committee to undertake the public lighting of the village for 10 years at £2 9s. 6d. per lamp per annum. There are to be 35 lamps.

Bolton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £5,217 for high-tension mains, conduits, &c., £2,672 for steam and feed pipes and feed tanks in connection with the new generating station at Back-o'-th'-Bank.

Bury.—An inquiry is to be held in London, on the 31st inst., respecting the question of the consent of the Lancashire Electric Power Co. to the proposed supply of electricity in bulk by the Bury Corporation to Heywood.

Cambuslang.—The police have been provided with powerful electric torches in place of the old-fashioned bull's-eye lanterns.

Canada.—Niagara Falls.—The Ontario Power Co. is seeking permission from the Queen Victoria Niagara Falls Park Commission to construct a third pipe line from its gate house on the upper river to its power house below the Horseshoe Falls. At present the company has two pipe lines, one of steel, which has been in use since the power house was put into operation, the other of concrete which was installed two years ago. Through these the company is diverting about 8,000 cb. ft. of water per second, which is approximately two-thirds the amount of water permitted to its use under the provisions of the International Treaty. By this amount of water, 12 units in the power house are operated. Providing the water is increased, the company proposes enlarging its plant to 14 units; and where now only 130,000 H.P. can be developed, the company will be able to transmit 196,000 H.P. The patents of R. O. Blainey, who assisted in the construction of the second pipe line, for a continuous concrete pipe are being investigated by the power company officials, and should they be approved, it is possible that a monolithic pipe, which will be the first of its kind in the world, will be constructed.—*Canadian Engineer.*

Carlisle.—The T.C. has decided to apply to the L.G.B. for a further loan of £534 to cover the difference between the estimated (£7,500) and actual cost (£8,034) of additional plant for the electricity works.

The Council has also reduced the charge for arc lamps for public lighting to £15 each per annum as from April 1st next. This is claimed to be the lowest charge in the kingdom.

Chester.—On Monday last, the Mayor, Mr. H. B. Dutton, formally opened the new hydro-electric plant, which was described and illustrated in our last issue.

Coniston.—Proposed Electric Light Scheme.—After a conference with Mr. C. H. Best and Mr. Pullan, both of Bradford, the Parish Council has expressed its favourable attitude towards a scheme for promoting a company to introduce electric lighting in the district. Further details are to be supplied by the promoters prior to the calling of a meeting of the parishioners.

Continental Notes.—Norway.—The A/s Glommen Pulp Manufactory has recently obtained the Government's permission to erect a new 20,000-volt transmission from Grorud to Ulverud, in Nitedal, to the north of Christiania. Permission has also been given for an increase of the pressure on the existing lines between Linderud and Grorud from 5,000 to 20,000 volts.

The Municipality of Värdalen, in the neighbourhood of Trondhjem, has quite recently decided on the harnessing of the

Uloild Waterfalls, and on the erection of a municipal electrical works in connection therewith. At the same meeting a resolution was passed to obtain a loan of £15,000 for carrying out the project.

Austria.—Speaking recently on the need for a reform of the electricity law, the Austrian Minister for Public Works stated that, notwithstanding its shortcomings, the number of generating stations in the last six years had nearly doubled and their capacity had augmented threefold. In 1912 alone 95 new installations were carried out. The number of hydro-electric works showed the greatest advance. In the last 2½ years electrical stations had risen in number from 675 to 854 (a 21 per cent. increase), and their capacity from 460,000 to 670,000 H.P., or more than 31 per cent., and the output from bulk supply stations from 320,000 to 457,000 KW., or a 27 per cent. increase. Although the difficulties were great, the Government intended to introduce and carry through this year a new electricity law.—*Zeit. Oest. Ing. und Arkt. Vereines.*

Clonakilty (Ireland).—The Urban Council has accepted the tender of the Clonakilty Lighting and Power Co. for the lighting of 50 street lamps of 50 C.P. each, for the annual sum of £100, the current to be supplied and the poles, plant and machinery to be maintained by the company. The Council is to give the company the old bridewell at a nominal rent as a power station, and the company agrees to supply householders with light at the rate of 6d. per unit. The contract is for a term of 15 years.

Cromer.—Electric Light Transfer.—The B. of T. has assented to the transfer of the electricity undertaking to Messrs. Edmundson's Electricity Corporation, Ltd.

Edinburgh.—New Plant, &c.—Estimates are to be accepted by the Electric Lighting Committee, for the extension of plant at McDonald Road, amounting to £12,000.

The Committee has agreed to lower the rate for electricity for power purposes to customers outside the city boundaries. At present the rate is 1⅜d., or ½d. per unit more than is charged within the city boundary, and in future it will be ¼d. per unit above what is charged to city consumers.

Flaxton.—Prov. Order.—The R.D.C. has decided to consent to the application of the York T.C. for a prov. order for electric lighting in the Council's area.

Fleetwood.—Application is to be made by the Council to the L.G.B. for sanction to a loan of £2,500 for electricity purposes—cable, feeder-pillar box, &c.

Glasgow.—The Electrical Exhibition at the Zoo Buildings was opened yesterday, 23rd inst., and will continue open until November 15th. A private Press view took place on Wednesday.

Greenock.—Several millowners who use water power, having in view the possibility of a shortage of power on account of the drought, are making inquiries of the electrical department, and there seems some likelihood of a change from water-power to electricity.

Hamworthy.—In order to give a supply of electricity to this parish, the Bournemouth and Poole E.L. Supply Co., Ltd., has served upon the Poole Harbour Commissioners a statutory notice for laying a cable in the fairway of the channel under the Hamworthy Bridge. The Commissioners have decided that the company has no statutory authority to lay the cable, but consent has been given to do so on condition that the company agrees to an undertaking that no claims be made upon any vessel for damage caused to any part of the cable by shipping.

Hastings.—The T.C. on October 17th decided to abolish meter rents, except in cases where an additional meter for checking purposes is installed for a consumer's own benefit, in which case there is to be a charge of 5s. per annum, and where a consumer's account for any year does not exceed £2 5s. During the last financial year the revenue from meter rents amounted to £827.

Hickleton (Yorks.).—At Hickleton Main Colliery electric safety lamps are to be substituted for the usual Davy safety lamps, and some 1,500 of them have already been procured.

Hindley.—Proposed Loan.—Application is to be made by the D.C. for permission to borrow £2,500 for the provision of a sub-station, cables, &c., for electric lighting. A L.G.B. inquiry will be held shortly.

India.—The Cape Copper Co. proposes to install electric power plant at the Rakha Hills Mine, in the Singhbhum District of Bihar and Orissa.

The Karachi Electric Supply Co. is about to erect a generating station in Karachi.—*Commercial Intelligence.*

London.—Shoreditch.—The E.L. Committee has for some time had the question of a bulk supply from the County of London Co. under consideration, arising from an offer made by the company at the time when the extension of the Council's Whiston Street works was decided on. The company's offer is for a load similar to what would be placed on the proposed new plant, with an ultimate minimum consumption of, say, 6 to 7,000,000 units per annum, ·45d. per unit, subject to a sliding scale for coal; energy to be delivered at Coronet Street works, as 10,000-volt three-phase 50-cycle current. After consideration, the Committee has adopted the borough electrical engineer's report, declining the supply, for several reasons:—Load factor not defined, but a higher load factor stipulated for than the actual load factor found in practice, which arrangement would increase the cost to the Council of producing the remainder of the supply; pressure unsuitable for interconnection with adjoining B.C. undertakings; transforming plant introduces extra charges beyond the figure quoted, and additional risks.

An interruption of supply for one hour in a considerable portion of the area of the Metropolitan Electric Supply Co. occurred on Monday evening. Apparently most of the main fuses at the Willesden generating station blew, and such an extensive failure has not occurred for about 15 years.

Japan.—A scheme is under consideration to bring about an amalgamation of all the electric lighting and tramway undertakings in the province of Kyushu. The concerns comprised in the affair are the Kyushu Electric Light Railway Co.; the Karatsu Electric Tramway Co.; the Sasebo Electric Light Co.; the Nanagawa Water Power Co.; the Daikan Electric Light Co.; and the Itojima Electric Light Co.

Keighley.—The Corporation Electricity Department is contemplating the purchase from the Manchester Corporation of a 150-KW. motor-generator for £400. The chairman of the Electricity Committee explained that the generator in question was only four years old, had not had much use, and had cost £900.

The Committee is also to obtain sub-station equipment, consisting of two switchboard panels, cubicles and metering equipment, in connection with the bulk supply of electricity to Bingley, at a cost of £258.

Manchester.—Proposed Trafford Park Power Purchase.—The Electricity Committee has requested the Parliamentary Sub-Committee to include in the proposed Parliamentary Bill the necessary powers for a new generating station, and also to include clauses to enable the Corporation to acquire the property and undertaking of the Trafford Power and Light Supply (1902), Ltd., and to generate and supply electricity in Trafford Park and the parish of Davyhulme. The Sub-Committee has decided to comply with these requests. At a meeting of the Council on October 15th, Ald. Wainwright complained that no definite figures had been given as to the acquisition of the property of the Trafford Power and Light Supply, Ltd. Councillor Dagnall, chairman of the Electric Lighting Committee, said it was not advisable to give the figures to the Council at the moment, but he would give the information to any number of the Council privately. The figures had been placed before the Parliamentary Committee and approved by it, and the Council could rest assured that the Committee was not shouldering a burden that could not be comfortably carried.

An Electrical Contractors' Association has been formed in Manchester, and at the first meeting held on October 16th, an executive committee was appointed to meet representatives of the Electrical Trades' Union, the members of which body are seeking an increase of 1d. per hour. The present rate paid is 9d. per hour.

Middleton.—On Monday a new generating set at the electricity works was formally started. Arrangements have now been practically completed with the Manchester Corporation by which Middleton will be able to supply the Rhodes branch of the Calico Printers' Association with electricity for power purposes. As previously reported in our columns, the Middleton Corporation could not supply the current required without expending a considerable sum of money upon extensions.

Moffat.—The T.C. has abandoned the scheme for lighting the town by electricity by means of water power obtained from the Well Burn, as, owing to the insufficient water power, the cost would be nearly £9,000. An alternative proposal is to be considered.

Newport.—Loan Sanction.—The sanction of the L.G.B. has been obtained to the borrowing by the Corporation of £10,772 for electricity supply purposes.

Northumberland.—Electric Winding.—The Cowpen Coal Co. is installing at the Cowpen Isabella Colliery, near Newsham, an electrically-operated winding engine to raise 150 tons of coal per hour from a depth of 900 ft., the number of trips per hour being 78. Two-deck cages are to be arranged, each deck holding two tubs, and all the decking will be performed by the winder itself, ordinary keps being utilised. The contract has just recently been placed with the A.E.G. Electric Co., and the winder will be operated on the Ward-Leonard system, supply being taken at 3,000 volts from the Newcastle-upon-Tyne Electric Supply Co.'s mains. It is stated that various improvements have been incorporated in this winder, whereby it is anticipated that the energy consumption will be extremely low, and better results will be obtained, especially when compared with machines now working under similar circumstances. This plant, which will be the first main-pit electric winder to be installed in any Northumberland pit, is expected to be in commercial service before the middle of next year.

Nova Scotia.—The Maritime Coal, Railway and Power Co. has recently decided to considerably extend the underground mechanical haulage at its Joggins Mines, and is now installing for the main haulage an endless-rope haulage gear, with rope wheel 9 ft. in diameter, operated by a motor of 250 effective H.P., the rope speed being three miles per hour. In addition to the aforementioned, six main-rope haulage gears, with motors of 25-50 H.P. and two main-and-tail haulage gears, with motors of the same size, are to be installed. The haulage gears are being made by Messrs. H. B. Wild & Co., of Birmingham, and the electrical equipment in connection with the whole of the above haulages by Messrs. J. H. Holmes & Co., of Newcastle, Mr. W. C. Mountain being consulting engineer for the scheme.

Nuneaton.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,000 for prospective expenditure on mains and services for three years.

Paisley.—Proposed Loan.—The E.L. Committee of the T.C. has recommended that application be made to the Secretary for Scotland for power to borrow £25,000, the estimated capital expenditure for the next three years.

The total is made up as follows:—Two boilers, with superheaters and other accessories, £4,000; boiler house auxiliaries and pumps, £400; 2,000 KW. of turbine generating plant, complete with condensers and pumps, £8,000; switchboards, £2,000; condensing water pumps and tanks, £500; culverts and screens for condensing water, £428; sub-station buildings, £1,200; transformers and switchgear, £1,200; mains and services, £4,000; meters, £1,000; contingencies, £2,272.

Pontefract.—Workhouse Lighting, &c.—The B. of G. has decided to obtain a supply of electrical energy for both power and light at the workhouse from the tramways company, under agreement for five years, at an all-round rate of 2¼d. per unit, without restriction as to user; that metal-filament lamps be used throughout; and that the Building Committee obtain tenders for the supply of small motors and necessary fittings to drive the laundry machinery.

Pontypridd.—A successful demonstration of electric cooking, with Tricity cookers, was recently held in the town, where considerable interest has been aroused by Mr. F. S. Grogan, the well-known lecturer on this subject.

Rawtenstall (Lancs.).—Plant Extensions.—Extensions are proposed at the electricity works, Hareholme, and L.G.B. sanction is to be sought for the borrowing of £10,000. At a meeting of the T.C. on October 16th, Ald. Coupe said that £7,000 was required for additional generating plant, and £3,000 for mains extensions. In spite of the fact that they had only recently opened a large extension, the plant was already fully loaded. The new generating plant would consist of a turbo-alternator of 1,500 KW., or about 2,500 H.P., complete with condenser, foundations, pipe work, switchboard panels, and air purifier and filter. The sum of £3,000 for cables would not be spent immediately. The raising of the loan of £10,000 would not mean any additional charge on the rates, as the money proposed to be spent would earn more than sufficient revenue to cover the additional interest and sinking fund. The electricity undertaking was in a very prosperous condition.

Rothesay.—The Police Committee has recommended the T.C. to adopt an electric light and refuse destructor scheme on the lines laid down by Mr. J. A. Robertson, of Greenock. It also recommends that Mr. Robertson be appointed engineer, and that he be instructed to prepare specifications.

Runcorn.—The works of the Highfield Tanning Co., Ltd., are to be electrically equipped, and the U.D.C. has approved of the cable route submitted by the Mersey Power Co., Ltd.

Rhyl.—New Plant.—The U.D.C. has approved a recommendation that application be made to the L.G.B. for sanction to borrow £3,900. The scheme provides for an additional Diesel set of 160 KW. capacity.

Sheffield.—The Fuel, Light and Power Exhibition is being opened to-day at the City Exhibition Hall by the Lord Mayor. It closes on November 15th.

South Africa.—An electric lighting scheme is proposed for Ficksburg, Natal Province, the cost being estimated at £8,000. —*African World.*

Southend.—The T.C. has allotted £4,000 from the profits of the electricity and tramway undertakings to the relief of the rates.

Swinton.—Street Lighting.—According to a report of Mr. Busbridge, electrical engineer, the experimental electric lighting on Manchester Road by the "Barrow" system has been satisfactory, and it is now proposed to extend it all round the tramway route, using two 50-C.P. lamps on each overhead span. Mr. Busbridge states that in addition to securing better and more constant lighting than is possible with incandescent gas lamps, the cost of electric lamps is considerably less. To carry out the proposed scheme will involve a capital outlay of £1,660. If the scheme is adopted, however, and half the lamps are switched off at midnight, the estimated cost per annum is £192, as against £269 for gas alone on the present system.

Residents in the Moorside district have petitioned the D.C. for an extension of the electricity supply to that quarter.

Several applications have been received by the D.C. for supplies of electricity in various parts of Swinton and Pendlebury. Messrs. Jones & Co., Pendlebury Foundry, and Mr. S. Pollitt, Pendlebury Rope Works, are having their premises wired for electric light, and an extended use of electricity at the Industrial School is expected.

Troon.—In connection with proposals to introduce electric light, a letter was read at a meeting of the T.C. from the T.C. of Kilmarnock, stating that it had resolved to apply immediately for the extension of the area for the purpose of supplying Troon and the intervening district. Seeing that no notice had been served, the letter asked if the Troon T.C. was prepared to waive its rights in this respect. The opinion was expressed that it would be unwise to allow another authority to invade its territory before it had seen whether it could not generate electricity on more advantageous terms itself, and it was agreed to consider the further matter.

Waterford.—The cost of the electric lighting and power scheme for the city is estimated at £27,[illegible], of which the power station will absorb £16,2[illegible], the balance being the cost of the transmission system.

Watford.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £15,150 for electricity purposes for the next three years. This will cover requirements for from 300 to 400 new consumers.

U.S.A.—The *Canadian Engineer* in a recent issue stated that the output of 303 electric supply undertakings in Great Britain in 1911-12 was 1,127,500,000 units, but Chicago alone had an annual output of over 800,000,000 units. The Chicago Edison Co. generated more energy than the local Edison companies of New York, Philadelphia, Brooklyn and Boston combined, but these companies did not supply power for local transportation, while the Chicago Co. did. [So far as the British figures are concerned, we may point out that some 300,000,000 units for railway traction are not included.]

An explosion which occurred at the Staten Island power station on Tuesday, left this district of New York in darkness and brought the electric railways and tramways to a standstill.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Lacroze Tramway Co. has applied to the Buenos Ayres Municipality for permission to construct a tramway starting in Calle Corrientes along Araoz to Warnes, from there to Constituyentes, and from there to the confines of the municipality.—*Review of the River Plate.*

Australia.—An electrically-driven street sweeping machine has just been put in service by the municipal authorities of Adelaide.

Bolton.—The Tramways Committee has ordered boxes for used tickets to be fixed on each of the tramcars.

Bradford.—The Tramways Committee has again been considering the question of the discontinuance of the Sunbridge Road-North Park Road car service, but great opposition has been expressed by shopkeepers, and it has now been decided to substitute for this service a service between Heaton and Rawson Square, which serves the wishes of the shopkeepers just as well.

The railless trolley schemes which have been dormant for a considerable time are, apparently, to be revived, 28 chassis for these trolley cars having recently been ordered by the Tramways Department. The Laisterdyke route, which was one of the first in the country, has made no big profits, but has been a valuable feeder for the tramway system. For some reason the Queen's Road route, which was prepared some months ago, has never been put into use, with the exception of one day, for the purpose of a trial of the Mercedes-Stoll car.

Bury.—A petition has been presented to the Tramways Committee asking that the time during which workpeople's tickets are available for the return journey should be extended for the benefit of people who work overtime. The manager has been instructed to obtain information from other towns and to report.

Cardiff.—The tramway employés have asked for a minimum wage for drivers and conductors of 6½d. per hour. They have also passed a resolution protesting against the long hours worked.

Cheltenham.—Local Tramway Sold.—The Cheltenham and District Light Railway (Tramway) undertaking has been disposed of to two London firms for, it is stated, between £90,000 and £100,000. The system was introduced by Mr. T. Nevins in 1901, and on his death the proprietorship passed to Mr. T. A. Nevins and near relatives.

Cleckheaton.—The U.D.C. has granted licences to the Yorkshire (Woollen District) Tramways, Ltd., to run motor-buses in the portion of the district not served by the cars, including the outlying wards of Scholes and Oakenshaw.

Darwen.—"Dinner-Hour Tickets."—The new system of granting cheap dinner-hour tickets is reported to be working very satisfactorily, and for the first 12 days, October 1st to 16th inclusive (Saturdays and Sundays excepted), the total increase of "dinner-hour passengers" is 8,480.

Continental Notes.—Austria.—A further progressive step in connection with the proposed conversion of the Vienna City Railway has been made by the announcement that the City Council has agreed to relinquish the management of the railway, so that the Ministry for Railways can proceed with the transformation scheme independently. As the expenditure on this particular work is estimated at only £2,083,000, it would probably be possible for the banking groups at the back of the Austrian electrical firms to raise the money, without troubling about an understanding with regard to the financing of the projected underground electric railways, where the participation of French capital is probably indispensable. A Vienna representative is about to proceed to Paris to conclude the negotiations respecting the latter lines.

Spain.—The Compania de los Ferrocarriles Vascongados, which owns the steam line running between Bilbao and San Sebastian, is stated by *Electron* to be studying the question of its electrification, with a view to the increased traffic which will result from through services over other companies' lines, to Oviedo, Hendaya, and the French frontier.

Germany.—A scheme for the construction of an electric tramway in the town of Gottingen, is at present under consideration.

Doncaster.—New Tramways.—The Rural Council last week received a deputation representing the Urban District Councils of Wombwell, Wath-on-Dearne, Bolton-on-Dearne and Thurnscoe, who introduced proposals of the joint Councils for application being made for an order enabling them to construct a system of tramways in the districts, and to run into the Doncaster area. The Doncaster Council passed no formal resolution on the subject, but opinion seemed to suggest that the Doncaster rural authority would support the proposals, subject to the proper protection by a clause in the order of the Rural Council and the inhabitants.

Dunfermline.—It was stated at a meeting of the T.C. last week that while in London recently, a deputation had an interview with Mr. Balfour, of the Dunfermline and District Tramways Co., with regard to the extension of the company's system to Rosyth. For road making purposes, the company is to pay £1,000 per mile for double track, and £500 for single track.

Gosforth-on-Tyne.—A serious accident occurred on the 18th inst. on the Gosforth-Wallsend route of the Tyneside Tramways and Tramroads Co.'s system, resulting in the practically immediate death of one man, and injuries to six other men, all employés of the Tramway Co. Shortly after seven o'clock a.m. a passenger car, "the Pitmen's Special," was returning empty from Gosforth to Wallsend, and when near Benton came into collision with a tour car used by the permanent way men of the company when proceeding to their work at different parts of the system. The morning was exceedingly foggy, and as each car was estimated to be going at about 10 miles an hour at the time, the impact was severe. The accident happened on the company's private tramroad, constructed on an old wagonway, so that there was no need to consider other traffic. The line is a single one, with loops, and it was expected that the passenger car would stop at a loop to enable the tour car to pass, but apparently the driver was not aware of the coming of the tour car, and the latter proceeded ahead unable to see in consequence of the fog, and seemingly unable to hear because of the noise of his own vehicle. The results of the collision were most serious. The conductor of the passenger car, William Amis, 25 years of age, who was standing on the platform beside the driver, was so seriously injured that he died within a few minutes, although medical assistance was immediately obtained. Robert Walton, the motorman of the passenger car, was very seriously injured, and has since died, while five others, also rather badly hurt, were not in such a condition as to necessitate their removal to an institution, being taken home after treatment. The fore end of the passenger car was entirely demolished ; the metal front had been broken off, the electric controller had been forced through the entrance into the car, the glass had been smashed, and the controller at the rear end of the car had also been broken. The tour car was not seriously damaged. An inquest has been opened.

Halifax.—The Tramways Committee has decided to relay the track for the whole length of Commercial Street. The work will probably be undertaken in the early part of the new year.

Huddersfield.—At a meeting of the T.C. last week, Alderman Aston, presenting the minutes of the Tramways Committee, said the receipts for the past half-year had increased by £4,029, which created a record for the town. There was a surplus of £8,792, an increase of £5,077 on the same period of last year. The reserve fund for renewals was now £25.521, but a considerable portion of the track required relaying. Ten new cars were on order.

Japan.—The work of electrifying the railway between Tokyo and Yokohama is making steady progress. The road-bed is being widened to allow of four tracks—two for electric trains and two for steam trains. The power station which will supply the necessary current is being established at Kamata, the motive power will be supplied by gas engines.

Leeds.—The Halfpenny Fare.—The Tramways Committee is conducting inquiries in other towns where the halfpenny fare is in vogue. It is realised, however, that if an extended halfpenny system is to be made to pay, there must be many more cars, and new vehicles are therefore being built. It is expected that in three months' time 50 additional cars will be put on the streets.

Mr. J. B. Hamilton, general manager, reported on the progress of the tramways for the first half of the year. It was estimated at the beginning of the year that there would be an increase of £11,074 on the receipts, but this sum has already been exceeded, the total figure being £14,368. This sum has, however, been largely swallowed by working expenses, which show an increase, of roughly, £12,000. The net surplus, however, shows an increase of £37,373, as against £32,458 for the corresponding period of last year.

Liverpool.—New Type Cars.—The Corporation has recently introduced a covered double-deck bogie car with a centre entrance and platform 7 ft. long, which divides the lower body and forms two compartments. The smaller compartment seats 12 passengers, and the other seats 20 passengers, whilst the upper deck, covered throughout its length, seats 51, bringing the total seating capacity of the car up to 83. The leading feature of this car lies in the central platform, which is divided into three by swing gates mounted on the vertical hand rails. In operation the near side gates are folded back, and form division barriers. The off-side is protected by extending the gates across the opening. The two outside portions of the platform are used as exits, and the larger, or centre, portion as an entrance. By this means all passengers boarding or leaving are brought to a focus under the control of the conductor. Two separate straight stairs run parallel from the platform and open into the upper deck through vestibules, the near side stairs being an exit and the off-side an entrance, enabling the car to fill and empty simultaneously, and thus avoiding confusion and loss of time. The platform has ample accommodation for a large number of passengers to stand, allowing of the car being started without delay, and the conductor to collect the fares before the passengers disperse to the different compartments.

At both ends a compartment is provided for the motorman and control gear, with single sliding doors opening into the car body for use of the driver and conductor as occasion may arise. The flap gate or barrier is so arranged that it is a mechanical impossibility for the starting signal to be given without the flap gates first closing, and they automatically open when the car comes to a stand. The cross barrier is held by a light spring, so that a passenger may board or leave the car whilst in motion, but in doing so must deliberately push aside the barrier and therefore do so at his own risk should an accident befall him.

A new single truck car recently adopted has end platforms each 7 ft. long, and a separate entrance and exit, with two staircases running in opposite directions for ingress and egress to and from the upper deck.

The upper and lower decks of the car are fitted with a combination of transverse and longitudinal seats, having a total seating capacity of 72 (or 12 more than the present single truck car), which will make standing unnecessary.

By an alteration in the construction of the body of the car the centre of gravity has been lowered, and smoother and safer running obtained. An electrical signalling arrangement is placed on the platform, and, as soon as the car commences to move, a distinct signal is exhibited requesting passengers not to board or leave until the car stops. This is claimed to be the first real departure in the design of a four-wheel tramcar from the car designed by the late George Francis Train, more than 40 years ago.

London.—The Metropolitan Railway Co., in accordance with the understanding when it took over the management of the G.N. and City Railway, has instituted a new and accelerated service between Finsbury Park and Moorgate Street, the time on the journey being reduced to 10½ minutes.

According to the *Financial Times*, the Stepney B.C. has decided to urge the L.C.C. to obtain Parliamentary powers with a view to linking up the tramways north and south of the Thames by way of the Rotherhithe Tunnel, through which at the present time there is no passage for the travelling public.

L.C.C.—Eight trial trailer-cars have been running for some weeks under the provisional sanction of the B. of T., and in view of their success the L.C.C. will apply for powers to adapt the trailer-cars to the whole of the tramway system.

According to the *Times*, the L.C.C. is trying on the Enfield Town and Euston tramway route, a portable automatic machine, the invention of a Cologne engineer, which prints and issues numbered tickets. The machine, which weighs 4 lb., is hung on a strap worn by the conductor, and with a turn of the handle it produces a ticket clearly printed, containing the number, date, where available to and from, the time of issue, the changing point when necessary, the amount of the fare, and some of the usual regulations. In addition, the machine automatically calculates the number of tickets of each denomination issued during the day and the amount to be paid in by the conductor.

Milngavie.—A plebiscite of the ratepayers has resulted in a majority in favour of the extension of the tramway system from Glasgow.

Newcastle-on-Tyne.—New Tramways.—At a meeting of the City Council on the 20th inst., an important scheme of tramway extension was submitted, and authority was given to the Committee to promote a Bill in Parliament. The City Council had been invited by the Longbenton Urban Council to extend the city's system into its area, which lies about two miles north of the borough boundary, and this led the Tramways Committee to go thoroughly into the question of extensions, which were embodied in its present report. The report recommended that Parliamentary powers be sought to construct and work a tramway from the city boundary at Heaton to Forest Hall in the Longbenton Urban area, a distance of two miles, passing through Longbenton village to Forest Hall ; another section will run from the Longbenton route into the urban area of Weetslade ; a third proposal was to run motor-omnibuses generally throughout the area of the District Council either during construction of the tramways or their repair, or for the purpose of testing the demand for tramway or an omnibus service along any route or proposed route, or between any particular points. In regard to the first and second proposals, the tramway will be a single line, with passing places, to enable a five minutes' service to be maintained. The electrical energy for traction will, for a minimum period of 10 years, be obtained

from the Newcastle-on-Tyne Electric Supply Co. As to the suggested service of motor-omnibuses, it is proposed to pay the District Council a sum calculated at the rate of ½d. per car-mile actually run upon the district roads in its area, and in consideration of this payment the District Council is prepared to give certain undertakings as to maintaining the roads in a condition fit for 'bus traffic. At the meeting of the City Council, the Chairman of the Tramways Committee moved the adoption of the report. He said the Longbenton Council had agreed to give the City Council practically a lease of 42 years, if Parliamentary powers were sought and the tramways taken into the urban district. There was a population of about 16,000 in that neighbourhood. He mentioned that the extension to Longbenton boundary, already carried out, had resulted in an increase of £80 per week in the receipts of the routes concerned. Mr. S. Easten moved that the report be sent back for reconsideration, but the amendment was defeated by a large majority, and the report was adopted.

North Staffs.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order made by them for the construction of light railways from Trentham to Newcastle-under-Lyme and Silverdale.

Warrington.—The Tramways Committee has been approached by the Winwick Asylum authorities as to the possibility of inaugurating a motor-omnibus service to Winwick.

TELEGRAPH and TELEPHONE NOTES.

Communication with Trains.—It is reported that the Midland Railway Co. has ordered an installation for communicating with moving trains, on the Railophone Co.'s system.

International Wireless Telegraphy.—It is reported from Brussels that an international company for radiotelegraphy has just been formed in that city, the constituting meeting being attended by Belgians, Englishmen, Germans, Austrians and Frenchmen. The company, which provisionally receives a subsidy of £2,000 from M. Robert Goldschmidt, general secretary of the Belgian Association of Engineers, is to carry out scientific and practical work. It is also proposed to make legislative suggestions to Governments, in order to guarantee the uninterrupted transmission of wireless telegrams according to a uniform system. The company further intends to issue regular publications, which are specially to assist the meteorological information service, and the Brussels Observatory is for this purpose to be equipped with special apparatus for wireless telegraphy.

Long-Distance Telephony.—In a lecture at Berlin last week an engineer named Riess described a new relay by which he claimed that the range of the telephone would be enormously extended; conversations over 2,000 km. could be heard with as much distinctness as those held over half that distance at present.

Postal Telegraphs and Telephones.—According to the Postmaster-General's report for 1912-13, the number of telegrams forwarded from offices in the United Kingdom was 88,494,000, a decrease of 0·7 per cent. Foreign Continental telegrams numbered 4,760,436 outward and 3,741,724 inward, the largest items being French and German telegrams. Foreign telephone calls numbered 94,073 outward and 109,054 inward, France and Belgium being the only countries concerned. On the Post Office trunk telephones there were 36,019,086 calls (including Continental), showing an increase of 7 per cent.; 3,330 circuits were in use, with 243,968 miles of wire. In London there were 244,320 telephones, an increase of 6·6 per cent., with 595,499 miles of wire; in the provinces, 486,443 telephones, an increase of 3·1 per cent., and 874,921 miles of wire. The total revenue from the telegraphs was £3,167,410, and from the telephones £5,785,701, including in each case about £53,000 as the estimated value of services rendered to other departments; the expenditure amounted to £4,124,976 on telegraphs and £5,395,627 on telephones, and there was a deficit on the former of £957,566, while the latter showed a surplus of £390,074. Redemption of capital on the telephones accounted for £1,416,523, and interest for £565,175.

Wireless in Cargo Vessels.—At a meeting of the National Seamen's and Firemen's Union in London on Saturday, it was resolved that the members should refuse to sign on ocean-going boats not equipped with wireless telegraph apparatus after May 1st, 1914.

Birmingham.—For some time past the Corporation has been at odds with the Post Office with regard to the erection of poles for telephone wires in the suburbs of the city. The P.M.G. applied to the stipendiary magistrate for power to erect the poles, but a compromise has been effected, the P.M.G. agreeing to put the wires underground in certain streets.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—November 26th. An electrically-driven storage battery industrial truck (2,000 lb.) for the Randwick workshops of the Government Railways and Tramways Department. Local representation. Specification, &c., from the office of the Electrical Engineer to the Department, 61, Hunter Street, Sydney. A copy may be seen at the Board of Trade C.I. Dept. in London.

March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices," October 17th.

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

December 14th.—Two sections switchboard, common-battery multiple. See "Official Notices" October 17th.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" September 26th.

Launceston (Tas.).—November 24th. Two 500-K.V.A. transformers; feeder cable, &c.; H.T. switchboard for sub-station. Specifications from City Electrical Engineer (£1 1s.). (Time extended from October 13th).—*Tenders.*

Hobart (Tas.).—December 1st. Dry cells for the P.M.G. See "Official Notices" October 17th.

Brisbane.—December 17th. P.M.G.: Insulators. See "Official Notices" to-day.

Banbridge.—November 3rd. Lighting public streets by gas or electricity for the U.D.C. Particulars at Town Surveyor's office.

Bedford.—November 12th. Corporation. (1) 1,000-KW. mixed-pressure turbo-alternator with exciter and condensing plant; (2) water-tube boiler with mechanical stoker and coal-handling plant. See "Official Notices" to-day.

Bulgaria.—Varna.—October 30th. 1,000 electric meters. Only makers to apply, and meters furnished with official certificates in the countries of origin accepted. Particulars from the Municipality.

Dublin.—November 1st. G.N. Railway Co. (Ireland). One year's supply of stores, including a number of electric and telegraph supplies. See "Official Notices" October 10th.

Germany.—Berlin.—November 11th. Imperial Post and Telegraph Administration. Telegraph posts required during the year 1914. Particulars from Telegraphen Baubureau des Reichs Postamt, 69, Mauerstrasse, Berlin, W. 66, enclosing postage (1 Mark).

Karlsruhe.—November 25th. Tenders are required for the supply of the machinery for the Murg hydroelectric station, comprising: five three-phase 5,000-K.V.A. generators and three of 350-K.V.A., with exciters; 13 transformers (110,000/10,000, 100,000/22,000, 10,000/3,000, 16,000/380/220, and 22,000/220 volts); switchboards for the power house and the Karlsruhe and Rheinau transformer stations (10,000, 20,000 and 110,000 volts); 120 km. of 110,000-volt transmission lines; 5 6,200-H.P. Francis turbines, and a 400-H.P. Pelton wheel for a fall of 133 metres, and 3 low-pressure 400-H.P. turbines; 390 metres tubing, &c. Particulars, &c. (30 Marks, returnable on submitting a tender, 25 Marks additional for plans of transmission lines, not returnable), from Grossherz Oberdirektion des Wasser und Strassenbaus, Abteilung für Wasserkraft und Elektricität, Karlsruhe.

Glamorgan.—The County Council desires to negotiate for the construction and working of five miles of light railway from Ynysforgan to Pontardawe. See "Official Notices" October 10th.

India.—October 29th. For the East Indian Railway Co.: (1) Steam turbines and condensers, &c.; (2) turbo-alternators. Specifications and forms of tender, 21s., not returnable, from the offices of the company, Nicholas Lane, Lombard Street, London, E.C.

Leith.—The Corporation Tramways Department invites tenders for the supply of a motor tower wagon. Tramways Manager, 165, Leith Walk.

London.—November 12th. L.C.C. (1) Installation at Colebrook Row Special School, Islington, N. 95 lighting points; (2) installation at County Secondary School, Chelsea, 180 lighting points. See "Official Notices" to-day.

The L.C.C. invites persons and firms, particularly manufacturers, to have their names placed on the list of those from whom tenders for supply of stores and execution of general maintenance contracts are invited by it. See "Official Notices" to-day.

Manchester.—October 29th. One storage battery, battery booster and switchboard, for the Corporation. See "Official Notices" October 17th.

Tenders are invited by Mr. Robert Carlyle, builder, Elsinore Road, Old Trafford, Manchester, for the supply and erection of two new 5-ton electric derrick cranes.

Neath.—October 28th. From 2,000 to 2,500 tons of through and through, or small steam coal, for the R.D.C. electricity works, Court Sart. Mr. G. H. Thomson, electrical engineer, 12, Green Street, Neath.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Rathmines and Rathgar.—November 4th. The Council. One 400-KW. generating set (high-speed engine direct coupled to two D.C. dynamos in tandem). See "Official Notices" October 17th.

Rhyl.—November 19th. One 160-KW. Diesel engine set, for U.D.C. See "Official Notices" October 17th.

Spain.—November 16th.—The municipal authorities of Glebe (province of Alicante) are inviting tenders for the concession for the electric lighting of the town during a period of two years.

Trowbridge.—Messrs. Samuel Salter & Co. (1913), Ltd., of Howe Mills and Stone Mills, are inviting tenders for fixing a dynamo for 115 volts, 200 amperes, 780 revolutions per minute, supplying a switchboard with about 10/12 ways, and wiring for 250 lights.

Warrington.—The electrical engineer has been instructed to obtain tenders for a supply of arc lamp carbons.

West Hartlepool.—October 27th. Corporation. Five car trucks. See "Official Notices" October 17th.

CLOSED.

Australia.—The *Australian Mining Standard* reports the placing of the following contracts :—

VICTORIA.—P.M.G.—

30 tons bronze wire, £2,593.—F. Vanderkelen & Co.

Department of Home Affairs.—

Machinery and tools for electrical workshops, Canberra, £529.—McPherson's Proprietary, Ltd.

NEW SOUTH WALES.—Metropolitan Board of Water Supply and Sewerage.—

Centrifugal pumps and electric motors, £1,900.—Zollner, Ltd.

SOUTH AUSTRALIA.—

Westinghouse brake material, £6,426.—Elder, Smith & Co., Ltd.

The Mount Morgan Gold Mining Co., Ltd., have placed orders for the supply and installation of complete switchboards, two turbo-alternators, and rotary converter of 1,500 KW., with the Australian General Electric Co.—*Mining and Engineering Review.*

Belgium.—Nine concerns—five German and two each Belgian and French—submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels, for the supply of a quantity of telegraph cables and accessories, the lowest offer being that of Messrs. J. G. Hiroux & Co., of Brussels.

Bolton.—The Electricity Committee last week accepted the tender of Messrs. Musgrave & Sons (Bolton) for the supply of air pump parts.

Bradford.—The tenders of Messrs. F. Parker & Co., Manchester; Beecroft & Wightman, Ltd., Bradford; and Jas. Rhodes & Co., Ltd., Bradford; for supplies of timber for tramcar bodies, have been accepted by the Tramways Committee.

The following tenders for supplies of machinery and equipment for the Thornbury workshops extension have been accepted by the Tramways Committee :—

Tangyes, Ltd. (Birmingham).—Armature winding machine, £88; and wheel-turning lathe, £808.
Leeds Engineering Hydraulic Co., Ltd.—Two sets hydraulic jacks, £230.
Jas. Keith & Blackman Co., Ltd.—Smiths' hearths (two single and one double), £81.

The chairman and deputy chairman and the general manager were authorised to purchase a suitable punching and shearing machine.

The Tramways Committee has recommended the purchase of 20 Dick-Kerr standard 40-H.P. motors, at £104 each, as special motors for use on cars on the through service between Bradford and Leeds.

Canada.—MONTREAL.—The *Canadian Engineer* states that the contract for the electrification of the Mount Royal tunnel has been awarded to the Canadian General Electric Co.

Carlisle.—The T.C. has accepted the tender of the Union Electric Co., Ltd., of London, for two motor-alternators, complete with switchgear, at £900.

Cleethorpes.—Messrs. Chamberlain & Hookham, Ltd., have received the Council's contract for prepayment meters.

France.—The French Post and Telegraph Authorities in Paris last week gave out contracts for the supply of lead-covered telephone cable, as follows :—Messrs. Grammont, of Pont-de-Cherny, one lot of 10 km., with 28 pairs of silk and cotton-insulated conductors; the Société Industrielle des Telephones, of Paris, one lot ditto, and one lot of 15 km. of cable, with 14 pairs of conductors; the Ateliers de Construction Electriques du Nord et de l'Est, of Jeumont (Nord), one lot of 10 km. of 28 pair conductor cable; La Société Materiel Telephonique, of Paris, one lot of 10 km., with 28 pairs of conductors, and one lot of 15 km., with 14 pairs of conductors; and the India-Rubber and Gutta-Percha Co., of Persan (Seine et Oise), one lot of 15 km., with 14 pairs of conductors.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Electric wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.)

CROWN AGENTS FOR THE COLONIES.

Train-lighting dynamos.—Mather & Platt, Ltd.
Electrical equipment for wagon turntables.—Craven Bros., Ltd.
Insulators, &c.—Siemens Bros. & Co., Ltd.
Electric fans.—British Westinghouse Electric and Manufacturing Co., Ltd.
Telegraph poles.—Siemens Bros. & Co., Ltd.
Telephone switchboard.—Siemens Bros. & Co., Ltd.
Telephones, &c.—British L.M. Ericsson Manufacturing Co., Ltd.
Copper wire, &c.—Elliott's Metal Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Accumulators.—Tudor Accumulator Co.
Cables.—London Electric Wire Co. and Smiths.
Dynamo.—Laurence, Scott & Co.
Fans.—Crompton & Co.
Motors.—Lancashire Dynamo, &c., Co.
Searchlight plant.—Lancashire Dynamo, &c., Co.
Switchboards.—Eckstein, Heap & Co.
Wire.—Elliott's Metal Co.; R. Johnson & Nephew; W. Bain & Co.

GENERAL POST OFFICE.

Manufacturing, supplying, drawing in and jointing a cable between Liverpool and Birmingham.—B. I. and Helsby Cables, Ltd.
Manufacturing, supplying, drawing in and jointing a cable between London and Birmingham.—Western Electric Co., Ltd.
Telephone exchange equipment, Aberdeen, Brixton, Chester and Dudley.—Western Electric Co., Ltd.
Telephone exchange equipment, Accrington and Portsmouth.—Automatic Telephone Manufacturing Co., Ltd.
Telephone exchange equipment, Grimsby, Lowestoft and Stockport.—Siemens Bros. & Co., Ltd.
Telephone exchange equipment, Romford.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; London Electric Wire Co., and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Sterling Telephone and Electric Co., Ltd.
Testing apparatus.—Evershed & Vignoles, Ltd.
Telegraphic cable.—Callender's Cable and Construction Co., Ltd.
Telephonic cable.—B.I. & Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co, Ltd.
Insulators.—J. Bourne & Son; Doulton & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.
Metallic-filament lamps.—Edison & Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.
Bronze wire.—T. Bolton & Sons; Shropshire Iron Co., Ltd.
Galvanized iron wire.—Whitecross Co., Ltd.

H.M. OFFICE OF WORKS.

Incandescent electric lamps.—Dick, Kerr & Co., Ltd.; Maxim Lamp Works, Ltd.; Pope's Electric Lamp Co., Ltd.

H.M. Office of Works has placed a contract for three years' supply of fuseboards and distributing switch and fuseboards in cast-iron and teak cases with Messrs. Drake & Gorham, Ltd.

Hereford.—The contract for the complete installation at the Picture House, Berrington Street, has been placed with Messrs. Walker & Co., of Hereford.

Keighley.—Messrs. Clough, Smith & Co., Ltd., London, have secured from the Corporation the contract for the erection of the 6,600-volt high-tension transmission line between Keighley and Bingley, at £734.

Leighton Buzzard.—Messrs. Francis Reade & Co., of Finchley, have just completed the entire installation at the Grand Theatre, Leighton Buzzard. Current is generated by a plant consisting of a Crossley gas engine and dynamo.

Littleborough.—The Electricity Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works, Ltd., for the laying of cable from Victoria Street to Joseph Street.

Maidstone.—The Corporation has given an order for switchboard extension to Messrs. Drake & Gorham, Ltd.

Malvern.—The U.D.C. has accepted the tenders of Messrs. Wilesmith & Son and the South Wales and Cannock Chase Coal Co. for the supply of from 350 to 400 tons of coal for the electricity works.

New Zealand.—The Christchurch Municipal Council has accepted the tender of Messrs. Turnbull & Jones for converters in connection with the Lake Coleridge hydro-electric supply scheme.—*Tenders.*

(*Continued on page 666.*)

THE ELECTRICALLY-PROPELLED CARGO VESSEL "TYNEMOUNT."

On several occasions we have published particulars of the vessel which has been under construction on the Tyne for service on the Canadian canals and lakes, and which is the first important example of an electrically-propelled cargo vessel built in this country.*

We are now enabled by the courtesy of the Electric Marine Propulsion Co., Ltd., to whose order the vessel has been built, to reproduce a number of photographs of the machinery, and to give a description of the installation in its final form.

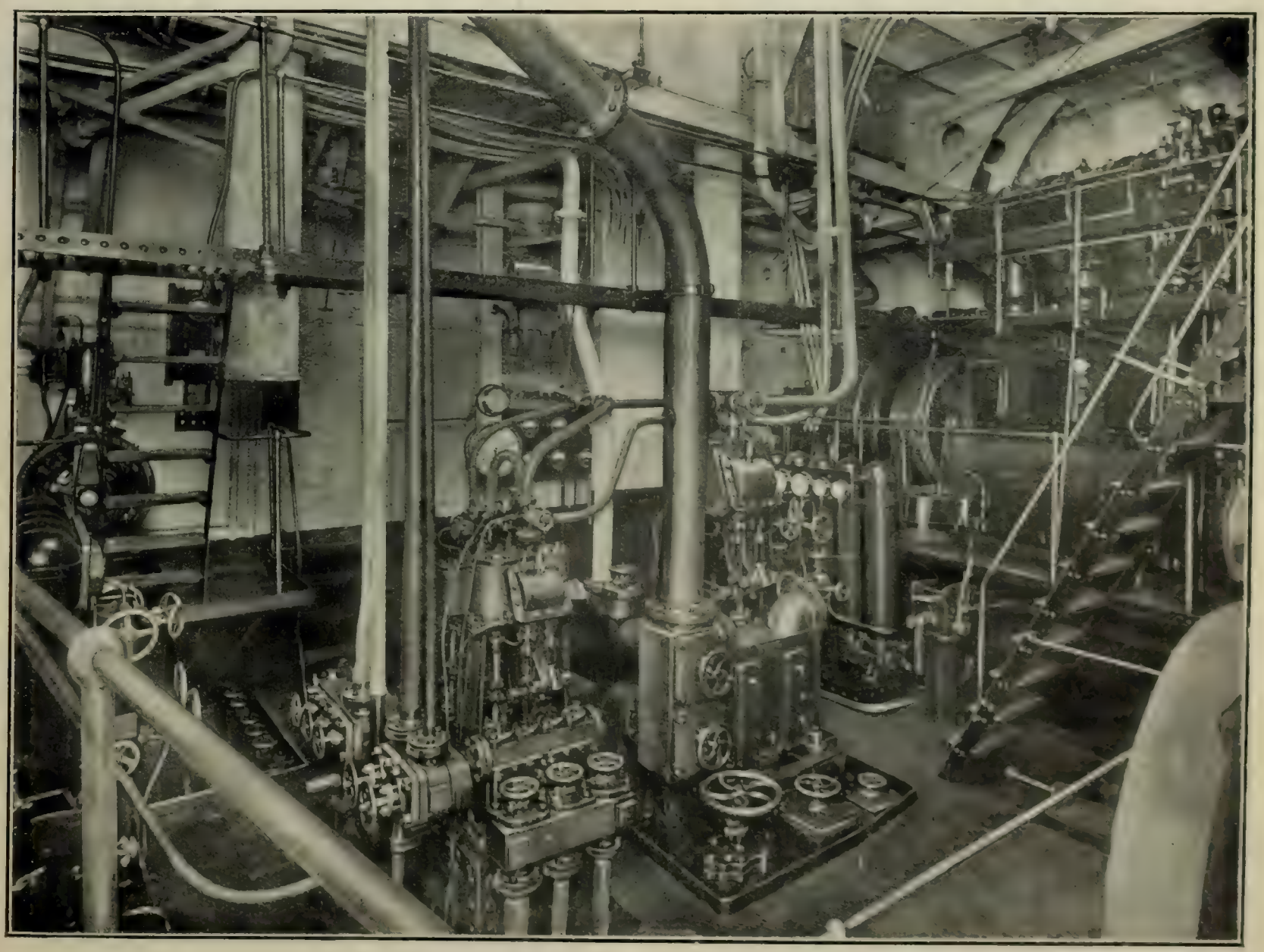
The system of electric drive is that designed by Mr. Henry A. Mavor, who has described the system and discussed its advantages in papers before several societies.



The "Tynemount."

This system has for its special object the simplification of the electric equipment. Many applications of electric power have been made to marine propulsion, but hitherto, with the exception of the *Electric Arc*, propelled on this system and built in 1911, and the U.S. ship *Jupiter*, continuous currents only have been used, the reason being that regulation of speed and control is easier for continuous current under ordinary conditions than for alternating current. The disadvantages attached to the use of alternating current in respect of regulation are associated with the greater number of conductors, and particularly with the property of A.C. motors, that the speed of the motor bears a fixed ratio to the speed of the generator, and that any departure from this speed is associated normally with loss of efficiency and with more or less complicated devices for changing the frequency.

In the system under notice these difficulties are overcome by the use of more than one frequency applied to each individual motor. The currents of different frequency



View of the Engine Room, Starboard Side, Showing one Generating Set.

* Electrical Review, September 22nd, 1911; September 20th, 1912; and September 26th, 1913.

are carried in independent mutually non-inductive circuits, the magnetic systems being entirely independent, but operating upon a common rotor, so that their mechanical effects can be superposed and the power transmitted in the separate circuits combined to produce the required mechanical effect. The required currents may be obtained from one or more generators.

The method of control entirely dispenses with the stopping and starting of the Diesel engines for manœuvring, an operation which, in itself somewhat difficult, becomes impossible if a liberal supply of compressed air be not available. To keep up a supply of compressed air for manœuvring a vessel in the locks and channels of a canal involves the upkeep of a very expensive and inefficient air-compressing plant, and the dispensing with this auxiliary is a very important feature of the system. It is also advantageous to have two units, each capable of driving the ship, so that in the event of any interruption to the running of either, the vessel is still under control.

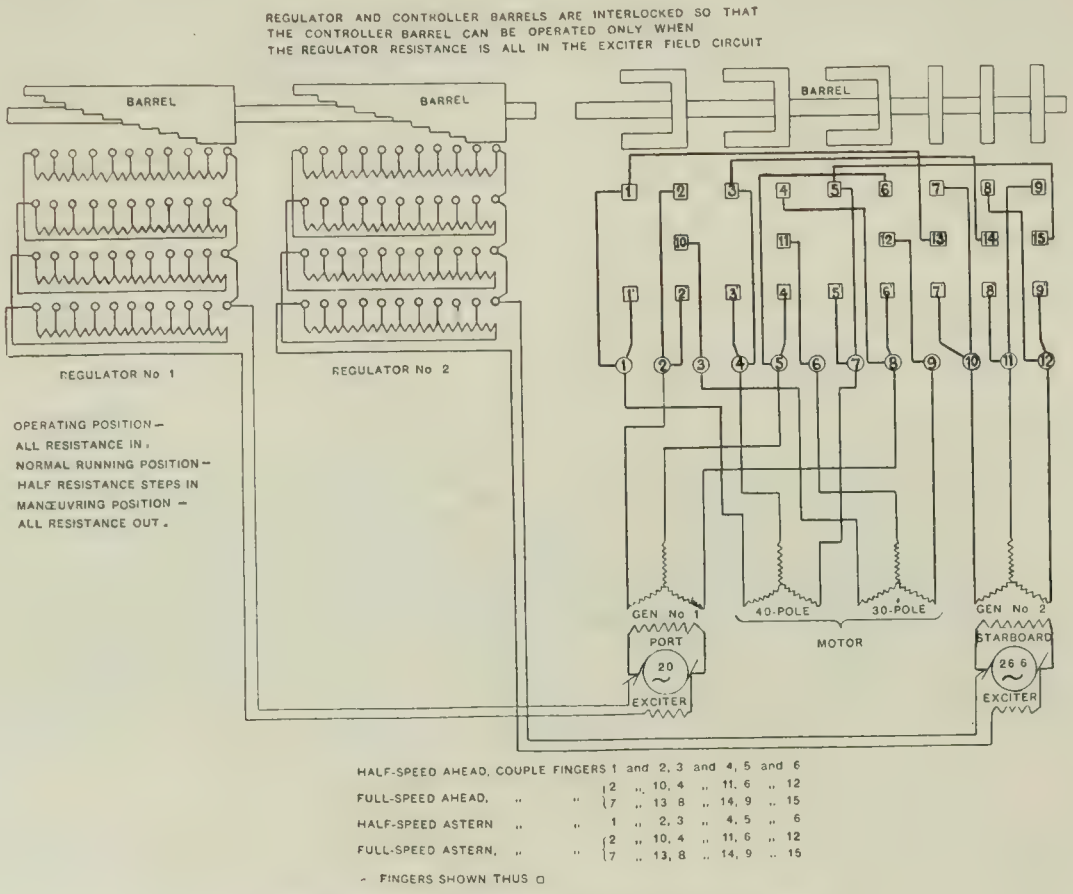


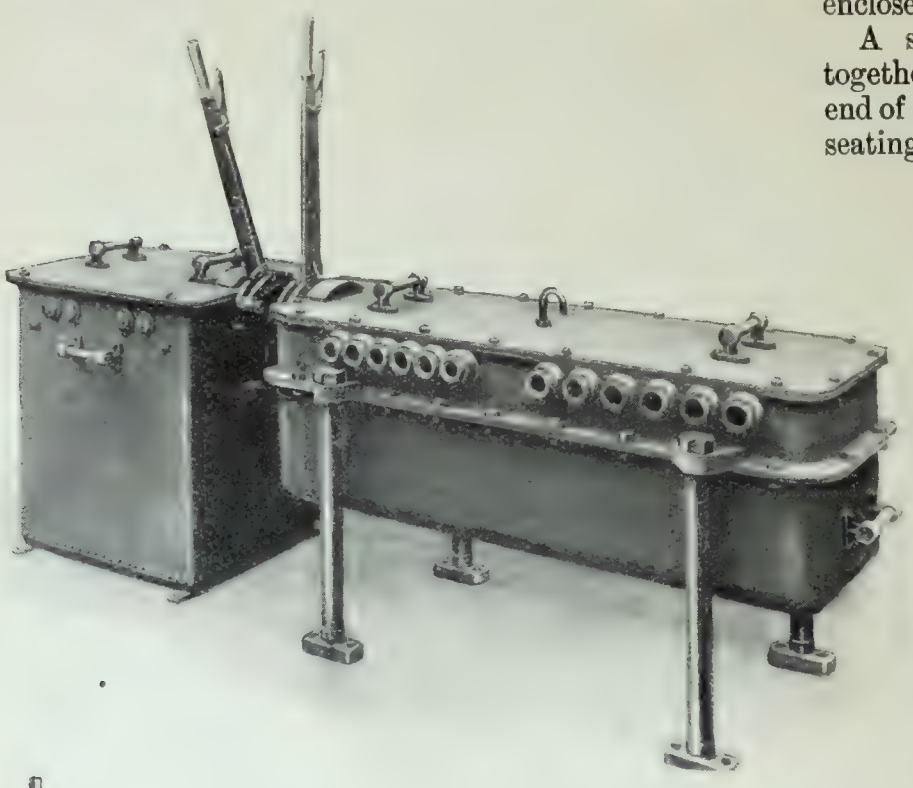
Diagram of Electrical Connections.

The vessel has been built by Messrs. Swan, Hunter and Wigham Richardson, Ltd., of Wallsend, and is 250 ft. in length by 42 ft. 6 in. beam and 19 ft. depth moulded. It has two masts; there is one steel deck, and three cargo holds, with seven large hatches. On the deck are steam winches for working the cargo with three 3-ton derricks; there is also a steam windlass and steam-steering gear. Electric light is fitted throughout. The auxiliary machinery is supplied with steam from two Cochran donkey boilers fired by means of oil fuel.

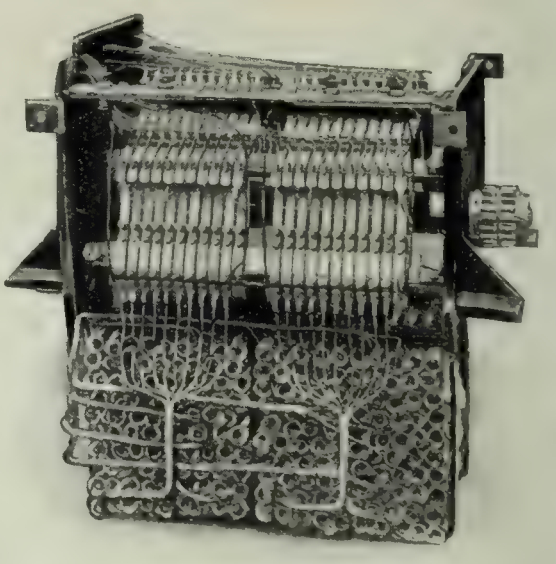
The vessel has a double bottom throughout, adapted for carrying water ballast and oil fuel. There are also two tanks for oil fuel on the deck.

The machinery is accommodated right aft under the poop. The prime movers of the installation consist of two six-cylinder high-speed engines of the well-known "Mirrlees-Diesel" type, as manufactured by Messrs. Mirrlees, Bickerton & Day, Ltd., Hazel Grove, near Stockport. They are each capable of developing 300 B.H.P. at 400 R.P.M. on the four-stroke cycle, the diameter of the cylinders being 12 in. and the stroke $13\frac{1}{2}$ in. The engines are totally enclosed, and forced lubrication is employed throughout.

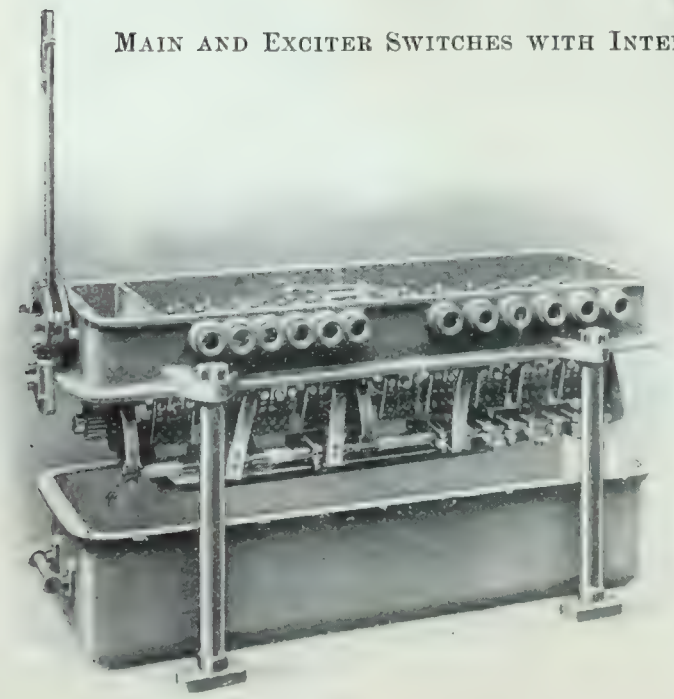
A substantial bedplate, cast in two pieces and bolted together, joins with the alternator bedplate at the fly-wheel end of each engine, the whole being secured to the raised engine seatings, which form part of the ship's structure on both port



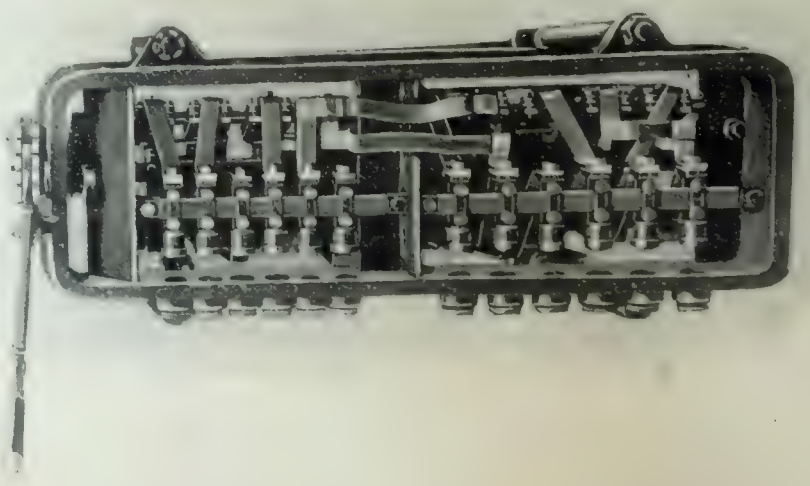
Main and Exciter Switches with Interlocking Gear.



Exciter Switch Removed from Case.



Main Switch, with Tank Lowered.



Main Switch in Plan.

and starboard sides of the engine room. The six cylinders of the engine are divided into two groups of three cylinders each, the vertical shaft which drives the cam shaft being placed between the two groups. The crankshaft is made in two pieces, the gear wheel which transmits the motion to the vertical shaft being bolted between the two flanges of the central coupling, and these flanges are turned solid with the shafts.

The engines, which are coupled to the alternators in the usual manner, are placed at the forward end of the machinery space on the port and starboard sides. Hand lever barring gear is provided for turning the engine into the starting position. Starting is effected by means of compressed air, three cylinders only being fitted with starting valves. These are arranged on the three cylinders at the fly-wheel end of the engines, and their operation is rendered easy for the engineers in charge by a system of bell crank levers and coupling rods, transmitting the motion from a control pillar placed on the engine room floor in close proximity to the air receivers of the engines. A device for stopping the engine and means of controlling the amount of air delivered by the air compressor are also provided on the same control pillar. Near at hand is the electric controller of the transmission system, the whole providing a compact and centralised arrangement for the operation of the propelling machinery.

At the after end of each engine a three-stage air compressor is fitted, direct driven from an extension of the engine crankshaft. This extension also provides means for driving the lubricating and circulating water pumps.

The two groups of cylinders comprising each engine are carried by two enclosed-type columns, each cast in one piece and provided with inspection doors of ample size. To these columns on the front or cam-shaft sides of the engines, cast-iron brackets are fixed which support grating platforms running along the whole length of each engine on the front side; these platforms provide easy access to the valve-gear and valves.

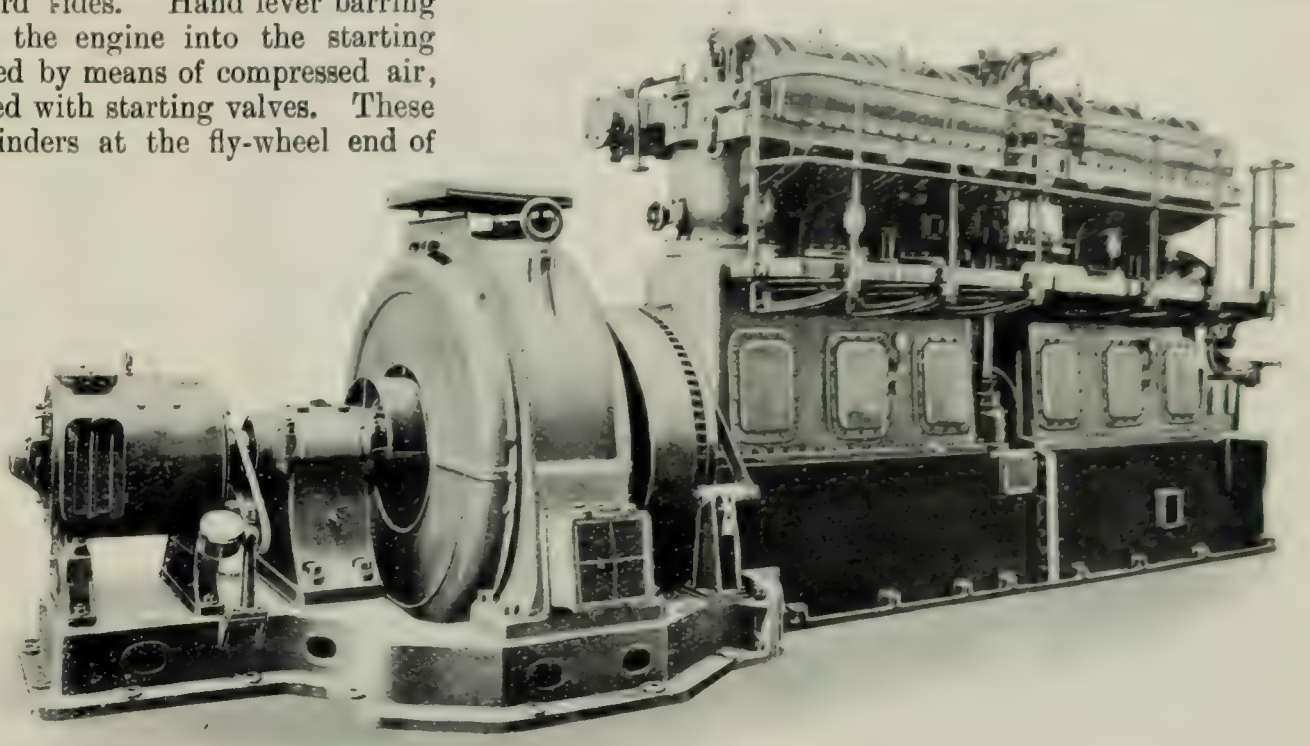
The valves are situated in the cylinder covers, the fuel valve being of the ordinary needle type opening vertically upwards; the exhaust and air valves open downwards, and all are operated by cams and levers in the usual way.

An important feature of these levers is the provision of a hinged and bolted joint in each, which allows, by the undoing of one bolt, any lever to be folded back, and by this means the work of withdrawing the valves is reduced to a minimum. All the valve seats are made separate from the cylinder covers, and can be withdrawn bodily with the valves. Spare valves and seatings are carried, and thus all grinding-in can be done on the bench at the engineer's convenience.

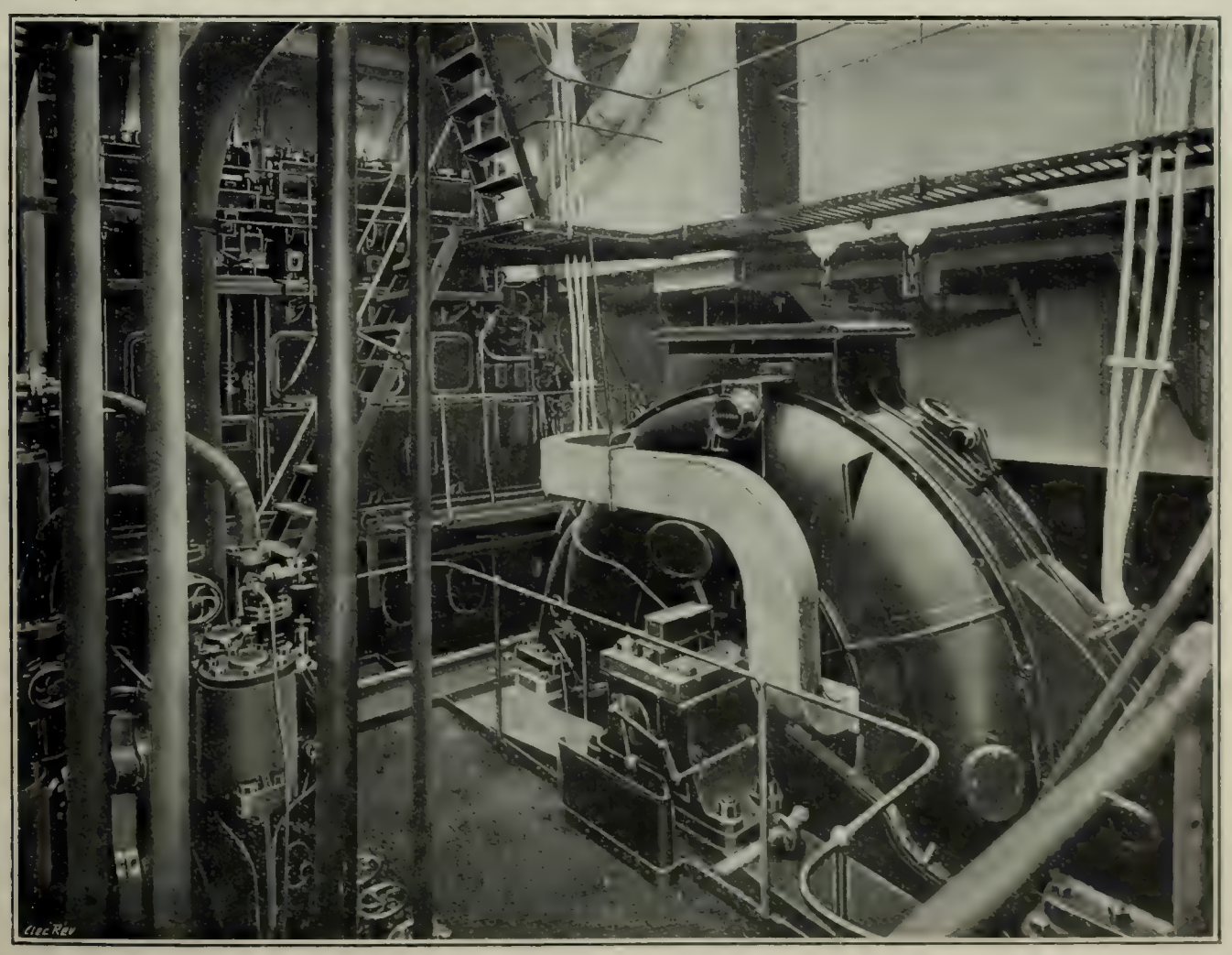
The pistons are of the trunk pattern, and have separate heads, and the top ends of the connecting rods are fitted with gun-metal bushes working on case-hardened piston pins.

The fuel pumps for delivering oil to the cylinders are situated on either side of the vertical shaft gear-casing, and are driven by eccentrics from the camshaft. Each of these eccentrics operates a small crosshead, to which are fitted the three plungers of each pump. Fuel oil is fed by gravity to the fuel-pump suction chamber from the ready-use tanks, which are situated on the forward bulkhead of the engine room. The amount of oil passing through the cylinders is determined by the governor, which is fitted on the upper portion of the vertical shaft: a system of coupling rods and levers is connected from the governor arm to a small spindle passing through the fuel-pump suction chamber, and to this spindle tappets are fixed which determine, according to the position of the governor, the length of time the fuel-pump suction valves remain off their seats, and until the suction valves are closed no oil will be delivered to the fuel valves on the cylinder covers.

The circulating water after passing through the engines

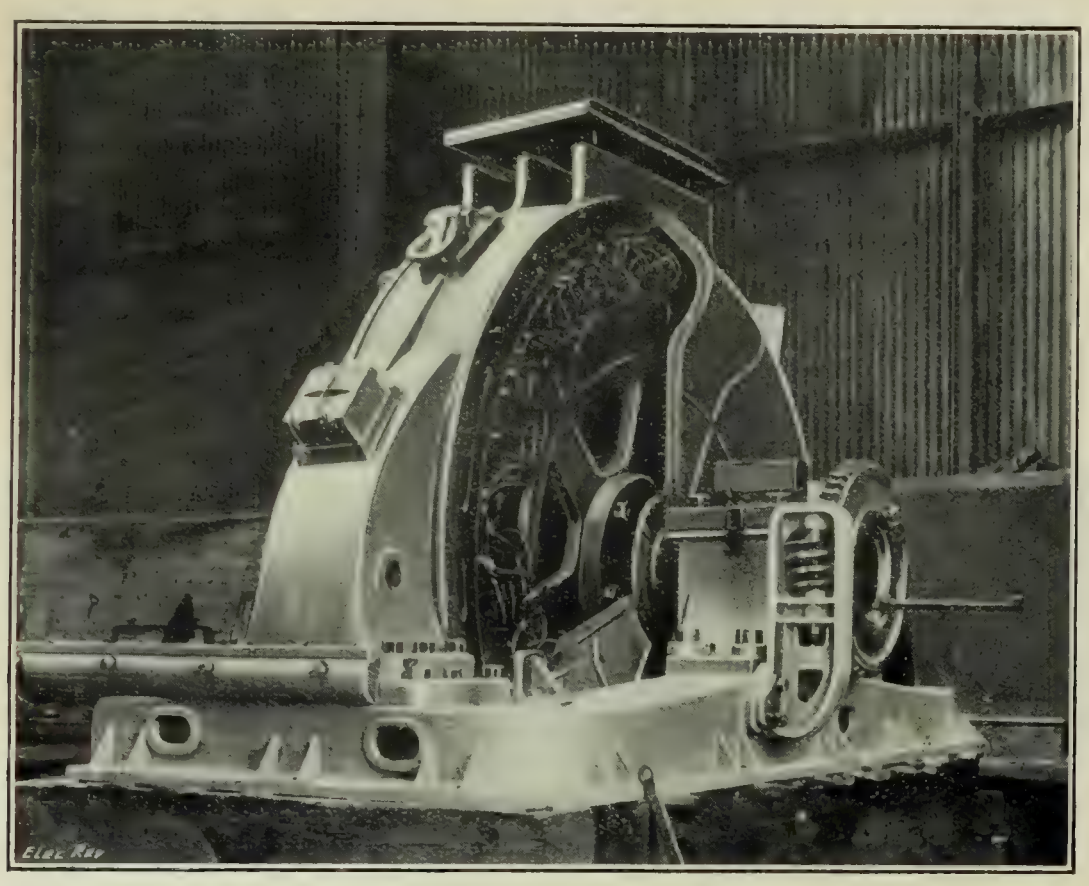


One of the 300-b.h.p. Diesel Electric Generating Sets on the "Tynemount."



View of Engine Room, Looking Aft, Showing Propeller Motor.

goes to the exhaust pipes, which are water-cooled. From thence it passes from each engine through a water-flow indicator into a branch piece from which two pipes are led, one pipe going to the discharge valve on the ship's side, and the other by means of a by-pass to the suction side of the circulating pump. By this means warm water can be mixed with the incoming water from the weed traps when the ship is sailing in cold waters. When the ship is



Motor with Guard Plate Removed, Showing Windings.

running in fresh water, it will be possible by means of a special arrangement to pass the hot circulating water from one engine into the feed tank of the donkey boilers. When the engines have been stopped and are cooling down, it has been arranged that the sanitary pumps may pass circulating water through them and thus lessen the chances of precipitation of salts or alkaline matter in the jackets.

The electrical equipment consists of two Mavor & Coulson three-phase alternators, each direct coupled to one of the Diesel engines. The alternators when running at their normal speed of 400 R.P.M. each give an output of 270 amperes at 500 volts per phase, which absorbs the full power of the engine. They are provided with six and eight poles respectively, making the frequency of the current 20 periods per second, and 26·6 periods per second respectively.

An exciter is direct-coupled to each alternator, and is capable of giving an exciting current of 30 amperes for normal working, which can be increased up to 50 amperes whilst manœuvring.

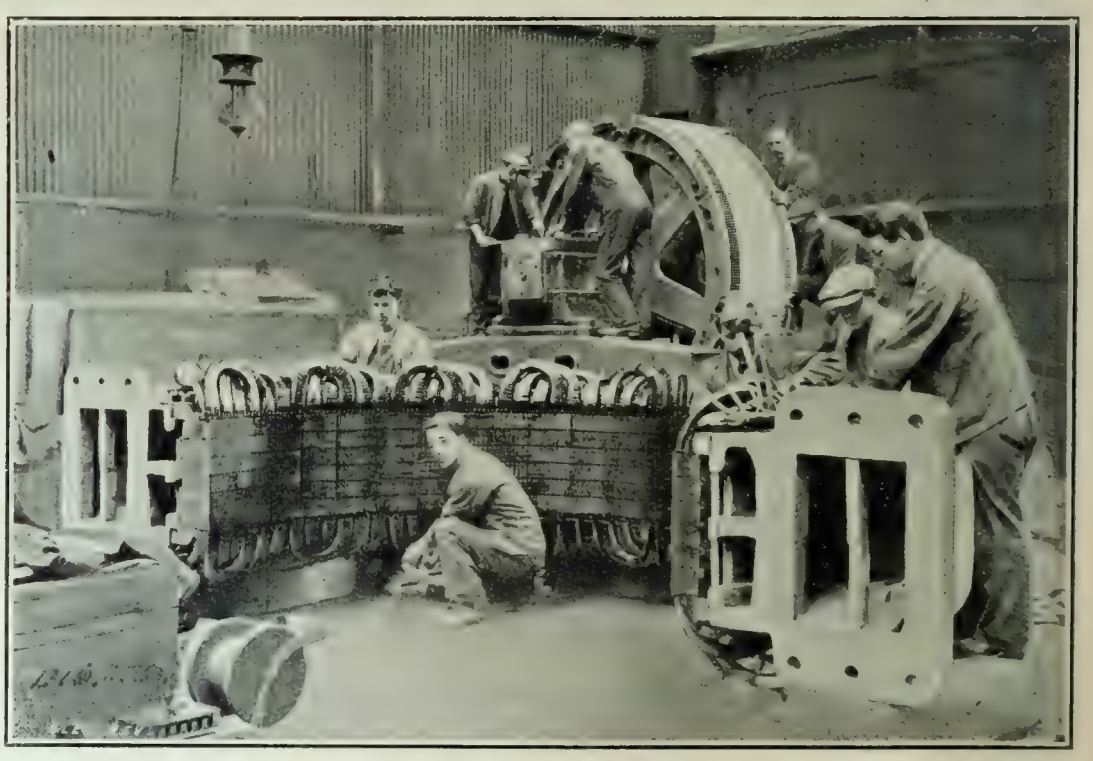
The current from these two generating sets is led to a 500-B.H.P. Mavor & Coulson patent induction motor of special construction.

The rotor of this motor is of the squirrel-cage type, but the stator is provided with two different and entirely separate windings, one of 30 and the other of 40 poles. When these two windings are supplied with current at 20 and 26·6 periods respectively, they give the same synchronous speed of 80 R.P.M. The motor will then absorb the full power of both engines and drive the propeller, to which it is direct coupled, at a speed of 78 R.P.M. This propeller speed corresponds to the fastest speed of the vessel.

In order to obtain a slower speed the connections are altered so that the alternator, giving 20 periods, supplies the 40-pole winding of the motor; the alternator giving 26·6 periods can be shut down and the 30-pole winding of the motor is also out of use. The synchronous speed of the motor with the propeller is now reduced to 60 R.P.M. One of the engines only is available, but as the speed of the ship is reduced to about three-quarters of the normal, half of the total H.P. is ample, and the great advantage is obtained of being able to shut down entirely that part of the plant which is not required at the low speed. It will be noted that the two alternators, when both are at work, are connected to entirely separate circuits, and they are, therefore, never run in parallel. The paralleling of two alternators, necessitating that they should be run up to speed and synchronised before being switched on to the load, is quite unsuitable for ship work; this operation not only requires skill and care, but would involve considerable delay in starting the propeller motor. The motor is readily reversed by interchanging the connections of two of the phases.

The switchgear by means of which the necessary changes of connection are made, is extremely simple; it consists of two parts:—A main switch of the tramway controller type having five different positions, "full ahead," "half ahead," "stop," "half astern," "full astern"; and a second switch, the purpose of which is to introduce resistance into the shunt circuit of the exciter.

The contacts of both switches work under oil, but it is inadvisable that the contacts of the main switch should be required to break the large main current flowing to the motor. The two switches are therefore interlocked so that it is impossible to work the main switch except when all the resistance has been introduced into the exciter field coils. There is then practically no excitation, and the whole system is "dead." With the resistance in the exciter field circuit, the main switch can be moved to any one of its four working positions, and when the main connections have been made for the new running position, the shunt switch lever is pulled over so as to cut out the resistance and restore the excitation. Until



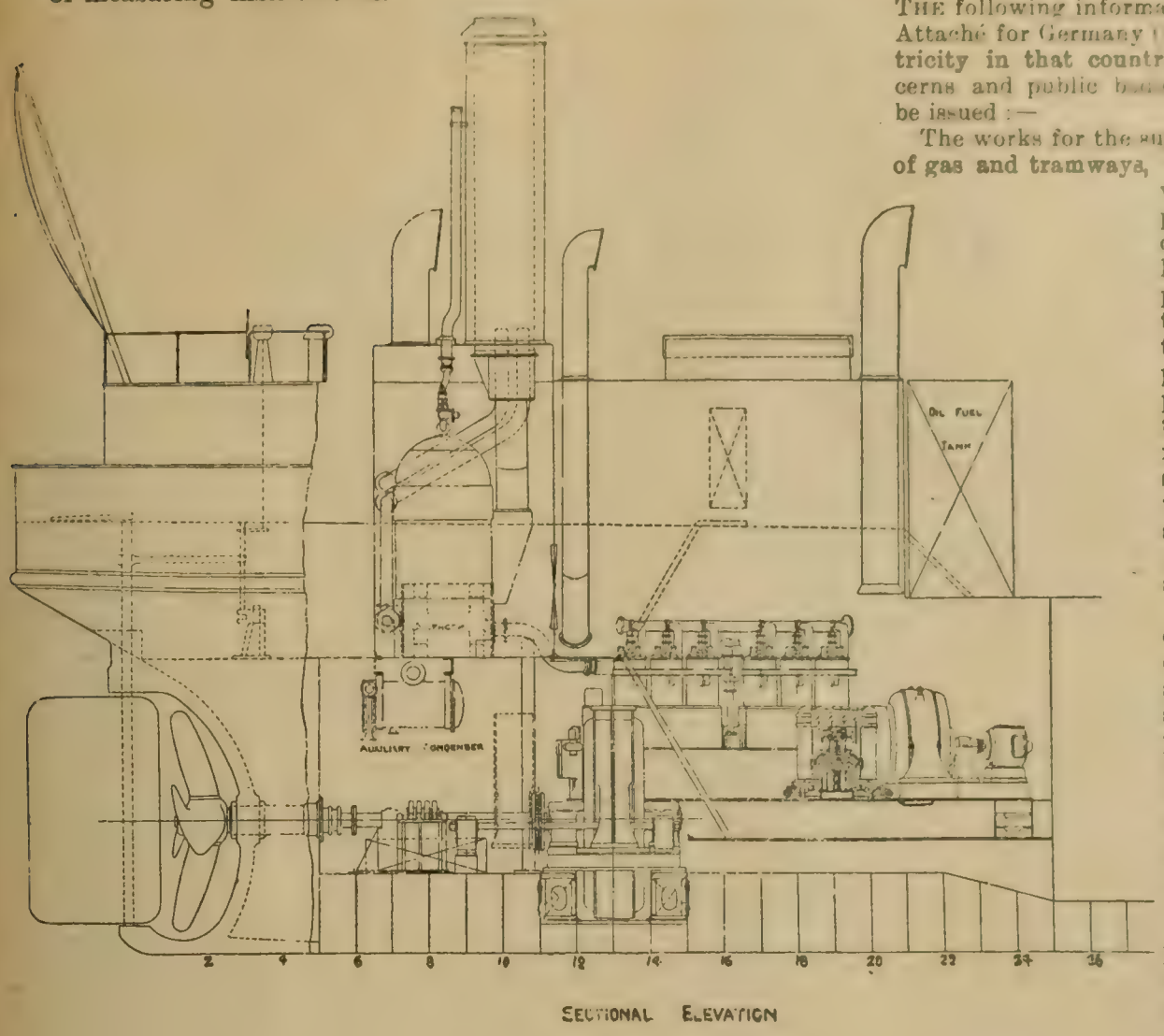
Stator of Propeller Motor under Construction.

the main switch is definitely on one set of contacts, the shunt switch is locked, so that the excitation cannot be restored. A diagram of the connections is shown on page 662.

It will be seen that the whole handling of the ship can be carried out by means of two levers which are so interlocked as to be practically fool-proof. In the present instance these switches are in the engine-room, but it is evident that by lengthening the connecting cables they could be placed on the navigating bridge.

The number of electrical instruments provided has been kept down to a minimum. There are provided only one

ammeter and one voltmeter for each alternator, and an ammeter and voltmeter for each exciter. The handling of the switchgear is so simple that there is no necessity for multiplication of measuring instruments.



ARRANGEMENT OF GENERATING SETS AND PROPELLING MOTOR ON THE "TYNEMOUNT."

The electrical drive permits the speed of the ship to be altered without altering the engine speed. It also permits a convenient gear ratio to enable the engines and the propeller respectively to be run at their most efficient speeds, and provides for the ready reversal of the propeller while the engines continue to run in their normal direction.

In addition to the above advantages, it is found that in many cases the system will allow of a reduction in the machinery space, and also in the bunker space required, thus increasing the cargo capacity of the vessel. As a subsidiary advantage, it lends itself readily to distant control, and in any case where it may be found advisable, the switchgear can be put on the bridge and the control of the motor driving the propeller placed in the hands of the navigating officer.

It is anticipated that, compared with a mechanically-geared or direct-connected Diesel-engine equipment, the electrical equipment will offer very material advantage in the operation of the vessel in the special circumstances under which it is placed.

MUNICIPAL ELECTRICAL ENTERPRISE IN GERMANY.

THE following information is from a report by H.M. Commercial Attaché for Germany (Sir F. Oppenheimer) on the supply of electricity in that country by the chief works in which private concerns and public bodies are jointly interested, which will shortly be issued :—

The works for the supply of electricity, like those for the supply of gas and tramways, were, in Germany, at first purely private ventures. Though owned by private companies, these enterprises partook of the character of monopolies—not necessarily legally secured. The rights of these companies rested upon concessions which, owing to the inexperience of municipal bodies, tended to work greatly in favour of the companies. In consequence, there followed a period of reaction in favour of municipal trading. It was hoped that these quasi-monopolies would thus be converted into a source of profit to the municipality, and that the interests of the consumers would, at the same time, be more thoroughly safeguarded against the high-handed methods sometimes adopted by the private companies.

Within recent years, however, opinions concerning more especially the supply of electricity have undergone further changes; at present the tendency is all in favour of a combined system, under which the enterprises are managed by a private company, in the working of which the interest of the community, as such, is safeguarded by a participation in the capital and in the management of the company. This combined system has found favour with the municipalities and the companies alike.

The municipalities admit that a purely public enterprise, municipally managed, has been found too inelastic to move as rapidly as modern circumstances of trade and industry may require; that the best managers cannot be secured among municipal officials with only municipal pay; that the town councils as controlling bodies show a lack of technical understanding; that the expected profits have failed to realise because the rate of charges had to be unduly lowered in deference to the demands of the people's representatives, or because wages had to be unduly increased. The profits under public management were further curtailed by unavoidable concessions to the public of unprofitable lines, low tariffs, a certain luxury in the rolling-stock, &c. In the case of the supply of electric power more especially, a great freedom in negotiating contracts with important consumers has proved essential; hard-and-fast tariffs are impracticable, because large consumers, whom it is essential to secure, demand an individual treatment which necessitates discretion.

More important than these is the consideration that electrical works, for technical and economic reasons, must aim at supplying the largest possible area—for thus alone can electric power be profitably supplied at low rates—so that in many cases a stage is reached where the system ought to be extended beyond the boundaries of the municipality. Technically, the supply of such vast areas has become possible only within a comparatively recent period; nothing, in fact, has tended more thoroughly to undermine the traditional ideas as to the advantages of municipal trading so far as the supply of electricity is concerned. It is also a notorious fact that the smaller communities prefer entering into contracts for the supply of light, power, &c., with private concerns rather than with their larger neighbours, of whom they are both jealous and suspicious.

Occasionally, too, cases have occurred in which municipalities have, for financial reasons, favoured an enterprise under private rather than under municipal management; they shirked the necessity of increasing their debt because they suspected that the Central Government would not give the necessary consent to increased borrowing.

Occasionally, too, the force of circumstances has led communities to consent to a combined private enterprise; they had hesitated too long in extending the area of their own works, and when they wished to expand they found that private companies were too firmly established outside their very gates to abandon the field on reasonable terms.

Private companies have favoured a combined working for a variety of reasons, quite apart from any considerations which may prompt (*a*) firms manufacturing electro-technical appliances, or (*b*) mining concerns with the necessary supply of coal, lignite or power, to take a share in electrical works.

The chief inducement for private concerns to work electrical enterprises with a municipality as a partner is the greater facility then afforded of financing enterprises of the necessary modern dimensions. Municipal credit, which is cheaper than private, can help them, for example, in the following different ways :—

1. The municipalities guarantee the loans necessary for the mixed works, and this results in an easier issue and a lower rate of interest. Thus a large share of the necessary capital can be procured by way of loans, and the issued share capital remains low and yields a higher return.

2. The municipalities themselves effect the loans and place the capital thus procured at the disposal of the common enterprise.

3. Municipalities purchase or build with their own issues, tramway lines, small gauge lines, &c., and subsequently leave their management to mixed works.

4. The municipalities reserve the right to take over a part of the share capital of the mixed works.

Again, it is notorious that many advantages, especially from official quarters, can be more easily obtained if the works are mixed rather than private—not only from the municipal authorities themselves, but also from the district or provincial authorities, *e.g.*, in connection with the use of roads, thoroughfares, &c.

Force of circumstances has again at times prompted the scheme of mixed concerns, cases in which the combined working is the result of a compromise. Repeatedly the field was found no longer free for a private venture ; there were municipal works, however inefficient, already in existence which were used as a start. Municipalities, moreover, were disinclined to give up the use of their streets and thoroughfares to a private company without a certain municipal control in the enterprise.

CONTRACTS CLOSED.

(*Continued from page* 660.)

London.—The Langdon-Davies Motor Co. have received the annual contract from the General Post Office for the supply of A.C. motors for 1913-14.

L.C.C.—The following tenders have been received by the L.C.C. for electrically lighting two schools :—

Royal Hill School, Greenwich—

Arthur Newman, Ltd. .. .. (accepted)	£148
C. H. Cathcart & Co.	165
Alpha Manufacturing Co.	172
Cunningham, Ltd.	174
G. F. Ratcliff & Co.	334
A. J. Howens	£81

Middle Row School, Kensington—

Arthur Newman, Ltd. .. .. (accepted)	£460
W. Mackie & Co.	471
H. J. Cash & Co., Ltd.	479
G. E. Taylor & Co.	492
E. Lawrance & Sons, Ltd.	570
G. F. Ratcliff & Co.	699

The L.C.C. Fire Brigade Committee reports that J. C. Braun, Premier-Werke, A.G., Nürnberg, having gone into liquidation, have notified their inability to supply the petrol-electric chassis for an escape van ordered from them at £930. The offer of Magirus, Ewald und Lieb to supply two Magirus ladders, for £1,200, has been accepted, and the offer of Cedes Electric Traction, Ltd., to supply, for £2,200, two petrol-electric chassis for fitting to Magirus ladders, and the fitting of the chassis to the ladders, has been approved. The contract for the engines is to be sublet to J. Tylor & Sons.

Sheffield.—The City Council has accepted the tender of the Electricity Department to wire the Brightside baths at about £38 17s.

South Africa.—The South African Railways and Harbours Administration has accepted the tender of the A.E.G. Electrical Co., of South Africa, Ltd., for the supply of 36,000 train lighting lamps to specification, and those of Orenstein-Arthur Koppel, Ltd., for the supply of 10 miles of train track, 24-in. gauge, 16-lb. section, complete with sleepers and fastenings, and 150 side-tipping trucks.—*African World.*

Stafford.—The contract for the installation of the new building for the Stafford Co-operative Society has been received by the Mechanical and Electrical Engineering Co., of Walsall.

Walthamstow.—The T.C. has accepted the tender of J. Baker & Co. for a supply of a dozen special tramcar axles, at £3 3s. per axle, and that of W. T. Henley's Telegraph Works, Ltd., for feeder cable.

Warrington.—The tender of the St. Helen's Cable and Rubber Co., Ltd., has been accepted by the Electricity Committee, at £171, for the supply of three sets of tires, with 1,200 miles guarantee.

The Corporation switchboard extension contract has been awarded to Messrs. Drake & Gorham, Ltd.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 24th. At 5 p.m. At the Imperial College of Science, Imperial Institute Road, South Kensington, S.W. Papers on "The Ice Calorimeter," by Mr. Ezer Griffiths, B.Sc.; "An Electrostatic Oscillograph," by Messrs. H. Ho and S. Koto.

Institution of Mechanical Engineers.—Friday, October 24th. At 8 p.m. Paper on "Modern Flour Milling Machinery," by Mr. R. B. Creak.

Manchester Association of Engineers.—Saturday, October 25th. At "Masonic Room," Grand Hotel, Aytoun Street, Manchester. Paper on "Engineering Workshop Organisation," by Mr. Hans Renold.

Institution of Electrical Engineers (Western Section).—Monday, October 27th. At 3.30 p.m. At Merchant Venturer's Technical College, the University, Bristol. Address by Mr. H. Faraday Proctor, chairman. At 11.30 a.m. Visit W. D. & H. O. Wills, Ltd., factory. At 7 p.m. Annual Dinner at Royal Hotel, College Green.

Institute of Marine Engineers.—Monday, October 27th. At 8 p.m. Discussion on Fuel Test.

Association of Electrical (Station) Engineers.—Tuesday, October 28th. At 7.30 p.m. At Chandos Hall, Maiden Lane, London, W.C. General meeting.

Wednesday, October 29th. At 8 p.m. At the Old George Hotel, Briggate, Leeds. General meeting.

Thursday, October 30th. At 7.30 p.m. At the School of Technology, Manchester. Paper on "Scientific Measuring Instruments," by Mr. T. S. Wallis.

Association of Mining Electrical Engineers.—Saturday, October 25th. At 4.30 p.m. At Royal Technical College, Glasgow. Joint meeting with National Association of Colliery Managers. Paper on "Power Transmission," by Mr. W. H. Telfer.

Batti-Wallah's Society.—Friday, October 31st. Smoking concert.

Greenock Electrical Society.—Friday, October 31st. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "The Principles of the Steam Engine," by Mr. J. Frew; and "Boiler Inspection," by Mr. G. R. Reid.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 31st. At 7.30 p.m. At Bolbec Hall, Newcastle-on-Tyne. General meeting.

Junior Institution of Engineers.—Friday, October 31st. At 39, Victoria Street, Westminster.

Salford Technical and Engineering Association.—Saturday, November 1st. At 7 p.m. At Royal Technical Institute, Peel Park. Short Papers.

NOTES.

The Royal Mint Report.—The annual report of the Deputy-Master, Sir Thomas Elliott, shows that during 1912 171 million coins, the highest figure on record, were produced. Of this total 162½ million were for Imperial issues, and 8½ million for Colonial use. Of the Imperial coinages, which exceeded by nearly 34 million any previous total, 36½ million pieces were gold, 49 million silver, and 77 million bronze.

The figure for bronze coins is nearly double the average of recent years, and the unprecedented demand was undoubtedly due to the increased use of small change rendered necessary in the payment of wages by the operation of the National Insurance Act. The net profit on the year's operations was £1,243,576. In the memorandum by Mr. Rigg, superintendent of the Operative Department, it is stated that the efficiency of the new gas furnaces (see ELEC. REVIEW, November 1st, 1912, p. 704) has been further improved. For the nine months in 1911, in which they were in use, the cost per cwt. of bullion melted was 13·8d., whilst in 1912 the cost per cwt. melted was 10·3d.

During the year the new buildings required for the various processes involved in the preparation of dies and plates for printing stamps were taken over from the Office of Works. In the moulding and depositing room six depositing baths for copper, four for nickel and one for steel facing, with the requisite washing tanks, were erected. Four motor-generator sets were also installed in a special glazed enclosure, the switchboard for the same being placed in the depositing room for greater convenience. In connection with the preparation of postage stamp plates and dies for postcards and wrappers, 111 copper electros, 1,098 nickel electros and 218 steel-faced electros were grown. For National Health and Unemployed stamp plate requirements, a total of 131 plates were grown, which, with two exceptions, were of nickel.

A motor-driven pump for the new exhaust steam heating plant has been erected in the cyanide hardening shop, as well as a motor-driven blower for work in connection with the die and seal branch.

The completion of the new buildings referred to above, and of the new gold melting house, has led to an extension of the electric light and power equipment. The number of motors in use has increased from 89 to 99, and their gross H.P. from 786 to 834¾. The arc, flame and silica lamps number 71, as against 78 in 1911.

Incandescent lamps in official premises have increased from 798 to 995, whilst the number in private residences remains the same—210.

The average monthly output of the Mint generators during 1912 was 30,058 units, as compared with 29,163 for the previous year.

In connection with the Ottawa branch of the Royal Mint, the Deputy-Master (Dr. Jas. Bonar) states that the introduction of separate dynamos for the gold and silver cells (see ELEC. REV., November 1st, 1912, page 704), in use in the new electrolytic refining plant, has proved satisfactory. Ten silver and 12 gold cells were in use throughout the year, and provision is already made for six additional cells, in order that the necessary periodical cleaning may proceed by six cells at a time, and leave 12 always at work. The automatic heating has been reduced to eight hours, and may possibly be dropped altogether.

Institution and Lecture Notes.—Manchester Association of Engineers.—On October 11th the inaugural address was delivered by the President, Dr. Edward Hopkinson, who reviewed the development of electrical engineering and its influence on mechanical engineering. He remarked that in the hands of the pioneer of the new branch of engineering there was necessarily closer touch with, and more intimate dependence upon, physical principles and theoretical scientific knowledge than in the older branches. So it was that electrical engineers were quick to realise that the efficiency of the dynamo and motor could and must be determined with accuracy, with the result that in the course of five or six years the efficiency was brought from a general level of probably about 75 per cent. up to 93 to 94 per cent., beyond which even the succeeding quarter of a century had carried us but little higher. This bedrock understanding of the efficiency of the dynamo had had a profound effect on all branches of engineering and mechanics, and had extended even beyond into regions of social and political activity. Very soon it became essential accurately to determine the efficiency of all machines converting energy from one form to another, with the result that, knowing what the loss in conversion was, and where it occurred, invention followed investigation and great improvements resulted. Electrical science differed fundamentally from others, in that the electrical engineer having no material conception of the electrical quantities he was dealing with, and being dependent entirely on being able to express them and measure them in terms of the fundamental units of mass, length and time, must necessarily treat his subject from a more purely mathematical point of view. No electrical engineer could acquire a competent knowledge of his subject without a knowledge of mathematics. No factor in the development of a branch of engineering had greater influence than the power of accurate measurement, and it had been foremost in contributing to the advance of electrical engineering. Nothing contributed more to accurate thought and reasoning, and accurate expression of thought in the student, than the opportunity and habit of making physical measurements with a high and known degree of accuracy. If he were restricted to one word of advice to engineering students, and indeed to all who followed the profession of engineering, he would say strive and study above all things to be accurate in measurement, precise in thought and knowledge, and exact in expression. Such qualities, though based on the moral desire to be truthful and honest in word and deed, involved much more, and could only be acquired by careful early training and constant striving after an ideal, which must be set up in youth. Their realisation would bring with them abundant personal reward, and was the only foundation upon which the future development of the profession in which they were all interested could be securely built.

Institution of Municipal Engineers.—The fifth annual general meeting will be held in London on Friday, November 7th. The Presidential address will be delivered at 2.45 o'clock, several papers will follow, including one by Mr. R. J. Spencer-Phillips, on "Electricity as a By-Product." A special general meeting is called for earlier on the same day, for the consideration of the proposed by-law amendments.

The Concrete Institute.—The thirty-ninth ordinary general meeting will be held at Denison House, on Thursday, November 13th, at 7.30 p.m., Mr. E. P. Wells, J.P., will deliver his Presidental address.

Birmingham and District Electric Club.—The opening meeting of the Club was held on Saturday last, at the Birmingham Electric Supply Department's showroom, 14, Dale End. Mr. W. E. Milns, of the Birmingham Corporation, gave a lecture on "Electric Cooking," with various demonstrations. It being a ladies' night, a large number of interested ladies attended and expressed themselves delighted with the apparatus shown, and much appreciated the examples of electric cookery which were handed round. The lecturer commenced by dealing with the ideal oven, and succeeded in showing that the electric oven was the nearest approach to this ideal. Various types of ovens were compared, and hints given on the selection of electric ovens. The important question of costs was dealt with, actual figures being put forward to show that on the score of expense electric cooking compared favourably with any other form. A year's cooking for a family, including the electric heating of two rooms, electric kettles, irons, &c., actually worked out at no more than £10. Advice as to the economical use of ovens was given, and it was shown that on an intelligently-selected *menu* one or two courses could be cooked after current was actually switched off.

At a recent meeting of the Institute of Mining, Mechanical and Metallurgical Engineers for Cornwall and Devon, at Camborne, Mr. L. A. Hards, manager of the Cornwall Electric Power Co., read a paper on "The Application of Electricity to Cornish Mining." He said that there was nothing above ground or below which could not be successfully dealt with electrically, excepting large winders.

Association of Mining Electrical Engineers (East of Scotland Branch).—The opening meeting of the session of this branch was held on Friday last at Dunfermline. The new Branch President (Mr. H. Gordon Fraser, Leven) delivered an interesting address, in which he regretted the fact that colliery electricians only represented 7 per cent. of their total membership. They must have in their ranks the men who actually installed and operated the electrical plant at the collieries. A paper by Mr. Peat, on "The Electrical Plant at Dalbeath Colliery," was discussed at some length.

(West of Scotland Branch).—The opening meeting was held on Saturday evening in the Royal Technical College, Glasgow. Mr. Matthew Brown, general manager of the Banknock Coal Co., the branch president, was in the chair. In the course of his Presidential address the chairman alluded to the gratifying fact that the branch was now the strongest, numerically, in the Association, and that its strength and influence had been recognised by the other branches in that, Mr. Alexander Anderson, one of their members, had been unanimously elected president of the general body. It was encouraging to note, further, that Mr. Wm. Walker, Chief Inspector of Mines for the Scotland Division, in his most recently published report, believed that the Scottish branches of the Association had to some extent been responsible for securing at the majority of mines throughout the country a better class of colliery electricians. Mr. Brown concluded his Presidential address by presenting Mr. James McCann, colliery electrician, Carron Collieries, with a prize of four guineas for the practical paper read by him in the course of last session on "Coal Cutters."

It was announced that the Council had arranged to hold a series of district meetings at Larbert, Hamilton, and Kilmarnock, with a view to stimulating greater interest in the work of the Association. The branch secretary (Mr. Davis Martin) intimates that papers on the undernoted subjects have been arranged for:—"Wireless Experiments," by Mr. James R. Laird; "Electric Winding," Mr. James Gillespie; "Specifying and Buying Electrical Mining Plant," Mr. J. P. C. Kivlen; and "Rock Drills," by Mr. C. E. Hart.

Last week a lecture was given by Mr. W. A. Toppin, President of Greenock Electrical Society, on "Motor-Driven Machinery." The lecture was illustrated with lantern slides, for which the author acknowledged his indebtedness to Messrs. Laurence, Scott and Co., Ltd., the Lancashire Dynamo and Motor Co., Ltd., Vickers, Ltd., and Royce, Ltd.

Rifle Club Match.—On Tuesday evening last, the 21st inst., a return match between Siemens Dalston Miniature Rifle Club and the Western Electric Co. was shot at Dalston, the result being a win for Siemens. The average scores were 95·3 for Siemens, and 88 for the visitors.

German Enterprise Overseas.—In a study of the expansion of German enterprise abroad, the *Revue Pratique de l'Electricité* states that in Russia the Germans have easily triumphed over the American competition; with the exception of the tramways, which the Belgians have kept, they preponderate in the production and distribution of electric power in St. Petersburg, Moscow, Warsaw, Lodz, Kiev, Baku, and Kabarowsk. The oldest concern is the Electric Lighting Co. of St. Petersburg, established in 1886, with a capital of 1,000,000 roubles. It secured the concession for St. Petersburg in 1898, and that for Moscow in 1895. It has taken over since, in 1909, the concession secured in 1900 by Siemens & Halske for Lodz. In 1912 the capacity of its machinery and plant totalled 120,000 H.P., with 729 km. of cable at St. Petersburg, 1,007 km. at Moscow, and 180 km. at Lodz. The principal German concerns are:—

	Capital. Roubles.	Net profits. Roubles.
Electric Lighting Co. of St. Petersburg	40,000,000	3,981,376
Electric Power Co., of Baku	4,025,000	327,346
Kiev Co.	6,000,000	746,000
Warsaw Co.	3,562,410	460,187

The German Transatlantic Electric Co. was constituted about 15 years ago, with the object of working electric installations and accessory operations, but excluding electric constructions. Its sphere of action is restricted to America. At the present moment the company has four principal seats (Buenos Ayres, Santiago, Valparaiso and Monte Video). At Buenos Ayres it holds, without monopoly, a concession for the production and distribution of light and power until 1957; at that date the city will become the owner of the installation; until then it will draw 6 per cent. of the gross receipts. The number of KW.-hours sold has advanced from 9,300,000 in 1901 to 129,000,000 in 1910. On December 31st, 1911, the aggregate capacity of these stations totalled 74,760 KW.; the length of the cables is 3,068 km., laid in underground conduits.

In the other cities of South America, the company only works indirectly. It is interested in the Chilian Electric Tramway and Light Co., which owns 120 km. of tramways, carries nearly 100,000,000 passengers, and possesses stations which supplied in 1911 200,000,000 KW.-hours. The Deutsche Uberseeische Elektricitäts Gesellschaft A.G. holds the whole of the 6 per cent. preference shares and more than half of the ordinary shares. It is the holder of all the capital of the Valparaiso tramways (43 km.), and owns a considerable part of that of the tramway company of Monte Video. It has, besides, made considerable advances to two later enterprises. The more lucrative is that of Buenos Ayres, which made £1,015,000 gross profit in 1911. The share capital of the Deutsche Uberseeische Elektricitäts Gesellschaft A.G. has been raised by successive issues from £500,000 in 1901 to £6,000,000 in 1912. The five latest issues were made at premiums rising from 115 to 130 per cent. At the same time, the company has contracted, between 1903 and 1911, a bond debt of £4,250,000 at 5 per cent. interest, the first issues being repayable at par, the others at 103. According to the balance-sheet of December 31st, 1911, the stations stood for £8,200,000, participations for £1,500,000, and advances for £2,350,000. The capital was £5,000,000, the reserves £1,400,000, and the bonds £4,220,000.

Appointments Vacant.—Assistant installation inspector, for Stepney Borough Council (30s.); laboratory demonstrator and lecture assistant, for Northampton Polytechnic Institute (£110); charge engineer for power station in India; switchboard attendant, for Erith Corporation (20-25s.); two junior assistant engineers for power station and sub-station, for Bury Corporation (32s. 6d. to 37s. 6d.). Particulars are given in our advertisement pages.

Educational Notes.—Concrete Institute.—A course of six lectures on "Reinforced Concrete, its Commercial Development and Practical Application," will be given by Mr. H. Kempton Dyson, secretary of the Concrete Institute, at 5.30 p.m. on Wednesdays, November 12th to December 17th, 1913, in the Lecture Hall of the Institute. There is no fee for the course; admission will be by ticket obtainable on application from the Secretary, The Concrete Institute.

Mr. H. F. Osler, chairman of Messrs. F. & C. Osler, Ltd., electrical fittings makers, who died on August 10th, left estate valued at £69,029 gross, with net personalty £64,291, a large portion of which will eventually revert to Birmingham University.

Imperial College of Science and Technology.—Scholarships have been awarded by the Delegacy, in the Department of Electrical Engineering, to R. F. H. Nalder (son of Mr. F. H. Nalder), R. H. Barfield and G. S. Oddie.

Northampton Polytechnic Institute.—Six special lectures on "Business Engineering in its Legal Aspects" are to be delivered by Major W. A. J. O'Meara, C.M.G., &c., on Tuesday evenings, commencing on November 4th. Particulars appear in our advertisement pages to-day.

Copper.—Messrs. Merton's circular for the half month shows the price even lower than for the termination of September. English stocks have fallen during the fortnight 955 tons, to 14,179 tons, while French are better by 391 tons. Total European supplies (including Rotterdam, Hamburg and Bremen, and estimates from other European ports) amount to 28,177 tons, a reduction of 742 tons for the fortnight.

Arrivals during the fortnight from North America are low, Spain and Portugal ditto, Chile shipments rather short, but Australian above average. Deliveries, at 17,184 tons, do not promise a large demand for the month. The high price and recent buying appear to be keeping the consumer off for the present. American stocks, as published by the American Producers' Association, have reached a low figure—13,300 tons at the end of September. The difference from the end of August is 3,804 tons, or about one-quarter of the present quantity. The total world's supply at the same date, including Holland and Germany, was 41,119 tons.

British Radium.—It is reported that the British Radium Corporation, Ltd., whose shares have just been placed upon the market, has secured the exclusive rights for mining pitchblende (uranium and radium) at the Trenwith Mine, St. Ives, Cornwall, under lease for 42 years from July 15th, 1908. Since 1911 the company has extracted and sold radium and uranium products approximately to the value of £33,000. Forward contracts have been made by the directors to the value of £35,000. It is calculated that the supply of ore already to hand is sufficient to occupy the works for several years. By means of automatic working in the manufacturing operations, it is hoped to reduce the cost of production to a minimum.

Fatalities.—On Monday an inquest was held at Wallsend and Newcastle on the bodies of W. Amos and R. Walton, who both died as the result of injuries sustained in the Newcastle tramcar smash. Evidence of identification was taken, and the inquest adjourned pending the appearance of Linkhorn, the driver of the repair car.

The Madrid correspondent of the *Daily Telegraph* reports that at Cartagena an electric cable carrying 1,000 volts got loose and fell down in a chemical factory on a wagon conveying nine workmen. Six of the men were killed instantaneously, and the three others were badly injured. A judicial investigation has been ordered.

Osram Week.—Owing to the success of their previous similar efforts, the General Electric Co., Ltd., have organised another "Osram Week Campaign," commencing on Monday next, October 27th. This year the condition of former years, that an order be placed for a specified number of lamps, is not imposed, all the assurance required from electrical firms desirous of co-operating in the scheme being that they will stock Osrams. The details of Osram week are doubtless familiar to most of our trade readers, but we may say that very full information relating to the very extensive scheme of prominent advertising in daily newspapers and other publications next week, bringing the word Osram and the names of local contractors under every reader's eye, can be found in a bulky portfolio containing copies of the special advertisements that are to appear and of all kinds of publicity posters and literature that will be distributed. Firms or others wishing to co-operate in this matter should at once write to the Publication Department of the General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.

Birmingham Electrical Golfing Society.—A society under the above title has been formed in Birmingham, and is open to all golfers in the electrical trade in the Midlands. The annual subscription is a nominal one, and includes free admission to three meetings per year, viz.:—Spring, Summer and Autumn. Substantial prizes are put up for competition. Application for membership should be made to the hon. secretary, Mr. W. A. Millinger, 9, Livery Street, Birmingham. The autumn meeting has just been held, and a cup presented by the Metallic Seamless Tube Co. was tied for by Messrs. J. D. Masters and F. Boyes, Mr. J. D. Masters being the winner in the play-off.

Colonial Demand for Engineers.—At a meeting of the Cheshire Education Authority at Crewe on 12th inst., it was decided to offer a series of University Scholarships. The chairman (Dr. Hodgson) said that they had been in communication with the authorities at McGill University, Montreal, and had arranged that Chester County and Technological Scholarships might be held for the whole or part of the three years for which they are awarded in the case of engineering students at McGill University. At that University they found there were 60 students coming out in the year, and over 400 applications from large employers of labour for these students who were leaving with the degree in engineering. There were immense openings in the Colonies for engineers with University training. He thought it would be a good thing for scholarship holders to spend two years at a British University and go to McGill University for the completion of their three years.—*Morning Post.*

Patent Litigation in America.—In view of the many electric engine-starting devices for use on motor-cars which have recently been brought out in the United States, it is perhaps not surprising to learn that patent litigation is being commenced. The Dayton Engineering Laboratories Co., of Dayton, O., the makers of the Delco starter, are the first in the field, they having just commenced an action against the North-East Electric Co., of Rochester, N.Y., for infringement of their patent.

Russian Railway Lighting Proposals.—H.M. Embassy at St. Petersburg reports that the Railway Department of the Russian Ministry for Ways of Communication is at present engaged on a scheme for the substitution of electric light for the lighting systems now used on the Russian State Railways. Foreign firms will be allowed to compete for this work, and United Kingdom firms desirous of putting in tenders should in the first instance formally notify the Minister for Ways of Communication of their desire, by means of a petition in the Russian language; it should be in duplicate and should specify previous contracts of a similar character which have been executed by the petitioners. The firm will then receive details of the requirements of the Russian Government.

Electro-Harmonic Societies.—There was a very large attendance at the first concert for the season of the Electro-Harmonic Society on Friday last; Mr. Frank Gill occupied the chair, and the entertainment was, as usual, thoroughly enjoyed. The next concert (ladies' night) will take place on November 17th.

The Manchester Electro-Harmonic society had a record attendance at its concert on the same evening, and several new members were enrolled. During the course of the evening a telegram of mutual congratulations was sent to the Electro-Harmonic Society, whose concert was in progress at the Holborn Restaurant in London. We are asked to assure members of the latter society that they will always be heartily welcomed at any of the Manchester Society's concerts.

Electricity for Lead Poisoning.—At the provincial meeting of the Royal Sanitary Institute at Newcastle on Saturday last, Mr. T. M. Clague, Ph.C., gave a demonstration of a new process of electrolytic treatment of lead poisoning, discovered by himself. It was found that by passing an electric current through the human body the lead could be extracted. Several manufacturers had put in installations, and as soon as an employé showed any signs of the poisoning he was treated. Very good medical results had been obtained, and considerable quantities of lead extracted from the men treated.

Company Secretary Fined.—According to a report in the *Times*, the secretary of the Patents Exploitation Trust, Ltd., was fined £4 and £1 costs at the Guildhall, for not calling a general meeting of the company once at least within a calendar year and not more than 15 months after the last annual meeting.

Lignite as Station Fuel.—It is announced that the Berlin Electricity Works Co. has now completed the purchase of the lignite mine of Golfra-Jessenitz, on which an option was secured several months ago. At the same time, the company in conjunction with a friendly syndicate has also obtained possession of a neighbouring mine—the Sachsenburg at Zschornewitz, near Bitterfeld. These mines are expected to render it possible to reduce the cost of production, and in the event of the renewal of the company's agreement with the Berlin municipal council the reduction in prime costs will enable Berlin consumers to be supplied at cheaper rates. The right of expropriation of the company's undertaking within the next two or three years is vested in the municipal council, although it is uncertain at present whether the right will or will not be exercised. Preliminary discussions on the matter have been proceeding between the company and the authorities for some time past, the former attaching considerable importance to the agreement being prolonged for a lengthy period. In the event, however, of the undertaking being transferred to the municipality in the course of the next few years, the company expects to utilise the lignite mines in connection with the generation of energy for supply to railways, large private consumers and existing electric supply works. The company already owns or controls, in association with a large manufacturing firm, several supply works outside Berlin, these having been acquired so as to ensure the continuation of activity in the supply department, even if the Berlin business should pass out of its possession.

The A.E.(S.)E.—The Assembly Room at the Crow's Nest Hotel, Newcastle-on-Tyne, was comfortably filled on Friday last on the occasion of the Association of Electrical (Station) Engineers' first smoking concert. The remarks made by the chairman (Mr. J. W. Lanham) and the local secretary (Mr. J. M. Fishley) in support of the Association were received with loud applause. A splendid programme was arranged and rendered from talent amongst the engineers. Owing to the success of the concert, the Committee is arranging for another in the near future.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. S. H. FOWLES, for two years mains assistant to Dewsbury Corporation, has obtained the post of mains superintendent of the southern district of the county borough of Stoke-on-Trent. MR. W. W. FIRTH, at present junior mains assistant to Dewsbury Corporation, has been appointed as successor to Mr. Fowles.

The Colne Electricity Sub-Committee has appointed MR. F. W. JENKINS, charge engineer of the Scottish Central Power Co., Bonnybridge, to the post of senior shift engineer.

General.—The staff of Messrs. Christy & Co., Ltd., of the Arc Works, Chelmsford, have presented a canteen of cutlery to MR. JULIAN A. R. PITTS, head of the order department, on the occasion of his marriage.

MR. F. CHARLES RAPHAEL, editor of *Electrical Engineering*, asks us to state that he is not the Mr. Raphael who supported the directors' policy at the meeting of Metalite, Ltd., reported in our last issue, nor is he in any way connected with that company; furthermore, neither he nor any of his relatives are in any way interested in any concern manufacturing electric lamps.

MR. W. H. MULHALL, who was formerly associated with Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston Works, as traction lamp expert, has been transferred to the Glasgow branch to handle their general electrical business in that district.

At the annual dinner of the National Association of Local Government Officers in London last Friday, MR. H. E. BLAIN, vice-president, was presented with a gold watch and chain and a silver tray in recognition of the part played by him in forming the Association.

MR. W. G. PAGE has joined the staff of the Safetee Controlling Appliances Co., Ltd., and is now travelling on their behalf.

MR. L. WEEKES, general manager of the British Electric Calibrated Fuse Co., has lately left England on the ss. *Virginian* for Montreal, from whence he will proceed right across country, calling at all the large towns *en route*.

The Manchester Education Committee on Monday approved the appointment of MR. ALLAN B. FIELD, M.I.E.E., chief designer of turbo-electric machinery to the Westinghouse Electric Co., Pittsburg, to the position of Professor of Mechanical Engineering at the Manchester School of Technology, in succession to the late Prof. J. T. Nicholson.

We regret to learn that Mrs. E. J. Smith, wife of MR. THOMAS ROBERT SMITH, engineer of the tramways and electricity department of the Leicester Corporation, passed away on Sunday in her forty-fourth year, after several months' illness.

The marriage took place at Lansdowne Baptist Church, Bournemouth, on October 15th, of MR. GEORGE A. PARRY, of Westbourne, son of Mr. Geo. Parry, of Croydon, and Miss M. Kitcher, daughter of Mr. Henry C. Kitcher, of Messrs. H. C. Kitcher & Sons, electricians, of Bournemouth.

MR. ARTHUR C. HEAP, of the firm of Heap & Digby, left London, on 18th inst., for the United States and Canada.

MR. ERNEST LAUBACH has resigned the position of manager of the Harland Engineering Co.'s Manchester office, in order to join Messrs. Siemens & Halske, in Berlin.

A marriage took place on Saturday, October 11th, between MR. H. GRANT, head of the accounts department of Messrs. Veritys, Ltd., London, and Miss Redwood, secretary to the managing director. The directors and staff presented Mr. and Mrs. Grant with a very handsome case of cutlery.

Obituary.—MR. A. W. KRAUSS, contractor, of Bristol, was killed in an accident to his motor-car, at Rio de Janeiro, last week. He was 40 years of age.

MR. ARTHUR CHAMBERLAIN.—We regret to record the death, which occurred on Sunday, at the age of 71 years, of Mr. Arthur Chamberlain, who was interested in Kynoch's, Ltd., Tubes, Ltd., Chamberlain & Hookham, and many other industrial concerns.

NEW COMPANIES REGISTERED.

Lighthouse Radiator Co., Ltd. (131,590).—This company was registered on October 14th, with a capital of £500 in £5 shares, to carry on the business of manufacturers of, and dealers in, apparatus and appliances used in connection with electricity, gas, petroleum or other power or spirit for the purpose of water heating or cooking, &c., and to adopt an agreement with E. A. Welch. The subscribers (with one share each) are:—W. Slater, Albion Hotel, Woking, hotel proprietor; S. H. Harper, Albion Hotel, Woking, hotel manager. Private company. The number of directors is not to be less than two or more than three; the first are W. Slater, F. C. Hunt and E. A. Welch; qualification, £20; remuneration (after first year) as fixed by the company. Registered by H. Hunt, 3, High Street, Woking.

Midland Fan Co., Ltd. (131,572).—This company was registered on October 13th, with a capital of £2,000 in £1 shares, to take over the business of a ventilating engineer carried on by H. Humphreys at 55, County Chambers, Birmingham, as the Midland Fan Co., and to carry on the business of engineers, designers, manufacturers and erectors of fans, blowers, exhausters and other ventilating appliances, &c. The subscribers (with one share each) are:—H. Humphreys, 55, County Chambers, Corporation Street, Birmingham, ventilating engineer; R. Parr, Drakeness Cottage, Hollywood, near Birmingham, agent. Private company. The number of directors is not to be less than two or more than four; the first are H. Humphreys and R. Parr (both permanent); qualification, £500; remuneration of H. Humphreys as manager, 20 per cent. of the net profits. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

Whitstable Electric Co., Ltd. (131,603).—This company was registered on October 14th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers of and dealers in electricity, motive power and light &c. The subscribers are:—E. A. Chell, 68, Ferndale Road, Herne Hill, S.E., managing director; Rodney Foundry Co., Ltd., 10 shares; A. R. Day, 42, Cromwell Road, Whitstable, managing director, Oxford Portable Hall Co., Ltd., 10 shares; G. W. Bisson, 76, Oxford street, Whitstable, fairman, 100 shares; F. Tyars, Gumshill, Whitstable, actor, 100 shares; Sir John H. Denham, Bt., "Goldsmiths," Whitstable, 100 shares; O. C. Wylson, "Beaconsfield," Tankerton, architect, 100 shares; J. W. Thwaites, Grange, Whitstable, gentleman, 200 shares. Minimum cash subscription, £100. The number of directors is not to be less than three or more than seven, the first are E. A. Chell, A. R. Day, G. W. Bisson, F. Tyars, Sir John H. Denham, Bt., and O. C. Wylson; qualification, £100; remuneration, £375 per annum and a percentage of the profits divided between them. Solicitor, G. Stanton, Whitstable. Registered by Waterlow Bros. & Layton, Ltd., Bircham Lane, E.C.

Central Wireless Co., Ltd. (131,661).—This company was registered on October 17th, with a capital of £1,000 in £1 shares, to establish and carry on in Birmingham or elsewhere schools for providing instruction in the science and practice of wireless radio-telegraphy, to deal in apparatus and instruments required in connection therewith. The subscribers (with one share each) are:—T. A. Graves, 10, Haven Green, Ealing, secretary; A. Drew, 1A, Ewhurst Road, Crofton Park, S.E., clerk. Private company. The first directors are Major C. P. Scudamore, L. J. Graham and J. McKeevor. Registered office, 45, Newhall Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £100 on July 18th, 1913, of charge dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed. (Notice filed October 13th.)

Newcastle-upon-Tyne Electric Supply Co., Ltd.—A memorandum of satisfaction in full on October 8th, 1913, of debs. dated October 24th, 1912, securing £250,000, has been filed.

Wellingborough Electric Supply Co., Ltd.—Particulars of debs. for an amount not exceeding one-half of the issued capital for the time being, created July 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Sunderland District Electric Tramways, Ltd.

MR. H. R. HOGG (chairman) presided on October 16th at Winchester House, E.C., over an extraordinary meeting of the preference and ordinary shareholders of the above company. At the preference shareholders' meeting the Chairman formally moved a resolution reducing the capital of the company, and it was carried without dissent. A similar resolution was carried at a meeting of the ordinary shareholders, and then at a combined meeting of the preference and ordinary shareholders the Chairman moved, and Mr. Taylor seconded, the following resolution:—

(1) That this meeting of ordinary shareholders hereby approves the proposed reduction of the capital of the company from £170,485 to £51,497 by the cancellation of the sum of 10s. per share upon each of the 95,495 preference shares of £1 each, and the sum of 19s. per share upon each of the 74,990 ordinary shares of £1 each. (2) That the rights of preference shareholders may be varied or modified in the following manner:—(*a*) That all arrears of dividend in respect of the preference shares be extinguished and cancelled. (*b*) That as and from the date of this resolution the preference shares be changed from cumulative shares to non-cumulative shares, entitled to a non-cumulative preferential dividend of 12 per cent. per annum.

The resolution was agreed to without any discussion.

Drake & Gorham, Ltd.

THE annual meeting was held at the offices in Westminster on October 16th.

MR. B. M. DRAKE, who presided, after moving the adoption of the report (see ELECTRICAL REVIEW, page 587), said that the year's profit of £10,268 compared with £9,021 and £7,184 for the two preceding years, so that there had been a steady improvement. As they were writing off the balance of the underwriting commission, viz., £4,000, this item in future would disappear from the balance sheet. It was proposed to pay a dividend of 5 per cent., as against 4½ per cent. for last year. During the year they had had their share of the better class of work, though some people seemed to think that electrical work, which requires a technical education and was full of pitfalls to the uninitiated, could be safely entrusted to plumbers and men of other trades. Unfortunately for the industry, no diploma or examination was at present necessary to qualify for electrical work, and the best protection for the public was to deal with old-established firms who had a reputation to maintain. Probably there was no branch of engineering in which a slightly higher price to cover the best work in the first instance proved a sounder investment in the long run. Electricity was a useful servant, but, like other servants, it required careful handling. Their Manchester office had done exceptionally well this year, and was busy with lighting and power work. Their Manchester managing director, Mr. George Hamilton, was elected M.P. for Altrincham, but he had agreed to remain on the board, and arrangements had been concluded by which he would continue to supervise the Manchester office. The chairman then gave a lengthy list of the year's *clientèle*, including H.R.H. the Prince of Wales (Tor Royal), the Duke of Westminster, the Earl

of Ellesmere, and many other distinguished people. Metal lamps had been still further improved during the year, and lamps of large candle-power were now ready for the market which used only half the energy of those commonly employed at present. In their wholesale business there was again a considerable increase. This section was conducted as a separate organisation, the controlling offices being situated at Felix Street, Westminster Bridge Road, adjoining the company's works. The ratio of profit made during the past two years had been maintained, and a slight reduction effected in the working expenses. The progress of the Liverpool business, which they purchased for the wholesale department, had more than answered their expectations. The turnover had largely increased, also the rate of profit. The consideration for goodwill to be satisfied from profits had nearly been met already, so that it was hoped that this branch would contribute to the next balance-sheet. A new catalogue embracing everything electrical was in course of preparation, and would shortly be issued to trade users. During the year the works, besides supplying their own requirements, had manufactured main switchboards for the Admiralty buildings, Home Office, Colonial Office, Marlborough House, and the British Museum, and had others in hand for Windsor Castle and the Natural History Museum. A number of the patent petrol gas machines had also been made. In conjunction with Colonel Holden a semi-automatic electric generating plant had been designed and was under test. It consisted of a self-contained set which after starting would run without attention till the battery was charged, when it automatically stopped. He considered this preferable to the all-automatic sets, for every plant required cleaning, refilling with fuel, and attention to the oil cups and brushes, and it entailed but little more trouble for the attendant to start the engine, after which he could leave it to itself. Also the restarting and stopping of the engine, while lights were in use, was apt to cause fluctuations and use current unnecessarily. Their arrangement had the merit of being less complicated and cheaper in first cost, and it could, in many cases, be added to existing plants. Long experience had shown that the only consistently reliable method of obtaining a steady light in country houses was the provision of an ample storage battery which was charged during the day. Although engines with a small battery and complicated apparatus might work well at first, there was always a day of reckoning, and this usually at an inconvenient time. When in America this year he was much impressed by the large number of commercial and pleasure vehicles propelled by electricity in the different cities visited, and as the information obtained showed that the cost per ton-mile was considerably less than for horse traction or petrol, this company had made arrangements to supply electric cars forthwith, which he hoped might soon develop into a large business.

The motion was seconded by Mr G. C. Hamilton, M.P., who briefly referred to the improvement that was taking place in country house installation business this year, and mentioned that he thought that there was a very good opening for electric vehicles here. He hoped that that branch of their business would soon develop into a remunerative one.

The report was adopted.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held at Newcastle-on-Tyne on 20th inst., Mr. James Falconer, M.P., chairman, presiding.

The Chairman said, in moving the adoption of the report (see Electrical Review, page 627), that the report of the year's working showed substantial progress, both in the development of the volume of business and also in the profits earned. He submitted statistics of the company's revenue from the year 1909 to 1913. These showed that in 1909 the revenue was £83,850; 1910, £105,576; 1911, £126,452; 1912, £120,145; 1913, £132,427. The costs for these years were: In 1909, £73,557; 1910, £86 632; 1911, £99,516; 1912, £85,449; 1913, £88,837. So that while the revenue had increased by £50 000, the costs had only gone up by about £15,000. In the same period the profits had increased from £10,293 to £43,590. At the present time they had contracts arranged which provided for additional horse-power, and this compared very favourably with their position at any previous meeting. One feature of these contracts was very gratifying, and that was that they had an important contract with the North-Eastern Railway Co. in connection with the electrification of a portion of their system, which was equal to about 20 miles of single line, and which was intended as a test of working the kind of traffic that the railway company had between Shildon and Newport. It was no secret that this might lead to further extensions of electrification and held out good prospects of business for the company in the future. Their finances as regards the debentures were now placed upon a sound and permanent footing. The position when they met last year was this: They had first debentures of £115,000, and they had second debentures of £225,000, all of them terminable at the end of last year. That had been so arranged to enable the company, after its business had developed, to make a more permanent arrangement on satisfactory terms. Well, after much negotiation, they had succeeded in making an arrangement with the second debenture-holders, under which the second debentures, amounting to £225,000, would be renewed over a period terminating in 1942. They had also arranged for an issue of first mortgage debentures, the total amount of which was £250,000, which were repayable over periods which terminated in 1935. Now, with regard to this £250,000, it was to be applied to the extent of £135,000 in paying off the existing first mortgage debentures of £115,000, and to the extent of £72,700 it was to be applied to the purpose of acquiring debentures up to the amount of £70,853 of the Parliamentary company with a view to consolidating these with the debentures of the limited company, and the balances, which would amount to £47,000, would be available for the purposes of the company in the future. They had asked for subscriptions for the £135,000, and he was glad to say they had been able to have the whole of that sum taken up. The net result of those operations was that they had arranged for the first and second debentures over a period which made their company financially secure and stable. The provision made for the repayment was that in 1919 a sinking fund of £10,000 per annum would be provided for the redemption of the debentures. The prospects of the company were such that before that time they would, he thought, be in a position to pay that £10,000 and fulfil all their obligations, and leave a very substantial margin for payment by way of dividend to their shareholders. They wished to change their financial year from ending on June 30th to ending on December 31st, so as to be in accord with the Parliamentary and the Northern Counties Co., and also so as to facilitate the task of drawing up the accounts. He thought this would be in the shareholders' interests, and what they proposed to do was to deal with the next six months, from June 30th, 1913, to December 31st, 1913, separately. They had had two special Acts of Parliament passed, one for the Parliamentary company and one for the Northern Counties company, with a view to giving them complete security for plant which belonged to them, and which might be erected on the premises of consumers.

Mr. Philip E. Noble seconded the adoption of the report.

Mr. Young, a shareholder, asked if the chairman could give any reason for the unsatisfactory position in which the company had been placed. He was told it was due in a great measure to the one-sided agreement which the directors had entered into, without the consent of the shareholders, with the Waste Heat Co., and he would like to know whether that was so.

Mr. Parsons also asked a question in regard to the Waste Heat Co. The report spoke of another project in waste heat being undertaken. Did that mean that the Power Co. were going to work it directly, or did it mean that it was going to be worked through the Waste Heat Co.? If the latter, why should they not work it directly?

The Chairman said the current they purchased from the Waste Heat Co. was, he believed, the cheapest supply of current which was to be found anywhere. They got from the Waste Heat Co. a supply of current on terms more favourable than they could get it elsewhere or generate it themselves. The advantageous character of this contract was shown by the fact that they supplied energy to the Durham and Newcastle Electric Companies—energy which they received through their contract and re-sold at a profit. No doubt the Waste Heat Co. had done well out of the arrangement, but then it was a great venture and a great enterprise to establish it. On the other hand, he had no doubt that they (the Power Co.) had done infinitely better than if they had had to supply energy themselves.

Mr. Gemmell said, in his opinion, the waste heat arrangement had been most ruinous to the ordinary shareholder. He also asked whether the board would take steps to ensure their auditors being the auditors of the three companies.

The Chairman having replied, the report was adopted, and a dividend on the preference shares at the rate of 4 per cent. was declared.

Marconi Wireless Telegraph Co. of Canada.

The report of the company for the year ended December 31st last, published in the *Financial Times*, states that under the new contract with the Canadian Government for the operation of wireless telegraph stations on the Great Lakes, four stations have been erected and placed in operation during the past year. One station is now being enlarged, and three other stations are to be built during the current year. The negotiations with the Newfoundland Government were brought to a satisfactory termination in December by completing a contract, which will continue the company's exclusive rights in Newfoundland until the year 1926. The number of steamers now operated by the company on its own behalf is 44, and, in addition, four steamers are operated on behalf of affiliated companies. As the old contracts for the equipment of steamships expire they are being replaced wherever possible by new standard contracts, by means of which better conditions are secured to the company. The standard ship contract is for a period of five years. The trans-Atlantic station at Glace Bay has been operated by the company on its own behalf throughout the year, and towards the end of the year the construction of the duplex receiving station at Louisburg and the construction of the six-wire pole line connecting that station with the transmitting station at Glace Bay were completed. The duplex system will be put into operation as soon as the corresponding station, now in course of construction at Clifden, Ireland, has been completed. A large sum of money has been invested in these undertakings, but it is confidently anticipated that the increased returns will not only fully warrant the expenditure, but will also assist in bringing much better returns on the total outlay at the Glace Bay station. The traffic receipts for the year have shown a satisfactory increase in all departments. The ship-to-shore station receipts totalled $52,300, as against $45,400 in 1911-12. The trans-Atlantic returns totalled $45,000, as against $27,700 in the previous year. During the recent session of Parliament the Canadian Government enacted a law making the wireless equipment of passenger vessels plying in Canadian waters compulsory.

Cape Electric Tramways, Ltd.

The directors' report for the year ending June 30th, 1913, states that the profit and loss account shows a profit of £80,978, and after providing for debenture interest, redemption of debentures, and taking into account the balance brought forward from last year, a net credit balance of £35,079 remains. From this sum the reserve fund has been credited with the sum of £8,000, leaving a balance of £27,079. The result of the operations for the past year shows a further increase in earnings on the figures of the previous year in both Cape Town and Port Elizabeth, and enables the directors to recommend a dividend of 5 per cent. free of income-tax on the ordinary share capital of the company. This will absorb £24,561, leaving £2,517 to be carried forward. During the past year the tramways in Cape Town carried 14,779,709 passengers, and the receipts amounted to £144,222, as against 13,733,656 passengers earning £135,369 for the year 1911-12. In Port Elizabeth 4,155,711 passengers were carried, earning £43,036, as against 3,747,913 passengers earning £39,823 for the year 1911-12. To meet the expansion of the traffic in Port Elizabeth, arrangements have been made to increase both rolling stock and power plant, and there is every indication of the continuance of the present satisfactory growth of the business at that port. Extracts from the reports of the general managers at Cape Town and Port Elizabeth for the year ending June 30th, 1913, are published by the directors, giving further details of the working of the undertakings. Towards the end of last year Mr. W. B. Rommel, the managing director, at the request of the board, paid an extended visit to both Cape Town and Port Elizabeth, which gave him the opportunity of discussing and arranging with the general managers on the spot many important details of the business, which it is believed will lead to further improved results in the future. The directors record the valuable services rendered by the local boards in Cape Town and Port Elizabeth, also by the general manager, Mr. J. A. Barkley, in Cape Town, the general manager, Mr. W. H. Freemantle, in Port Elizabeth, and the staffs under them.

The meeting is to be held at the London Wall Buildings, E.C., on November 5th.

Western Union Telegraph Co.—The report for the year ended June 30th states that the fiscal year will be changed to end on December 31st, and a full report will be submitted next April. In his present statement, president T. N. Vail says that the increase of $4,700,000 in gross earnings is satisfactory when due consideration is given to the general business conditions during the period under review. The principal increases in operating expenses were :—Reconstruction and depreciation, $1,652,800 ; improvements at offices and establishing new offices, $443,200 ; relief department and pensions, $124,300 ; proportion of messenger service (extending radii), $121,900 ; increase in wages, $2,488,000.—*Financial Times.*

Reduction of Capital.—The Traction and Power Securities Co., Ltd.—A petition for confirmation of reduction of capital from £2,000,000 to £1,829,180 has been presented. Particulars of claims, &c., must be sent by November 1st to R. B. Philpott, of Surtees, Philpotts & Co., 6, St. Helens Place, E.C., solicitors.

Otis Elevator Co., Ltd.—A petition for confirmation of reduction of capital from £200,000 to £68,190 has been presented. Particulars of claims, &c., must be sent by November 12th to Bristow's, Cooke & Carpmael, 1, Copthall Buildings, E.C., solicitors.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—The accounts for the year to June 30th show a gross income of $6,114,973, and operating expenses and taxes $2,963,180, leaving net earnings $3,151,792. A comparison of the gross income with the previous fiscal year shows an increase of $649,686, or 11·9 per cent., and the net earnings an increase of $329,393, or 11·6 per cent. The business of both divisions of the concern has shown a satisfactory growth, the sales of gas showing an increase of 6·9 per cent., and the sales of electricity an increase of 20·4 per cent., as compared with the previous fiscal year.—*Financier.*

Australia.—According to a Sydney newspaper, the Supreme Court at Perth has granted an order winding up the Cottesloe Electric Light Co., Ltd. The petitioning creditor said that the company was insolvent and unable to pay its debts, and that its assets, including book debts, were valued at £450.

United Electric Tramways Co., of Caracas, Ltd.—The net revenue account for the year to June 30th shows a disposable balance of £9,204, out of which the directors recommend the payment of a dividend for the year of 5 per cent. (less income-tax) on the share capital, which will absorb £8,500, leaving £704 to be carried forward.

Marconi's Wireless Telegraph Co., Ltd.—At an extraordinary general meeting held on Friday last, Mr. Marconi presiding, the resolutions already passed increasing the capital, were confirmed.

Brisbane Electric Tramways Investment Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum (4s. per share), free of income-tax, on the ordinary shares for the half-year ended June 30th.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1½ per cent. on the ordinary stock is announced

Continental.—Germany.—The Rhenisch Westfalische Electricitatswerke Gesellschaft, of Essen, is declaring a dividend of 8 per cent. for the last financial year, the same as for the preceding 12 months.

With a view of extending its plant the Liegnitz Electricitätswerke Gesellschaft, of Liegnitz, is increasing its capital from £100,000 to £115,000.

France.—La Société Electrique des Extensions Est de Meaux is the name of a new company which has lately been formed at Meaux (Seine-et-Marne) with a capital of £7,000 to establish a small electric lighting station.

A New Electrical Industrial Bank in Norway.—A new bank has recently been formed under the name of "Det Norske Aktieselskap for Elektroteknisk Industri, Norsk Industrihypothekbank," and entered in the register at Kristiania. The capital of the bank is £222,222, and it has been formed with the view of supporting the electrical industry in general by promoting new enterprises and assisting those that are already in existence and require support for increasing their activity and for extensions by means of loan on mortgage or by temporary loans, &c. It is reported that General-Director Eyde, the well-known engineer and founder of the Norwegian nitrate industry, is one of the promoters of the bank, which will start operations in the near future.

Sweden.—A new company has recently been formed at Stockholm by the A/B Stockholms Glödlampfabrik and the A/B Svensk Glödlampfabrik for the manufacture of tungsten wire according to a new patent which belongs to the former company. The capital of the new company is £2,100, and the rights of the above-mentioned patent have been transferred to the new company against a payment of £1,700 in shares to the vendors.

Switzerland.—The Aktien Gesellschaft Columbus für Elektrische Unternehmungen, with a capital of 25,000,000 fr., has been formed at Glaurus, for the financing and development of electric undertakings of all kinds, by itself or through others. The Brown, Boveri Co., of Baden, is represented on the directorate.

Monte Video Telephone Co., Ltd.—The directors report for the year ending July 31st last, states that after providing for all charges in Monte Video and London, the net profit for that period is £25,834, as against £25,120 for the previous year. The interim dividends paid on May 1st last absorbed £4,343, leaving a balance of £21,491 plus £4,315 brought forward, making an available balance of £25,806. After applying £8,500 to depreciation of the company's property and plant, and transferring £8,500 to reserve for renewals, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving a balance of £4,464 to be carried forward. The number of new subscribers during the year has again shown a moderate increase. The meeting will be held on October 29th at Winchester House, E.C.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Humphrey Pump Co., Ltd.—30,000 ordinary shares of £1 each, 10s. paid, Nos. 1 to 30,000; 100,000 ordinary shares of £1 each fully paid, Nos. 30,001 to 130,000; and 25,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 25,000.

And to allow the following to be quoted in the Official List :—

Mississippi River Power Co.—$16,000,000 common stock; $6,000,000 6 per cent. preferred stock; and $14,500,000 additional first mortgage 5 per cent. 40-year gold bonds.

Norwich Electric Tramways Co.—A financial daily states that the accounts for the year ended June 30th show a net profit, after providing for debenture interest, &c., and including £575 brought forward, of £10,561. The directors propose to transfer £2,500 to reserve (raising that fund to £15,179), and to pay a dividend of 3 per cent., leaving £141 to be carried forward.

British Coalite.—According to a financial daily, a scheme has been prepared for reorganising the capital of the British Coalite Co., Ltd., under which the £60,000 of first mortgage 5 per cent. debentures remain untouched, and £75,000 of second mortgage 6 per cent. debentures will be created, of which about £40,000 will be issued at once. The ordinary shares will be reduced from £721,081 to £103,858, and the deferred from £500,000 to £183,108.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 7 per cent. per annum for the six months ended June 30th last, payable on November 15th.

The number of units delivered to consumers during the four weeks ended September 26th, 1913, amounted to 1,361,378, compared with 1,258,799 units in the corresponding four weeks of 1912.

Metallic Seamless Tube Co., Ltd.—The directors' report for the year ended June 30th last states that the net profits were £5,764 plus £1,740 brought forward. A dividend of 20 per cent. is recommended, and £2,887 is carried forward.

Chloride Electrical Storage Co., Ltd.—The directors have declared an interim dividend of 5 per cent. actual, free of income-tax, on the ordinary shares.—*Financier.*

Hong-Kong Tramway Co.—Interim dividend at the rate of 5 per cent. per annum for the six months ended June 30th, 1913.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange surmounted the difficult settlement last week with more ease than was generally expected, and prices, in some cases, have shown a mild tendency to recover. There has been little enough check to the fall in the securities of the utility companies operating in Mexico and Brazil, some of the Canadian properties also joining in the weakness; but, on the other hand, the acute pressure to sell good stocks has been relaxed, and the retention of the Bank Rate at 5 per cent. was hailed as a sign that the monetary position might be regarded as somewhat easier.

Stock Exchange markets are moving in vicious circles. Of these, the one which will probably appeal most to those who read this column is the heavy depreciation that has taken place in stocks and shares of all kinds, which renders the investor either unwilling, or unable, to take advantage of the many opportunities for picking up quite attractive issues at the current quotations. To buy these it would be necessary in some cases for him to sell others, which stand so much below the original prices of purchase that the sacrifice seems not worth the making, because, manifestly, were general conditions to change, the values of his existing securities would move up with everything else. Thus, the exchange would be as broad as long, save that the innate dislike of selling anything at a very heavy loss practically forces him to forego the purchase of the stock that he would like to have.

It is a dismal thing to do, but it may serve a useful purpose if we set out the comparative prices of some of the Latin-Canadian descriptions which have had such severe falls during the past few weeks. To buy anything connected with Mexico or Brazil requires unusual courage at the present time; but, unless the skies fall, some of the bonds in the annexed list must be certainly bargains. Leaving shares out of account, we take bonds only, all of them bearing interest at 5 per cent., with the exception of the Mexico Tramways 50-year issue, which is a 6 per cent. security :—

Five Per Cent. Bonds.	Price Sept. 1st.	Present price.	Fall.	Yield. £ s. d
Mexican Light and Power First Mortgage..	92	86	6	5 16 3
Mexican Light and Power 50-year Mortgage	81	75	6	6 13 4
Mexican Electric Light First Mortgage ..	82	75	7	6 13 4
Mexico Tramways First Mortgage	91	85	6	5 17 8
Mexico Tramways 50-year Mortgage ..	94	93	1	6 9 0
Rio de Janeiro Tramway First Mortgage ..	107	100½	6½	4 19 6
Rio de Janeiro Tramway 50-year Mortgage	97	90½	6½	5 10 6
Monterey Railway, Light and Power First Mortgage	77	75	2	6 13 4
Pachuca Light and Power First Mortgage..	87½	80	7½	6 5 0

In each case quoted above, we have taken the top prices in the Stock Exchange Official List. Actually, the bonds can be obtained a point or two more cheaply, and when the dates of interest payment are also taken into account, the yield will, of course, be increased. It is easy enough to buy these securities, but they are not so readily saleable in several instances.

The news from Mexico is undoubtedly bad, and even if the difficulties were to be settled to-morrow, it would take the country a long time to recover from the effects of the revolution. It is the rate of exchange which provides a factor almost as disturbing as that of the political troubles themselves. Mexico Trams Common shares have fallen 6, the Preferred 7; Mexican Light and Power are down 5, the First Mortgage bonds a similar amount. Mexican Electric First Mortgage Debenture at 72½ is 6½ lower; all these changes have occurred since we wrote last week.

The Electrical Supply market is quietly dull. Falls have taken place in the Ordinary shares of the Westminster, St. James' and County of London Companies. County Preference are also ⅛ easier, and so are Charing Cross Preference. City "Lights" Preference hardened to 13 middle. Edmundson's Preference are ⅛ down. There should be little doubt but that the *Maison Electrique* at the Ideal Home Exhibition will prove an extremely effective advertisement to the smaller consumer. One of his objections, by the way, to electric light, as opposed to gas, is the cost of the lamps; and although the recent reductions in the prices of these mark a valuable step in the direction of attacting new customers, there can be little doubt that further economies in this direction would draw an ever-increasing army of consumers. In which connection may be noted with interest the latest invention for treating metal-filament lamps of which the filament is broken or the glass blackened. It is claimed that the lamps can be renewed at a price substantially below that charged for most of the existing makes.

The Home Railway market, after being heavy, hardened up on Tuesday. Metropolitans fell to 42¼, but recovered to its previous price of 44¼. Districts at 32¼ were ¾ lower, but they also rallied. No further changes have occurred in the Central London group. British Electric Traction 7 per cent. Preferred eased off to 50½. London and Suburban Preference shares and Debenture stock have both improved, and Potteries Ordinary hardened to 7s. 6d. middle.

The Telegraph market is idle. Great Northerns went back to 30, a fall of a sovereign; the other changes in the list are insignificant. Oriental Telephones recovered part of their fall of last week, and New York Telephone 4½ per cent. bonds rallied ¼. After its sharp drop, American Telephone and Telegraph capital stock steadied to 126: this represents a fall of a point on the week. Anglo-American Telegraphs are a little better. National Telephone Deferred moved up to 8⅛, and held its rise. Marconis have been a dull market, and with the recession in the Ordinary the prices of the subsidiaries are also lower. The report of the Canadian Marconi Company is disappointing to the many who had looked for some better sort of profit than $62 for the past financial year.

In the Manufacturing division, British Aluminium Ordinary continue to improve, and the price has risen ⅜ to 25s. British Insulated Cables eased off to 8⅜. Crompton Debentures have gained 2½. Rubber shares remain very dull, and the various kinds of remedies proposed to rehabilitate the price of the raw stuff, do not command a great deal of confidence in their being able to do more than palliate the existing condition of affairs. One of these days, of course, it will be right to buy rubber shares, but the time seems scarcely to have arrived even yet. Amongst metals, the price of copper rose sharply upon a strike breaking out on the Rio Tinto Mine; but this, though of somewhat large proportions, does not appear to be regarded seriously by those most interested in the copper share market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, October 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£24	..
a Lead, Nitrate	„	£30	..
a „ White Sugar	„	£27 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	100/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8d.	½d. dec.
c „ Tube (brazed)	„	10¾d.	½d. inc.
c „ „ (solid drawn) ..	„	10d.	½d. inc.
c „ Wire, basis	„	8⅛d.	¼d. dec.
c Copper Tubes (brazed)	„	1 3/8d.	⅜d. dec.
c „ „ (solid drawn) ..	„	11⅜d.	..
g „ Bars (best selected) ..	per ton	£91	..
g „ Sheet	„	£91	..
g „ Rod	„	£91	..
d „ (Electrolytic) Bars ..	„	£78 10	..
d „ „ Sheets ..	„	£96 10	..
d „ „ Rods ..	„	£84	..
d „ „ H.C. Wire	per lb.	10⅛d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	6/6 to 7/6	..
h India-rubber, Para fine	„	3/2	2d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	52/1½	1/1½ dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 15	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£188 to £189	..
n „ Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals ..	per ton	£44 to £206	dec.
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 10	£1 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913a.	Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8¾ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	5	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref	5	4½	4½	4 — 4½	— ⅛	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 3⅞	— ⅛	5 16 2
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	15⅜ — 16⅜	..	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	+ ½	4 8 11
Do. 5 % Deb.	Stock	5	5	115 — 119	..	4 4 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11½ — 12	— ½	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½—104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4½	..	8 6 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	— ⅛	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 88	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	..	7⅝ — 8⅛ xd	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	5	2½	..	1½ — 1⅝	..	4 12 7
Do. 6 % Pref	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 8
Metropolitan	5	4	4†	8⅜ — 8⅞	..	5 3 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4⅞	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102 xd	..	4 18
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10¾	..	5 11 7
Oxford	5	7	6†	5⅞ — 6⅛	..	5 9 10
St. James' and Pall Mall, Ord. ..	5	10	10†	8¼ — 8½	— ¼	5 8 1
Do. 7 % Pref	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 86½	..	4 1 10
South London, Ord.	4	5½	..	2⅜ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 . 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 5/16 — 1 7/16	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	88 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	— ⅛	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4⅝ — 6⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913a.	Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	5½	..	7½ — 7¾	..	5 9 8
Do 5 % Pref.	5	5	5	5 — 5¼	+ ⅛	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	105 —110	—5	6 7 3
Do. 7 % Pref.	$100	7	7	117 — 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 11/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	5	90½ — 92½	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	⅛ — ⅜ xd	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El Lt., 5 % 1st M. Bds.		5	5	70 — 75	—6½	6 13 4
Mexican Lt. & Power, Common	$100	4	4	55 — 60 xd	— 4	6 13 4
Do. 7 % Cum. Pref.	$100	7	7	80 — 94 xd	—1½	7 8 11
Do. 5 % 1st Mort. Gold Bds.		5	5	82 — 86	—5	5 16 3
Do. 5 % 2nd Mort. Bonds ..	100	5	5	71 — 75	—3	6 13 4
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	72 — 75	- 1	6 13 4
Montreal, Lt., H. and Power ..	$100	9	10†	210 —220	—7	4 10 11
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	5½	6†	130 —135 xd	—3	4 8 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100⅛ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	⅝ — 11/16	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	5	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913a.	Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Amazon Telegraph	10	4½	..	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	125 —127	—1	6 8 0
Do. Collat. Trust	$100	4	4	92 — 94	..	4 5 1
Anglo-American Telegraph ..	Stock	3	3	62 — 65 xd	+ ⅜	4 12 4
Do. 6 % Pref.	Do.	6	6	104½—105½ xd	+ ½	5 14 0
Do. Def.	Do.	30/-	..	23½ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	3	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	..	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9½ xd	+ ½	6 9 9
Do. 10 % Pref.	10	10	10	14¾ — 15½ xd	+ ⅜	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127 —130 xd	..	5 7 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75— 77 xd	..	4 10 11
Do 4 % Mort. Deb.	Do.	4	4	96½— 98½	..	4 1 8
Eastern Extension	10	7	7	12¼— 12¾ xd	— ¼	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
East and S. Africa Tel. 4 % Mt. Db Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11⅞ — 12⅛	..	4 17 0
Great Northern Telegraph ..	10	20	5†	29 — 31	—1	6 9 0
Indo European Telegraph ..	25	13	..	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	3¾ — 3⅞	— 1/16	5 8 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	8⅜ — 8½	..	5 4 7
Monte Video Telephone, Ord. ..	1	6	5	1⅜ — 1 5/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98¾ — 99½	+ ½	4 10 3
Oriental Telep. and Elec. ..	1	10	..	1⅜ — 1 7/16	— 1/32	5 1 7
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9⅝ — 10⅛	..	9 17 6
Submarine Cables Trust	Cert.	6	6	121 —124 xd	..	4 16 9
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅛ — 2⅜	..	4 11 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10⅛	..	5 18 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 9¾	..	6 3 1
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 13½	..	5 5 3
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	93 — 95 xd	..	4 14 0

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	5/32 — 6/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12½ — 14½	..	..
Do. Do. Deferred	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	49 — 52	—1	5 15 5
Do. 5 % Perp. Deb.	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	6	6†	1/2 — 3/4	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 5/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	1/4 — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	+ 1/32	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	78½ — 81½	+4½	5 10 5
London Elec. Railways, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol.	100	1⅝	1¼†	44 — 44½	..	3 13 0
Do. Surplus Lands	100	2¾	2¾†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	84 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan District Ord.	100	Nil	..	33 — 33½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	+ 3/32	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	110 —113	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding). Ord.	5	Nil	..	1/4 — 1/2	..	Nil
Do. 6 % Pref.	5	3	1½†	8 3/8 — 8 7/8	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 1/16 — 4 5/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/8 — 4 5/8	..	5 18 11
Do. 4 % Deb.	100	4	4	91 — 93	— ½	4 6 0
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do 5 % Deb.	100	5	5	99½ — 100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 — 102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	—1	6 13 4
Brisbane Trams Invt., Ord.	5	8	8†	7¼ — 7¾	+ ⅛	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅓	+ ¼	4 10 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	121 —124	..	6 9 1
Do. Pref. Ord.	100	6	6	109 —113	..	5 6 2
Do. 5 % Pref	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100 xd	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con Deb.	100	4½	4½	89 — 92	..	4 12 5
Calcutta Trams, Ord.	5	7½	6†	6 — 6½ xd	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	+ ⅛	4 15 3
Do. 4½ % Deb	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1/4 — 13/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 13 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	18 — 28	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4⅜d.	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$100	5	5	97 — 99	..	5 1 0
Mexico Trams Com	$100	7	7	81 — 84	—6	8 6 8
Do. Gen. Con. 5 % Bonds	..	5	5	82 — 85	—7	5 17 8
Do. 6 % Bonds	100	6	6	89 — 92	—2½	6 10 5
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅞ — 6¼	— ⅛	8 2 8
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	—1½	5 1 0
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ — 100½	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	83½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$100	5	5	100 —103	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5¼	+ ¼	6 13 4
Do. 6 % Pref.	5	6	6	4 7/8 — 5⅛	+ 1/16	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	25/32 — 27/32	..	7 13 4
Babcock & Wilcox	1	16	..	2 1/16 — 3 1/16 xd	..	5 1 2
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 5/16	+ 1/16	..
Do. 6 % Cum. Pref.	1	6	6	15/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½ — 87½	+ ½	5 14 3
B.I. & Helsby Cables	5	10	..	8⅛ — 8⅝	— ⅛	5 15 11
Do. Pref.	5	6	6	6 — 6⅓	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	— ¾	4 14 9
British Westinghouse, Pref.	3	Nil	..	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75⅓	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35⅓ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	..	11 — 11¾	..	6 7 8
Do. Pref.	5	5	5	5 — 5¼	+ ⅛	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	.	3 3/16 — 3 5/16	..	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	57 — 62	+2½	8 1 4
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 27/32 xd	..	7 2 2
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/8	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9½ — 10¼	..	5 14 3
Do. Deb.	100	4	4	88 — 93	+1	4 6 0
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13½ — 14¼	..	5 5 3
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 1 9
Telegraph Construction	12	20	5†	37 — 39	..	6 1
Do. Deb.	100	4	4	96 — 98	..	4 — 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1913.

Compared with the preceding month, the electrical export and import business during September showed a considerable improvement. The exports reached a total value of £445,155, inclusive of £69 830 worth of telegraphic material and cable, these figures comparing with £434,226 and £65,429 respectively in August.

The imports for September were valued at £252 741, as compared with £216.301 in the preceding month, and the re-exports, at £30.610, were some £13,000 in advance of the August total.

The exports of electrical machinery showed a gratifying improvement during the month, which was shared by most of the sections, and only, to some extent, marred by a drop of nearly £20.000 in the value of cable exports.

A general increase in values is noticeable in the imports sections of the table; indeed, the glow lamp total shows an increase from £7.600 in August to £14,196 in September.

India and our Australasian Colonies were excellent customers, as usual, but, for some unaccountable reason, Argentinean business, as shown in our returns, dropped to insignificant proportions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway, Denmark and Danish West Indies	1,082	229	94	160	2,189	429	8,630	169	650	133	168	18,153	32,086
Germany	3,418	1,264	186	47	694	45	3,945	32	107	98	146	1,191	11,171
Netherlands, Java and Dutch Indies ...	2,293	1,260	338	...	163	34	1.042	...	204	38	...	303	5,675
Belgium	603	867	45	19	114	32	1,881	...	96	42	1,879	...	5.578
France	4,348	32	840	14	...	192	4,426	104	27	46	51	45	10,125
Portugal	304	380	...	...	...	6	50	...	22	8	300	735	1.805
Spain, Canary Isles and Spanish N. Africa...	362	...	10	...	87	14	2,709	30	...	6	172	1.595	5.045
Switzerland, Italy and Austria-Hungary ...	719	435	972	36	...	10	1,565	302	...	437	31	2,199	6,706
Greece, Roumania and Turkey	171	26	146	24	20	...	657	1.142	21	...	3,600	458	6.265
Channel Isles, Gibraltar, Malta and Cyprus...	109	11	18	12	...	...	129	...	29	...	...	15.440	15,748
U.S.A., Philippines and Cuba	102	61	81	112	...	161	29,536	...	...	...	...	14	30 067
Canada and Newfoundland	1,763	3,995	193	492	15	237	6.662	124	580	13	1,730	7,408	23 212
British West Indies and British Guiana ...	201	18	94	94	...	...	...	6	29	...	111	27	580
Mexico and Central America	258	545	20	29	...	...	321	255	...	11	5	87	1,531
Peru and Uruguay	102	...	23	10	...	432	2,005	4	1,481	...	...	278	4.330
Chile	361	112	256	94	...	196	2,476	18	144	...	74	70	3,801
Brazil	1,134	777	359	559	...	273	2,253	3.437	427	23	5,007	3,330	17,579
Argentina	37	...	...	...	...	...	25	...	...	...	9	64	135
Colombia, Venezuela, Ecuador and Bolivia...	252	...	3	67	...	...	345	...	...	...	...	...	667
Egypt, North Africa and Persia	953	319	98	28	...	4	2,010	...	158	12	96	884	4.562
British West Africa	252	772	...	86	...	102	436	158	19	...	86	71	1,982
Rhodesia, O.R.C. and Transvaal	3.216	168	242	459	...	...	1.250	...	71	...	35	10	5,451
Cape of Good Hope	1 107	1,766	545	387	9	590	2,038	28	2,110	17	648	686	9,902
Natal	1,153	4,406	223	359	33	123	3,932	176	40	...	54	478	10.977
Zanzibar, Brit. E. Africa, Mauritius & Aden	224	393	65	122	...	28	119	6	167	...	51	257	1,432
Azores, Madeira and Portuguese Africa ...	192	259	82	51	16	2	460	...	6	10	...	765	1,843
French African Colonies and Madagascar ...	...	...	12	...	...	...	...	...	...	...	...	11	23
China and Siam	1,773	347	440	433	55	1.518	5.965	141	77	291	3,568	1.659	16 267
Japan and Korea	496	63	192	53	...	551	10,604	6,304	3,632	30	3,036	238	25,201
India	4,591	7,580	882	3,249	129	1,557	37 432	3.943	4,935	108	1,227	817	66.450
Ceylon	295	646	114	235	...	...	210	95	136	...	823	622	3,176
Straits Settlements, Fed. Malay States, British North Borneo and Sarawak ...	1,157	213	399	20	62	32	6.303	284	289	...	1,295	662	10,716
Hong Kong	1,042	471	8	196	...	211	1,824	141	61	35	4	71	4,064
West Australia	267	550	46	768	13	452	395	...	15	9	697	1,998	5,210
South Australia	123	4,075	60	239	...	24	1,022	...	351	12	31	2,631	8,568
Victoria	3,610	3,822	659	1,765	282	680	3,354	120	239	3	1,670	1,376	17.577
New South Wales	1,206	16,548	614	1,579	253	1,770	6,625	1,111	1,212	184	2,112	4,458	37.672
Queensland	419	54	49	81	...	...	1,290	...	172	...	3,547	...	5,612
Tasmania	134	107	...	56	...	...	178	...	1,074	...	100	...	1,646
New Zealand and Fiji Islands	1,629	2,755	827	616	99	389	7,453	538	487	71	9,086	768	24,718
Total, £	41,458	55,323	9,235	12,551	4,233	10,094	161,607	18,670	19,068	1,637	41,449	69,830	445,155

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	11	...	...	170	...	...	6,215	170	835	...	8.618	16,019
Germany	5,708	30,162	2,033	11,123	10,177	2,332	51,275	1,270	6,782	8,138	4,908	133,908
Holland	...	47	10	1,068	1,100	19	54	...	...	...	30	2.328
Belgium	611	1,566	828	101	113	...	3 798	...	295	...	13,082	20.394
France	93	2,440	177	1,229	163	1,280	363	4	351	4,609	1,140	11.849
Switzerland	226	944	9	...	...	347	2,053	...	...	64	26	3.669
Italy	...	4,448	...	...	103	...	35	...	...	5	...	4,591
Austria-Hungary	4	253	...	459	20	14	63	...	157	120	...	1,848
United States	7,857	2,744	694	46	727	186	15.460	25.312	497	2.130	2,232	57.885
Total, £	14,510	42,604	3,751	14,196	12,591	4,178	79,880	26,756	6,917	15,066	30,036	252,491

Additional imports: Spain, carbons £99; Canada, electrical goods £151.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,626	629	...	10,822	255	...	6,004	...	308	644	322	30,610

Total Exports: £445,155. Total Re-Exports: £30,610. Total Imports: £252,741.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ON CORROSION ON TRAMWAY POLES AND ITS ARREST.

By A. J. BOUSFIELD, A.M.I.Mech.E.

A Protective Coating for Corroded Tramway Poles.

The exposed situation of tramway poles, and the unmechanical lines of their structure—due to the fact that for æsthetic reasons no struts or stays can be fixed—necessitates more than usual attention being paid to their condition so that their strength may not be depreciated by corrosion.

The worst type of corrosion is seen as pitting in the form of "rust cones," which is much more dangerous than an equal amount of simple corrosion distributed uniformly over the surface of the steel.

In order to decide what form of protection to use against this evil, we must understand the cause of the formation of these rust cones, for paints which when properly applied and maintained will prevent simple corrosion, will not stop the continued growth of rust cones when once they make their appearance.

Simple corrosion is due to the action of three elements in the atmosphere, viz., moisture, carbon dioxide and oxygen acting and re-acting on the iron, first forming ferric carbonate, and ultimately ferric oxides and hydrates.

Rust cones are apparently caused by electrolytic action, and the necessary condition is a particle of mill scale, rust or other foreign body, such as metallic lead or copper, on the surface of the steel, and moisture.

The steel, the foreign body and the moisture make a tiny galvanic cell, water is decomposed, the oxygen combining with the iron to form rust, and the hydrogen is liberated, pushing the paint up in the form of a blister. The rust so formed seems to gather over and around the foreign body, which clings to the surface of the iron, moving inwards as the electrolytic action removes more iron. The result is a cone of rust pointing inwards and having the foreign body for apex.

Now this foreign body, which is the cause of all the trouble, is very difficult to remove; it may be only the size of a pinhead, and is deep in the depression left by the rust cone. The wire brush and scraper most probably leave it untouched, no matter how careful the inspection may be. With our climate there will often be quite enough moisture retained in the conical recess to start the cycle over again after the pole has been repainted.

In this connection it may be noted that, as the sun goes down, iron cools far more quickly than the air, and in so doing moisture is deposited and forms a layer between the iron and any paint which is being applied. This fact, and the varying temperature of air between one day and the next, and between morning and evening, is one of the reasons why we may get such different results when using the same paint under apparently similar conditions.

The writer has tried many and varied paints and preservatives for tramway poles, including :—

1. Lead paints mixed with boiled oil and turps.
2. Zinc oxide mixed with boiled oil and turps.
3. Patent paints having a secret basis and oil vehicle.
4. Patent paints having oil and varnish vehicle.
5. Bituminous paints.
6. Cement coating bound and waterproofed with a coat of oil paint.

Lead paint, of course, is a very poor coating for steel, especially near the coast, and its use is often the original cause of rust cones, chloride of lead being formed from the chlorine in the atmosphere, and eventually metallic lead separating out, after which electrolytic action ensues with the formation of rust cones.

Zinc oxide was tried with the idea that, zinc being highly electropositive, any electrolytic action taking place would be at the expense of the coating and not of the steel, but it was found that this coating did not wear well, zinc oxide not possessing the property of combining intimately with the binding vehicle, which soon dried out, the oxide then wearing away as a powder. Many kinds of patent paints claiming to be indestructible were tried with varying results, but no paint which was tried stopped the "rust cone" trouble.

A paint that was tried, having a tar or bituminous basis, was unsatisfactory owing to acid being present in its composition; a really pure bituminous paint gave very good results, but could not be used as it could not be painted over with a coloured paint, black being objected to by the local authorities.

An experiment was then tried with a cement coating; Portland cement was mixed with water to the consistency of fresh cream, and applied to the pole surface with a grass brush, and a second coat two or three days after the first, so as to ensure that no part of the pole remained uncovered. After a lapse of three or four days, when the cement was quite dry, the poles were painted with a good moisture-proof paint, two coats at a suitable interval being applied. The first coat was almost entirely absorbed by "suction;" the cement in drying absorbed all the moisture on the surface of the pole, and the paint rendered the cement waterproof. Experience showed that all electrolytic action had ceased, no sign of rust of any moment being observed over a long period, where, previous to this treatment, corrosion was excessive and continuous. The poles require painting at the ordinary intervals in order to keep the cement dry and firm.

This treatment is recommended to tramway engineers afflicted with the rust cone trouble on their tramway poles as an efficient—if rough and ready—cure.

REVIEWS.

Die Telephonie ohne Draht. By Dr. K. Markau. Brunswick: Fried. Vieweg & Sohn. Price 4 M. 50 pf.

In this small volume a concise but clear discussion of the subject of wireless telephony as at present understood is given. No attempt to give the fundamental theory of electromagnetic waves is made, but taking this for granted, the treatment and language are simple and easily understood even by the non-mathematical reader.

The earlier attempts at speech transmission without connecting wires are first described, including Preece's magnetic induction telephony and telephony by means of the "speaking arc" and selenium cell. Then the various modern electromagnetic wave systems are discussed and compared. These include the high-frequency arc systems of Poulsen, the Telefunken Co., Majorana, De Forest, &c., the shock excitation systems of Wien and Lorenz, and the high-frequency alternator systems of Fessenden and Goldschmidt.

The last chapter is devoted to a useful detailed description of some of the auxiliary apparatus used in wireless works, such as variable condensers, variable inductances and the different forms of detectors.

Hand-Book of Structural Steelwork. Calculated and compiled by the Technical Staff of Messrs. Redpath, Brown and Co., Ltd.

This is a new and enlarged edition of the Hand-book of Structural Steelwork which this firm have now issued for some years. It contains about 550 pages of steelwork data, most of which it would be difficult to find in such a useful form elsewhere. The book is divided into six parts, and as far as possible all the particulars relating to that class of work are placed together.

Thus, Part I deals with girders, and gives a number of tables detailing weights and safe loads for different spans for both simple and compound girders, as well as information about steel joists embedded in concrete. Part II is devoted to stanchions, the safe loads for various sizes having all been worked out in accordance with Moncrieff's formulæ. These formulæ are based on a very complete investigation of the strength of steel columns, and are finding much favour amongst practical steel structure designers. A useful application of the Moncrieff formulæ for stanchions having both ends flat is given in the form of two vertical alignment

charts on pages 200 and 201, which should prove very useful.

Part III is devoted to roofs, and contains much information as to stresses, wind pressure, and roof coverings. On page 227, an interesting alignment chart on the same principle as those already referred to is given for ascertaining the normal wind pressure acting on a roof for a given horizontal pressure and inclination of roof, this chart being based on Duchenist's formulæ.

Part IV explains the main principles underlying steel structural work. The language used is lucid, and it should prove of great service for office reference. The tables are very full, and a separate section gives complete mathematical tables, including logarithms, antilogarithms, sines, cosines, tangents, fractional parts, &c.

Part V is largely devoted to dimensions of steel joists, angles and tees, and gives a number of perspective drawings of end angles and fishplates, stanchion caps and bases, &c., which should be of real service.

Part VI, which for distinguishing purposes is printed in green ink, gives extracts from the London County Council (General Powers) Act of 1909, and shows how these affect the safe loads and other details given in the earlier sections.

The book is well arranged, and the repetition of important notes at the foot of each table is a good feature. It should prove of great use to steel-work designers, and inasmuch as the cost of steel-work is largely influenced by the wise use of standard sections, the general public should indirectly gain from its preparation and publication.

Oil. By W. Antrobus. Manchester: John Heywood Ltd. Price 3s. 6d., post paid.

This little book is written very much in the tone of an eighteenth-century controversy, and the language might be better chosen. What, for example, are we to make of the statement that the principal object of this work is to "make it commercially possible to produce, in considerable abundance, ample motor fuels in the United Kingdom, to make us absolutely independent of any importations whatever"? We quite fail to see how a little bit of a book can do this. From another prefatorial paragraph it would appear that the book is full of useful information in a condensed form; but this information largely takes the shape of interjaculatory jottings, for it is too inconsequential. The preface commences in a way leading to the impression that oil is to wipe out coal, but in Chapter II the author has apparently found out that King Coal is still a merry old soul, and that oil at best is but the fuel for the special occasion, and more particularly so when the occasion is brief. The only serious books on oil fuel were written before oil had reached half its present prices, and in one at least the author saw deeply enough into the relation of oil to coal to prescribe a limit to the use of the fuel he was describing, which was found to exist in such a relatively small quantity.

Later, attention is drawn to the Scotch shale oil, Kimmeridge clays and other lias (*sic*) formations. And what may be vegetable limestone? Thus we might continue carping at the book, which is put together in too much of a hodge-podge to be so useful as the author expects. Before the book is finished the author fairly gives up the idea that there is so much oil in the world, and his book leaves us unconvinced as to its having accomplished what it set out to do. Chapter VIII is headed: How to Solve the Oil Difficulty, by using not coal but other materials equally abundant and as widely distributed and more easy to get.

We are then introduced to "The System," which is held up to our eyes as the solution. Its possibilities are varied and far-reaching: it will prolong our coal supplies 100 years: it reduces economies to an irreducible minimum (this looks bad, but is probably meant to mean something different): the system is Nature's system minus the waste and prodigality of Nature. There appear to be certain raw materials hovering in the background and only waiting a call to distribute blessings on us all. And thus the book continues, while "The System" still remains elusive. This manner of writing of wonders which are not brought upon the stage is truly reminiscent of Dickens, whose characters were often wont to converse on unspeakable subjects behind a veil of words in which the object was dimly pictured, yet never named. And so we reach the end of the book, and know not what lean fuel formations are those which are to make of "the system" such a world-stirring success. We judge that peat is one of the lean fuels. What may be others we fail to gather. But we should like to say that if the Navy is to rely much on liquid fuel, our coal supplies are the source whence this fuel is likely to be derived if the overseas supply is cut off. Indeed, any serious justification for the use of liquid fuel in the Navy lies in the ability to use our native solid fuels from which to obtain liquid hydrocarbons, if ever they are necessary.

SUB-STATIONS.

By W. E. H.

The word "Sub-Station" seems to carry with it the idea of roominess, and a place in which safety is made the first consideration; such, however, is far from being the case. Many networks exist on which sub-stations were planned years ago, which were then supposed to be excellent things of their kind; others have been built in the same areas of recent years, but show little or no improvement. The aim of the persons responsible for these designs seems to have been to pay out as little as possible for the construction of what is the most important place outside the central station for ensuring continuity of supply, which ought to be of sufficient size to render the handling of any pressure perfectly safe; this, however, is generally overlooked.

In most central stations one sees the greatest care exercised. Assistants are protected against contact with live parts. Switchboards are made of well-seasoned teak, have thick rubber mats, and specially designed floors of glass, and there is no metal work within yards of anything alive; yet the same job will have sub-stations that do not afford the room to house satisfactorily a brood of chickens, and the engineer will consider he has got a first-class job, free from danger, being quite of the opinion that it is impossible to get a shock, however slight.

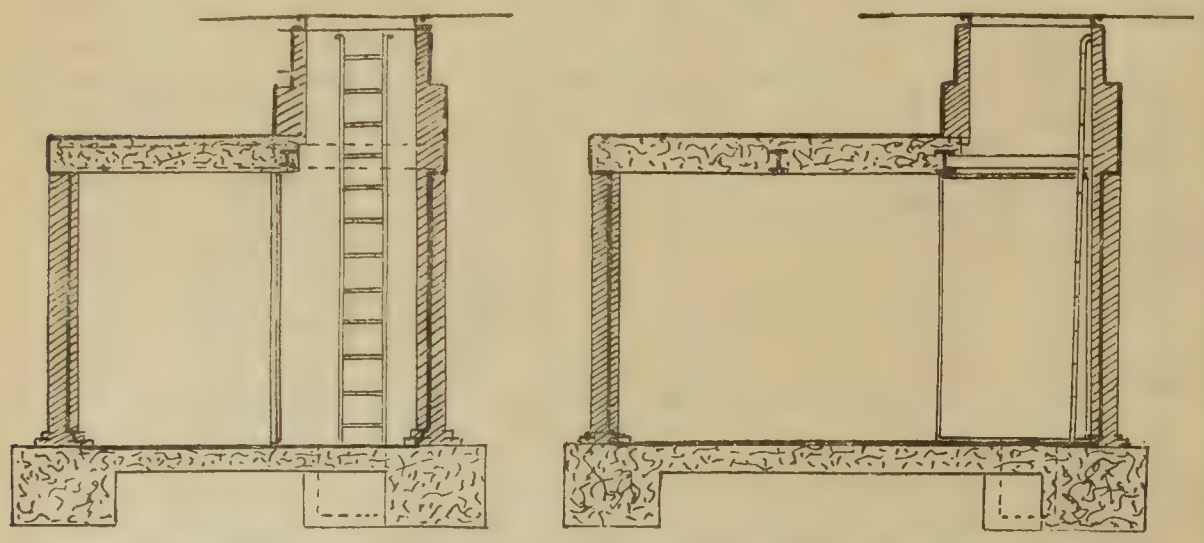
A certain system was laid down a few years ago, the usual care being taken at the works, but when the underground sub-stations were designed it was thought sufficient that they should be 9 ft. × 8 ft., with head room 6 ft. 6 in. The opening or entrance way came into the corner or centre at the side, and was about 3 ft. 9 in. square; into these sub-stations were crowded two transformers, the sizes being about 3 ft. 6 in. × 3 ft. × 4 ft. high, with two high-tension switches and two low-tension boards, which had to take four concentric distributors. However one tried to sort out and arrange the above, the fact remained that the person handling the gear was always in contact with metal cases. A carefully-laid wood floor and a plentiful supply of rubber were of no great account if one's gloves were faulty. The temperature in these sub-stations was always above 100° F.

The writer will not attempt to describe the switchgear, beyond saying that it was considered perfect. It was, however, scrapped on the incoming of a new engineer, and gear was installed in keeping with safety. Other sub-stations are at work where the area does not exceed 50 sq. ft., and in these pits are placed two transformers with the necessary switchgear. No attention whatever could have been paid to the construction; the work is poor and the materials used in the roof are very bad indeed. After every shower of rain the station resembles a shower-bath, making it unsafe to handle any gear; even in dry weather there is considerable moisture, owing to the naturally damp ground. No asphalting or water-proofing was thought necessary during construction. The above-mentioned chambers were designed during the last 12 years, after previous experience had been gained in such death-traps. The original chambers were so constructed that the attendant in charge had to enter by way of an iron ladder, passing close to the transformer, and from the ladder the high-tension switch fuse could be operated. Needless to say, trouble overtook such methods, and a separate entrance was provided. The improved sub-stations still have high-tension switch fuseboards designed over 20 years ago,

and the blowing of a fuse invariably results in setting up an arc, which does its share of damage.

These sub-stations are now undergoing a transformation, and it is to be hoped that room will be found for gear adequately to protect the persons engaged therein.

Some of the fool-proof switches designed as recently as 10 years ago were of a type that was capable of doing great bodily harm; one in particular was so constructed that the glass-panelled door of the front cover could not be opened when the switch handle was at the "on" position, a very wise precaution. The handle for operating the switch was placed on the underside in the centre, and so arranged that the case was gas-tight. To operate the handle, however, it was, in consequence of the confined space, almost necessary to stand in front of the glass panel. The fuses, also inside the case, were of the cartridge type, with fibre body and brass contact pieces. On one occasion the writer was in a sub-station equipped with this class of switch, when the assistant in charge on closing the switch was almost carried off his feet by an explosion which blew out the glass front.



Longitudinal and Transverse Sectional Elevations of Sub-station.

On another occasion a similar explosion occurred; this time an arc was set up which destroyed the switch and some feet of the cable leading to the transformer, and was only stopped by switching off the feeder at the central station. A third explosion resulted in blowing out the front of the switch, and one of the fuse caps was carried across the station with such force as to crack the porcelain tiling of the sub-station; fortunately for the assistant, he stood slightly to one side before operating. After the above accidents, and as a precaution against further trouble, the glass fronts were removed, the bomb-like fuses were abolished and ordinary copper fuse wire was substituted.

The cost of a sub-station thoroughly well built and provided with a separate entrance chamber, and having a floor space of 90 sq. ft., with a clear head-room of 7 ft. 6 in., constructed of 9-in. brickwork with concrete roof, lined with two layers of asphalt, finished off with 4½-in. glazed brickwork, and fitted with ventilating shafts, ventilating frame and cover, with earth-plate and earth strip on three sides of the chamber, would be about £250 in London.

This size of sub-station allows of four 100-kw. transformers of the Berry type being placed at one end; thus the whole wall space of the two sides is available for high and low-tension switchgear. This station gives ample room for switch gear sufficient to control six or eight high-tension circuits feeding a set of insulated bus-bars, besides transformer switchgear. The opposite wall, on which are mounted the low-tension switches, is capable of accommodating up to 14 sets of double-pole controlled distributors and four sets of transformer switches.

The whole, when complete, makes a very neat job, and is suitable for a network where lighting is the principal load.

Lamp Litigation.—Having been asked for the name of their solicitors with a view to infringement proceedings, Messrs. Pope's Electric Lamp Co. announce that they give their clients their absolute assurance that their indemnity holds good against all risk of action and damages.

THE BRITISH ASSOCIATION.—VI.

The Electric Arc as a Standard of Light.

By J. F. Forrest, B.Sc.

(*Section A. Abstract.*)

M. Blondel and others have investigated the suitability or otherwise of the intrinsic brilliancy of the crater of the electric arc as a standard of light. The conclusions arrived at by these experimenters may briefly be given as the basis on which the author's work has been built.

M. Violle suggested that the light was independent of the current and arc length. M. Blondel confirmed this, but came to the conclusion that the light was affected by the presence of impurities in the carbon. The carbons used by M. Blondel were, however, of a kind which would not, at the present day, be considered good varieties, their ash amounting to as much as 2 per cent.

Mr. Trotter noticed that the crater of a hissing arc appeared to consist of a bright line or comma, which was rapidly revolving.

Prof. Petavel found that the light was not independent of the current density. In view of the author's experience with a two-carbon arrangement, not unlike Prof. Petavel's, it seems as if he was not observing the true crater.

A three-carbon combination is in use at the present time. The negative carbons at first were inclined to the horizontal, but the horizontal position completely eliminates the tendency of the arcs to climb up the negative electrodes. The carbons are all turned slowly by hand. There being but two negatives, they are easily controlled, and, when both arcs are silent, a large steady crater is formed on the end of the positive.

When the arcs are hissing the crater is no longer quiescent, but suffers violent changes of temperature and configuration which it is impossible to describe. While hissing is actually heard the bright revolving line or comma, described by Mr. Trotter, can readily be seen by using a stroboscopic method of observation, but it almost certainly disappears with the silencing of the arc. A telephone, connected across the terminals of a low resistance carrying all the current, affords a ready means of listening to the note emitted, without the distraction of outside noises. Starting with a loud high-pitched note, the volume of sound and the pitch of the note become less and less until the limit of audibility is reached. At the same time, the speed of rotation of the arc gets lower and lower until it is visible to the naked eye. The cessation of sound and of rotation of the crater are apparently simultaneous. The area of the crater is approximately proportional to the current. The current density is 1·5 amperes per square millimetre; this uniformity is what one would expect.

The intrinsic brilliancy is independent of the current and of the nominal current density. The figure obtained—162 candles per sq. mm.—compares with Blondel's 163-158·4, and with Petavel's highest, 160.

Special Electra carbons are undoubtedly the best; they are also the dearest. In any case, the results are close enough together to encourage one to investigate further with those grades of carbons which are found most suitable.

The Improvement and Unification of English Waterways.

This subject was dealt with in Section F by several authors. Lord Shuttleworth recalled the circumstances under which a Royal Commission was appointed in 1906 to inquire into the inland waterways question in the United Kingdom. After four years' labours, they reported on English waterways, contrasting their disunited and unimproved condition with the results of unification and improvement of this system of transport in foreign countries, and recommending the appointment of a Central Waterway Board to deal with waterways, much as the Road Board deals with roads, without undertaking the business of carrying.

The Commission had done its part, and it now rested with the traders and their organisations to press the recommendations on Parliament and the Government, in the form of step-by-step improvement—first, the formation of the Waterway Board; secondly, unification; and thirdly, the first instalment of improvement of one or two of the main routes of waterways. To answer doubts, he pointed to the present obsolete condition of our canals, and the undeveloped state of our rivers, as well as the fact that we had a fine network of connected waterways in England, but remaining unimproved since 1830, in contrast with those in Northern France and Southern Belgium, where the results of unification and improvement during recent years should be visited and studied, as well as the statistics of increase of waterway traffic, accompanied by simultaneous increase of railway traffic also. In England, not only would the railway traffic be similarly increased by the development of the output of inland factories, thanks to a cheaper transport of raw materials, &c., but the transfer of industries to the coast and subsequent loss of railway rates would be arrested.

After quoting from the anticipations of the Commission of indirect return on the probable cost of unification and improvement in the shape of benefit to trade, he pointed out that the perseverance of France, Belgium and Germany year by year in the policy of

waterway improvement proved that experience had convinced foreign Governments of the benefit to trade resulting from waterway reform and extension.

Sir J. P. Griffith read a paper advocating the improvement of the nation's waterways by the State, and said that he regarded the proposals of the Royal Commission as reasonable and practical. The opposition came mainly from the railway companies, but there was reason to believe that these would themselves be able to make profitable use of the canals. Public opinion with regard to State aid of means of transit was undergoing a change, and interest in inland navigation would develop as the need for improved facilities was felt.

Mr. F. R. Durham dealt with Continental waterways, and pointed out that in France an expenditure of over 25 millions sterling on canals and navigable rivers was contemplated. The average rate per ton-mile in France on the waterways was 0·235d., and on the railways 0·7d. A programme involving the outlay of 30 millions sterling was in progress in Germany, and would be completed in 1915.

Mr. R. B. Dunwoody reviewed the English waterways, which aggregate 4,053 miles in length, and in 1905 carried goods worth 37½ millions. But only 2,400 miles were now in use, carrying 32 million tons a year, of which coal formed 45 per cent. The net revenue in 1905 was £308,000. The whole of the routes could be brought up to the 100-ton standard, and some of them could be made to carry vessels of 300 or 600 tons. At present the freight charge for water-borne coal between the Leicestershire coalfields and London was 0·55d. per ton-mile, almost as much as by rail; under improved conditions this could be reduced to 0·27d. per ton-mile.

Mr. W. M. Acworth read a paper to show that canals as a means of transport were necessarily and inherently inferior to railways; that canals could not carry cheaper than railways if the total cost of carriage was taken into consideration; that canals could only compete with railways if, as in France and in Germany, the competition was subsidised and a large part of the cost of canal carriage laid on the shoulders of the taxpayer, and that therefore a forward canal policy had no economic justification.

The writer pointed out that in England, where canals and railways had been left to compete on equal terms, the canals had been definitely beaten; that in America the bulk of the canals had been abandoned, and even the Erie Canal, though maintained as a free highway at public expense, had lost all its old importance; that in France, not only were the canals free highways maintained at public expense, but the railways were forbidden to reduce their rates to the canal level, and still the average total ton-mile cost was higher on the canals than on the railways.

From Germany figures of the important Dortmund-Ems Canal were given to show that its construction had resulted in an economic loss to the State, and only a small gain to the individual trader.

It was pointed out that canals were necessarily inferior to railways as a means of transport, because their capital cost was higher, their carrying capacity was smaller, they only catered for low-class goods in bulk, and they could only reach the ultimate point of production or consumption by the supplementary use of wagons or railway trucks.

It was also pointed out that the traders and localities for whom canals were potentially available naturally had an interest in promoting their construction by public enterprise, as thereby they, paying only a proportion of the total cost of carriage, threw the remaining half of the cost on the public at large, and so not only reduced their expenses, but obtained a differential advantage over competitors to whom the railway only was accessible.

The writer concluded that the adoption of a forward policy could not be justified as in the interest of the community at large.

In the discussion which followed, Mr. Impey questioned Mr. Acworth's statements, but Mr. Jebb said the proposed expenditure of 17 millions could not be justified on economic grounds. Mr. Boddington said that trains of small barges were preferable to large boats, and the locks need not be lengthened, but should be widened only. Mr. J. A. Saler said that water carriage was the most economical method, and a cheaper means of conveying goods from the Midlands to the coast than by rail was necessary. Mr. N. Chamberlain supported the recommendations of the Commission on the ground that the country as a whole would benefit. The extensions of the Continental waterways proved that canals were not obsolete, and the formation of a Waterway Board would be of great advantage to the trading community, even if no improvements were carried out.

In Section G, Mr. L. Blin Desbleds described a method of propelling barges on canals by means of aerial propellers, which are exempt from the difficulties experienced in connection with the use of submerged propellers in shallow and narrow waterways, or where the water is weedy. An efficiency of 16·7 per cent. has been obtained with this system, which, it is claimed, will reduce the cost of haulage by more than half compared with horse haulage, and will not cause erosion of the banks of a canal. The machinery would be installed on deck, but in order to pass through low tunnels or bridges the apparatus can be lowered to only a few inches above the deck.

Radio-elements as Indicators in Chemistry and Physics.

By G. Hevesy, Ph.D.

(*Section B. Abstract.*)

By means of an α-ray electroscope of ordinary sensitiveness it is possible to measure accurately as small a quantity as 10^{-17} grm. of a radioactive substance having a half-value period of one hour. The extraordinary simplicity and at the same time sensitiveness with which it is possible to measure these extremely small quantities of radioactive bodies makes them of the greatest use not only in studying substances in great dilution, but also as indicators of physical and chemical processes.

If 1 mg. of lead is mixed with a quantity of radium D which gives 10,000 units of activity in an electroscope, one-millionth part of this mixture is easily detectable by the radioactivity of radium D. In this way 10^{-6} mg. lead is quantitatively determinable. By this method also the solubility of the difficultly soluble salts of lead such as the chromate and the sulphide has been determined. Further, the amount of lead chloride entrained by a precipitate of silver chloride after washing the latter thoroughly with water is measurable.

The Inflammability of Coal Dust in Air.

By Prof. W. M. Thornton.

(*Section B. Abstract.*)

A mixture of coal dust and air requires a certain minimum quantity of dust to be in suspension per unit volume of air before flame can travel through it by self-ignition. Its sensitiveness to ignition can be measured by the magnitude of the least electric current which can cause ignition of the cloud. The presence of even ½ per cent. of gas has effect in raising the probability of ignition of coal dust in air.

The present paper is an account of experiments made to find the least current which will ignite a mixture of dust and gas, the percentage of gas in this case being kept constant in the successive trials whilst the circuit is broken with different currents flowing.

The results obtained with Newcastle coal gas are given in the following table and in fig. 1:—

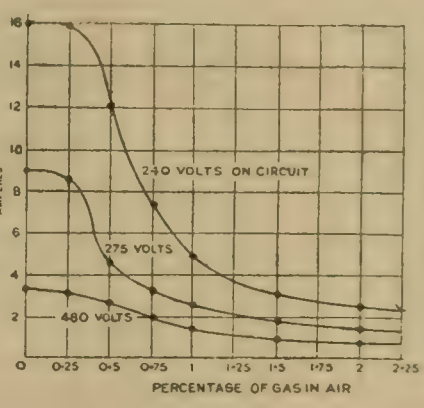


Fig. 1.—Least Igniting Currents for Clouds of Coal Dust in Air with Coal Gas present.

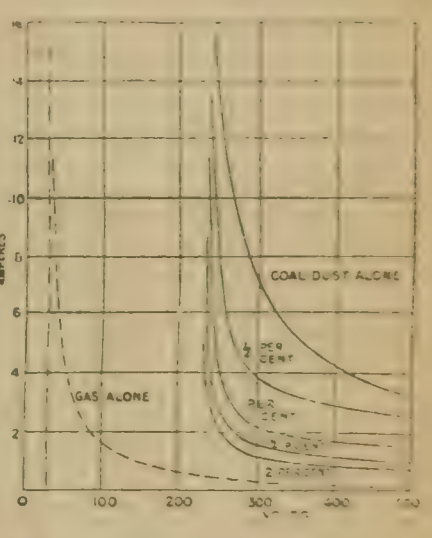


Fig. 2.—Relation between Voltage and Least Igniting Current of Coaldust with Gas Present.

TABLE I.—Least Continuous Current to Ignite a Cloud of Coal Dust raised in Mixtures of Coal Gas and Air.

Percentage of gas in air.	Voltage. 240 Amperes.	275 Amperes.	480 Amperes.
0·0	16·0	9·0	3·5
0·5	12·0	9·0	8·0
0·75	7·5	4·0	—
1·0	4·75	2·5	1·5
1·5	3·4	1·8	1·0
2·0	2·7	1·5	0·8

There is at each of the three voltages a definite relation between the least igniting current and the percentage of gas. The height of each curve is the least current which at the given voltage and percentage of gas causes a full ignition, and it is seen from the figure that ½ per cent. of gas has little or no effect in forwarding ignition, though with more than this there is a rapid increase in sensitiveness.

The same result is obtained with pit gas. The values obtained were as follows:—

Voltage 480 Throughout.

Percentage of pit gas in air ...	0	½	1	1½	2
Least igniting current in amperes ...	2·8	2·4	1·6	0·7	0·50

Comparing these with the coal-gas curves of fig. 1, it is seen that coal gas has slightly more effect in helping the ignition of the dust than pit gas.

Another view of the results which brings out several significant points is obtained by drawing the curves to a voltage base line as in fig. 2. There is now seen to be a voltage (about 200 in this case) below which ignition of clouds of dust, even with 2 per cent. of gas present, is exceedingly difficult. The nest of curves is symmetrical about a line drawn through this point on the base and through the nearest point on the "no-gas" curve. This would, therefore, appear to be about the highest voltage which may be regarded as relatively safe in a gassy and dusty atmosphere where the percentage of gas is not above 2, and where very large open flashes are not possible.

Although the gas has so great an influence in forwarding the combustion, it is very clear that the dust is still the dominant factor in the explosions, for the set of curves fits symmetrically under that in which no gas is present. This could not occur if the gas were the more important, for the zero voltage of the characteristic voltage-current curves for gases alone is about 25; and if the gas were the more effective, these curves should be symmetrical to that voltage as an axis, and this is not the case. The gas must be regarded as the auxiliary, not as the principal, in the ignition of the combined mixture of gas and dust at low percentages.

AN AUSTRALIAN ELECTRICAL STORE.

As will have been gathered from our occasional references to the statistical returns of Australian imports, the electrical requirements of the market are very large, and are constantly increasing. Manufacturing of certain classes of machinery and apparatus is carried on in several States, but only to a very limited extent, therefore the great bulk of the goods used for lighting and power service are imported from either this country or the European Continent, or else from the States. In the case of a market so far distant, one of the essentials of successful business is the ability to carry large stocks, owing to the long time occupied with correspondence and transport. And the carrying of large stocks implies the need of a thorough acquaintance with the local requirements of the many classes of purchasers from West to East of the Continent if there is to be successful selling, while it also suggests the necessity for an intimate knowledge of the newest, best and cheapest articles that are being turned out in the great electrical manufacturing centres of the world. The opening of a Colonial electrical store is not to be lightly undertaken. It is most frequently a success when it is done by enterprising men engaged on the spot in some more or less allied occupation which permits of their watching their opportunity and knowing just how and when to launch out. Some of the largest trading concerns in the Antipodes have been built up brick by brick, so to speak, by practical men who have opened a small shop, known how to wait, and have not minded taking off their coats when emergency has placed an opportunity in their path. There is, perhaps, not so much of this sort of thing happening in Australia to-day as was the case several decades ago, for in most of the big centres —Melbourne, Sydney, and so on — many thoroughly established businesses exist which have extensive headquarters from which they serve sub-departments or agents who are on the look out for trade for them in less important towns and districts. One of the well-known businesses in New South Wales is shown in the accompanying photographic views, which represent some of the departments at the store of Messrs. W. G. Watson & Co., Ltd., electrical engineers, suppliers and contractors, in Clarence and Kent Streets, Sydney. Here, as the pictures show, there is large accommodation for displaying and trading in all kinds of electrical apparatus for lighting and power, instruments, electric heating and cooking apparatus, vacuum cleaners, arc lamps, meters, cables and wires, electric lighting sets, motors and other machinery—indeed, every likely requirement for either domestic or industrial electrical service. As many of our readers are already aware, Mr. Watson has been in London for the past few months, and he has opened an office here.



A Sydney Fittings Showroom.



An Australian Electrical Store.



An Australian Store: Counter Trade.

Fireproof Trains.—The Great Western Railway Co. is running two experimental fireproof trains between London and Windsor. The trains each consist of four coaches—first and third class. The coaches are entirely of steel, with asbestos floors, and are lighted throughout by electricity. Instead of seating six, as hitherto, the first-class carriages each seat eight. The coaches are kept coupled, as the electric-light wires run the entire length of the train. The footboard appears to be the only wooden part of the train, and this has been cut down to the smallest dimensions. In case of fire it could easily be knocked away.—*South Wales Daily News.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Paraffin-Electric and Pumping Set.

Messrs. Boulton & Paul, Ltd., of Norwich, have recently constructed the lighting and pumping set shown in fig. 1 for an auxiliary schooner, under the directions of Mr. James A. Smith, naval architect. The set consists of a 2-H.P. paraffin engine directly coupled to a dynamo, which is to charge the batteries for lighting the yacht, and also supply current to electric deck winches. At the commutator end of the dynamo the shaft is extended, and drives through reducing gear an air compressor, also a small "Bam" type bilge pump, which is clearly shown in the view; the gear box is fitted with silent chains in place of spur wheels to reduce the noise to a minimum, and with a small throwing-in clutch so that the dynamo can be run without the compressor when not required. Another point of interest in connection with the set is that provision is being made for a long jacketed exhaust pipe, around which water is to be circulated by an independent pump. This water is forced through small radiators in the cabins for heating purposes. The firm specialises in such plant as that illustrated, and is publishing a new catalogue in regard to its engines, dynamos, pumps and air compressors.

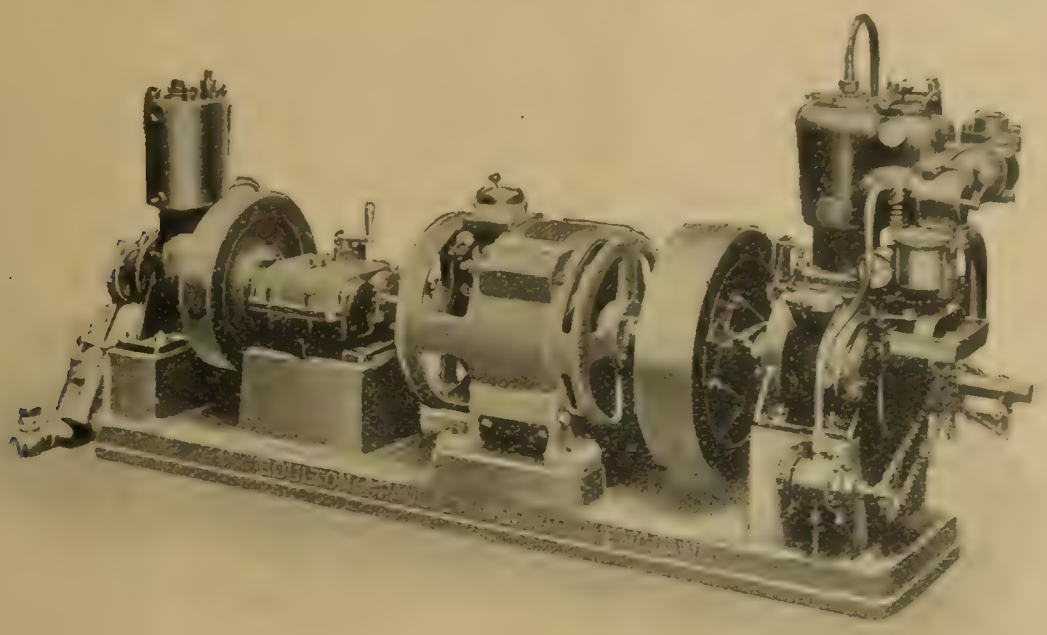


Fig. 1.—Combined Paraffin-Electric and Pumping Set.

The R.U.V. Steriliser.

The Westinghouse Cooper Hewitt Co., Ltd., of 80, York Road, N., have introduced an ultra-violet ray water steriliser suitable for domestic purposes, as illustrated in fig. 2; this device has an output of 22 gallons per hour, and needs no attention. It can be used on all D.C. voltages from 100 to 250 volts, but requires a special converter where the supply is alternating. In starting, the switch is closed and the water supply turned on; the lamp is then tilted and allowed to return to its normal position. Should the electric circuit be broken, an automatic valve closes the water supply, to prevent unsterilised water from passing through. Apart from the effective sterilisation, the water is absolutely unaffected by the process. Type B5 takes 2 amperes. As ordinary filters are often disease disseminators rather than water purifiers, the ultra-violet ray steriliser should be heartily welcomed as a valuable addition to our hygienic resources. The apparatus is of handsome appearance, and is very suitable for use in hospitals and works, as well as for domestic purposes.

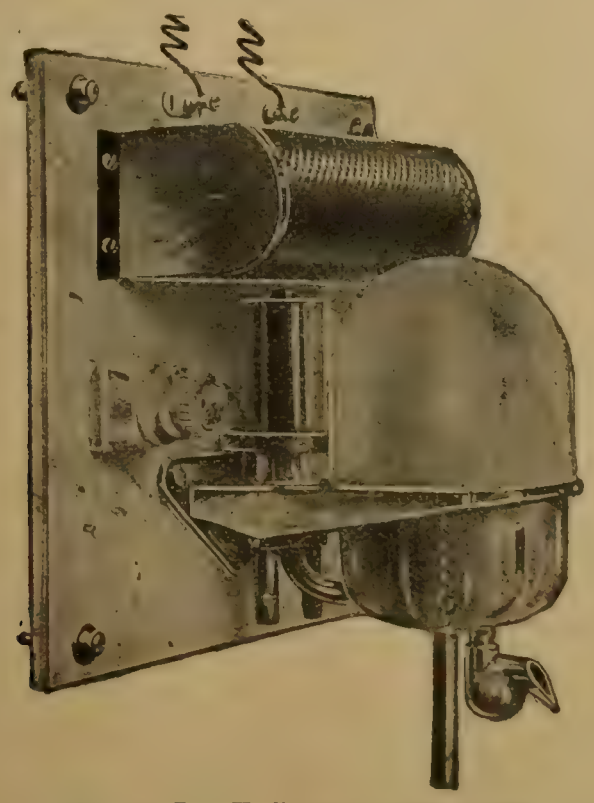


Fig. 2.—R.U.V. Water Steriliser.

The "Losles" Water Heater.

Mr. George Wilkinson, of Beech Mount, Harrogate, has introduced a new automatic electric water heater, known as the "Losles," which we illustrate in fig. 3. This heater takes a small current for a long period, thus securing the benefit of specially low charges; all the connections and heater pockets are fixed upon the bottom of the water chamber, so that there is no metallic connection between it and the outer casing, and the intervening space is packed with a heat-insulating material of exceptionally high efficiency. A simple thermostat influenced by the temperature of the water controls the electric supply, and adequate provision is made for installing the apparatus with ease, and sealing up all the electrical parts. The standard size is of 12 gallons capacity, which is sufficient for a 25-gallon hot bath, its dimensions being 36 in. high × 15 in. diameter; two heaters are provided, each taking about 500 watts at 200 to 230 volts. With one heater in action, the maximum output is equivalent to 24 gallons of boiling water per 24 hours, and with both heaters the output is doubled. The temperature of the water may set at anything from 160 to 200° F.

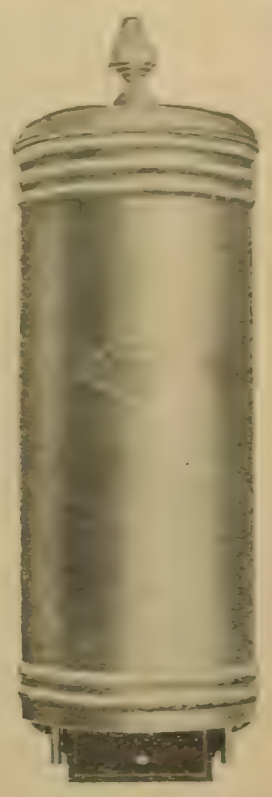


Fig. 3.—"Losles" Water Heater.

Improved Wireless Receiver.

Messrs. Whitford & Co., of Grosvenor Road, Ilford, Essex, have introduced the "Ford" receiver, specially designed for wireless work, and wound for resistances from 1,000 to 6,000 watts. These receivers are light, neat and of high efficiency, and are carried on special-tempered spring steel headbands; we illustrate in fig. 4 one of the double type, of which we have received a sample for inspection. The workmanship is excellent, and the design allows of very fine adjustment of the diaphragm to the magnet poles.



Fig. 4.—"Ford" Wireless Receiver.

Royal Ediswan Daylight Lamp.

The Edison & Swan United Electric Light Co., Ltd., of 36, Queen Street, E.C., has introduced the Royal Ediswan Daylight Lamp for use in colour matching. With the metal-filament lamp burning at a high efficiency, shades of blue or green can be compared, but the results are still very far from satisfactory in the reds. By the adoption of a specially tinted bulb for the metal-filament drawn-wire lamp the violet rays are stopped, and an effect is obtained equal to that of daylight. The lamp is known as the "Royal Ediswan Daylight Lamp," and by its use tests show that colour matching of the most delicate shades and tints in draperies, silks, papers, &c., can be carried on with almost as much ease and exactness as by daylight. It is also a capital reading lamp and restful to the eyes.

New Indicator.

Messrs. Gent & Co., Ltd., of Faraday Works, Leicester, have recently introduced the new indicator movement, shown in fig. 5. The instrument is strong, but very sensitive in action. The swinging pendulum is composed of one part made of a stout iron stamping, and swings on knife edge bearings giving exceptionally long swings. There are no light or delicate parts about it, and it



Fig. 5.—New Indicator Movement.

is claimed to be impossible to put it out of adjustment in any way. We believe Messrs. Gent were the original designers of pendulum movements, having introduced their first pendulum indicator in 1879, and since that date many other striking designs. The new movement is, however, an advance on its predecessors, and it has the great advantage of being exceptionally cheap; it is made throughout at the firm's works at Leicester.

B.T.H. "Fostoria" Table Lamps.

One of the most novel and interesting lighting appliances for the development of which the British Thomson-Houston Co., Ltd., have recently been responsible, is the "Fostoria" table lamp, which represent, a complete departure from traditional table standard designs.

These lamps are made of glass—either white veluria or tinted iris—moulded into quaint shapes and etched with pretty designs. Both the pedestal and the dome or reflector are made of glass.



Fig. 6.—B.T.H. "Fostoria" Table Lamp.
(For one Mazda lamp under dome, and one in pedestal.)
Made of Iris golden glassware.

Beautiful effects are obtained by using, in the case of three out of the four available types, a small lamp in the pedestal as well as under the dome. The B.T.H. "Fostoria" table standards are an agreeable change from the metal standard and silk-shade convention, which has been rigidly observed since oil-lamp days. They can be seen at the B.T.H. Co.'s showroom, Mazda House, 77, Upper Thames Street, E.C, or on the stand of Messrs. Godfrey Giles & Co. at the Ideal Home Exhibition.

Reyrolle Wall Plugs.

Messrs. A. Reyrolle & Co., Ltd., Hebburn, have introduced a line of wall plugs for domestic use, in which the terminal pins are so guarded that they cannot be touched when alive, as the frame of the plug is made to fit over the socket like a spigot and socket joint. Secondly, the plug and socket provide proper arrangements for earthing in such places as bathrooms and scullieries, where electrical apparatus is used in close proximity to water pipes, &c. The plug is somewhat heavier than one generally associates with domestic work, but its elegance in design permits of its use, and thanks to that feature and its good finish, it is not unsightly or out of place in living rooms.

Electric Clock Movements.

Regarding the spring device described under this heading in our last issue, the Magneta Time Co., Ltd., of Chatham House Works, Turnham Green, Chiswick, write pointing out that it formed the subject matter of one of their early patents, the specification of which is before us.

ELECTRIC WINDING IN SCOTTISH PITS.

Electric winding is coming more and more into favour. It is cheaper than steam; the plant as improved is compact and easy to operate. There is a great saving in first cost, as the rotary converter, driving motor, control gear, and winding apparatus cost very much less than boilers and steam engines; and the reduced winding costs and lower depreciation and interest on capital represent quite an appreciable reduction in the cost per ton of coal raised.

One engineering firm—Messrs. Crompton & Co.—have patented a system which is proving exceedingly satisfactory in practice. Two winding installations in Scotland have just been completed on the Crompton system. The rotary converter has an unusual method of starting. A triple-pole switch is used with resistance units permanently connected across the terminals, the resistances being such that a current sufficient to start the rotary without a load is obtained. Closing the main oil switch on the transformer circuit therefore starts up the rotary, and when the latter has got up speed, the closing of the triple-pole switch short circuits the resistances and provides full current.

Two sets of winding apparatus are being fitted at the pits of the Mount Vernon Colliery Co., West of Scotland; and at Messrs. Dunn and Stephens's South Kenmuir Colliery, an electric winding plant is now in full operation. Both plants are on the C.M.B. system. The Dunn & Stephens pit has gear for a working depth of 160 fathoms, the present depth being 90 fathoms. The cages carry two hutches apiece, the loaded hutches taking 17 cwt., which, with 65 winds per hour, represents 55 tons of coal. The ascending load totals 57 cwt., and the descending load 23½ cwt., leaving 33½ cwt. to be dealt with by the winding gear. To deal with this load a 120-kw. motor-generator working at 400 volts is employed, the two winding motors being each of 150 b.h.p., and running at 400 r.p.m. On test the maximum demand from the mains was a little over 120 kw., while the units per ton working from an 85-fathom level, were only 0·8, which, with energy supplied at ¾d. per unit, gives the winding cost per ton at the low figure of ·6d. (without capital charges). The average winding speed of this plant is 1,120 ft. per minute, and the maximum, 1,360 ft., with an acceleration period of 8 seconds, a full speed period of 29 seconds, and a retardation period of 8 seconds. The banking time is 10 seconds, and the time taken for each wind is 55 seconds. With a day of eight working hours, on this basis, the lift is 440 tons.

The power supply in the South Kenmuir district is three-phase alternating, 25 cycles per second, voltage 440. This is directly coupled up to the rotary converter through a triple-pole oil switch with overload circuit breaker attachment, while the motor has a wound rotor with slip rings for starting, a liquid starting resistance being employed. The alternating circuit panel has mounted on it the usual volt and ampere meters, and also a voltage coil which connects the leads to the emergency trip gear of the brake.

The main winding drum is of the spiro-conical type, designed to minimise the torque during acceleration. Control is by a regulator in the field circuit of the motor-generator, and by a reversing switch in the winding-motor circuit, the two switches being connected so that before the motor can be reversed the current must be shut off and the brake applied. The magnetic brake is automatically applied as the controller is brought back, but comes into action should any electrical failure occur. There is also an emergency brake actuated by a pedal should the supply from the mains fail. There are limit switches operated by the depth indicator which is geared to the winding drum. The operator notes the exact position of the cages at any moment, and during the actual wind has only the controller to handle, and the depth indicator and motor-generator ampere meter to watch.

The reversing switch is only moved at the end of each wind, and changes over the connections without opening the motor circuit, the cages being always held in position electrically, the armatures being short-circuited, and the motor circuits fully excited during the actual moment of changing over. Pilot contacts are provided on the reversing switch, which are coupled up through the limit switches and the voltage coil on the motor-generator controller to the exciter. If the reversing switch is wrongly used, the controller then returns to the "off" position, and sparking on heavy currents is stopped. These pilot contacts acting with the limit switches, also allow the gear to be reversed should the cage have been allowed to run too far.

At a meeting of the Mining Institute of Scotland, held in Edinburgh on Saturday last, Mr. Willoughby M. Dunn read a paper descriptive of "The Electrical Winding Gear at South Kenmuir Colliery." The author said that when it was determined by the firm of which he was a member, to re-open and equip South Kenmuir Colliery for winding coal, a difficulty arose from the fact that the space available for the usual steam plant was too limited. As electricity could be obtained at a reasonable figure from the Clyde Valley Electrical Power Co., owing to the proximity of their mains, the idea of utilising this power for winding, &c., presented itself. An estimate of the cost of a steam winding plant was made out, and a schedule of particulars was sent to the various manufacturers of electric winders for their prices and guarantees, and it was found that the cost of steam winding, on a basis of 110,000 tons per annum, worked out at 2·958d. per ton, while the electrical winding on the same basis cost only 1·938d. per ton. Further, the estimated cost of the steam equipment was for good second-hand plant, while the electrical installation was new plant. The electric system which found most favour was put forward by Messrs. Crompton & Co., Ltd., Chelmsford, with whom the order was placed.

From tests made and figures ascertained, the writer believed that this winding gear was capable of winding 720 tons per shift, or 180,000 tons per annum, from a depth of 76 fathoms, at a total cost for wages, stores, power and allowances for depreciation and interest of £910. That outlay on the basis of 180,000 tons per annum gave a cost of 1·123d. per ton. Over a certain period the results obtained were:—Output of minerals, 29,605 tons; total energy consumed 26,438 units; energy consumed per ton, ·893 unit. The time taken to wind 17 cwt. from the 76-fathom level was 24 sec., plates to plates, and with 10 sec. allowed for banking, the winder, if it were kept running without a halt, was capable of raising 720 tons from that depth in eight hours. The safeguards in the winder which has been installed were four in number, viz.: (1) There was an electromagnetic brake which came into operation at the end of every wind; (2) on the indicator column there were trips which came into operation immediately after the limit switches were tripped, and applied the mechanical brake by the release of a heavy weight; (3) this weight was also released to apply the mechanical brake by means of a solenoid connected direct on to the supply mains, which came into operation in the event of the current supply failing; and (4) the mechanical brake was operated by means of a cramp at the engineman's foot.

No difficulty had been experienced in training men to work the winder—ordinary winding enginemen being employed. It was also admitted by those who had travelled on the cage, that the ride was a much more steady one than that experienced with the steam winding engine.

NEW LABORATORIES AT DUNDEE.

Sir Alexander B. W. Kennedy, LL.D., F.R.S., on Tuesday 14th inst., formally opened the new engineering department at University College, Dundee, which has been erected at a total cost, including equipment, of £15,500. The new department forms an L-shaped block, and the main building, forming the north side of a quadrangle, is two storeys in height, broadly treated in a domestic form of classical design and roofed with a steeply pitched roof of grey slate. This contains the lecture rooms, drawing offices, library, private rooms, and hydraulic laboratory, with two rooms set apart for a possible future architectural department. An architectural feature is provided by the central tower, some 80 ft. high, which accommodates the fan and machinery for the forced ventilation of the building, and also contains a storage tank of 10,000 gallons capacity, from which the mains in the hydraulic laboratory are supplied. In the lower storey are accommodated the heat-engine laboratory, and the boiler-house; the strength-of-materials laboratory; the cement-testing room, and the workshop. Owing to the completion in 1910 of the Peters Electrical Laboratory, the college is well equipped for the study of this branch of engineering, and the present laboratories are devoted to the investigation of problems involved in civil and mechanical engineering. Sir Alexander Kennedy gave a valuable address on engineering education, in the course of which he observed that, as regarded the general trend of our academic training, he thought engineers were entitled to ask that it should be so arranged as best to train the best engineers. He put it in that way because he meant it to be understood that while on the one hand the best engineer was certainly not the man who knew his own business only and narrowly, on the other hand, he thought they were entitled to demand that the engineer should not be looked upon as the mere by-product of the training, but as the chief result to which other things were to be subordinated. In saying this, however, he particularly did not mean that the academic training of engineers should be laid out on superficially utilitarian lines.

The idea of giving a young man just as much mathematics, just as much physics, or just as much chemistry as he could professionally require, was not only pernicious, but absolutely fallacious. He was sure that the only way of learning a subject up to a certain point, in such a fashion that up to that point it could be thoroughly utilised, was to study the subject up to a point very much further advanced. It was not at all a valid objection to the teaching of any particular point in mathematics or physics that it was more complicated or more advanced than anything which the engineer would be likely to require. It was desirable, indeed necessary, from their point of view, that the advanced work in purely scientific subjects should be specially chosen so as best to deepen and make certain the knowledge of the earlier work. Young engineers should have continually impressed upon them the very simple fact that the answer to any question could only be as accurate as the data on which that question was founded. In his student life a young man would get a great number of problems put before him of which all the data had been simply fined down into the form of an examination question, to which a definite and exact answer could be given. After some years of this kind of work he sometimes found it more than a little difficult to realise that the questions which actually came to him in his profession never had very exact data, and, in particular, never had the exact data with which he had been familiar in an examination paper. For engineering purposes the method of working out the answer was only secondary; the answer itself was the chief thing, and they really must have that answer right when it found itself translated into steel or stone. There was more than a tendency to make technical teaching complete by covering an enormous number of subjects without considering the possibilities of the student himself in the way of receptiveness. No doubt it was very desirable that the student should know a little about as many branches of his profession as possible, but for the average young man it was impossible for him to know thoroughly more than a very small range of the ground upon which he might later on be called upon to work. It must be recognised that after he had left College he still had an enormous amount to learn, and it was very undesirable to put before him while he was at College more educational nourishment than he was really able thoroughly to digest. The best that could be hoped for, and what was really to be aimed at, was that a student should have had a thorough grounding in the general principles underlying all branches of engineering work, should have become fairly familiar with some details in a very limited section of the work, and also—perhaps above all—should have learned how to use his wits in applying his general knowledge later on to practical working at details in whatever branch was thrown in his way by circumstances. For it was little use a young man saying that he intended to be electrical, or constructive or mechanical, or what not. If he was worth his salt he would take up, when he had to earn his living, whatever work came in his way, and it was as well that he should keep this in mind from the start.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

HOLLAND.—The Board of Trade have received information to the effect that the proposed new Dutch tariff, reference to which has previously been made in these columns, has been withdrawn from the Chamber of Representatives by the Minister of Finance.

NEWFOUNDLAND.—The Government have decided that all instruments, apparatus, supplies, &c., imported and used by the Marconi Wireless Telegraph Co., of Canada, Ltd., in installing, maintaining and operating various wireless telegraph stations in Newfoundland and Labrador, shall be admitted into the Colony free of duty during the term of the agreement which has been made with the said company, to end on April 6th, 1926.

ITALY.—The Italian Customs authorities have decided that electric cord consisting of a bundle of conducting wires, each wire being covered with insulating textile thread, fastened together first by means of cotton yarn then by a strip of paper and a thin sheet of lead, and finally covered with paper and plaited cotton material, shall be dutiable on importation into Italy at the rate of 28 lire per 100 kilogs. (25 lire = £1, kilog. = 2·204 lb.).

PARAGUAY.—The Board of Trade have received a copy and translation of a circular issued by the Paraguayan Government directing that bills of lading for merchandise destined for Paraguay must be presented to the Paraguayan Consul in the country of origin in triplicate. These three copies will be legalised by the Consul who will charge $1 (4s.) for the original, and 50 cents each for the two copies. Should the shipper desire to have further copies of the bill of lading, a charge of 50 cents for each additional copy required will be made. Shippers of goods to Paraguay must also present to the Consul for legalisation the commercial invoices and certificates of origin relating to such goods. No charge is made for the legalisation of these documents, which are to be sent by the Consul, together with one copy of the bill of lading, to the Customs authorities at the port of destination.

NEW ZEALAND.—The Customs authorities have decided that a siren, electrically driven, with an electric motor forming an integral part of the same, is to be dutiable at the rate of 20 per cent. *ad valorem* if of British origin, and 30 per cent. if of foreign origin. Similar rates of duty are also fixed for step-treading of lead-filled steel for tramway cars and carriages.

SOUTH AFRICA.—A notice issued by the High Commissioner for South Africa as to the duty to be levied on catalogues sent by post from the United Kingdom to South Africa, states that in connection with the tariff of Customs duty on advertising matter, including catalogues, price lists, almanacks, calendars, labels, posters and showcards, that when any of above-named articles are sent to any person or firm in the Union of South Africa through the medium of the post office, the duty payable thereon may be prepaid

by means of stamps affixed to each separate letter, packet or parcel. Stamps of various denominations may be purchased at the office of the High Commissioner for the Union Government of South Africa, 32, Victoria Street, London, S.W. The duty on the articles enumerated above is 2d. per lb. or 25 per cent. *ad valorem*, whichever shall be the greater. In connection with the above, senders are reminded that a certain differentiation is made between catalogues of South African firms posted to persons or firms in the Union of South Africa and those of non-South African firms. A South African firm is defined as a firm having a place of business in South Africa at which stocks are held for sale. The following assessment is now in force for catalogues of non-South African firms :—

Up to 8 oz.	Free
Over 8 oz. and up to 16 oz.	2d.
Over 16 oz. and up to 24 oz.	3d.
Over 24 oz. and up to 32 oz.	4d.

and, thereafter, at the rate of 1d. for each additional 8 oz. or fraction thereof. The same scale is to apply to catalogues of South African firms, except that 1d. be charged on any catalogue weighing under 8 oz. The minimum duty payable by means of postage stamps is 1d. The stamps must be affixed to the top left-hand corner of the packets. Under the Imperial Post Office Regulations packages or parcels of over 5 lb. in weight must be sent by parcel post, in regard to which there are special regulations dealing with the question of Customs declaration of contents and value. No duty can, therefore, be prepaid by means of stamps on packages of advertising matter over 5 lb. in weight.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,435. "Improvements in band brakes particularly applicable to electrically-operated band-brakes for electric cranes and the like." Lancashire Dynamo and Motor Co., Ltd., R. S. McLeod and H. B. Whitmore. October 6th.

22,437. "Radio-telephony." F. J. Chambers. October 6th.

22,458. "Ear-caps for use in telephoning." J. C. McGowan. October 6th.

22,464. "Electric current induction apparatus." D. Suchostawer. October 6th.

22,486. "Electric apparatus for cleaning and other domestic work." E. W. Lancaster. October 6th.

22,491. "Electric intermittent automatic heat and fire register alarm." A. Ewen and T. Powell. October 6th.

22,502. "Electric self-starting devices and lighting circuits for motor-vehicles." T. W. Tattersall and J. W. Tattersall. October 6th.

22,503. "Switches for electric self-starting devices and lighting circuits for motor-vehicles." T. W. Tattersall and J. W. Tattersall. October 6th.

22,527. "Magneto-electric ignition machines for internal-combustion engines." M. Anschutz. (Convention date, December 12th, 1912, Germany.) October 6th. (Complete.)

22,531. "Electrical treatment of gold solutions and apparatus therefor." A. A. Lockwood. October 6th.

22,537. "Wireless telegraph transmitter." J. G. Balsillie. October 6th. (Complete.)

22,544. "Manufacture of resinous condensation products." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 6th.

22,549. "Electrical motors and dynamos." F. E. E. G. Schreiber. October 7th.

22,575. "Fuses or cut-outs for electric circuits." V. Hope. October 7th.

22,583. "Generation of electrical power and systems of transmission of same, with means of producing electro-mechanical power and speed regulation; the electro-mechanical propulsion of ships, railway, tramway, road, and other self-contained vehicles, electric trains, cars and the like." W. P. Durtnall and A. H. Binyon. October 7th.

22,706. "Metal-working machines with work-holding magnets." Magnet-Werk G.m.b.H. (Convention date, October 25th, 1912, Germany.) October 8th. (Complete.)

22,707. "Portable electric lamps." J. Neu. October 8th. (Complete.)

22,723. "Electric furnaces." E. Stassano. (Addition to 8,901, 1911.) October 8th. (Complete.)

22,724. "Electric furnaces." E. Stassano. October 8th. (Complete.)

22,744. "Process for the electrolytic deposition of metals from solutions containing the same." N. V. Hybinette. October 8th. (Complete.)

22,745. "Electrolytic process for extracting copper from ores." N. V. Hybinette. October 8th. (Complete.)

22,765. "Electrically-illuminated fountains." H. P. Allison. October 8th.

22,782. "Electric bells and signals." R. Nicholas. October 9th.

22,798. "Switch which contains battery for the supply of electric current." A. V. I. Bickerstaff. October 9th.

22,805. "Self-cleaning sparking-plug." W. H. Gamble. October 9th.

22,813. "Means for and method of regulating currents by static regulators." A. M. Taylor. October 9th.

22,816. "Discharge tube with incandescent cathode and enclosed vapour-forming body." Allgemeine Elektricitats Ges. Convention date, October 14th, 1912, Germany.) October 9th. (Complete.)

22,841. "Secondary batteries." A. Icoemus, filho. October 9th.

22,850. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt. Ges. (Addition to 18,498/12. Convention date, October 11th, 1912, Germany.) October 9th. (Complete.)

22,876. "Glass globe or shade holder for incandescent and other lamps." Veritys, Ltd., and A. E. Watson. October 10th.

22,886. "Constant-current dynamos." A. E. Brewerton. October 10th.

22,902. "Electrical relays such as motor-driven time relays or delay-action contact devices." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) October 10th. (Complete.)

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23,013. "Attachment for arc lamps." H. G. Dyer and C. S. Adams. October 11th. (Complete.)

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Electric Batteries. C. D. Galloway, Junr. 2,402. January 25th. (February 1st, 1912.)

Cord Grips for Electric Connections. B. J. Grigsby. 3,014. February 5th.

Impulse Transmitters for Automatic Telephone Plant. G. A. Betulander. 4,792. February 25th. (February 28th, 1912.)

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Devices for Medical Administration of Electricity. J. Schneidrzik. 13,145. June 6th.

Temperature Alarm. J. F. J. Malone. 17,112. July 25th.

A Fishing Story.—Whilst out fishing from Langstone Harbour shore recently, Mr. G. G. H. Ogburn, of Portsmouth, noticed a lamp being washed about in the surf. He "caught" the lamp, and noticed it was an "Osram" metal-filament 50-volt, marked G.E.C. The filament appeared to be intact, and when the finder had dried and tested it, he found it all O.K. Presumably the lamp had been dropped or washed overboard from some vessel, and had been blown and knocked about till it reached the shore. At the time it was rescued it was blowing rather hard, and consequently the sea was rough. The chances that the lamp bulb would escape destruction on the shingle were feeble enough, but that the filament should be intact is still more surprising. The incident certainly forms a testimonial to the virtues of the Osram lamp.

The Effects of Ozone.—A correspondent of the *Times* recently quoted a report on the authority of the official organ of the American Medical Association, which alleged that ozone possessed no properties of hygienic value, but was rather injurious than beneficial to human beings. Replying to these statements, Mr. E. L. Joseph, managing director of Ozonair, Ltd., ascribed them to ignorance on the part of the authors, stating that the whole value of ozone, so far as its use in ventilation was concerned, lay in its powerful oxidising effect, and the amount required for the useful purification of the air was so small that no possible ill-effect could be suffered by anyone breathing such an atmosphere. He quoted the investigations of Dr. Leonard Hill, showing that the use of ozone in the proportion of one part to one million parts of air was fraught with the greatest benefit, freshening the air and rendering it invigorating.

THE

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ELECTRICAL REVIEW.

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COLLIERY EXPLOSIONS.

In spite of rules and regulations, improved methods of working, and the greater scientific knowledge of mining, terrible disasters such as that which occurred at the Universal Colliery in South Wales on October 14th evidently cannot be prevented, and the worst feature is that the more recent explosions have been the more prodigal in the sacrifice of human lives. The loss at the Universal Colliery is not as yet definitely known, but there is not a shred of hope that any of the poor fellows still in the mine can be alive. Strenuous efforts were made by the band of heroic rescuers, two of whom willingly sacrificed their lives in their eagerness to save their comrades, and several more have been on the verge of death. All honour to them!

It is, however, estimated that the dead will number over 420, rendering this the greatest calamity that has ever occurred in the British coalfields. This, following so closely upon the Hulton disaster with a toll of 344 lives as recently as December, 1910, and the still more recent explosion at Cadeby, resulting in 87 deaths, amongst them being three of H.M. Inspectors of Mines while directing rescue operations, emphasises the necessity for careful consideration of the whole question. There will be the usual clamouring of the miners' leaders demanding investigations, and, if necessary, more rules and regulations to harass the management and owners, because in their (the leaders') view it is *always* the fault of the managers, and usually because they have set at defiance some Government rule or regulation; which, of course, is mere prejudice.

So far it does not appear that electricity, which has been said to be the cause of other recent explosions—particularly in the cases of West Stanley and Hulton—has been blamed for the Universal disaster. Whatever the cause, however, it is the earnest desire of everyone that this shall be actually ascertained, and both managers and owners will be only too glad to adopt any means without an Act of Parliament to prevent a like calamity. Up to the present, however, beyond the fact that it was a coal-dust explosion, no suggestions have been made as to its origin, and, of course, it is very questionable whether the actual cause will ever be established.

Explosions, however, in themselves are not spontaneous; there must be some spark, fire, or light of sufficient intensity initially to ignite the explosive fire-damp, which usually precedes, and is the cause of, a coal-dust explosion. A "blown-out" shot during blasting will also start a coal-dust explosion, but it is exactly similar in its action to an explosion of fire-damp, so that provided these two dangers can be effectually removed, coal dust, *per se*, is not so dangerous. Some dusts are certainly much more prone to explosive effects than others, but we very much question whether it has been definitely established that coal dust will explode if merely ignited by, say, the flame of a lamp or an electric spark. The presence of even as little as ½ per cent. of gas in the fine-dust-laden air enormously increases

its tendency to explode, as the recent investigations of Dr. Thornton have shown, but it would appear that some *violence* of ignition, such as a minor explosion, is necessary to establish a coal-dust explosion.

Therefore, assuming that the ignition of gas and "blown-out" shots could be prevented, it would appear that these disastrous explosions would become very rare. It is practically impossible in the working of a very fiery mine absolutely to ensure that the gas given off shall always be sufficiently diluted with air to render it harmless, as the amount of air in circulation is a more or less limited quantity, but the gas is an unknown quantity, and a sudden "blower" may upset all the calculations of the most expert mining engineer; and it is for this reason that the stringent rule relating to the withdrawal of workmen in the presence of gas is enforced.

To guard against the ignition of gas, the use of safety lamps is enforced, and under the new Coal Mines Regulation Act, only those lamps which have been tested and approved by the Home Office may be used. But though they are tested and approved, and further examined and locked before being given into the hands of the workman, there is still the element of danger known as the "human factor" which is always present. And this, in our opinion, is the greatest of all, and the most difficult to deal with. With regard to shot firing, this is a danger purely dependent upon the care and judgment of the workman. It is entirely in his hands, but so unreliable has he become, that in many fiery mines the management have—at great cost—dispensed with it entirely. The danger lies in overcharging with explosive the shot holes, not putting in a sufficiency of stemming, or not using proper material for stemming. Hence we see that the two chief causes of explosions are mainly in the hands of the workmen themselves, and very much depends upon their own *carefulness* and the exercise of a little common-sense judgment. One of the recent new rules relates to a search of workmen before descending the mine, and Mr. Walker, in his report for 1912, says:—"The result of these searches has been to find a number of the men with prohibited articles in their possession. . . . The fact that more than one of the mines was fiery is disquieting, and shows that a daily search is necessary, and should be carefully carried out." In addition to this, 10 workmen were prosecuted for contraventions of provisions about safety lamps; 14 about matches and smoking, and 27 for breaking rules relating to explosives. Even in South Wales, the scene of this terrible calamity, the chief inspector (Dr. Atkinson) in his report gives a list of 51 prosecutions of workmen by the owners for contraventions of provisions about safety lamps; no fewer than 89 *about matches and smoking*, and 10 about explosives. Similar lists are given in all the other inspectors' reports, and although many of the offences were probably due to inadvertence, we are afraid that in the main they are the result of wilful carelessness, and a lack of respect for all laws, and most of all a want of interest in their employment. Here is the great opportunity for the miners' leaders, and they would do a vast amount of good if, instead of clamouring for the moon and raising dissension between employers and employed, they would first teach their followers their duty to their fellows, and generally set their own house in order before attacking others.

As regards the fear that the use of electricity may lead to the ignition of gas, this is entirely unfounded. That the breakdown of any part of an electrical installation should cause a fire has been proved in practice to be impossible when the plant is properly installed and maintained. It has now been proved by recent tests made by the U.S. Bureau of Mines, that it is *impossible to ignite gas* by sparks obtained when breaking the circuit of a glowing filament in a *portable electric lamp*. Here then seems to be the solution of the lamp problem. The glowing filament possibly would ignite gas, but such a condition would only occur when a blow was, say, just sufficient to break the guard, the thick protecting glass, and finally the thin glass bulb itself, leaving the very delicate filament untouched and unharmed. Such a condition may be theoretically possible, but practically would be impossible to obtain. However, to allow for such a remote contingency, all that it is necessary to do is to design the mounting of the lamp bulb so that a blow sufficient to break the bulb will short circuit or open the electric circuit of the lamp. Even with electricity for power transmission purposes Dr. Thornton has shown that it is extremely difficult with a voltage up to about 200 to ignite a coal-dust-laden atmosphere, even when 2 per cent. of gas is present.

We have constantly advocated the use of low voltages underground generally on the score of safety from shock to workmen, and less difficulty with insulation, and have always been inclined to the opinion that taking 2,000 and 3,000 volts direct to underground machinery was a risky and unwise proceeding. The idea, of course, was economy in cables, but it is much better to study ease and low cost of maintenance, with a much lessened risk of breakdown or danger to workmen, than a low initial cost. This fact is now being recognised, and coal-cutting machines are being installed to work with a pressure of only 220 volts. Hence we come to the conclusion that an intelligent application of electricity for power transmission and lighting, the use of electric safety lamps in place of oil lamps, and strict discipline with regard to rules relating to matches, smoking, and explosives, would do much to make a fiery coal mine, so far as the danger of an explosion is concerned, one of the best and safest places in which a workman could be employed.

The Future of Electricity Supply.

With the fall of the leaf the Institution of Electrical Engineers awakens from its æstivation to renewed activity; the first signs of motion are manifested in the Local Sections, and copies of the inaugural addresses of the chairmen have already begun to flow in.

The first of these was delivered at Newcastle last week by Mr. Charles Vernier, and we have found it so interesting that we have thought it well to abstract it at considerable length. We hardly need say that the author has had unique opportunities on the North-East Coast of acquiring experience in the distribution of electricity on the largest scale as yet attained in this country, and his views on this subject therefore possess exceptional weight.

There can be no doubt that the remarkable development of municipal electricity supply in this country, involving the erection of numerous generating stations of small capacity and supplying absurdly restricted areas, has had a highly detrimental effect upon the progress of the electrical industry within our borders; not only has the price of electrical energy necessarily been maintained at a much higher level than would have been the case if the supply had been derived from large undertakings, thus hindering the general adoption of electricity for domestic and industrial applications, and restricting the market for electrical apparatus, but also our manufacturers have been deprived of

the opportunities enjoyed by their foreign competitors of developing their designs on the grand scale, and thus equipping themselves with the experience necessary to enable them to secure a fair share of the huge undertakings which have been and are being carried out abroad—even in our own Colonial possessions.

The keynote of the whole course of events is *waste*; waste of effort, waste of opportunity, waste of capital; waste of heat and fuel, and not least important, waste of *time*—for modern conditions of industry render the competition between nations a continual race, in which the swiftest gains the prize.

Once again we are led to express our admiration of the epoch-making address in which Dr. Ferranti, with a prophetic vision reaching far into the future, and a breadth of view in striking contrast with the parochial tendencies of the age, laid bare the radical defects of our existing system, and pointed out the direction along which we must advance in order to derive the utmost benefit from our national resources. Mr. Vernier recalls the ideal thus set up, and declares that the first step towards its realisation must inevitably be the centralisation of generating plant, whether entirely in the hands of private companies or with the co-operation of local authorities being immaterial. No time should be lost in disseminating this doctrine, for the electrification of our main-line railways is undoubtedly on the horizon, and unless the chance of providing for their demands is seized beforehand, the railway companies will be compelled to build new generating stations, and a priceless opportunity of retrieving our past errors will be lost. There is no fundamental reason why our municipal authorities should stand aside in "splendid isolation"; once they are led to realise the facts, their commercial instincts will surely enable them to take part in the reorganisation of electricity supply throughout the country, with the certainty that the result will be to the advantage of the communities which they represent.

On the subject of mains, Mr. Vernier is naturally very much at home. We are glad to note his remarks regarding the present attitude of the Board of Trade towards overhead cables, the use of which is absolutely indispensable to the universal development of electricity supply, and we are at one with him regarding the desirability of compulsory powers to enable the opposition of landowners, and even of local authorities, to be overruled.

In conclusion, we cannot but regret that custom forbids the discussion of the chairman's address in open meeting, for we feel that such a discussion on Mr. Vernier's masterly address would be of great benefit to the industry. Is it not possible to remedy this drawback? At least, the widest publicity should be gained for its essential features.

Copper.

Conditions in the copper market continue as strong as ever, and the sole restraining influences upon the upward course of prices are the tightness of money and the pessimism born of adverse reports as to the progress of general trade in all parts of the world. There has within the past few days been a very serious tightening up in the price of cash and near dates, which reveals the scarcity of metal, and it is much to be feared that this unwelcome feature will persist for a rather long time, in spite of any efforts which may be made to relieve the position, for the scarcity of actual copper grows almost daily more pronounced, and it is certain that there will be a further depletion in the world's visible supply at the end of the month. The premium on cash and early prompts is not only having the effect of shaking further the not very robust confidence entertained as to the position, but it also tends to check fresh buying on the part of consumers. These are moderately supplied for their near requirements, but have fair quantities to purchase for future needs, say, over December and onwards. Where copper in anything but retail quantities is to be got hold of in the event of any notable extension of demands, is not at all clear. Certainly it is not to be found in England, and equally the stocks on the Continent are very small, while the returns published from month to month across the Atlantic show the steady process of depletion which has been in progress, and which has brought the reserves down to a record low level. It is the general anticipation that the next statement will show a fresh diminution in the quantity held by American refineries, but the market has lately taken the successive reductions very philosophically, and from the point of view of the price ruling, nobody would imagine that the copper market stood in a more perilous position as regards supplies than at any time on record. The strikes at Lake Superior mines are still in full blast, and it seems quite hopeless to expect any resumption of operations on a normal scale at the Lake smelters for the rest of this year. In any event, therefore, the production of Lake copper this year should show a shortage compared with last year of some 40,000 tons, while to add to the difficulties of the market, the entire Rio Tinto concern in Spain is closed, also as the result of labour troubles. This involves a shut-down in production in Europe of about 2,500 tons a month. The recurring labour troubles in the United States have hit the refineries hard, and in order to keep plant occupied the leading refiners have been compelled to have recourse to Europe, where they have been busy buying up the whole of the available material for shipment to New York for refining. In this way practically all the Chile bars here have been swept up for America, while the process of acquisition has actually been extended to copper which refiners have not hitherto been willing to look at on account of what was regarded as its unsuitable quality. This is now being entirely overlooked, however, so keen is the scramble for metal to keep plants busy. Last week the Amalgamated Copper Co. shipped several hundred tons of Chile bars from Liverpool for New York, and is this week transferring about 1,000 tons of rough English material to the same place. At the present rate of withdrawals, it will not be long before the entire English stock of material in warehouses has disappeared. The fact that speculation is almost totally at a standstill is a very good thing for the market, otherwise there is no telling at what level prices might not have stood. As it is, prices are quite high enough for the comfort of the consumer; and any material elevation of the present level would be bound to react prejudicially upon demands. At the moment, there is plenty of occupation in the copper-consuming industries, the wire and electrical trades generally being especially bright spots.

The New Tungsten Lamps.

Two papers recently read before the American Institute of Electrical Engineers, by Messrs. Langmuir and Orange, on the development of the nitrogen-filled tungsten lamps were of exceptional interest; we commence an abstract of them elsewhere in this issue.

It is now clearly established, as the result of a brilliant research, that the main causes of the blackening of the tungsten lamp are two—direct evaporation from the filament, and transfer of metal by the agency of water vapour, the material ultimately deposited on the glass being in either case metallic tungsten. The method adopted for preventing the discoloration, which is the chief factor in shortening the useful life of the lamp—viz., filling the bulb with nitrogen at atmospheric pressure—is one which, at first sight, appears to offer little chance of success, more especially in view of the remarkable cooling property that hydrogen was found to possess at high temperatures; nitrogen, however, behaves in a very different manner, and appears to afford a satisfactory solution of the problem in the case of comparatively thick filaments.

Unfortunately the rate of loss of heat by convection from small filaments is relatively so much greater that the prospect of achieving equal success with small lamps appears at present to be rather remote.

We note that the intrinsic brilliance of the filaments at an efficiency of two candles per watt is five to eight times as great as that of the one-watt filament; this, no doubt, will be a useful property in some applications, but not in the lighting of streets or interiors, for which the unshielded glare of the filament is already in excess, and therefore it will be necessary to sacrifice some of the gain by using diffusing screens. But there is no room for doubt that for high candle-powers the new lamp will come into use directly it is put on the market.

The Case of Driver Caudle.

Early last week Samuel Caudle, who, as our readers will not have forgotten, drove the second train involved in the Aisgill disaster past the Mallerstang signals, which were set against him, was found guilty of manslaughter, and sentenced to two months' imprisonment in the second division. We understand that there may be an appeal, and consequently the matter must still, to some extent, be regarded as *sub judice*, but there are several comments which occur to us, and which may, we think, be lawfully made at this stage.

From the point of view of the ordinary travelling citizen, the whole case, from the incidents immediately preceding the catastrophe, down to the latest development, is to the last degree unsatisfactory. The engine of the first train was overloaded, coal was bad, and a second engine could not be obtained; the engine of the second train needed lubrication while in motion, coal again was bad, the engine-driver was not at his post, and the train passed signals at danger. Then, owing largely to the presence of gas on the train, several persons were burned to death, and inquests were held. In the first, held on ordinary people, the Coroner's jury found emphatically against manslaughter. Later, another jury, considering the death of Sir Arthur Douglas, found a verdict of manslaughter against the driver, and this verdict has now been confirmed. Another jury, which wanted to blame important officials, had to bring in four verdicts before it could please the Coroner.

We are thus confronted with the fact that, if Sir Arthur Douglas had not succumbed to his terrible injuries, the man immediately responsible would have escaped all punishment —would never, in fact, have been brought to trial. It is apparently necessary for a titled and influential gentleman to die before justice can be set in motion.

There can be no possible question that Caudle's first duty was to look out for signals: for if it could be taken as a matter of course that all trains always ran true to time, signals would be unnecessary. In railway work, as in other things, it is the unexpected that must be provided against. That being so, Caudle was to blame, and deserved some punishment; though we are not inclined to think, as does the Judge, that he has been too leniently treated. There are others who should have been punished first, and severely.

But the cause which chiefly contributed to the awful nature of the consequences of the collision was certainly the gas carried on the wrecked carriages. Now, we suppose all railways are anxious to keep down expenses; and as the great expresses of the North-Western, Great Central, South-Western, Brighton and other lines are more often than not electrically lighted, we have *prima facie* ground for believing that the extra expense, if any, involved is not such as to influence the dividends. The Midland itself generally uses electricity in the dining cars, while the ordinary coaches of the same train are illuminated by gas. The lay Press, of course, got "expert" opinion on this matter at a very early stage, and one gentleman announced, in quite the most approved *ex cathedra* manner, that the power taken by the dynamos reduced the speed of the train. Any ordinary individual who knows an electric lamp when he sees it can calculate for himself that a 15-coach train can be lighted electrically with well under 10 H.P. Add another 20 if cooking is done electrically, and we are not asking a great deal of the locomotive, even in the worst circumstances.

The evidence of the Midland officials, from Sir Guy Granet downwards, absolutely out-Heroded Herod. They talked gas more strongly than gas engineers themselves would have done. We are almost persuaded that the fire would have been far worse without the gas; that the gas, in fact, acted rather as an extinguisher than as food for the flames. We ought to inquire very carefully into the reason for this attitude, which is not novel or unfamiliar on the part of the Midland staff. And who bought the bad coal?

The ideal solution would be the complete electrification of all railways, and we hope that the Railway Commission just recently appointed will be able to hear evidence on this matter. In the meantime, however, the use of electricity for lighting and cooking on trains, and of electrical signals, actuating an audible device on the engine, should be made compulsory, and that immediately.

CANADIAN ELECTRICAL TRADE.

[COMMUNICATED.]

From notices and articles which have recently appeared in the technical Press, it would appear that the relatively small value of British-made electrical fittings imported into Canada is attributed in a large measure to the regulations of the National Boards of Underwriters.

As there is some danger that the effect of these rules is being very much magnified, to the detriment of the British manufacturer, and the benefit of the American, it is the writers' object to show that although these regulations undoubtedly have some bearing on the question, they are not the main cause.

Let us suppose that the National Code is done away with, and that there are no Underwriters' Laboratories or inspectors, will the situation from the British manufacturers' point of view be materially altered for the better?

Take the case of electric cable for house wiring. The Canadian has found that a type of cable chiefly manufactured in the United States is mechanically and electrically quite suitable for his requirements. This cable may not be from a theoretical point of view equal in quality to that manufactured in Great Britain; still it does what he wants, stands the rough usage well and, above all, is cheap. By using this he can materially reduce his total cable bill per annum, or the capital outlay on any particular job, which, in a country that is developing rapidly, is of vital importance.

At the present time the British cable manufacturer cannot produce this cable, and the higher grade cable which he says he makes, is hopelessly out of it in price. Some makers even go as far as to say that they would not produce such a low grade material. If the manufacturer does not make what is required, how can he expect to export it?

It is interesting to note what the effect of the much-abused National Code regulations is in this case. Their specification is very detailed; it gives clearly the minimum physical and chemical properties which will be accepted; samples of all cables have to be submitted to the Underwriters' Laboratories, and the bulk is subject to their inspection. The consequence is the required quality is rigidly maintained and price-cutting by different manufacturers, due to the use of inferior materials in unsuitable proportions, is prevented.

When we remember that the purchaser is usually quite ignorant of the properties of cables, it certainly seems that the existence of the National Code regulations is an advantage to both manufacturer and consumer. They obviously prevent rubbish being sold as cable which could only bring all the manufacturers into disrepute, to the temporary material advantage of the few, to say nothing of the effect on fire insurance premiums generally.

Again, take the case of electric conduit. In large Canadian towns most of the buildings are of the skeleton structural steel type filled in with concrete; in the smaller towns the houses are of the framed wood type. In the former case, the conditions of building are very severe, the labour is unskilled, and everything is subject to very rough usage. The consequence is that it has been found desirable to use conduit of a heavier gauge than that used in this country, where buildings are substantial and high-class labour is cheap.

Exactly the same conditions prevail in the United States as in Canada; the former country has for years been manufacturing a suitable conduit in enormous quantities; the American manufacturer is able to produce it at low cost, and, therefore, to sell it at prices for the same weight per foot run which our manufacturers cannot at present touch. So that here again the ability to obtain our share of the imports depends upon our manufacturers producing the right article at the right price.

There is not the slightest doubt that once the British manufacturer realises the enormous market in the above articles alone, he will set about making exactly what is required, and will then compete.

Another interesting case is that of the small switch for house use. In Great Britain we use the "Tumbler" type;

in the United States they chiefly use the push-button snap type, and Canada has followed suit. Whether in this case the National Code regulations have had a material bearing or not, it is difficult to say. As is well known, their regulations state that switches for this purpose must make and break circuit with a quick action, and must not stop when motion has once been imparted by the handle; in other words, they must be of the quick "make" and "break" type. The ordinary type of tumbler switch does not comply with this requirement, and for this reason was, we believe, rejected in Canada on one or two occasions some time ago. On the other hand, we know that the Underwriters' Laboratories now regard the tumbler switch with no unfavourable eye, and although up to the present it has not been officially recognised in the Code, they have accepted it when specially asked to do so, so that it cannot be said that the tumbler switch is debarred by the Underwriters. It must, however be remembered that to a considerable extent the demand in Canada hitherto has been for flush types of switches for room use, and that here again the price of the flush push-button snap switch of American manufacture is cheaper than the flush pattern tumbler.

As regards small double-pole knife switches for house service use, the price for these in Canada is so exceedingly low that the British manufacturer practically declines to make them even in large quantities. The National Code has, therefore, no effect whatever on the British exports of this article.

The above instances, we think, show that the real reason why the British exports to Canada of these articles is so low is that the British manufacturer has not yet realised that the demand in Canada is for a type of article different from that being made at home, and that if he wants a share of Canada's business he must make what the Canadian requires, and not merely try to sell him what he makes.

When the British manufacturer realises this and sets seriously to work to compete, the existence of the National Code will be, in our opinion, a positive advantage. It clearly sets forth what is required, the rigid inspection compels the maintenance of the quality, and given a settled type, no country can produce a good article at less cost than Great Britain. So that eventually her competition will be severe, and she will secure her proportion of their trade. It appears to the writers that this aspect of the case has been overlooked.

The British manufacturer will probably reply that this may be all right, but he cannot compete in price until he is manufacturing in large quantities, that is, until he can get the orders, whereas, if his usual standards were accepted by the underwriters, he could compete now and increase his outputs in them. The cases cited above of cables, conduit, and flush and knife switches, entirely disprove this.

There is also a further point to be considered. The requirements of the National Code, and the types of apparatus supplied in accordance therewith, are well known in Canada. The factor and retailer knows that switches, cable, &c., which have been passed by the Underwriters' Laboratories have certain well-defined qualities which appeal to the consumer, and therefore he has confidence in carrying a stock of them; and the consumer knows that in purchasing apparatus which is approved by this body he is getting an article which is suitable for his purpose. In a sense he has come to look upon the Underwriters' label as a guarantee. This does not necessarily mean that British types are inferior; but it does mean that if we are going to get British types accepted, our manufacturers will have to start an expensive campaign to prove to the consumer that our types are superior to those now commonly sold, and after they have convinced him on this point, they will have to show that they are so superior that he should pay a great deal more for them.

Again, we must remember that, owing in a great measure to the National Code, the Americans have standardised most commonly-used fittings—such as knife switches, snap switches and clusters—to such an extent that those supplied by different makers are practically interchangeable. Can this be said of British knife switches, ceiling roses, tumbler switches, &c.? We hardly think so. The lack of standardisation forms a very serious obstacle to the use of British fittings in a large country like Canada, which is sparsely populated, and where the volume of business in numerous small towns does not warrant the retailer holding stocks of all makes and sizes.

Does it not, therefore, appear that the only way to increase our exports to Canada in small electrical fittings is to accept the situation as it stands, and make apparatus exactly similar to that in use out there; have it approved by the Underwriters' Laboratories, which can now be done in Great Britain by British engineers; reorganise our selling arrangements out there; and obtain our share of the trade by showing that we can supply exactly what the customer requires, at the right price?

Let the British manufacturer also remember that the United States have just effected a reduction of their import tariffs; this means that they are going to invite competition by foreign manufacturers. If we are to obtain our share in that market, we shall have to make the types required, which are the same as those for Canada. So that in developing the types for the Canadian market, the manufacturer will be putting himself in a position to compete in the United States market in due course.

LEANING BUILDINGS AND THEIR STRAIGHTENING.

In the case of a chimney which leaned considerably to one side owing to prevalence of wet weather during building, it was desired to straighten it. The inclination was not from the foundation, but was more in the nature of a curvature of the shaft, chiefly in its lower part where the soft mortar was compressed on the weather side because of the building being carried out too quickly for the mortar to dry sufficiently to carry the load. This manner of shrinking is not likely to take place to-day, because cement or ganged mortar should be used under such conditions. It is hardly possible to carry up a building in cement mortar so quickly that the weight increases as rapidly as the sustaining capacity of cement mortar.

In the case of the chimney above referred to, ropes were attached to the chimney at a high point, and so much tension placed upon them as would hold the chimney whilst a narrow wedge was cut out of it, the gap being well mortared over the cut surface, and the chimney allowed slowly to come over upon this mortar. Well carried out, this leaves very little sign, and is effective in bringing back the centre of gravity of the chimney near, or nearer, to the middle of the base.

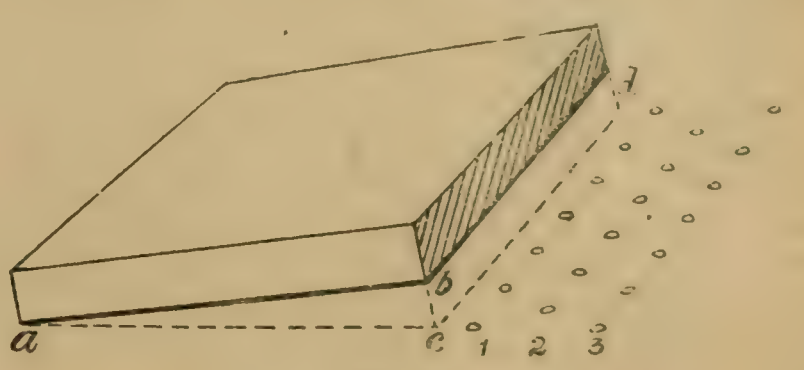


Fig. 1.

But a chimney may lean because one side of the foundation yields too much. Such a case would be represented by fig. 1, wherein the square foundation block takes a slope, and requires a flat wedge of earth to be removed from beneath it—namely, *a b c d*. To set such a foundation level, the volume of this wedge must first be calculated. This will be one-half of the product of $(a c \times c d) \times b c$.

Alongside the high side of the foundation, a row of holes No. 1 should be bored to a depth of 20 or 30 ft., if the earth is of a yielding nature to this depth. The first hole should be at the middle of the high side, and the others should be placed at the extremities of the line *c d*, then half way between the holes already bored. The end holes should be placed a little further apart than the length of the block. The first row of holes may remove a volume of earth whose bulk

must be calculated only below the level of the base or *a c*. Thus, suppose the base is 30 ft. sq., and the height *b c* is 3 in., the volume of the wedge *a b c d* will be $30 \times 30 \times 0{\cdot}25/2 = 112$ cb. ft. Then 11 bored holes of 6 in. diameter carried 28 ft. below the line *a c* would remove approximately 62 cb. ft. This might be too drastic for a first trial. It would be better to try, say, 4-in. holes, and remove about 28 cb. ft. from below the *a c* level. Theoretically, this should so remove lateral support from the earth under the block, that the foundation would come down $\frac{3}{4}$ in. or $\frac{28}{112}$ of the wedge volume. This would be a matter for observation.

The yield of the bored holes would be tested by means of rods. If very slow, as in dry hard clay, a little water filling would help them to crush in. Then a second line of boreholes, 2, would be put down opposite the spaces between the first set of borings. The amount of settlement would again be watched, and when complete, the amount of subsidence noted and the third line of holes undertaken—perhaps of only 3 in. diameter if the shaft was getting near the perpendicular. Some little lean might still remain with advantage, for settlement would probably continue for a time and too much should not be done, the mass removed not being so much as the wedge volume. If the upper parts of the holes do not cave in, they should be filled up. Or the holes may even be cased down as far as the line *a c*, and after the first removal and caving in, the holes may be rebored until the wish-for result is obtained.

The object of making the bored holes is, of course, to remove the lateral support from the cube of earth below the foundation block. This mass of earth cannot stand without this lateral solidity; it slowly crumples up, and continues to yield until it has crushed all the holes solid, when no further yield is possible until another boring again takes away support and allows further crumbling of the earth below the block.

Such work must be done slowly and with caution, so that the movement may be slow and steady, and the settlement must be watched and controlled so that one corner does not sink faster than another. Should this occur, the next row of holes must be spaced so as to adjust matters.

It is desirable or preferable, on general principles, that the the holes should be cased, if only with stove-piping, down to the foundation level, and after the caving-in of the unlined lower portion the casing should be filled up or removed as the filling is put in.

The system is scarcely applicable except to foundations of comparatively small area which will move as a single piece. It would be applicable, possibly, with care, to the case of the four supporting piers of the dome of St. Paul's considered alone, but the attachment of the superstructure to other portions of the general structure precludes such treatment, for it would be impracticable to carry out such a process upon a number of separate footings entirely disconnected except by the same superstructure, which would be badly shaken as a result.

CONSUMERS' HIRE ACCOUNTS.

By "INTERESTED."

Municipal electricity supply undertakings are hedged about with much legal growth, the usefulness of which is more or less open to criticism. One of the numerous statutory requirements is that where electrical apparatus is hired to consumers, the demand note or invoice must clearly show the sum charged for hire or rental of the apparatus as distinct from the charge for energy consumed. Under certain circumstances, this inflexible rule tends to make the consumer's accounts unintelligible to one who neither knows nor cares for the so-termed "red tape" reflected in the figures on his invoice.

In some instances it is possible to present a demand note for payment to a customer in a lucid form, but in others quite the reverse is the case. Take, for example, a Council which has in operation a scheme for hiring arc lamps to consumers on the basis of so much per annum for a guaranteed number of hours' use, including the supply of carbons, trimming, cleaning, &c., any excess being charged for at a predetermined rate set out on the application form. A simple manner of rendering accounts, and one which many consumers would perhaps prefer, is merely to invoice each quarter one-fourth of the agreed annual charge, adding to the fourth quarter's account any extra charge due where the total hours the lamps have been alight exceed the agreed guaranteed minimum. However, the law says this will not do, and stipulates for separate items showing hire or rental and likewise energy consumed; and in order to comply with this request, it is necessary to charge upon the actual length of time the lamps are used each quarter.

Of course, it is not a diplomatic move to explain to a prospective customer just how and in what form his accounts will be rendered. The result is that upon receipt of his first demand note the consumer is puzzled to know why the charge is not merely one quarter of the annual sum agreed upon. To devise a form in which to render the accounts so as to show clearly how the charge is made up, and to save repeated inquiries, is rather difficult at first sight. One method of doing this is as follows (see Card No. 1):—

Card No. 1.

ARC LAMPS ON HIRE.

Address..... Application No.....
No. of Arc Lamps..... Name.....
Guaranteed hours' use per annum ..... Cost.....
for £ .....

Date.	Hour meters.				Units used.		Arc lamp rental.	Total rental.	Remarks.
	No. 1 reading.	No. 2 reading	No. 1 advance.	No. 2 advance.	Units at 3d.	£ s. d	£ s. d.	£ s. d	

No. 1 card or book, whichever is preferred, is intended for use at the electricity works, and at the top are recorded particulars of the chief points in the agreement. Below are columns for readings of the hour meters, which record the number of hours the arc lamps have been used, the quantity of energy consumed, the cost of the energy, and also the charge for hire.

The method of working out the charges will, I think, be clearly seen from the figures shown. (See Card No. 2.)

Card No. 2.

Town Hall, London.
.....19.....

M .....
.....

Dr. to

Quarter ending June, 1913.	Arc Lamp Hire a/c. (one pair) Minimum guarantee, 800 hours p.a. Annual charge, £14 Used during quarter, 380 hours $= \frac{380}{800}$ of £14 =	£6 13 0
	Extras:	
	Analysis: Energy consumed: 266 units at 3d. = £3 6 6 Balance being hire charge:— £3 6 6	
		£6 13 0

No. 2 is the suggested form of invoice for sending to the consumer. The details shown afford the consumer every opportunity of seeing how the charges are arrived at, and likewise point out that the sum fluctuates according to the length of the time the lamps are used.

It is worth a little trouble to explain matters to consumers, for it must also be remembered that he views his account from the aspect of a purchaser, and cares nothing for the enforced red-tape methods of the supply department. After all, extensions come from those consumers who are not given the chance to complain.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Travelling Representative.

One is sometimes tempted to question the usefulness of the enormous army of travelling representatives maintained by manufacturing firms in this country whereby the cost of the products must necessarily be substantially increased. The custom of sending out travellers with samples arose long before the electrical industry came into being, and at a time when no other means existed of bringing new products to the notice of possible buyers. In these days of Press notices and frequent exhibitions the need for personal calls is not nearly so great, yet owing to competition we have an actual increase in the proportional number of representatives travelling about the country whose expenses have to be paid by the consumer in the form of higher prices.

The effect of personal visits varies with the knowledge of the prospective purchaser and the nature of the product for which it is attempted to obtain orders.

The technical Press is willing enough to give descriptions of any apparatus in which novel and advantageous features are to be found, hence both consulting engineers and contractors are *au fait* with what is on the market in their particular lines. Moreover, orders from these sources are seldom given without obtaining prices from a number of different firms, consequently the only result of a call—if, indeed, an interview be granted—is to keep the name of the firm in mind when inquiries are being sent out. Amongst consulting engineers must be included engineers-in-charge to large industrial or municipal undertakings, who, in up-to-date knowledge, are generally equal to their independent brethren.

Time and money spent upon looking up contractors and engineers is therefore practically wasted excepting for the purpose of keeping them reminded of a firm's existence, but this object can be equally well effected by sending out periodical circulars and by advertising in journals of repute. We refer here more particularly to the calls of ordinary representatives. Where the principal or managing director of a manufacturing firm, perhaps himself an engineer, makes a round of old customers, the effect is often very useful. Again, the ordinary traveller seldom possesses more than a smattering of technical knowledge, and engineers rather resent calls from representatives of this type.

The smaller consumer who is very often ignorant of prices and the comparative merits attaching to various makes of article or machine he may require, can sometimes be approached by travelling representatives with success, but more often than not he will send out to a number of firms for competitive prices and place his small order with the lowest tenderer. In any case business of this description takes a lot of getting, and prices are generally cut pretty fine, so that by the time travelling expenses have been covered very little profit remains.

The only legitimate field for a travelling representative in connection with electrical machinery and apparatus is the explaining of new complex products, of which the advantages cannot be clearly set forth on paper. A good technical man is required for work of this nature, and he must be well up in the products offered by competing firms while being enthusiastic over the advantages of his own.

If travelling for orders were confined to this field, and the annual rounds of old customers by principals or managing directors, as mentioned above, the whole electrical industry would benefit from the increased trade promoted by lower prices.

Anti-Traveller.

Remarkable Motor Records.

The writer of the letter under the above heading, in the issue for October 24th, evidently assumes that the article published on October 10th was written by the designer of the machines referred to; in this he is mistaken.

I notice that he imports into his letter a figure, viz., 160 B.H.P., which nowhere appears in the notice of the 10th.

The writer of that notice claims nothing, he simply states facts. The machines were designed to do 120 B.H.P. at 650 R.P.M., and they have been running under these conditions with the most perfect satisfaction for the past four or five years.

Your correspondent's remarks as to temperature and time taken to reach the maximum rise apply to ordinary type machines, but these are not ordinary type machines, and the same rules do not apply to them. They reach their maximum rise after running for three hours.

This is purely a matter of design. I have built machines which, running on constant load, reached their maximum temperature after two hours, showing no further rise whatever, although kept running on the same load for six hours.

Your corresponent speaks of "the nature of the design," while he is totally unacquainted with the design he presumes to criticise, and so far from his assumptions in regard to the losses being anywhere near the mark, I may assure him that when these machines are putting out 120 B.H.P. at 650 R.P.M., the total losses do not amount to the 7 per cent. he apportions to the armature C^2R and iron losses, and no matter how long they may continue to run under these conditions, the temperature of no part would approach anywhere near the ordinary limits.

In regard to commutation and the state of the commutator, I would recommend your correspondent to read the notice of October 10th over again, and with a little more care than he appears to have bestowed upon it formerly.

In conclusion, I would say it is just because designers have so long travelled what they consider a well-defined road that they find it so hard to deviate from the beaten track, and thus do not know how to get the maximum result from a given amount of material.

I shall be pleased to furnish test-sheets or test-curves, if the Editors will allow space for their publication.

Henry Chitty.

London, N., *October 28th*, 1913.

Electric Cooking for the Smaller Consumer.

I was much interested in the communicated article on this subject in your issue of October 17th. The solution of the problem of introducing electric cooking to the smaller consumer is not an easy one, and, as usual with central-station officials, the writer of the article blames the manufacturer of the apparatus for his lack of enterprise in helping the solution; the manufacturer in his turn does not hesitate to blame the central-station officials for their general apathy upon the subject. Some day, perhaps, they may cease to waste their energies in this manner and combine their talking and writing abilities in a campaign on the consumer, in something approaching the American manner. I fancy the results might be happier for both.

It might be well for the central-station engineers and other self-constituted critics of the manufacturer to bear in mind that in all electrical apparatus, and more especially in electric cooking apparatus, where the demand is very fluid and has not yet crystallised into any very definite form, thanks partly to the diverse views held by station engineers themselves, the manufacturer is compelled to feel his way cautiously along the margin of effective demand. Just now that demand, caused by the ignorance of the public of first principles, is for an electric cooker which looks and works as nearly as possible like a gas cooker, and for an electric hot plate which looks and works like a gas ring, neither of which articles can be regarded as really efficient. Central-station engineers and their assistants could help a great deal, if they would, to educate the public, and so create a demand for apparatus, the design of which should in every way be the outcome of the problem to be solved, not a mere imitation of articles with quite other origins. There is at present on the market an oven so designed. It is made in

two sizes; the small size will take joints up to 7 lb., and is loaded to 600 watts; the large size will take up to a 14-lb. joint and is loaded to 1,200 watts; both are fitted with heat regulation. Either size will attain cooking temperature in six minutes, and, further, by a simple and ingenious device, there is practically no loss of heat on opening the oven door, thus avoiding one of the greatest losses in electric cooking. In a test recently taken in our kitchen, a 6-lb. joint of beef was cooked, and cooked well, with a consumption of 1 unit. If the writer of the article in question, or any other station engineer, is sufficiently interested in efficiency, my firm would be happy to send descriptive matter or to lend an actual sample for test.

Simplex Conduits, Ltd.

T. Birkett, *Manager*,
Heating and Cooking Department.

Birmingham, *October* 21*st*, 1913.

"Oil."

A London gentleman has called my attention to a review on my book *re* above in last issue Electrical Review.

Probably the enclosures will sufficiently explain themselves.

The writer of the article must have been blind mad with malice when drafting, to put the mildest possible construction on it, it is not fair comment—it is truly scurrilous.

I have no undue desire to take full advantage of the position, if you care to publicly rite the wrong there has been done in public, the matter drops.

Otherwise shall consult my solicitor at the end of seven days, when we will see whether the book or the reviewer is 200 years behind the times, or whether the author or the reviewer has made a hodge-podge of it, then the reviewer will probably learn what lias formations are, and will be actually shown some vegetable limestone in distinction to lias and carbonaceous limestones.

The attack is deliberate, wanton and deplorable, and I'm not the sort of man to take such damnable treatment lying down.

It is remarkable that such a "bit of a book" should command such a lenthy review.

However, the repair must be unmistakable—not half-hearted, as the review was certainly not.

W. Antrobus.

Eccles, *October* 25*th*, 1913.

[The author of this book wrote us some time ago, asking if we would give it a favourable review; we replied that we were always prepared to review books on their merits, and if he sent us a copy of the book we would give it proper treatment. This we have done. The author's suggestion that our criticism was actuated by malice is ridiculous; it was written by an expert on both oil fuel and geology, and we have personally satisfied ourselves, by an examination of the book, that his comments were just.

Our reviews are not adjusted in length according to the size of a book, nor are they based upon an inspection of the preface and table of contents, as some of the "Press Opinions" sent us by the author appear to have been; and the fact that these "opinions" differ from ours leaves us cold.

We regret that the author's feelings have been hurt; but those who cannot bear criticism should not write books. For the rest, his letter, printed as written, speaks for itself. —Eds. Elec. Rev.]

Faraday House O.S.A.—The annual smoking concert of this Association is to be held on Friday, December 5th, at 7.30 p.m., in the Crown Room of the Holborn Restaurant. The president, Mr. H. T. Harrison, M.I.E.E., will occupy the chair.

Italian Tariff.—The Italian Customs Authorities have lately given a decision to the effect that "air-suction electric ventilators" are dutiable under No. 314A of the Tariff, the duty being 25 lire (about £1) per 100 kg.

LEGAL.

Osram Lamps Works Co., Ltd., *v.* The Ostra Light Co.

In the Chancery Division on Friday, October 24th, this case was mentioned to Mr. Justice Joyce upon a motion by the plaintiffs for an injunction which was mentioned by Mr. Lunge.

Mr. Newbolt, for the defendants, said his clients were anxious to ascertain the facts in this case. These 156 lamps were in Court. All the lamps sold by the defendants bore their mark, and among the 156 none bore the defendants' mark. His clients, therefore could not help thinking there must be some mistake, and as they were indemnified by their vendor, they wanted to have an opportunity of seeing the lamps. It was desired that they should be kept in the custody of the Court. Plaintiffs said defendants had infringed their patent by selling some lamps, but when the defendants looked at the lamps they said these were not the ones they sold.

His Lordship: I suppose the plaintiffs' evidence identifies them by marks.

Mr. Newbolt: It identifies them, but not by marks.

His Lordship: Then it does not identify them.

Mr. Newbolt: It identifies them by exhibiting them.

Mr. Lunge: They are not exhibited at all. They are our private property. They were broken for purposes of analysis, and there are some residues left over, which are in our possession.

His Lordship: I never heard of such a thing as objecting to produce things which you say are an infringement.

Mr. Lunge: There is no objection, except that I don't know of any machinery for detaining the things in the custody of the Court.

His Lordship: I can find machinery, but I don't suppose you would mind lending them to the other side.

Mr. Lunge: Now it is suggested that the identity is in dispute that would be curious.

His Lordship: You must allow the other side to see them, or I shall make no order.

Mr. Lunge: We have offered to let them see the things at any office they can suggest.

Mr. Newbolt: I want to prevent them being changed again. My clients say plaintiffs have got some other infringement without their marks, and I say I can prove that defendants did not sell these.

His Lordship: You don't dispute the patent.

Mr. Newbolt: Not a bit. I am indemnified, but my vendor says I did not sell you these goods, and it is no good talking about indemnity.

His Lordship: You are not going to sell anything you know to be an infringement.

Mr. Newbolt: I am selling for my vendor, who says they are not an infringement.

In the end, the motion stood over for a week, his Lordship remarking that unless the parties could agree on some place for the deposit of the alleged infringements so that defendants could see them, he would order them to be brought into Court.

Osram Lamp Works, Ltd., *v.* London and Provincial Electric Lamp Co.

In the Chancery Division on Tuesday, before Mr. Justice Joyce, Mr. Hunter Gray, on behalf of plaintiffs, moved for judgment against defendants in an action for alleged infringement of the plaintiffs' patent.

Mr. Gray said this was a motion for judgment in default of defence, and remarked that it appeared that the defendant company was being carried on by a lady under her own name.

His Lordship made the order as asked.

Dumbarton Tramway Co. Sued.

In the Court of Session, Edinburgh, Lord Skerrington and a jury tried an action by a general dealer belonging to Renton, against the Dumbarton Burgh and County Tramways Co., Ltd., for £1,000 for personal injuries through being hurled from the top of a float. The contention was that the wheel of the vehicle caught against the side of one of the tram rails, and that at the point where the accident happened, the setts had become sunken. The company denied that the roadway was dangerous. The jury returned a verdict for pursuer, and assessed the damages at £250.

National Electric Construction Co., Ltd., *v.* Redditch Urban District Council.

Last week Judge Amphlett's reserved judgment in this case, which was heard in August, was delivered. Plaintiffs claimed £12 16s. 5d., said to be due under an agreement dated January 3rd, 1899, made between the plaintiffs. The amount was made up of three outstanding free-wiring rentals accrued between June 24th, 1908, and September 30th, 1912, which three customers of the defendants had not paid.

Judge Ingham now announced (according to the *Redditch Indicator*) that judgment was given in favour of the plaintiff company, with costs.

Mr. F. W. Whiteley, on behalf of the Council, pointed out that several vital matters were affected if the judgment held good against the Council. He asked his Honour to grant leave to appeal, with a stay of execution to enable the Council to meet.

Mr. Tunbridge said he did not object to a stay of execution for the usual time, and the application was granted.

INSTITUTION OF ELECTRICAL ENGINEERS.

Newcastle Local Section.

On Monday, last week, the Chairman, Mr. C. Vernier, delivered his inaugural address, of which an abstract is given below :—

Previous to the year 1900, public electricity supplies in this country were, generally speaking, chiefly utilised for lighting. As the result of an investigation in 1898 a Joint Committee of the House of Lords and the House of Commons made certain recommendations, which resulted two years later in the granting of statutory powers to several Undertakings formed for the purpose of supplying electrical energy over very large districts, covering in many cases some hundreds of square miles.

The advantages which have been claimed for these Undertakings, and which are no longer open to question, may be briefly summarised as follows :—

(1) The low capital cost per kilowatt of Generating Stations and the increased economy in running charges obtained by the use of very large generating units.

(2) The development of high load and diversity factors resulting from the varied uses which are made of the electrical energy supplied.

(3) Low fuel costs obtained by the favourable location of Generating Stations and the opportunities afforded for the utilisation of waste heat and other forms of waste fuel.

In general, the higher the price of fuel, or the poorer the load factor, the less a high capital cost can be defended on economical grounds. It may also be stated that in a large scheme, the cheaper the fuel, the more desirable it is to run the plant at a high load factor; therefore, any stations operating with cheap fuel, such as cheap waste coal, heat or water power, must be run as nearly as possible continuously at 100 per cent. load factor, the ordinary coal-fired stations dealing only with the fluctuations of load. This is where the producer of waste heat finds it to his advantage to co-operate with a Power Company.

If we now examine the conditions under which electrical energy is produced in this country, it is clear that, with a few exceptions, we are very far from according with the conditions I have described as essential to a low cost of production.

The multiplicity of small generating stations, some 40 per cent. of which are of a capacity under 1,000 k.w., supplying small districts, inevitably results in high capital charges, poor load factors and high fuel and running costs.

When we note that the use of electricity from public supply sources in that portion of the North-East Coast served by the Power Companies has increased by over 3,200 per cent. within the past ten years* and that, as the result of a cheap and abundant supply of electrical energy, new industries are springing up in our midst, it is surely a matter for regret that similar rapid progress has not taken place to the same extent elsewhere.

Dr. Ferranti, in his inspiring address to this Institution three years ago, set before us an ideal of what electricity supply should be, and it is perhaps pertinent to ask ourselves what we in this country are doing towards the realisation of that ideal.

Do we not see each year existing generating stations of small and moderate size being extended?—Generating stations which in many cases are quite unfitted, by their unfavourable situation, to achieve the economical production of electrical energy.

Then what of our load factors? How very few (less than 3 per cent.) of our electrical undertakings of to-day can exceed even a twenty-five per cent. load factor.

Again, how many of our Undertakings can profitably avail themselves of the utilisation of such waste heat as may exist in their neighbourhood?

The waste heat from coke ovens and blast furnaces in this country, would, if fully utilised, be more than sufficient to operate the whole of our existing public electric supply stations, with a combined maximum load last year of between 700,000 and 800,000 kilowatts.

The first step towards the realisation of Dr. Ferranti's ideal must inevitably be in the direction of the centralisation of all coal-fired generating plants into large power stations supplying in bulk over very large districts, so as to obtain the benefit of large outputs and increased load and diversity factors. These stations will have, as far as possible, to be interconnected together, while all available sources of waste fuel must be fully utilised.

I do not underrate the difficulties which will have to be overcome before this development becomes an accomplished fact, but that we have in this district already proceeded a tolerably long way towards its solution should be evidence that if the problem is approached in the right way, its solution is not to be feared.

What then is the chief obstacle to the centralisation of our electric power supply? Is it not largely the opposition which is almost invariably offered by municipal authorities, and particularly by the more important of them, to the exercise of private enterprise within their borders? It will not be easily forgotten how strenuously the Power Bills were opposed by the municipal authorities, with the result that in most cases the larger towns and industrial centres were entirely excluded from the area of supply, while the supply in bulk within the area of any existing undertakings is usually made subject to their consent. To this fact, coupled to the aversion of many of our Local Authorities to themselves entering into contractual relations with Public Companies for bulk supplies, must be attributed the slow progress which many of the Power schemes have achieved.

It may be argued that the centralisation of power supply is not of necessity a matter to be undertaken by private enterprise, but the jealousy of control between neighbouring authorities appears to be an even greater obstacle than the ones previously mentioned.

While the Electric Lighting Acts afford to Local Authorities the right of combination or to promote joint schemes, similar schemes between a number of Companies or between Local Authorities and Companies are denied, and even the supply from a single generating station of two or more districts scheduled under separate Provisional Orders but operated by a single Company, cannot be carried out without special parliamentary authority; all powers granted to Companies, if we except Power Companies, being subservient to the right of purchase of Company Undertakings by the Local Authority for the district.

Although from time to time we have been assured that the position of our electrical supply industry was in no way behind that of other parts of the world, I question very much whether we can make the same statement to-day, in view of the rapid progress which is taking place in other countries at the present time. If we assume that our electrical supply industry commenced in 1890—although a few undertakings were started earlier than this—at the end of the first 13 years the annual consumption had risen to 247 million units in round figures, while in the next 10 years (1903-1913) this consumption amounted to 1,318 million units (see Garcke's Manual), or an increase of 433 per cent. If the pioneering work of the first-named period is considered, few, I think, and least of all in this district, will be prepared to agree that the increase within the last 10 years represents the rate of progress which we ought to expect. The reason for this is clearly that the great majority of our Undertakings by their operations on the restricted scale created by their condition of municipal isolation, are not in a position to supply the larger users, such as industrial power consumers of all kinds, and railways. Nor is it possible that we shall ever be in such a position, so long as for sentimental or other reaons it is considered essential to retain a power station for each town or district, irrespective of its size or facilities for economical production.

That many of our Undertakings are experiencing the pressing necessity for larger outputs and higher load and diversity factors is evidenced by the special efforts which are being made to develop electric cooking. To those of our undertakings especially whose operations are circumscribed by limitations of the area of supply, this development must be of particular importance, and it is so far fortunate that their inability or unwillingness to improve their position by other possible means has compelled them to break new ground and direct their attention to the energetic development of this business.

Meanwhile, unlike the small power business, which in many places has reached no unsatisfactory proportions, the development of the heavy industrial power supply over a large part of the country appears to be languishing, and yet how much remains to be done may be seen from the last Census of Production, which gives the total horse power, of engines in use at that date (1907) in the factories and mines of this country at 10½ million horse power, of which 1½ million horse power, or only some 14.3 per cent. represented the total plant capacity of public electric supply undertakings.

More recent complete figures are not available, but some measure of the increase of horse power available in our generating stations can be obtained from Garcke's Manual, which shows an increase of plant capacity between 1907 and 1913 for those public supply undertakings which furnished returns of just over one-half million H.P. or rather less than the average rate of increase since 1890. I have been unable to obtain any figures bearing upon the total horse power of engines in use in the country at the present time, but assuming, for the purpose of comparison, that no alteration in the figures has taken place elsewhere than in our public electricity supply stations, our progress would be represented by an increase during the past five years of four per cent. of the total.

A further surprising fact shewn by the last Census of Production is that there was approximately one million horse power in private hands utilised for generating electrical energy, which produced an output equal to fully 62 per cent. of the entire output of our public electricity supply undertakings. Comment would be superfluous

The most important development of the not very distant future will undoubtedly be the electrification of our railways. Steam locomotives have about reached the maximum dimensions allowed by the present load gauge, and the demand is

* In that portion of the North-East Coast not served by the Power Companies, which includes many of the large towns, the corresponding increase is under 450 per cent., which is also about the average for the whole country for the same period.

still for heavier loads and more frequent traffic, two problems which electric traction is eminently fitted to solve.

But now as to the supply of electrical energy to work our railways, are we going to repeat the mistakes of the past and add to our already too numerous generating stations by compelling our Railway Companies to put down their own generating stations, as several have done already? This load at any rate is not one which for various reasons our municipalities can ever hope to touch and there is, I think, no better illustration of the shortcomings of the present state of our electric supply industry having regard to its ability to meet all demands.

It is certain that the ability to supply a likely demand will largely create such a demand, and if we wish to see a more rapid development of the electrification of our railways, the electrical supply industry must place itself in a position to supply all the requirements of our Railway Companies at a rate which will induce these Companies to undertake electrical working. It is not to be supposed that our Railway Companies would expend the necessary capital for putting down generating stations of their own if a sufficient, cheap, and, above all, a reliable supply were to be obtained from public supply sources.

It appears to me that here lies the key to the future position of our electric supply industry. There would seem to be but two alternatives, once the electrification of our railways begins in earnest; either, as I have said, our public supply undertakings must then be in a position to undertake the supply of all the requirements of our railway companies, or our railway companies will themselves put down large generating stations, and, at a certain stage of their electrification developments, will inevitably seek to supply other undertakers in bulk. In either case, the compelling agency will be that of larger outputs and the better load and diversity factors to be obtained by co-operation. The balance of advantage should obviously lie with us, who are first in the field.

There is further a vast and practically virgin field in the supply of electrical energy for electro-chemical and electro-thermal processes, which, however, will only be secured at rates which are but a small fraction of the present works costs of the large majority of our undertakings. In this field, so far, a few of the power companies stand practically alone, and chiefly those operating in this district, where, as a result of the electrical facilities offered, a number of important new industries have erected works adjacent to the power stations of these companies.

If our position is now relatively unsatisfactory when compared not only with other leading countries, but especially, and I think this is the more correct view to take, with what it should be, considering our industrial supremacy and the density of our population, it is surely a matter of the first importance that the causes which at present hamper the progress of the industry should be enquired into, and that the best means to remove these disabilities should be once more discussed and formulated in the light of present-day experience. This is a question which the Institution, in pursuance of its broader policy, cannot afford to ignore.

It will be of interest to observe that public electricity supplies in Germany have developed on very similar lines to those of this country, in so far as many of the Local Authorities established their own works. Perhaps in one respect their condition was even worse than ours, for in 1909 it was estimated that 80 per cent. of these Municipal Works were of a capacity under 500 k.w. Germany is at present wrestling with this problem of the centralisation of power generation, which we ourselves must eventually face, and is putting down large stations for supply in bulk, many of them in connection with Iron and Coal Companies, utilising waste heat from coke ovens and unsaleable qualities of fuel.

The co-operation of municipal authorities is being secured in some cases by buying out municipal undertakings upon terms advantageous to both sides, but more usually by giving these municipalities a financial interest in the Power Company. As an instance, the Municipality of Strasburg takes the whole of its supply from a power company supplying also some seventy communes in Alsace-Lorranie and in which it owns a large number of shares. As the result of the operations in 1909, the Municipality received dividends and a share in the profits amounting approximately to £38,000, which, after deducting 4 per cent. interest on its invested capital, left a balance of over £21,000 for the relief of local taxation. In other instances, groups of Urban and Rural Authorities co-operating with a power company have the option of subscribing for ordinary shares in the promoting company, usually up to 40 or 50 per cent. of the total capital, or in some cases, when wishing to avoid risk, to preferential shares with a fixed dividend and a further share in the profits.

In each case, the Municipalities are directly represented on the board. The mutual advantages are obvious, in that the companies enjoy the benefit of the greater facilities afforded for raising capital, while the community, through its directors, maintains a live interest and a share in the control of the undertaking. Such schemes of harmonious co-operation, it must be admitted, cannot fail to hasten the solution of this problem.

It is, perhaps, in the United States of America, however, that the centralisation of electric power production and distribution is making the greatest progress, and it is also remarkable that in that country the supply of electrical energy is chiefly in the hands of private enterprise. We have nothing to compare with the electric service in Chicago, with its maximum load of 230,000 kilowatts (which compares with 20,000 kilowatts ten years ago) or with more Urban supplies, such as the Public Service Corporation of Northern Illinois, supplying 46,000 consumers in 150 communities, whose combined population is only one half million distributed over a tract 150 miles long, and working on a system load factor approaching 70 per cent. This load factor in itself is a striking example of what can be achieved by supplying various demands over very large areas. Another example, out of many which might be quoted, is that of the Central Illinois Public Service Company in the same State, which is gathering into one management and system the electrical requirements of a Rural District of 350 miles radius (larger than the United Kingdom) with a population of only a quarter of a million, whose present 90 local generating stations will shortly be replaced by a small group of modern central stations.

The principle of State regulation of Public Utility Companies, which not only include electric supply, but also gas, water, telephones, telegraphs, tramways, light railways and railway services, is that which finds its adoption in the United States under the description of Public Utility Commissions. These Commissions, which are of recent origin and adoptive for each State, are appointed to deal with all questions relating to public services, such as the ratification of franchises, the settlement of disputes between Undertakers, the revision of rates, amalgamations into joint schemes, the approval of new issues of share capital, technical regulations and inspection, and not only to regulate but to press forward the development of such services.

What the effect of these Commissions may be upon the ultimate development of the electric supply industry in the States cannot yet be judged, but I have looked in vain for any serious criticism by those most nearly concerned of the principle there adopted, while the remarkable strides which are taking place in the consolidation of Central Station interests at the present time would tend to show that their effect is, on the whole, a beneficial one.*

It is almost unnecessary to remark that one of the factors which have largely contributed to rapid progress in other parts of the world, is the facilities which exist for an extended use of overhead wires for transmission and distribution purposes. Such extensive schemes as I have already referred to, chiefly in America, could not possibly have been developed otherwise.

The use of overhead wires in this country has always proved a matter of some difficulty, and some of the complaints which have been made from time to time have been as follows:—

1. The objection of the Board of Trade to the use of overhead wires.
2. The difficulty of obtaining wayleaves across country, and the absence of legislative assistance in this matter.
3. The arbitrary powers granted to Local Authorities.

With reference to the first of these complaints, whatever may have been its attitude at one time, there is no doubt that for a number of years the Board of Trade, thanks largely to its Electrical Adviser, has facilitated the use of overhead wires in every possible way, with due regard to public safety. There is a substantial saving in first cost, even with the very best construction, by the use of overhead wires in place of underground cables. The higher the voltage, the greater the possible saving becomes, while at pressures exceeding 30,000 to 40,000 volts, 3-core cables for three-phase transmissions can no longer be used, except perhaps in short lengths.

The highest pressure hitherto used on overhead lines in this country is 20,000 volts, but I have not the least doubt that, given a good standard of construction and the adoption of modern protective devices, the Board of Trade would be quite prepared to allow the use of overhead wires up to any voltage which is likely to be required here. The Power Companies in this district have already 170 miles of overhead transmission lines, chiefly running at 20,000 volts.

The difficulty and delays in obtaining wayleaves are a serious obstacle in the development of overhead construction, and our position in this respect compares very unfavourably with that of other countries, notably Italy and Switzerland, which have adopted legislation compelling the grant of wayleaves for overhead lines across private land. Such works are there viewed as of public utility, and private interests are not allowed, subject to compensation, to take precedence of the general interests of the community.

We unfortunately cannot hope to obtain greater powers than our Post Office, and we take such a different view of the rights appropriate to the ownership of land than is common in more democratic countries, that I am not at all sanguine of our being able to secure greater facilities from Parliament possibly within our generation.

It follows that the use of overhead wires for transmission purposes is at present to a large extent at the mercy of our landowners, but we are fortunate in the North in that the land is largely in the hands of large owners, whose interests

* A leading New York Banker has stated in an address recently that the electrical industry in the States can profitably employ a capital of eighty million pounds per annum for the next five years.

are so intimately bound up with the industries whose needs we seek to supply, or, if not, who are already so well accustomed to wayleave matters in connection with the mining industry, that apart from delays, we do not experience the same difficulties as are perhaps strongly felt in some other parts of the country. The slow progress of negotiations is, however, a serious, but in the circumstances, an inevitable objection, which we must at present accept with the best grace possible.

The Electric Lighting Acts have probably done more to discourage overhead wires than all the rest put together, by stipulating that before any overhead wires are erected the consent of the Local Authority must be obtained. This stipulation not only applies to the erection of overhead wires in public streets, but to all overhead wires, even if erected entirely on private land. On the other hand, an individual or Company which does not work under an Act or Provisional Order can erect overhead wires on private land without the consent of the Local Authority, and in the absence of special local by-laws, of which very few are in existence, can erect overhead wires across public roads without seeking any consent from the Local Authority, provided the consent of the owners of the soil on each side of the road is obtained, and also that the wires are erected at such a height above the roadway that no obstruction is caused.

Lastly, non-statutory Undertakers are not compelled to erect their works in the first instance in compliance with any regulations of the Board of Trade, except that the Board of Trade may, if it thinks fit, serve a notice upon the owners of such overhead lines requiring that they continue to be used only in accordance with such regulations as the Board may prescribe.

It is, in my opinion, essential that an early opportunity should be taken to amend the Electric Lighting Acts in this respect, for if, as all agree, regulations are essential in the case of statutory Undertakers, how much more are they necessary in the case of non-statutory bodies, who are usually the least qualified by reason of their not being primarily engaged in electrical work.

Efforts should also be made to secure a curtailment of the absolute veto of the Local Authorities in regard to overhead wires, particularly if it be not proposed to erect these wires along public thoroughfares, and the Local Authorities' consent should, in all cases, be made subject to an appeal to the Board of Trade. At present a single Local Authority may imperil the successful carrying-out of a large project in which it has no particular interest, while this power is further open to abuses which need not be further specified.

A great deal of the prejudice which exists against overhead wire arises from the haphazard fashion in which much of it is put up. Crooked poles, neither set plumb nor in line, wires run with all sorts of twists and angles, ugly cross arms, etc., certainly add nothing to the beauties of the landscape, and yet it is remarkable how little objection can reasonably be offered to overhead wires when these and other details have been carefully studied. Good overhead line work is entirely a matter of minute attention to details of design and construction which many seem indisposed to give, or perhaps to pay for.

If we are to obtain the best results in the supply of electrical energy over wide areas, it is of no small importance that the capital cost of our transmission systems be kept as small as possible, and the use of overhead wires at high pressures enables this to be achieved in a marked degree. It is not only that overhead transmission lines across country usually enable a considerable saving in route length to be made as compared with underground cables laid along roads, but even length for length and for the same sectional area of conductors, the capital cost of a first class 20,000-volt overhead line is only approximately one-half that of a similar 20,000-volt underground cable, while if the pressure were raised to say 60,000 volts, at which pressure the use of three-core three-phase underground cables would no longer be possible, the capital cost per kilowatt of such an overhead line would only be from one-fifth to one-sixth of that now incurred for a 20,000-volt underground cable of equal section.

The chief obstacle at present in the way of the adoption of higher pressures is the heavy cost of switchgear for these higher pressures, which, in this country, where the average distance between switching points is small, becomes the predominant factor.

On the other hand, the use of higher pressures than 20,000 volts will become a necessity, if only to deal with the heavy loads which have to be transmitted and which will soon exceed the possibilities with 20,000-volt lines.

A further consideration in the use of higher transmission pressures in this country is the practical impossibility, for many and various reasons, of erecting an entirely continuous overhead system, and most of our overhead lines must of necessity include a fair percentage of underground cables over sections of the route; therefore, whatever pressure may be adopted for the overhead system must also be suitable for use with underground cables. This leads to an examination of the high-voltage cable position.

No very notable advance can be recorded since the laying of the extensive 20,000-volt three-phase cable system in this district some seven years ago, if we except a large system of 30,000-volt 3-phase cables laid in Berlin about two years ago, following upon the experience obtained here.

There are, I understand, some short lengths of 45,000-volt 3-core 3-phase cables in use in France, but this, as far as I know, is the highest pressure hitherto applied to 3-core cables in commercial service, and it is difficult to foresee any possibility of greatly exceeding this or even much lower pressures on a large scale on account of the heavy capacity currents and increased dielectric losses (which are continuous losses and independent of the load) which would be experienced at our usual frequencies. While with cables these losses increase in proportion to the square of the voltage, they are practically non-existent on overhead lines up to the limit of pressure at which corona effects take place. Another factor which largely determines the highest pressure which can economically be dealt with by an underground [illegible] cable is that of the maximum diameter and weight of cable which can be handled. Beyond this, it is necessary to resort to the use of three single-core cables at a greatly increased cost. At present I would set down the superior practical limit of pressure for 3-core cables at not more than 40,000 volts, while there is no very obvious difficulty in constructing single-core lead-sheathed cables for three-phase working up to a working pressure of 80,000 volts between phases, that is, nearly 50,000 volts per cable with the neutral point earthed. Capacity currents, and the copper and dielectric losses to which they give rise and also sheath losses arising from the use of single cables, would not prove of serious importance if these cables were used as an adjunct to our overhead lines in moderate lengths, distributed as usual at points along the route.

I therefore apprehend no serious difficulty in increasing our overhead line pressures to anything between 60,000 and 80,000 volts if required.

Considering the importance of the subject, our knowledge of the science of cable design is still very incomplete, and although the general principles are fairly well established, there is a remarkable dearth of technical data upon the properties of extra-high-tension cables. It is evident, for instance, that our thicknesses of insulation for E.H.T. cables are in many cases unduly liberal and purely arbitrary. From what we know of potential gradients, it is clear that a thickness of insulation which will be correct for a large size of core, as, for instance, 0.25 square inch, will not necessarily be correct for a smaller core, or for a round core against a clover-leaf core. The potential stresses will be relatively much greater in each of the last mentioned cases, and yet we find that our engineering standards do not discriminate between such cases, but even allow thicker insulation on the larger sizes of cables compared with the smaller. It is no wonder that many of our paper cables frequently show factors of safety of 10, or even more, under test, and we might well refer to such as factors of ignorance.

One cannot commend our lack of enterprise in research. While our cables undoubtedly rank as the best in the world, this position has been arrived at more as a result of careful attention to details of manufacture than by the application of scientific principles to design. Although there are happily signs of an awakened interest in this matter, still there appears hitherto to have been no co-ordinated effort to place it upon a sure foundation, and yet I feel confident that a full investigation should enable a reduction to be made in our thicknesses of insulation, with a consequent saving of possibly anything from 10 to 25 per cent. in the cost of extra-high-tension cables (6,000-volt and upwards) as the result of smaller over-all diameters and the consequent cheapening of lead sheaths and armouring. This question is one for further investigation, but, in the meantime, we may take some comfort from the prospect that many of our existing cable systems are capable of being worked satisfactorily at much higher pressures than those for which they were originally laid down.

Our known workable coal measures must at the present rate of working become exhausted hundreds of years before those of our nearest industrial rivals. Notwithstanding this striking fact, we continue to export some 30 per cent. of our total output, or 87 million tons of coal last year. In the face of such figures, it seems futile to expect that anything we can do towards conserving our coal resources will for a long time to come be more than insignificant, when we consider that the entire coal consumption of our public electric supply undertakings in 1907 was well under 3 million tons, and cannot at the present time exceed 5 million tons. Yet some remarks as to the possibilities in this direction by the utilisation of waste heat may not be without interest.

The chief sources of this waste heat are coke ovens and blast furnaces. Our annual production of metallurgical coke from coke ovens is about 13 million tons, in the manufacture of which some 200,000 million cubic feet of gas of an average calorific value of 500 B. Th.U. is liberated. About half of this gas may be profitably utilised in heating the ovens, in the case of regenerative by-product recovery gas ovens, leaving an equal amount available as a by-product. Assuming, therefore, 100,000 million cubic feet of disposable gas and a heat consumption of 10,000 B.Th.U. per B.H.P.-hr. if used in gas engines, over one half-million horse-power (557,000 H.P.) might be made available continuously by the proper recovery and utilisation of this waste gas. Only about 20 to 25 per cent. of our coke ovens are of a type which allows any recovery of the gas to be made: but we may expect to see a very large increase in the installation of by-product recovery ovens in the near future.

Our blast furnaces produce some 10 million tons of pig iron annually, and assuming an output, upon a conservative

estimate, of 150,000 cubic feet of gas of an average calorific value of 100 B.Th.U. per cubic foot for each ton of pig iron produced, if the disposable gas, which is about 40 per cent. of the whole, were also utilised in gas engines, another 685,000 H.P. could be made available.

Taking both these sources of waste heat, we find, therefore, that even if only 80 per cent. were made use of, some one million horse-power could be utilised continuously, of which at present the greater part is entirely wasted.

This is quite irrespective of the utilisation of the exhaust steam from reciprocating engines, as to the amount of which I have no figures.

I think we may look to see some interesting developments in the utilisation of these waste gases within the next few years, both for the production of electricity and for town gas lighting. Use is already being made of coke-oven gas for town lighting in Germany and America, and, to come nearer home, the town of Middlesbrough has just entered into a contract with a firm of ironmasters to take the whole of its town gas supply from coke ovens, while another interesting experiment is that of the Corporation of Birmingham, which has put down some coke ovens primarily to produce town gas and to dispose of the furnace coke produced as a by-product. Seeing that coke-oven gas should be obtainable at some figure below 6d. per 1,000 cubic feet, keen competition may be anticipated in those districts where such gas is available.

The utilisation of waste heat to its fullest extent for electrical purposes is only possible to those Power Companies with widely ramifying networks, as much of it is only available at some distance from the large centres of population and chief points of power utilisation, but by feeding into the main network at so many points remotely situated from the chief power stations, considerable economies in the transmission system and its losses may be attained.

There are, of course, objections in the way of its rapid adoption, such as the limited quantities of waste heat usually available at any one plant, which would result in heavy capital cost for small stations, but when the use of by-product recovery ovens becomes more general, it will doubtless in some cases be possible to concentrate the generating plant, the gas being piped from a number of near-by coking plants to a power station placed at some point favourably situated with respect to these sources of production.

Another, and perhaps at first sight more serious, objection, is the liability to interruptions from labour troubles and industrial depression, resulting in the shutting-down of the producing plants. Some alternative method of keeping the station plants in operation, such as coal or oil-firing, or producer or oil gas if gas engines are used, would be desirable at some of these stations, but not necessarily at all. This might in these cases be necessary to maintain the general scheme of distribution in the transmission system, although loads would obviously be very much diminished in such circumstances.

I do not think I need pursue these and other technical aspects of the problem of the centralisation of power supply any further. The hindrances to our progress are by no means technical in character, and it is true that the world's achievements in electrical and mechanical engineering are far in advance of any of the possible requirements of this country for many years to come. When we learn, as from the States, of 30,000-kilowatt turbo-generators, of which seven are already under construction, the daily operation of high-voltage overhead transmission up to 140,000 volts and covering distances up to 240 miles, of 300,000 horse-power central-station developments and the electrification of some hundreds of miles of main line railway, we need have no fear as to the ability of engineers to keep pace with the world's industrial demands. But, for ourselves, can we ever hope to maintain our position in the Electrical Engineering world if we are content to allow our electric supply industry to develop along its narrow way; indeed, have we not already lost too much ground? What training ground shall we offer the rising generation of British Electrical Engineers if we wish to take our part in the electrical development of our Empire overseas, and how shall our electrical manufacturers assume their proper place in the markets of the world when handicapped at home by a restricted market, which might easily be increased to many times its present proportions? Truly this question is more far reaching than may appear at first sight. It is not my intention to discuss here the seemingly delicate question of how we may best reconcile the different and admittedly powerful interests which at present operate to the disadvantage of our industry, and I shall esteem my task well done if I but succeed in turning your thoughts in this direction.

Western Local Section.

On Monday last the Section opened its new session. In the morning the tobacco factory of Messrs. W. D. & H. O. Wills was visited by a large party of members, who were received by Mr. R. Earle, chief engineer to the Company. Most of the plant is electrically driven, but the visitors were mainly interested in the manufacturing processes, which are rarely shown by the firm.

In the afternoon the opening meeting was held at the Merchant Venturers' College of the University of Bristol; Professor Wertheimer welcomed the members on behalf of the University, and Mr. H. Faraday Proctor, the new chairman, read his address, of which we give an abstract below. The President, Mr. W. Duddell, proposed a vote of thanks, to which Mr. Proctor briefly responded; the members then adjourned to the electrical laboratories, where Professor David Robertson demonstrated an improved pattern of friction brake which, with the aid of the stroboscopic method of measuring the speed and maintaining it constant, and an ingenious self-compensating device for the brake torque, enabled brake tests to be made with an accuracy of about one part in 1,000.

In the evening the annual dinner took place at the Royal Hotel, about 90 members and guests being present. Mr. Proctor presided, and was supported by Mr. Duddell, Mr. J. F. C. Snell, Mr. Judd, and Mr. Rowell, from headquarters, and Mr. W. A. Chamen (retiring Chairman), Alderman Pearson (Chairman of the Electricity Committee), Mr. D. Roberts (Vice-Chairman of the Section), Mr. W. Collins (who with Mr. S. B. Haslam is joint Hon. Secretary) and other prominent members of the western district.

After the loyal toast, Mr. Proctor proposed "The Intitution of Electrical Engineers," which, he said, had done much for the industry, but was only at the beginning of its activities; amongst the many matters awaiting its attention he referred in particular to organisation, standardisation and research. He entered a vigorous protest against the industry's neglect to protect the interests of its younger members in charge of central-station plant, who in many cases would be much better off in point of salary if they exchanged positions with the men under their orders. They went through a full electrical and mechanical training and were expected to act, on their own initiative, with promptitude and discretion in emergency, and they carried out their duties wonderfully well in spite of their poor pay; he hoped the Institution would take action on their behalf. Mr. Proctor cordially welcomed the President, whose work in wireless telegraphy and other branches of scientific engineering was well-known, and who was an equally keen worker on behalf of the non-technical side of the industry; his progress had been wonderfully rapid, and the high esteem in which he was held by the Institution was evidenced by his election as President for two years in succession, the highest honour that the electrical industry could confer upon its members.

In his reply, Mr. Duddell agreed with the Chairman's remarks regarding the broadened views of the Institution, and emphasised the importance of standardisation, which was a question of vital interest to our manufacturers; if they were to compete successfully in the world's markets, they must see to it that international standards were adopted for the rating of electric machinery, which would be fair to all parties, and the Institution was acting with that end in view. Standardisation of the smaller apparatus also, such as those which affected the consumer, was urgently needed. During the coming winter a great deal of valuable research work would be in progress; the investigation of magnet steel had been begun, the heating of underground cables was to be determined, and the co-ordination of wireless research by means of the new International Commission, on which the Institution of Electrical Engineers was represented, would be undertaken. He sympathised with the younger members of the profession, having himself experienced the difficulty of securing a reasonable salary on the completion of an extended training in both mechanical and electrical engineering.

Mr. J. F. C. Snell proposed "The Western Local Section," and expressed the firm belief that at no distant date the Institution of Electrical Engineers would be the premier engineering institution of the Empire, for electricity was becoming an indispensable factor in every branch of engineering. The original idea in founding the local sections was that they should continue and add to the discussions on papers read before the parent Institution; while they preserved their individuality, they should remember that they were all partners in one organisation, and they could help the parent Institution in three ways: by holding meetings, and producing papers of interest to the whole membership; by forming recruiting centres and encouraging young engineers to become Associate Members by passing the examinations, which would do a great deal to raise the status of the Institution; and, in the future, by carrying out the examinations on behalf of the Institution at the local centres. He pointed out the importance of the Western Local Section, which included not only Bristol, but also South Wales, Plymouth, and Cornwall.

Mr. D. Roberts in reply referred to the unfortunate division of the district by the Bristol Channel; in spite of this difficulty, however, the average attendance at the meetings had been about 50.

Mr. W. Judd, proposing "The Visitors," commended the authorities of the University for their regard for the humanities; strictly technical training was not sufficient—arts and sciences ought to go hand in hand. Too much "shop" made a man one-sided, and literary ability was not without value in commercial work; narrow views produced a stunted imagination, and that was bad for one's business career as well as for one's happiness. He drew the attention of the municipal authorities of Bristol to the abolition of the smoke nuisance as a worthy object of their enterprise, for the sake of the health of the children of the poorer class of town dwellers.

In reply Alderman Pearson, who expressed surprise at finding himself in the position of a visitor in Bristol, referred to his

22 years' association with Mr. Proctor in the conduct of the City's electrical undertaking. He humorously regretted the scarcity of fogs in Bristol as a cause of loss to the electricity works, and emphasised the necessity for a municipal committee to stick to the commercial management of the undertaking, leaving the technical work to the electrical engineer.

Mr. W. A. Chamen proposed the health of the Chairman, in whom he felt the greatest confidence; the toast was accorded musical honours and Mr. Proctor expressed his determination to do his best for the Section.

An excellent entertainment was provided by Messrs. Townsend, Royce, Thomas and Stonelake, whose joint and varied talents are worthy of the highest praise.

In the course of his inaugural address, Mr. H. Faraday Proctor reminded the members that about 3½ years ago he was approached by their late Chairman, who invited him to accept nomination for the Council of the Institution, and to promote if possible the formation of a Local Section of the I.E.E. for the Western Counties. The Section was formed, and had now completed the first year of its existence, with a success which exceeded the anticipation of the promoters.

It must be borne in mind that the object of a Local Section was not confined to the welfare of its members: it was formed with the view of enabling its members to do that which would be of use to the Institution as a whole, and the Electrical Industry generally. It was desirable therefore that papers read and discussed at the Sections should not be of local interest alone; but should, as far as possible, appeal to the greater body of members and be read and discussed at the Institution Headquarters and other Local Sections.

Advice was so often sought as to the proper course of training for an Electrical Engineer, that he might be pardoned for introducing a few comments upon that subject. It was desirable that the boy be first a gentleman; secondly—make him into a man; and thirdly—into an engineer. If he lacked the instincts of a gentleman, he would not gain confidence; if he had not learned to behave like a man he would progress but slowly on his own initiative, and would require constant pushing, whilst if he had not the elementary principles of engineering ingrained, he would not get on even when pushed.

Mechanical engineering was the broad foundation upon which electrical engineering was based; the mechanical engineering must itself have a foundation broad in proportion to the superstructure to be erected upon it, and capable of unlimited expansion. The young engineer did not know in what particular direction he might have to develop, and a broad intelligence based upon a sound general education was the best asset of an engineer.

The American definition of an Engineer was: "A man who can do for one dollar, that which any fool can do for two." It was only by close attention to the commercial or financial side of business that men could hope to rise, and he was particularly glad that their Institution had recently allowed itself to deviate from confining its attention to the consideration of matters from the scientific point of view alone.

He looked upon Standardisation as the key to cheapness (without nastiness), and Co-operation as the key to Standardisation. A great work had been undertaken by the Engineering Standards Committee, and great good had already resulted. He looked forward to the time when the standardisation of two-pin plugs and sockets, heavy-current lamp holders and fuse terminals would remove the most common source of the every-day consumer's little worries.

Few could realise the economy of time and freedom from worry that would result from anything approaching prefect method in office working. The standardisation of paper sizes would greatly facilitate filing. Efforts had been made in this direction, and a little had been done; much more might be done. The need for standardisation, with the resultant economy became the more urgent in Electricity Supply Departments owing to the decreasing revenue derivable from the individual "lighting" consumers. In 1909 a careful comparison was made of the consumption of electricity by a large number of consumers in Bristol who had installed one-watt lamps throughout their premises with that of the same consumers when using carbon-filament lamps. The result showed an average economy to the consumer of 53.8 per cent. Since, however, the one-watt lamp represented an economy of about 68.5 per cent., it was evident that those consumers on the average had increased the candle-power installed by about 50 per cent. It was interesting to note that after a lapse of four years, the proportionate figures still held good. From this it would appear that the average consumer had been educated up to require illumination 50 per cent. in excess of that with which he was satisfied before the introduction of one-watt lamps. With the advent of the "half-watt" lamp, he believed a similar result would be obtained.

Lighting by electricity would, with the half-watt lamp, cost so small a sum that business premises would be more generously lighted, and in residences artistic effect would be given greater consideration, whilst less attention would be paid or necessitated as regards economy.

Since the light given forth by the half-watt lamp was very much whiter than that of the one-watt lamp, it should be excellent for the judging of colours. The lamps should, however, be kept well out of the direct line of vision—thus indirect lighting should be encouraged to the utmost extent. The cost of electric light would be so reduced as to put all competitive forms of illumination out of court, and the fact that electricity would henceforth be adopted for lighting all premises requiring artificial illumination (even if only for the sake of economy) would tend to keep the cable system satisfactorily loaded.

With the diminished revenue per consumer, the cost of making new connections would become a still more serious factor in the costs of supply. In Bristol the present cost of connecting premises adjoining the mains was £3 8s. 0d. (exclusive of the cost of the meter). Since the average revenue per connection derived from so many as 20 per cent. of the lighting consumers amounted to only 35/- per annum, the importance of this item was evident. It was also evident that it was necessary and urgent that the uses of electricity for purposes other than lighting be developed to their utmost, otherwise the lighting consumer might become a serious drag upon the undertakings. Another matter of serious import, which the lighting engineer should bear well in mind, was the probable adoption of a Daylight Saving Bill.

Electric cooking had developed wonderfully during the last year or two, and with the standardisation of details would rapidly displace its rivals. He believed that the satisfactory heating of water for domestic uses would soon remove what was now the greatest obstacle advanced against the introduction of electric cooking. To get rapid and highly efficient water heating it would, he considered, be necessary to use immersion heaters, probably applying the heating element direct to the water, avoiding the risk or possibility of shock by utilising the resistance of two columns of water—one on the supply side and the other on the delivery side of the heating appliance: the supply and delivery extremities of these columns of water, most remote from the heating elements, being electrically short-circuited and earthed. The elements must, in such an appliance, either be self-cleaning or be arranged so that they might be very readily cleaned so as to avoid trouble due to lime or other deposits. He looked to such appliances arranged alternatively, for rapid water heating supplied at the usual heating rate of charge, and for continuous use supplied on a fixed annual kilowatt charge, as the probable solution of the domestic hot-water problem.

In that City the power consumption had increased eight times as rapidly as the lighting consumption during the last 10 years: during the next two years this ratio would be doubled.

It was the Business-Getting Department to which they must look for the bulk of their progress.

What was a "Volt" in 1766?—"Sahib" writes:—I herewith enclose a definition of a "volt" which recently came to light during a conversation I had with a non-technical friend who wanted some information respecting amperes, ohms and volts of the *usual* type for motor-car purposes. I had given him the usual elementary reply to his query, and then forgot the matter. However, he had not, but turned up with a dictionary with the following explanation:—

"Volt. In the manège, a round or circular tread; and hence by the phrase, to make volts, is understood a gait of two treads made by a horse going sideways round a centre in such a manner that these two treads make parallel tracts, one larger, made by the fore feet, and another smaller, made by the hind feet, the croup approaching towards the centre, and the shoulders bearing outwards.

"Sometimes the volt is of one tread; as when a horse makes volts in corvets and in caprioles, so that the haunches follow the shoulders, and move forwards on the same tread.

"A renversed volt is a tract of two treads, made by the horse with his head to the centre and his croup out; so that he goes sideways upon a walk, trot or gallop, and traces out a small circumference with his shoulders, and a larger one with his croup.

"This different situation of the shoulders and the croup with respect to the centre, give this volt the name of renversed, as being opposite in situation to the former."

Load Factors in Large Power Station.—With the increasing diversity of the load on large power stations, and the better terms offered for limited night and early morning supply, the load factors are steadily improving. The following figures for December, 1912, are of interest:—

The Commonwealth Edison Co., of Chicago, had a peak load of 233,000 KW., an annual output of 799 million units, and a load factor of between 43 and 44 per cent.

The New York Edison Co. had a peak load of 210,800 KW., an annual output of 619 million units, and a load factor of 33·4 per cent.

The Brooklyn Edison, Boston Edison, and Philadelphia Electric Companies, with peak loads of from 40,000 KW. to 66,000 KW., had load factors of 33·7, 30·6, and 32 per cent. respectively.

The Victoria Falls and Transvaal Power Co. expects the load factors of most of its stations to be shortly in the neighbourhood of 70 per cent., on account of the almost continuous work at the mines.

TUNGSTEN LAMPS OF HIGH EFFICIENCY.

The last issued number of the proceedings of the American Institute of Electrical Engineers contained two extremely interesting papers, one by Mr. Irving Langmuir, on the blackening of tungsten lamps and methods of preventing it; the other by Messrs. Langmuir and J. A. Orange, on nitrogen-filled lamps.

The author of the former points out that with perfect efficiency white light would be produced with the expenditure of only 0·1 watt per candle, so that the ordinary tungsten lamp has an efficiency of only 6 to 10 per cent. The lamp can be run up to an efficiency as high as 0·2 watt per candle before melting; its commercial efficiency is not determined by the melting-point of the filament, but by the blackening of the bulb. The fragility of the filament, once so serious a factor, has nowadays been completely overcome by the production of ductile tungsten wire and by the adoption of improved methods of mounting the filament; the life of the lamp is therefore determined solely by the loss of candle-power due to blackening of the inner surface of the bulb, the changes in candle-power of the filament itself being insignificant.

In order to ascertain exactly the cause of blackening, and thus to render possible the use of higher efficiencies, an extended research was undertaken. Experience indicated that it was due primarily to minute traces of residual gas, or to electrical discharges within the bulb; special apparatus was therefore devised to study the sources of gas within a lamp, and the effects produced by various gases. It was possible with this apparatus to make a quantitative chemical analysis of a single cubic millimetre of gas.

Most of the gases are nearly completely removed, or precipitated on the walls of the bulb, by the "clean-up" that takes place when phosphorus is volatilised into the lamp and the filament is flashed, the final pressure being about 0·001 mm. It was found that the gas evolved from the filament—mainly carbon monoxide—was given off within a few seconds on first heating the wire above 1,500° C. In large lamps gas is evolved from the leads and anchor wires. But these gases, and the residual gases, are quite insignificant compared with the gas on the inner surface of the bulb; a 40-watt lamp bulb, after being thoroughly dried, gave off 200 mm.^{3} of water vapour at 200° C., a further 100 mm.^{3} at 350° C., and 150 mm.^{3} more at 500° C., besides 30 mm.^{3} of carbon dioxide, and 5 mm.^{3} of nitrogen. The great difficulty of completely removing the gases from the bulb makes this source particularly troublesome.

Small quantities (up to 0·1 mm. pressure) of various gases were let into lamps, and their effect on the operation of the lamps was noted; each gas produced characteristic phenomena. Dry hydrogen had not the slightest tendency to produce blackening of the bulbs, at any pressure. Oxygen formed a yellow oxide, which was deposited on the bulb, but did not produce blackening. Nitrogen caused the formation of a brown deposit of tungsten nitride, but under practical conditions never caused any discoloration of the bulb. Carbon monoxide and carbon dioxide were not responsible for blackening. Water vapour, even at very low gas pressures, reacted with the tungsten filament and caused rapid blackening of the bulb; lamps exhausted at low temperature (100 to 200° C.) blacken very rapidly, and have a short life due to its presence. Apparently the oxygen combines with the tungsten filament and liberates hydrogen: the oxide is distilled and condenses on the bulb, where it is reduced by the hydrogen to metallic tungsten, with the reformation of water vapour, so that the process can go on indefinitely. Methane and argon, as well as many other gases, including mercury vapour, were acquitted of blackening.

In order to remove water vapour as far as possible, lamps were exhausted in a special vacuum oven, in which they could be heated about 100° C. higher than when exposed to atmospheric pressure; they were sealed off when the internal pressure was reduced to 0·00005 mm. Contrary to expectation, however, they were not materially better on life test than the best of the lamps made regularly in the factory. Lamps exhausted in the vacuum oven were run at 0·7 watt per candle, with the bulbs immersed in liquid air; others with the bulbs at room temperature; and others with the bulbs heated to 150° C., during their whole life. The life of all three sets was practically identical. The conclusion was that the blackening of the bulbs of ordinary well-made lamps was not caused by imperfect vacuum.

Experiments were next made to determine whether the blackening was due to evaporation of the filaments; it was found that the loss in weight of filaments was proportional to their surface, and measurements at various temperatures agreed closely with the theoretical values of the vapour pressure of tungsten, which is at—

1·0 watt per candle	(2,400° absolute),	0·000,000,05 mm.
0·4 „	„ (2,800°	„),	0·000,03
0·2 „	„ (3,540°	„),	0·080
	(melting point)		
	(5,200° absolute),		760
	(boiling point).		

The conclusion was that the evaporation of the filament was the true cause of blackening. A lamp was filled with hydrogen at atmospheric temperature, and run at normal temperature for 360 hours without perceptible blackening of the bulb, though the heat loss by convection was so great that 17 watts per candle were required to maintain the temperature. The life of a filament in vacuum, with a bulb as hot as in this case, would have been very short indeed. The heat conductivity of hydrogen at very high temperature was subsequently found to be abnormally great, the hydrogen molecules being dissociated into atoms. In mercury vapour the heat loss by convection was extremely small, and the rate of evaporation was very greatly decreased. Nitrogen at atmospheric temperature was entirely inert towards the tungsten, and conducted very little heat, the efficiency being as high as 0·24 watt per candle at a temperature near the melting point of tungsten, with a filament of fairly large diameter. Unfortunately, it was found that the heat loss by convection from very small wires was nearly as great as from much larger wires, so that with wires of the sizes ordinarily used in lamps the temperature would have to be raised excessively in order to obtain an efficiency of even 1 watt per candle. Thus in nitrogen a filament of 0·001 in. diameter (as used in a 20-watt 110-volt lamp) would have to run at 3,000° C. to give 1 watt per candle. At this temperature of filament, the life of the ordinary lamp would be about 20 minutes. With filaments of larger diameter (0·005 in. and more), the loss of heat by convection is not nearly so serious, so that, if the rate of evaporation of the metal is very largely reduced by the presence of the gas, it should be possible to raise the efficiency considerably without shortening the life.

The advantages of a large diameter filament can be practically obtained by coiling a smaller wire into a tightly-wound helix or otherwise concentrating it into a small space.

In lamps with a very high vacuum, the atoms of tungsten given off from the filament by evaporation travel in straight lines until they strike the bulb. They are electrically uncharged. Since the light from the filament also travels in straight lines, according to similar laws, it follows that in a high vacuum the deposit always collects most on those portions of the bulb where the greatest intensity of light passes through the glass.

With nitrogen at atmospheric pressure, the brown deposit of nitride is carried by convection currents to the upper part of the bulb, the glass on a level with the filament usually remaining perfectly clear. This fact is of great importance in connection with lamps containing high pressures of gas. Not only does the gas decrease the rate of evaporation, but it may be made, by proper design, entirely to prevent the blackening of those parts of the bulb that transmit the light.

(To be concluded.)

BUSINESS NOTES.

Dissolutions and Liquidations. — Ohio Power Syndicate, Ltd.—This company is winding up voluntarily, with Mr. E. J. Trollope, of 42, Cranbourn Street, London, W.C., as liquidator.

Adelphi Cycle, Motor, Electrical and General Engineering Co., cycle, motor and electrical engineers, 42, Meadow Lane, Leeds.—James Henderson and Thomas Adamson have dissolved partnership. Mr. J. Henderson will attend to debts and continue the business.

The Cheap Power Supply and Engineering Co., Ltd.—Creditors must send in their claims by December 1st, to the Liquidator, Mr. W. T. Green, 33, Lloyd Street, Manchester.

Anderton & Beatson, electrical and gas lighting engineers, 72, Surrey Street and 14, Waingate, Sheffield.—Messrs. H. Anderton and H. Beatson have dissolved partnership. Debts will be attended to by Mr. H. Beatson.

Shipping Exhibition.—We are informed that success is already assured for the Shipping, Engineering and Machinery Exhibition, which is to be held at Olympia, in the autumn of next year. The list of patrons includes the leading shipping and engineering magnates, the First Sea Lord and the Director of Naval Construction, and a Committee of experts has been formed to ensure that the Exhibition is carried out in a sound and practical manner. The variety of the exhibits can be gauged from the sections into which they have been divided, the principal being the naval engineering section, which deals with war vessels and their equipment; naval architecture, embracing every class of ship; marine engineering, including heavy machinery working under steam, oil, gas, water and compressed air; fishery exhibits; general marine and engineering and foundry and machine tools. There will be an installation of wireless telegraphy, so that messages may be sent from one end of Olympia to the other.

Electric Clocks.—We learn from the Silent Electric Clock Co., Ltd., of Goswell Road, E.C., that they have been exceptionally busy all the year, especially with extensive and important contracts for H.M. Post Office. Other installations, either erected or in hand, include Johannesburg Town Hall; the Hong Kong and Shanghai Bank new head offices; the G.P.O., Alexandria, Egypt; the *Dundee Advertiser* offices; the Piccadilly Hotel extensions; the Y.M.C.A., Melbourne; New Government Buildings, Christchurch, N.Z.; Miller Hospital, Greenwich; Florence Nightingale Hospital extensions; British Syphon Co.'s Works; Indian Telegraph Department; Colombo Observatory, and many other important installations for private houses, while many shipments through overseas agencies have been made to Australia, India, Canada, &c. The company's system has been awarded a Gold Medal at the Ghent Exhibition.

Award.—The Jury of the International Building Trade Exhibition at Leipzig has awarded a Gold Medal (highest award) to the Korfund Co., for their "Korfund" insulation system.

Lead.—In their report dated October 25th, Messrs. James Forster & Co. state:—

"Closing prices last week were £20 15s. October delivery, £20 10s. October shipment, £19 13s. 9d. November, £19 7s. 6d. December, and £18 13s. 9d. January. The market has been quiet and steady throughout the week until the close, when London desilverisers, who on Thursday paid £20 15s. for October delivery, sold at £20 1s. 3d. for October shipment. There is no change in the position. Lead is badly wanted, both for home consumption and for export, the last price bid yesterday for October delivery being £20 12s. 6d., with no prompt offering even at this figure. Export demand continues, and a considerable business has been done for shipment right up to January. The Mexican position seems to get worse rather than better, and in the absence of any relief from that quarter, there is little prospect of other than a continued scarcity of supplies, and manipulations of the market such as we had yesterday can only have a very temporary effect. Consumers are begging for prompt lead, and it is abundantly proved that there are no stocks to be drawn upon anywhere. October shipment lead was done early in the week at £20 15s., and sold down to £20 1s. 3d.; November, £20 to £19 12s. 6d.; December, £19 2s. 6d. to £19; January, £18 16s. 3d.; and February, £18 12s. 6d.; the lower figures representing the close of the market last night. English lead—£20 10s."

Cable-Laying Fifty Years Ago.—The accompanying illustration is reproduced from a woodcut which appeared in the *Illustrated London News* on September 19th, 1863, showing the "*Kirkham* and the *Assaye* taking in telegraph cable at Mr. Henley's Works, North Woolwich." The cargo being taken on board the two ships is a portion of the submarine cable between Bussorah (now Basra) and Karachi, which cable was an important link in the new telegraph line to India then being laid down under the supervision of Sir Charles Bright and Mr. Latimer Clark. The shipping of this submarine cable was quite an important matter in those days, particularly as it was at that time double the weight of any previous submarine cable, the length being 1,250 nautical miles, and the total weight 5,100 tons. Five large sailing ships were used to convey the cable to its destination.

The laying of this new line was undoubtedly of more than ordinary interest at the time, as the *Illustrated London News* devoted four large illustrations to the subject in addition to a long descriptive article. This line was established at the instigation of Sir Charles Wood and the Indian Council owing to the failure to establish electric communication with India *via* the Red Sea and there is no doubt that it was a momentous undertaking.


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NEW TELEGRAPH TO INDIA.

THE KIRKHAM AND THE ASSAYE TAKING IN TELEGRAPH CABLE AT MR. HENLEY'S WORKS, NORTH WOOLWICH.

Catalogues and Lists.—Messrs. Thomas Kesnor and Co., Ltd., Whippendell Road, Watford.—Binding cover containing publications Nos. 30 to 35, in which are given illustrations, together with descriptive matter and tabulated prices of the following specialities:—Kesnor patent elevator controller (D.C.); push buttons for lift and remote control work; push button relays; car direction and limit switches; gate locks and automatic motor starters.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 7,002 (eight pages), containing an illustrated description of the B.T.H. sewing machine motors for domestic use.

Messrs. Musgrave & Co., Ltd., 35, Maddox Street, London, W.—Large postal card giving illustrated particulars and tabulated prices of their slow-combustion stoves and air-warmers.

Messrs. J. H. Heathman & Co., Parson's Green, Fulham, London, S.W.—Several illustrated lists showing various types of step ladders, extending ladders, telescopic ladder towers, and fire-extinguishing appliances.

Messrs. Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden.—Four new and effective picture postcards (in colour) have been issued by the company. A supply can be provided for customers' use with their names imprinted.

The Davis Electrical Co., 17, Moor Street, Charing Cross Road, London, W.C.—Circular relating to decoration lamps for electrical illumination of Christmas trees, &c., also cards giving particulars of "Delcoblast," a solution for frosting lamps, and the "Elico" invisible lamp lock.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—The company have just issued in postcard form a reproduction of their new poster, in which three coloured gentlemen from afar fall down and worship the sun, which, as a matter of fact, is none other than an Ediswan "Royal."

Thirty-two-page catalogue (second printing) of electric heaters and radiators for the current season. It shows a variety of designs of luminous type radiators (Dowsing patent), with from two to six lamps, convectors and illuminated convectors (Dowsing-Huntley system), log fire heaters, and quartzalite (Bastian) heaters of several shapes and designs. Dimensions, weights, prices and other particulars are given.

Messrs. Archibald J. Wright, 11, Beech Street, Barbican, London, E.C.—Illustrated and priced leaflets relating to a number of electrical and other scientific novelties.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Sixteen-page illustrated list relating to the use of aluminium in the construction of automobiles. Tables of weights of aluminium sheets, and of the physical and mechanical properties of brass, steel and aluminium, are included.

The International Time Recording Co., Ltd., 171-173, City Road, London, E.C.—Booklet just issued describing the different methods of wages payment by the premium, bonus, piece-work, balance and other systems. It is entitled "Bonus and Premium Systems of Wages Payment," by Zähler. It will be sent post free to anyone applying to them for it.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London, E.C.—One hundred and four-page fully illustrated catalogue of terminal boxes. The contents are in no way cramped, indeed the illustrations, which are numerous, are of very fair size, and everything is boldly printed. The contents include boxes for indoor and outdoor use for electric light and power, telephone terminal boxes, colliery boxes, &c. The following new types are described:—Single sealing boxes for pressures up to 11,000 volts; right angle boxes for pressures up to 20,000 volts; outside type terminal boxes, in which the cables and tails enter and leave on the underside; telephone terminal boxes; colliery terminal boxes. Several pages are devoted to illustrations of terminal boxes which the company have designed from time to time for various clients.

Thirty-two-page illustrated catalogue (new issue) giving prices and other information relating to wires and accessories for the Henley wiring system. While the publication is largely a reprint of previous editions, there are several additions, such as the Universal bonding clamp, Tee and joint boxes, and Rawlplugs, which have been covered in separate pamphlets. The Henley system is being used in all types of buildings, as the pictures in this pamphlet show.

Mr. A. C. Hands, 30 and 32, Snow Hill, London, E.C.—New catalogue (158 pp.) containing illustrations and prices of a large and pleasing variety of electric fittings which are supplied in many styles and finishes of metal-work, and with shades of different materials. In addition to fittings for residential and business interiors there is a range of cast-iron water-tight fittings and outside lanterns and brackets, while electric radiators, switch-covers, glass, bead and silk shades, and other lines, are also shown and particularised.

Preston Engineering Co., Ltd., Charing Cross Chambers, Adelphi, London, W.C.—Priced leaflet of Preston tungsten-drawn wire lamps.

The Schniewindt Electric Co., Staniforth Street, Birmingham.—Leaflet No. 16 giving prices, &c., of Triumph electric water boilers and stewing pots.

Russia.—According to a St. Petersburg dispatch in the *Financial News*, under the auspices of the United Cable Works, Russian copper wire mills have formed a syndicate with a view to the regulation of sale prices.

Bankruptcy Proceedings. — C. Lewis, electrical engineer, Old Trafford, Manchester.—First and final dividend of 20s. in the £ and 4 per cent. interest, payable October 31st, at the Official Receiver's offices, Byrom Street, Manchester.

H. W. Wilson, consulting engineer, director of limited companies, Liverpool.—Trustee appointed October 22nd: Mr. Louis Nicholas, 19, Castle Street, Liverpool.

Canada.—A firm in Ontario, interested in the erection of a brick-making plant, to cost 50,000 dols. (about £10,250), will require electrically-driven machinery to manufacture plain wire-cut and pressed brick, and also hollow tiles and floor tiles. Some further information may be obtained at the B. of T. Commercial Intelligence Department in London.

Trade Announcements.—Mr. E. C. Beman, secretary of the London Electric Warehouse Co. (formerly the Supplies Department of the Brush Electrical Engineering Co., Ltd.), who was associated for over 12 years with the Edison & Swan Co., and for some time manager of their town department, has resigned his appointment in order to commence business in partnership with Mr. F. J. Allen (late outdoor representative to the Brush Co. and the London Electric Warehouse Co.), as manufacturers' agents and factors of electrical apparatus. They are trading as the Electrical Supplies Co., as already announced.

The sale of the electrical business of the Adams Manufacturing Co., Ltd., to the Igranic Electric Co., Ltd., has now been completed, and the business will be continued by the Igranic Electric Co., Ltd., at the works, at Bedford, and at 147, Queen Victoria Street, London, E.C., and the branch offices. All moneys due to the business belong to the Igranic Electric Co., Ltd., who will also pay all accounts in connection with the business incurred since April 11th, 1913. They announce that they are prepared to undertake contracts for the manufacture and supply of motor-control gear for all purposes.

The business formerly carried on by Messrs. T. L. Hellyar and Sons at 196, King Street, Hammersmith, is now being carried on by Hellyar & Sons, Ltd., at 169, Church Road, Barnes, S.W., Mr. T. L. Hellyar having retired from business two years ago. All communications should be addressed to 169, Church Road, Barnes, S.W.

Messrs. J. H. Heathman & Co., of Parson's Green, have added a new factory 85 ft. × 58 ft. to cope with increasing business, and a water tower 65 ft. high has been erected for an installation of the Heathman automatic sprinkler fire protection. The firm has received a gold medal for its exhibits at the Imperial Services Exhibition.

Mr. Albert Maund, electrical engineer and contractor, has removed from 13, Corporation Street, Southport, to Electricity House, 327, Lord Street, Southport.

Book Notices.—"Electricity in the Service of Man." By R. Mullineux Walmsley. Vol. II. Section 1. 1913. London: Cassell & Co., Ltd. Price 7s. 6d. net.

"Alternating-Current Problems." By Louis Cohen. 1913. London: Hill Publishing Co. Price 12s. 6d. net.

"Dynamo and Motor Attendants and their Machines." By Frank Broadbent. Seventh edition. 1913. London: S. Rentell and Co., Ltd. Price 1s. 6d. net.

"Recent Physical Research." By David Owen. London: *Electrician* Printing and Publishing Co, Ltd. Price 3s. 6d. net.

"Second Report of the Institution of Civil Engineers' Committee on Reinforced Concrete." 1913. London: Wm. Clowes & Sons, Ltd. Price 2s. 6d. net.

"*Proceedings* of the Engineering Association of New South Wales." Vol. XXVII. Sydney: The Association.

"Telephone Cables." By J. C. Slippy. 1913. Pittsburg, Pa.: The Author. Price $2.50.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 10. October, 1913. New York: The Institute. Price $1.00.

"The Physical Review." Vol. II, No. 3. September, 1913. Lancaster, Pa.: The American Physical Society.

"Atti dell'Associazione Elettrotecnica Italiana." Vol. XVII, No. 18. September 30th, 1913. Milan: Stucchi, Ceretti & Co. Price L.1.50.

"Elementary Theory of Alternating-Current Working." By Capt. G. L. Hall. 1913. London: *Electrician* Printing and Publishing Co. Price 3s. 6d. net.

"Electric Lighting." By A. H. Avery. 1913. London: Cassell and Co., Ltd. Price 2s. net.

"Clock Repairing and Making." By W. J. Garrard. 1914. London: Crosby Lockwood & Son. Price 4s. 6d. net.

"The Principles of the Application of Power to Road Transport." By H. E. Wimperis. 1913. London: Constable & Co., Ltd. Price 4s. 6d. net.

"*Mechanical World* Pocket Diary and Year Book for 1914." Manchester: Emmott & Co., Ltd. Price 6d. net.

"*Transactions* of the Institution of Civil Engineers in Ireland." Vol. XXXIX. Dublin: The Institution.

LIGHTING and POWER NOTES.

Acton.—Electricity Accounts.—Mr. S. Lord, accountant to the U.D.C., with regard to the accounts of the Metropolitan Electric Supply Co., Ltd, a summary of which appeared in the Electrical Review last week, has furnished Councillor Hamilton, who sent in a question in regard to the report, with the following reply: "The actual payments during the year 1912 for loans, instalments, and interest on the loans raised by the Council totalled £5,111. Assuming the additional capital expenditure by the company since the date of the transfer, amounting to £33,362, had been made by the Council, and had been borrowed on the same terms as the loans already raised for electricity purposes, the annual repayments therein would have amounted to £2,068. Deducting the gross profit as shown by the company's accounts, viz., £2,974, the charge upon the rates would have been £1,205."

Algeria.—Good progress is being made with the erection of the central station which is being established at Oran by the Société des Exploitations Electriques. It is hoped that the plant will be ready for operation by the end of the year.

Argentina.—The Cia Anglo-Argentine de Electricidad has made a proposal to the Chivilcoy Municipality to extend electric lighting in that city at a cost of about $250,000, which would include the cost of new machinery in the power house.—*Review of the River Plate.*

Australia.—The Grafton T.C. is considering the question of supplying the town with electricity, produced by water-power, at an estimated cost of £11,000.

The Sydney Municipal Council proposes to borrow £250,000 for the purposes of the electric lighting undertaking.—*Tenders.*

Barnes (Surrey).—L.G.B. Inquiry.—An inquiry was held this week into the application of the U.D.C. for a loan of £3,000 for generating plant, &c., at the refuse destructor, to be utilised in connection with plant for making paving slabs.

Barnsley.—The T.C. has decided to include in the provisions of a Bill to be promoted, a clause enabling the Council to sell, let, hire, and fix electric fittings, apparatus, &c. When the matter came before the Council, Mr. Maudsley asked whether it was the intention that the Council should set up shopkeeping in opposition and competition with tradesmen. If so, he should oppose the clause. The Mayor replied that it was not their intention to go into competition with private traders; they were simply getting full powers. The clause was agreed to.

Bedford.—The T.C. has decided to apply to the L.G.B. for a loan of £600 for transformers.

Bradford.—New Plant.—The Electricity Committee has passed the following resolution:—"That, if found advisable, a 5,000-kw. turbo-generator be substituted for the 3,000-kw. turbo-generator recommended in the engineer's report on the installation of additional plant at the Valley Road Electricity Works, at an estimated additional cost of £5,000."

Canada.—The International Joint Commission met in Ottawa recently, and disposed of the preliminary hearing of the Michigan and Lake Superior Power Co. for permission to build a dam at Sault Ste. Marie, and granted the application of the Olgoma Steel Corporation for a preliminary hearing for a request to build a similar dam from the Canadian side. The two companies each propose to build a dam from its own side of the international boundary, and these will meet in the centre to form one project. The whole will result in a considerable diversion of water, and further hearings will be held in Sault Ste. Marie, to enable local objections to the scheme to be heard.

Chertsey.—The B. of T. has asked the R.D.C. if it has any objection to the revocation of the extension order of the Woking Electric Supply Co., so far as it relates to the parish of Thorpe, owing to the powers granted not having been exercised. The Council has no objection to the revocation.

Continental Notes.—Germany.—Further utilisation of Bavarian water reserves is in contemplation. The Bayerischen Stickstaffwerken A.G. (Nitrogen Co.), located in Trostberg, and a Bavarian financial group, have secured a preliminary concession empowering them to make surveys with a view to utilising the last section of waterfalls on the Alz River between the Tacherting weir and the watermeet of the Alz and Salzach Rivers, where some 60,000 H.P. may be developed. This scheme was considered some years ago by the Badische Analin und Sodafabrik, of Ludwigshafen, but was relinquished on account of the attendant cost of requiring ground and other incidental expenses. The present scheme is practically a revival of the former one, with the difference that the river will be utilised in two sections. The upper section will be developed by the Bayerische Co., which has for some years worked the falls situated between Altenmarkt and Tacherting for the supply of current to its factories located in Trostberg and Tacherting, where the Frank Carosch process for the production of manures, nitrate of lime and sulphuric acid, is carried on. The present hydro-electric scheme is necessitated by this projected enlargement of the firm's works. The remainder of the falls between Hirten and Hölzfeld will be utilised by the financial group before-mentioned for electro-thermic, electrochemical and chemical purposes.—*Zeit. für des Gesamte Turbinenwesen.*

Turkey.—Good progress is being made with the construction of the new central electricity station in Constantinople, and it is hoped soon to commence the supply of current to private consumers. The work of electrifying the tramway system is also well in hand, and it is expected that it will again be opened for traffic by the end of the year.

France.—A new central electricity station, which will supply current for lighting and power purposes in the Departments of the Somme and La Seine Inferieure, and for the operation of the electric tramway between Eu and Treport, has just been completed by the Société d'Electricité de Ricardie.

La Société des Acieries de Trignac et de Caen is contemplating the installation of a number of electric furnaces for refining steel.

Denmark.—The Swedish Government has granted permission for supplying electricity to a large part of Seeland from the waterfalls of Halland, *viâ* Helsingborg, through submarine cables laid under the Sound to Elsinore.

Austria.—The municipal authorities of Marburg, Styria, have secured a concession to utilise the water power of the River Drau in the generation of electrical energy for lighting and power purposes. It is stated that about 20,000 H.P. is available.

A large new electricity-generating station is at present being constructed near Zillingdorf, in conjunction with the lignite mines of the Braunkohlen Gesellschaft. At present only two 8,000-H.P. steam turbines and generators, built by the Brunner Maschinenfabrik Gesellschaft, of Brunn, are being installed, but provision is being made for doubling the capacity as the demand increases. The current will be transmitted to Vienna at a pressure of 35,000 volts, and first stepped down to 6,500 volts, a further reduction in voltage to that required for lighting and power purposes in the Austrian capital being made at sub-transformer stations.

Spain.—An Electrical Exhibition.—The muncipal authorities of Barcelona have voted a credit of £40,000 towards the cost of organising the International Electrical Exhibition, which is to be held in that city in 1915.

La Sociedad Hidroelectrica del Genil is the name of a new company, which has just been formed in Cordoba, with a capital of £120,000, to acquire the 1,500-H P. generating station already established on the River Genil and the concession for the supply of electrical energy for lighting and power purposes in the principal towns in the provinces of Seville and Cordoba. The plant is to be extended to a capacity of 5,000 H.P., the contract for the supply of the necessary machinery having been placed with the Allmanna Svenska Co., of Madrid.

Dudley.—The Electrical Undertaking Sale.—A meeting of the local Traders' Association was held last week, at which a letter was received from the town clerk in reference to the proposed sale of the Corporation's electrical undertaking. The Association, the town clerk stated, was now the only opponent of the sale. The Corporation was now in communication with the B. of T., and he asked, on behalf of the Electrical Committee, that the opposition be withdrawn, thus avoiding the town being put to the great cost which an inquiry would involve. After discussion, a resolution was adopted agreeing to withdraw all opposition, but expressing the opinion that the Association had been fully justified in the action it had taken.

Workhouse Lighting.—The B. of G. has decided to consult an expert respecting the proposed lighting of the workhouse by electricity.

Eccles.—Application having been made by the managements of local places of amusement for a revision of the terms of supply of electricity, the Corporation has resolved that supplies be given at the present terms, at the flat rate of 4d. per unit, on the total amount consumed, or, in the alternative, at a fixed charge of £7 per KW. of the maximum rate of supply demanded, plus 1½d. per unit consumed at the option of the consumer.

Edinburgh.—Future Extensions.—While the necessity for an addition to the Corporation generating plant is admitted, the question has arisen among the members of the Electric Lighting Committee as to whether extensions should be carried out on the vacant ground at M'Donald Road station, or whether a new station should be erected. The Committee is also considering whether, if a new station is decided on, it should not be erected near the sea, so that a plentiful supply of water could be readily obtained. Sir Alex. Kennedy has prepared a preliminary report on the matter, and a sub-Committee will now go into the merits of the whole question.

A proposal has been made to supply direct current in Portobello, but the city electrical engineer reports that the probable demand for electricity does not justify the expenditure.

Erith.—The gross profit for the last year's working of the electricity department was £8,473, and the net profit £1,524. The output sold was 2,477,590 units, as against 2,007,699 in the previous year. The results obtained from fixed-price lighting in connection with 31 houses which had been wired and fitted up, are stated to be quite satisfactory.

Galashiels.—The Galashiels and District Electric Supply Co. has been formed with a capital of £30,000. The directors include Mr. George Balfour, London. A prov. order is to be applied for, and a site with water supply has been secured at Netherdale Haugh, close to the railway. The power station will be equipped with plant having a capacity of 1,400 H.P., and the buildings are to be sufficient to accommodate plant of a capacity of 4,000 H.P. It is calculated that the company will begin with from 600 to 800 connections. Various mills are expected to purchase all their power. Mr. Kenneth Sanderson, Edinburgh, is secretary to the new company.

Glasgow.—The Electricity Committee is purchasing stokers from the American Engineering Co. Mr. Lackie, the Corporation engineer, saw this type of stoker during his recent visit to America, and one pair of boilers will be equipped, at a cost of £1,400, on the understanding that if the stokers do not prove satisfactory the company is to remove them free of cost.

Greetland (near Halifax).—Public Lighting.—A ratepayers' meeting has been called at Upper Greetland to consider the public lighting of the town. Proposals for both electric and gas lighting will be submitted.

Grimsby.—The Public Lighting Committee has recommended the extension of the supply mains in Wellington Street, at a cost of £1,000.

Halifax.—The Tramways and Electricity Committee has decided that on and after the end of December quarter, 1913, the charges for the supply of electricity for lighting purposes within the borough be as follows:—Accounts up to 1,200 units per quarter 4d. per unit, current in excess of 1,200 units per quarter 2d.; and that a discount of 5 per cent. be allowed on all accounts if paid within the prescribed time.

Japan.—The establishment of a second power plant to serve Taihoku (Formosa) is contemplated, partly as a reserve against interruption of the original plant by floods and partly to provide for the continually increasing use of electricity in the vicinity; the cost is estimated at £25,500.—*Board of Trade Journal.*

The construction of the hydro-electric generating station which is being established by the Inawashiro Water Power Co. is making steady progress, and the plant is expected to be completed about the middle of next year. It is stated that the Tokio Electric Light Co. has already contracted to take 10,000 H.P. for 10 years from the new station, and that the Government railway authorities, in view of the electrification of the Itaya Pass section of the Oshu main line, have also contracted for the supply of the necessary electrical energy.

A new company is in course of formation with a capital of £700,000, and the title of Lake Biwa Water Power Co., to establish a plant to utilise the water power of the upper reaches of the River Ujigawa. It is said that 20,000 H.P. will be transmitted for power purposes in the city of Osaka.

Kenilworth.—The T.C. has adopted a recommendation not to apply for a prov. order for electric supply, but to advise it upon the negotiations with the Midland Electric Co., it has appointed Mr. J. C. Baudry, of Edgbaston, as consulting electrician, provided a suitable fee can be arranged.

Leicester.—L.G.B. Inquiry.—An inquiry was held on October 24th into the application of the Corporation to borrow £52,350 for additional plant. The Inspector, Mr. H R. Hooper, took exception to the arrangement of keeping separate capital accounts for the Aylestone and Lero power stations, and suggested that one capital account should serve for both. There was a balance of some thousands sanctioned for mains at Aylestone, and they were now asking for £17,000 for mains for the Lero station. The tramways should in future be looked on as a consumer, and both stations be regarded as one. He further warned them that the Board would never sanction a further loan until the outstanding loan on obsolete plant at Aylestone had been paid off; he suggested that this should be possible in two years' time.

The T.C. is seeking powers to extend the area of supply for electricity, so as to include the parishes of Birstall, Humberstone, Evington Oadby and New Parks.

Llanfairfechan.—E.L. Scheme.—The U.D.C. has decided to apply for a prov. order for electric supply in the district, the scheme being estimated to cost £5,500. It is proposed to light the chief streets by electricity.

London.—St. Pancras.—Up-to-date flame arc lamps are to be substituted for the present mode of lighting in Hampstead Road and Charlton Street, at an estimated cost of £226. The Electricity Committee recommends the adoption of a scheme for supplying and maintaining outside electric arc lamps. It is proposed to make the annual maintenance charge £8 10s., £9 9s. 6d.; £10 14s. 5d., £11 18s. 1d., and £13 1s. 10d. for one 10-ampere arc lamp (equal to three high-pressure gas lamps of the usual C.P.), burning six days a week from dusk until 8, 8.30, 9, 9.30 and 10 o'clock respectively. Beyond these hours will be charged at 2½d. per lamp per hour. In cases where consumers desire a less number of arc lamps than four hours in series, high-power incandescent lamps are to be adopted, with maintenance charges at the rate of £7 10s., £8 12s. 6d., £10, £11 5s. and £12 15s. per lamp per annum, the charge for extra burning hours being the same as above. For the purpose of comparison the Committee states that the cost of three high-pressure gas lamps is usually £20 per annum, only allowing for 800 hours' burning.

Poplar.—The 5 per cent. allowance made to the electricity department in respect of the management of public lighting, is, in future, to be calculated yearly on the savings effected on the sum of £2,663 for cost of maintenance, exclusive of current.

Hackney.—Loan Sanctions.—The Finance Committee of the L.C.C. has recommended the Council to sanction the borrowing by the B.C. of £56,748 for the purpose of the electricity undertaking, £31,150 is for mains, £16,350 for plant and £6,532 for buildings.

Hampstead.—The B.C. has decided to let out cooking apparatus on hire, with a view to encouraging the use of electricity.

Shoreditch.—A loan of £6,706 is to be taken up from the L.C.C. for electricity mains. The L.C.C. is to be asked to sanction the borrowing of £4,058 to cover expenditure on small mains extensions and house connections.

Battersea.—The Electricity Committee reports having had under consideration for some time past the question of wiring and fitting up of the premises of the Council's present and prospective consumers under the provisions of the L.C.C. (General Powers) Act, 1906. It also had under consideration a scheme submitted by the electrical engineer for the provision, fixing and maintenance of arc and metal lamps and supply of the necessary current at an inclusive charge per annum, for outside lighting. Under this scheme it is proposed at the commencement to undertake wiring work through contractors, the electricity department dealing with the supply of apparatus and maintenance work, and with minor cases of wiring which

could not be tendered for conveniently. The Committee recommends that the scheme prepared by the engineer be approved and adopted at an expenditure not exceeding £500. The Highways Committee reports having had under consideration a scheme of the Electricity Committee for lighting by electricity the streets in the Borough where electric mains for street lighting are already laid and which are at present lit by gas. The lamps proposed to be installed are of the same illuminating power as those used by the Council for certain streets in Nine Elms, and the charge offered is at the rate of £2 14s. 6d. per lamp per annum—2s. 6d. of the charge representing repayment of cost of installation. Before submitting a recommendation to the Council involving so large a number of lamps, namely, 295, as would be affected by the conversion in all the streets in question, the Committee desires to have an opportunity of seeing how the type of lamp offered compares in illuminating power, &c., with the gas lamps which would be displaced. Under these circumstances it has adjourned the consideration of the general scheme until the present method of lighting has been compared with the lamps at Nine Elms. The proposal has resulted in a deputation of gas workers protesting against the scheme.

Loughrea.—A Committee has been formed to go into Messrs. Edmundson's offer to install electric lighting in the town. The estimated cost is about £2,000.

Lytham.—The Council has decided not to take electricity in bulk from the St. Annes' Council, and it is reported that a decision has been come to to erect a generating station at Lytham. The estimated cost of plant and cables is approximately £15,000.

Maguiresbridge (Fermanagh).—Steps are about to be taken to supply the village with electricity.—*Fermanagh Times.*

Maidenhead.—Workhouse Lighting.—The B. of G. has decided to obtain alternative estimates for lighting the new workhouse laundry by electricity or gas.

Maidstone.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for a loan of £6,120 for electricity purposes, including £4,646 for an engine and generator. The Town Clerk intimated that there would be an early application for another loan of £4,000 for mains and services. There was no opposition.

Manchester.—Half a Year's Progress.—The half-yearly statement shows remarkable progress. The electricity sold amounted to 53,762,108 units, or 6,614,851 more than in the corresponding period of last year. The income was approximately £216,426, an increase of £17,710. This increase is higher than the Committee, six months ago, estimated as the increase in revenue for the whole year. The quantity of electricity generated during the half-year was nearly 70,000,000 units, or 8,278,240 more than in the corresponding period of last year.

At the annual meeting of the Manchester Smoke Abatement League on October 22nd, a letter was received from Sir Charles Macara, President of the Federation of Master Cotton Spinners' and Manufacturers' Association, in which he said :—"I would have liked to have added my testimony to the value of the electrical driving of machinery. One of the mills with which I am connected in Ancoats has been driven by electricity, supplied by the Corporation, for six years, and other firms in the same neighbourhood, I understand, have followed. I am convinced that if this were generally adopted, it would add very materially to the purification of the atmosphere in that densely-populated district."

Middleton.—It is reported that the amount of electricity required by the Calico Printers' Association, and which the T.C. can now supply by reason of the arrangement with Manchester, may be two million units per annum.

Norwich.—E.H.T. Supply.—The T.C. has applied to the L.G.B. for a loan of £6,000 for mains, and for £4,000 for other purposes. The B. of T. has also been asked to consent to the laying of mains for extra-high-pressure supply and the establishment of sub-stations.

Ormskirk.—The B. of G. has decided to apply to the L.G.B. for sanction to the borrowing of £1,000 for the installation of new generator, gas engine, and water-softening plant.

Plymouth.—Loan Sanction, &c.—At a meeting of the Electricity Committee on October 24th, it was reported that the L.G.B. had sanctioned the borrowing of £5,500 for an extension of plant at the electricity works. The quarterly report of the electrical engineer showed a sale of 669,712 units, and estimated receipts £6,192, compared with 582,956 units sold and £5,653 received in the corresponding period of last year. There was an increase in the consumption of current under every head, the supply for private motors having nearly doubled in the year. At the end of the quarter there was 1,660 consumers and 113,152 lamp connections, as against 1,503 consumers and 104,985 lamp connections a year ago.

Salford.—Bulk Supply, &c.—The T.C. is to be asked to confirm an agreement for the supply to the Corporation of electrical energy in bulk by the Lancashire Electric Power Co. A resolution is also to be submitted to the Council directing that applications be made to the L.G.B. for sanction to borrow £10,500 for the purpose of affording an additional supply of energy to No. 9 dock of the Manchester Ship Canal Co., and also £3,000 for the purpose of affording a three-phase supply in the Ordsal district.

Shipston-on-Stour.—The R.D.C. has approved a draft agreement with the E.L. Co., with the addition of one clause, and the reduction of the acknowledgment fee of £1 1s. to 10s. 6d.

Southampton.—Proposed Loans.—Application is to to made to the L.G.B. for sanction to borrow £6,000, in lieu of £3,000, previously agreed to, for services, and £8,000, in lieu of £3,000, for mains ; also for sanction to borrow £1,000, for cable required in connection with the supply of current to the works of Pirelli, Ltd.

South Shields.—L.G.B. Inquiry.—An inquiry was held before Mr. T. C. Ekin on October 28th, in respect to the application of the T.C. for sanction to borrow £33,305 for the extension of plant at the electricity works. The town clerk explained that £30,000 was for the extension of the generating plant, the balance being to cover excess of expenditure on works already carried out. Notwithstanding the recent extensions, the demand on the plant has been so great that further extensions are now necessary. During the 17 years that the works had been in existence, the sum of £1,600 had been repaid to the rates, and the remainder had been carried to the reserve fund, which amounted to £12,845. In addition to the reserve fund they had reduced the capital expenditure from £191,975 to £118,597. The maximum demand upon the station had more than once exceeded the normal capacity of the plant, allowing for the proper reserve. That had been particularly the case on the direct-current side where the maximum demands had been already 1,350 KW. on the turbine, the normal capacity of which was only 1,000 KW. It was therefore proposed to install a new turbo-generator set of 2,000 KW., which would operate two generators in tandem, and two water-tube boilers, with economisers and coal conveyors, and electric circulating water pumps. Mr. H. A. Ellis, the borough electrical engineer, gave evidence in support of the town clerk's statement, and, there being no opposition, the inquiry closed.

South Wales.—Storm Damage.—A hurricane which swept through the Taff and Rhondda valleys on Monday night did considerable damage to electric power stations, and in the valley of the Aber four townships were without the usual electric supply, Bargoed in the Rhymney valley being similarly affected.

Stalybridge.—At a meeting of the Joint Board on October 23rd, the chairman replying to a vote of thanks for his services during the past year, said he was expecting the extensions at the generating station to be completed by the end of the year. They were putting one turbine down out of revenue, and they were expecting the cost would be paid out of this year's work, so that there would be no interest or sinking fund to pay.

Teignmouth.—Proposed Electric Light Scheme.—The Urban Council has received a special report from Mr. E. M. Lacey regarding a supply of electricity for the district, including Shaldon, which lies on the other side of the River Teign. Mr. Lacey advised that in the initial stages the area of supply should be confined to those portions of the district from which there would be a profitable demand—the shopping centre, hotels and the private residences on the sea front. He recommended that a portion of the district should be supplied through underground cables, and the outlying portions of the town, as well as Shaldon, by overhead wires. Dealing with the capital expenditure, Mr. Lacey estimated the work for both Teignmouth and Shaldon to cost £20,800. In the event of Shaldon having a small power station, which he did not advise, the cost would be £3,900. Mr. Lacey also gave some figures of estimated receipts and expenditure :—First year : Receipts, £2,455 ; expenditure, £2,435. Second year : Receipts, £3,320 ; expenditure, £2,715. Third year : Receipts, £4,391 ; expenditure, £2,817. For the larger district the cost would be 6d. per unit, reducing to 5d. It was decided that the members of the Council be supplied with copies of the report, and that the subject be considered at another meeting.

Torpoint.—After considering a proposed agreement for electric lighting with the E.L. Co., the U.D.C. has decided to refer the document back for the insertion of the names of the promoters of the company.

Walthamstow.—Proposed Loan.—Application is to be made to the L.G.B. for sanction to the borrowing of £2,320 for mains extensions and house services during the next three years. The question of altering the price of current supplied to the tramways department is under consideration.

Waterford.—Prov. Order.—The Corporation has decided to apply for a prov. order for the proposed electric lighting scheme.

Willesden.—The Electricity Committee has decided in future to supply all electrical contractors requiring energy solely for advertisement purposes, at the rate of 1½d. per unit. Having considered a report of the electrical engineer upon a deputation he had interviewed with reference to the practicability of introducing special charges for outside lighting to meet the competition of the Gas Light and Coke Co. in supplying, maintaining and extinguishing high candle-power lamps, the Committee states that it is unable to submit terms low enough to compete with the Gas Co.

Woodford (Essex).—The U.D.C. has deferred a recommendation in favour of a supply of electricity for the town, pending the approval of the intended prov. order by the Council.

TRAMWAY and RAILWAY NOTES

Argentina.—It is expected that the first section of the electric tube railway between the Plaza de Mayo and Plaza Once will be opened to public service towards the end of November.

The Chamber of Deputies of the Province of San Juan has sanctioned a law authorising the construction of an electric tramway line in the capital of the province.

Barnsley.—The Barnsley and District Electric Traction Co. has applied for permission from the Wombwell U.D C. to augment its service between Barnsley and Wombwell by the addition of 15 vehicles.

Barton.—Local Tramway Rating.—At the meeting of the Guardians on the 22nd inst., the clerk was asked the figures relative to the dismissal of the appeal by the Salford Corporation against the rating of the tramways. He stated that the rate for Eccles against which the appeal was made, was £1,853, and the Salford Corporation set up a contention that it ought not to be rated at all. Since £1,853 was adopted, the valuer had increased the amount to £3,500, but that was not the subject of the appeal. The important point involved in the discussion was relative to the contention of the Salford Corporation that the Swinton and Eccles lines of tramways were to be treated as separate entities, and not held to be part of the whole system of the Salford tramways. The Barton Assessment Committee adopted the opposite contention, and that had been upheld.

The clerk stated that other unions considered the question at issue so vital to themselves that Haslingden, Blackburn, Ashton-under-Lyne, Fylde, Bury, Rochdale, Todmorden, Warrington and Salford had arranged to enter into an agreement to give the Barton Union financial co-operation. In reply to a Guardian, who asked if the rate would be increased to £3,500, the clerk said that would have to be considered by the Assessment Committee.

Birmingham.—The Tramways Committee has decided to allow "strap-hangers" to the number of six per car, before 9.30 a.m.

Bolton.—The Corporation intends to promote in the next session of Parliament a Bill, authorising, among other works, the construction of various new tramways.

Bradford.—The Tramways Committee has entered into an arrangement with the owner of premises in Forster Square to lease the property to the Corporation for a further period of five years, these premises to be used as tramway offices as at present.

The Committee has also decided to accede to the application of the Bradford Postmaster with respect to the conveyance of mails between Bradford and Shipley by tramcar.

Brazil.—About 18 months ago Messrs. Dodsworth & Co., of Rio de Janeiro, were granted the work of installing a new electric tramway and lighting system in Pernambuco, and it was arranged that Messrs. J. G. White & Co. should do the construction work. The foundation for the power house is now being built, and surveys are being made for the car barns and track, a portion of which has already been laid. The gauge is 1 m.; English cars will be used, but the power machinery and rails are all of American manufacture. The power plant will generate 4,000 H.P.—*South American Journal.*

Canada.—The Canadian Northern Railway has let a contract to the Canadian General Electric Co. for the electrification of the tunnel and the terminal beneath Mount Royal. The contract amounts to about $800,000, and calls for seven electric locomotives and eight cars for the local service. Trains are to be running within a year, and a 7-minute service is to be provided through the 4-mile tunnel.

The Canadian Pacific Railway is also making arrangements with the General Electric Co. for the electrification of the new short tunnel route over the Rocky Mountains. With the development of Canadian water-powers now proceeding, the electrification of Canadian railways is expected to proceed rapidly.

The Government has abandoned the intention of completely electrifying the Hudson Bay Railway now under construction. There are plenty of water-powers along the route, but a committee has just reported that the electrification of the route is not feasible. The grounds of this decision are not given. There is no coal in the district through which the road runs, nor, in fact, in all the North-West, except a low-grade lignite.

Castleford.—The Yorkshire (W.R.) Tramways Co. has given an undertaking to the U.D.C. that it will overhaul the track in the Castleford area, and put it in good condition, approximately about April, and in the meantime take up the Church Street track, double the track in Beancroft Road, and do really urgent repairs. The Council has accepted this undertaking.

China.—Railless Services.—The Shanghai Electric Construction Co., Ltd., is at present making some trials of railless electric traction. If these prove successful, it is proposed to start a number of services of trolley 'buses along routes which are too narrow to permit of the construction of tramways.

Continental Notes.—Austria.—The State Railway Administration has planned the utilisation of the whole of the water-power of the Stubach and its feeders, save the Odbach, for the generation of electrical energy for railway driving purposes. By the construction of storage reservoirs a constant output of some 16,000 H.P. will be attained. *Der Elektrotechniker.*

Germany.—Good progress is being made with the adoption of electric traction on the mountain sections of the railways in Silesia. The first line, that between Konigszelt and Dittersbach, is approaching completion, and trial runs over it are expected to be made early in the new year. The next sections to be completed will be the Dittersbach-Hirchberg; Nieder Salzbrunn-Halbstadt; Rubbank-Lieben; and Hirchberg-Grunthal. These lines are expected to be ready for operation by the spring, while several others will be opened for traffic in the autumn.

The Western section of the Great Berlin Underground Electric Railway, between Dahlem, Witbergplatz and Uhlandstrasse, has just been opened for traffic.

A number of new electric taxicabs have lately been placed in service in Berlin. They are four-wheel machines built by Messrs. Gebhardt & Harhorn, of Schoneberg.

Dublin.—The Tramway Co.'s returns to the 24th inst. show a decrease, through the strike, of £12,781. Last week the service was almost complete, but, according to the *Morning Post*, many people are still afraid to use the cars.

Edinburgh.—A petrol-electric 'bus service is to be run on the Newington route, and a garage will be erected to hold seven cars. The cost of the 'buses is estimated at £5,000, and of the garage at £1,500. A 10-minute service will be given.

Erith.—The year's working of the tramways undertaking resulted in a gross profit of £4,156; after meeting loan and interrunning charges, the net result was a deficit of £2,142, which, however, was some £847 better than in the previous year.

Glasgow.—The electors of Busby and Clarkston have decided in favour of the extension of the Corporation tramways to the Sheddens.

The Corporation is to consider a proposal for tunnelling from Gibson Street to Byres Road, for the construction of tramways.

Greenock.—Proposed Tramways Purchase.—The Corporation has received expert advice which confirms the opinion that it would be advisable, from a financial point of view, to municipalise the tramways undertaking at the present break in the lease.

Halifax.—Six Months' Working.—For the six months ended September 30th, the income from the tramways amounted to £58,147. The expenditure was £49,742, leaving a profit of £8,405. From the motor-'buses there was a loss on the six months of £240, the total income being £1,413, and the expenditure £1,653.

The Tramways Committee has decided to relay the track in several streets, at a total cost of £4,500.

Haslingden.—As a result of a conference between representatives of the Corporations of Accrington, Haslingden and Rawtenstall, it has been agreed to continue the present 10-minutes service of cars from 2 o'clock each day for one year, on condition that the Rawtenstall Corporation will forego its claim for the payment of the difference in current consumption, alleged to arise through the use of the regenerative system of control on Rawtenstall cars running through Haslingden. Councillor Waddington, at a meeting of the T.C. on October 22nd, said the arrangement was satisfactory, in that through-running would be continued, but, in the financial sense, there would be a loss. They hoped, however, if the financial loss continued to be serious, that at the end of next year the Rawtenstall representatives would meet them and let them have a time-table which would give the minimum of loss.

Japan.—Owing to the extension of the electric tramways in and around Tokio, the present output of 20,000 H.P. from the plant of the Kenagawa Water Power Co. has become insufficient to meet the requirements. As a result two new turbines and generators have just been installed, which will practically double the company's plant capacity.

An application has been made to the Tokio Prefectural authorities for a concession to construct and work an electric elevated mono-rail tramway between Neno and Asakusa, a distance of nearly two miles. The scheme has been drawn up by Mr. Okayama Masaysu, who has recently returned from Europe, where he made an investigation into various systems of electric traction.

Leeds.—Two Corporation tramcars were in collision last Saturday morning, owing to the mist. Near Kirkstall Abbey a car ran into the back of a dray belonging to the Leeds Co-operative Society, and the driver was knocked under the dray; while in York Road, also, a car collided with a coal cart

Leicester.—The Tramways Committee has recommended the Council to purchase 10 new tramcars, at an estimated cost of £7,000.

London.—Stepney.—The B.C. has consented to the proposed extension of the tramways from the Aldgate terminus to a point near Mark Lane Station.

Proposed Crystal Palace Tube.—The Lord Mayor, in a letter to the Camberwell B.C. on the subject of the acquisition of the Palace, stated that the Underground Railways Co. was prepared to continue the present tube railway from the Elephant and Castle through Dulwich and Sydenham to the Norwood end of the Palace, provided it was supported by the districts concerned.

Manchester.—A committee has been formed to try to bring about improvements which will give "a better Manchester." Amongst suggestions issued to municipal candidates last week by the committee were the following relating to the tramways:—(1) Transfer tickets, which would lessen congestion in the central districts; (2) allow district nurses free; (3) inner circle of cars or motor-'buses running in both directions, thus connecting all the railway stations; (4) all stopping places to be lighted up at night, and the signs "Inward" and "Outward" replaced by the actual destination; (5) sign "Full" on all cars, controllable by the guard, but showing the sign above the driver's head; (6) shelters at every terminus, and *en route*, where there are important stages and crowds congregate, combined with lavatories where practicable; and (7) abolish all standing inside cars.

Mr. McElroy, general manager of the tramway undertaking, holds out no hope in reference to the suggestions for the issue of monthly or quarterly contract tickets and transfer tickets; for the running of through cars to Salford; for the establishment of an inner circle service to connect the railway stations; and for the introduction of first-class cars. His Committee, he said, was not in favour of allowing district nurses to travel free. As to the protection of drivers in inclement weather, the Committee had been experimenting for years, but some people, including drivers themselves, thought glass vestibules impaired their vision and hearing. The suggestion that a sign "Full" should be operated on every car by the guard, Mr. McElroy said, had been tried in many places, and had proved useless, because the guard could not be on the platform all the time. The Committee had decided that cars should be equipped with numbers 9 in. high, and that small hand-maps should be issued showing routes traversed, and giving the key to the route numbers. More shelters were also to be erected. The night service, which would be extended on Saturday nights to 12.30, would be continued till Christmas, when the analysis of passenger returns would be considered. The Committee proposed to supply guides in the shape of small hand-maps of the system in each car and shelter; these guides would show the routes traversed, and would indicate the starting and finishing times on each route. Regarding standing in cars, the Committee was now considering the whole question of how to meet the requirements of the travelling public. In the first six months of this year, 10 million more passengers were carried than in the corresponding period of last year, and they had to devise a system for meeting not only the requirements of to-day, but those of the future. Mr. McElroy added that his report on his observations in America and on the Continent would be issued two or three months hence.

Newport (Mon.).—The Tramways Committee is asking the Works Committee for its views upon the suggestion that the latter should bear a proportion of the cost of the paving of the tramway permanent way, on the ground that the roadway is not worn by the tramcars.

Shipley.—The D.C. has decided to complete the reconstruction of the tramway along Keighley Road, and is prepared to receive tenders for the laying of a double track from the Branch Hotel to Saltaire.

South Africa.—The Pietermaritzburg Corporation does not propose at present to take any further action regarding the railless tramways. The Corporation has, however, ordered a 40-H.P. petrol-electric char-à-banc, which will be used to test the traffic value of various routes in and about the city.—*Board of Trade Journal.*

South Shields.—At a meeting of the T.C. on October 22nd, the tramways manager presented a special report on the proposed extension of the tramways to Harton. The distance from the Market Place, South Shields, to Harton Nook, was 2·38 miles. The approximate cost would be:—Track, £12,600; overhead equipment, £1,350; contingencies (at 5 per cent.), £700; total, £14,650. The Tramways Committee recommended the adoption of the report. Ald. Hilton moved that the consideration of the subject be deferred until Harton was incorporated in the borough. He said there was only a population of 800, and he believed that there would be a loss of some £17,000 on the extension. Mr. A. D. Johnston seconded the report, saying that tramways had reached high-water mark, and that the motor-'bus was the vehicle that was now preferred by the experts. Ald. Wylie, who had moved the Committee's report, said that if the Corporation did not do something to get the increasing population to go to the outskirts of the town it would probably be faced with a big housing scheme. The amendment was adopted.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephony.—New telephone rates between England and France, in most cases half the present rates, will come into force to-morrow. The London-Paris rate for three minutes' conversation will be 4s.

Australia.—The amount of the tender of the Australasian Wireless, Ltd., for the wireless installation at Fremantle has been increased to £4,600.—*British Australasian.*

Canada.—The Marconi Wireless Telegraph Co., of Canada, has completed its contract with the Canadian Government, and will erect three additional stations during the next year. There are now about 32 stations at work in Newfoundland. High-power stations are to be erected at Hudson Bay and Le Pas, Manitoba.

International Time Congress.—Last week the Congress met at the Paris Observatory and unanimously approved the International Convention for the creation of an International Time Association, with its headquarters in Paris, and the regulations connected therewith. The Governments of 15 countries were represented at the Conference.

International Wireless Commission.—As briefly mentioned in our last issue, a meeting was held in Brussels at the commencement of last month at which the question of organising an International Commission to carry out wireless experiments was discussed. At the International Time Conference in Paris last year a series of resolutions was passed with reference to the formation of an International organisation for the scientific study of Hertzian waves and their relationship to the medium through which they travel; at this Conference Mr. R. Goldschmidt, of Brussels, placed his high-power station at Brussels and the sum of £1,000 for preliminary studies at the disposal of the proposed International Commission.

Arising out of these resolutions the representatives of the different countries who were present at Brussels last month drafted a provisional constitution for the International Commission and a scheme for its work.

The objects of the Commission are:—To carry out experiments on the propagation of electric waves; to make wireless telegraph measurements, and to study the problems related thereto.

The provisional programme of the work of the Commission will consist in making measurements in different countries, at different distances and in different directions, of the strength of signals sent out from the station at Brussels. These measurements will be repeated from day to day, or hour to hour as necessary in order to determine the variation of the strength of the signals with time, with distance and with direction, and later the effects of wave-length and decrement will be studied.

It is proposed to set up a receiving station near the transmitting station in Brussels in order accurately to control the strength of the waves sent out, so that an allowance can be made for any unavoidable variation, in reducing the final results.

The organisation consists of a number of National Committees, one in each of the countries taking part. The National Committees will send delegates to the International Commission, and these delegates, together with the officers, will constitute the Commission. It is proposed that the International Commission should meet once a year, or more often if the work is sufficiently advanced.

The Institution of Electrical Engineers has decided to undertake the formation of the National Committee for Great Britain, under the scheme for the organisation and encouragement of electrical research which was announced at the Institution meeting on December 12th last.

In the first instance, a sum of £2,000 presented by Mr. Robert Goldschmidt will be available to meet working expenses, and afterwards the National Committees will provide the necessary funds. Mr. W. Duddell is the first president, and Mr. M. Wien vice-president; Mr. Goldschmidt is the general secretary.

The test signals will be sent out on Mondays, Wednesdays and Fridays, at 11.25 a.m. and 3.25 p.m., starting from January 1st, 1914, with a wave-length of 3,300 m, and will consist of the letter V for one minute; this will be followed by 10 dots and spaces of one second each, a space of 10 seconds, a dash of 10 seconds, and a space of 20 seconds, the cycle being repeated three times.

New Cable.—A new cable 2,280 nautical miles in length is to be laid between Aden and Colombo by the Eastern Telegraph Co., bringing the aggregate length of that company's cables up to 110,367 nautical miles, in addition to 6,200 miles of landline.

Post Office Telephone and Telegraph Society of London.—In succession to the Telephone Society of London, which was formed under the auspices of the National Telephone Co., the Society above named has been formed, with the Postmaster-General as President, and the opening meeting of the 1913-14 session was held on Monday last at the Institution of Electrical Engineers, Sir Alex. King presiding. The chairman of the Society, Mr. Alex. Moir, superintending engineer of the London Engineering District, read a paper on some features of the district, in the course of which he gave the following forecast of the telephonic requirements of London, based upon a complete survey which has just been completed:—

	Lines.	*Stations.*
1913	130,000	222,000
1921	267,000	432,000
1928	414,000	680,000

During the past year 102,000 miles of underground wire have been provided to replace overhead wires which have been taken down.

Wireless on Board Ship.—An International Conference on Safety of Life at Sea will meet in London on November 12th, at which, amongst other questions, regulations for the use of wireless telegraphy on board ship will be considered.

Wireless Rescue.—Last week news arrived of another vessel, the ss. *Templemore*, which caught fire in mid-Atlantic, and summoned help by Marconi wireless telegraphy, on September 29th. The ss. *Arcadia* received the call, and rescued the crew, who had been compelled to take to the boats in a heavy sea.

United States.—It is reported that legal action is about to be taken with a view to setting aside the sale of the United Wireless Co.'s assets to the Marconi Co.

THE ELECTRIC VEHICLE IN ENGLAND.

In a recent issue of the Electrical Review* we illustrated a number of electrical vehicles of the commercial type, with a view more particularly of showing the wide sphere of activity which has been secured for the electric truck in the States, and which is to a large extent open to such vehicles in this country also.

While by comparison we have but little to show in this direction, yet there are unmistakeable signs that the commercial electrical vehicle will shortly enter into competition with the various types of road vehicle commonly used at the present time in this country for goods transport.

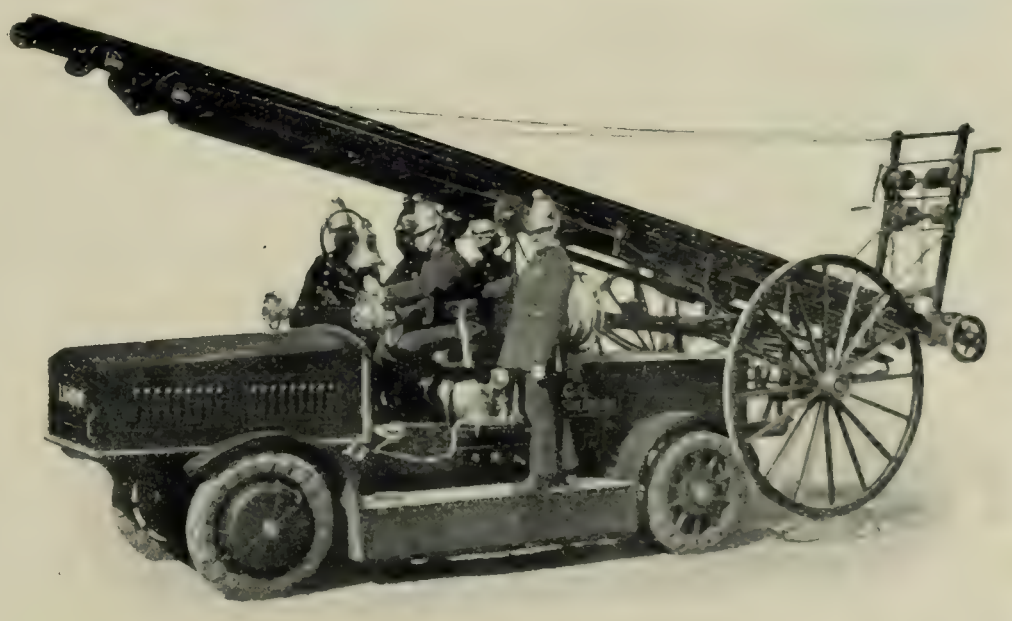
Much the same may be said as regards the electric carriage or vehicle of the pleasure type, for while in London many excellent vehicles of this class have been in use for years, they have obviously a much wider sphere of use than is the case now, both in London and the provincial cities. In this connection, the recent announcement of the Electric Vehicle Committee of the Municipal Electrical Association (Elec. Rev., September 26th) may be taken as an indication that a certain amount of organised co-operative effort will be brought to bear on this class of business in the near future.

It is, moreover, satisfactory to know that there are central station engineers sufficiently energetic to take the matter up practically and on their own account. For instance, Mr. J. W. Beauchamp, who controls the West Ham electricity department, has recently brought about the sale of two Edison trucks for use in his district, one of them being for the Stratford Co-operative Society, of two tons capacity, and to travel 35 to 45 miles on one charge.

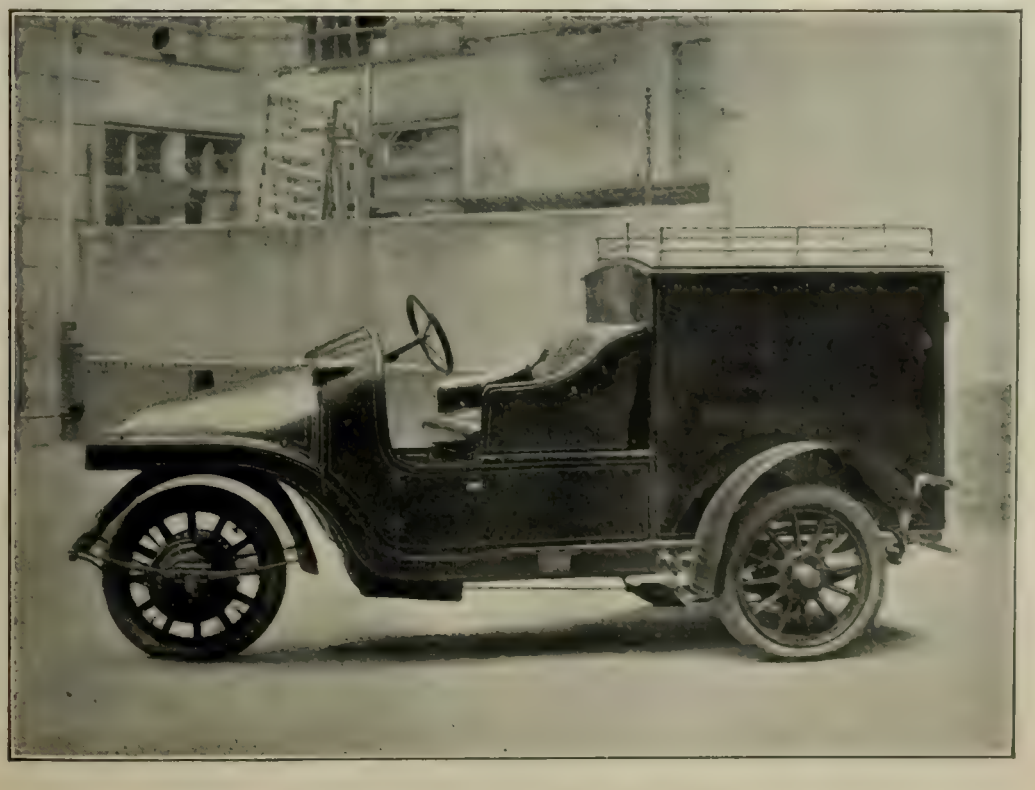
There are also in his area, four Cedes electric ambulances in regular use in the Dock district under the control of the Port of London Authority, and a heavy electric truck in use by the Silvertown Co., of their own make, for carrying cable, &c.



Electric Dock Ambulance by the Cedes Co.



Cedes Electric "First-Aid" Car, London Fire Brigade.



Torpedo Electric Delivery Van.

These vehicles are mainly charged from the Corporation's charging stations which have been established in Canning Town and Stratford.

In order to interest possible users, the West Ham electricity department has issued pamphlets, undertaken suitable advertising, and specially instructed some of its power representatives in methods of obtaining this class of business.

A large number of demonstration journeys have been arranged in the district, which it is almost needless to say offers considerable scope for the heavy electrical carrier.

Our readers are probably aware that the Glasgow Corporation has a 1-ton electric delivery van in use, some particulars of which were given at the last Municipal Electrical Convention, by Mr. W. W. Lackie, the city electrical engineer; the Blackburn Corporation electricity department is also using an electric roadster car.

If only they were popularly recognised as "electrical," the handy little ambulances used by the City Corporation and recently adopted by the Port of London Authority, also the numerous electrically-driven appliances of the London Fire Brigade, would be an excellent advertisement for the electric battery vehicle.

The present City ambulances were supplied by the Electromobile Co., a concern which was established in 1902 for the sale of electric carriages, &c., and to whom all credit is due for the considerable measure of popularity which these vehicles have achieved in the metropolis.

In 1902 the Electromobile Co. commenced hiring out its vehicles, and at the present time over a hundred hired electric vehicles are in constant service, the company having 130 carriages in use for this purpose, while it has also supplied a number of light delivery vans.

The features of the Electromobile carriage are the straight chassis and underslung interchangeable battery, which is

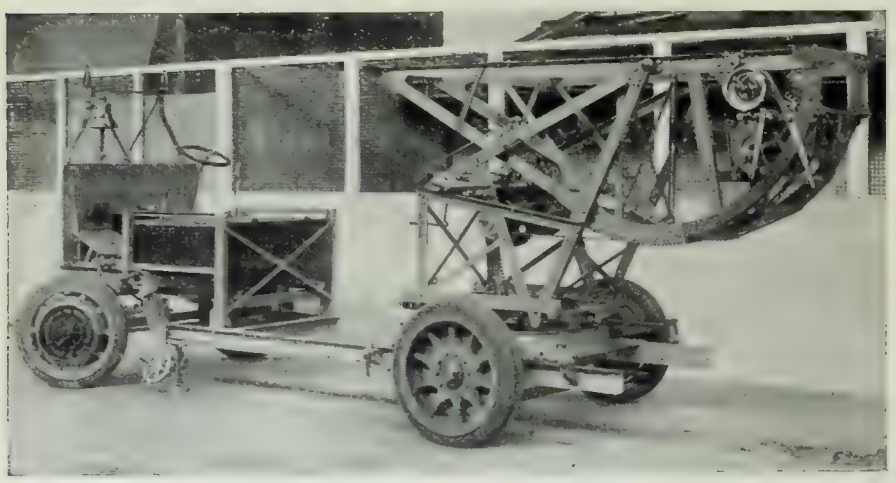
* Electrical Review, October 3rd.

sufficient for a 45-mile run; an 8-H.P. motor, capable of giving 16 H.P. for short periods, is fitted, and the control provides for speeds of 3 to 20 M.P.H.

In view of the company's experience, it will be gathered that there is nothing experimental about its methods.

A good many electric vehicles for special purposes, of the Cedes type, are in use in the London area, some of which we illustrate; the Port of London Authority ambulances supplied by the Cedes Co., which are typical, weigh two tons with driver, nurse and two patients; they have a speed of 20 M.P.H. and run from 40 to 45 miles on one charge.

The special feature of the Cedes vehicle is the driving motor arrangement, the motors being fitted in the hubs of either front or back wheels, thus giving a direct and noiseless drive which dispenses with all gearing.



Cedes Electric Turn-Table Ladder.

The ambulances are fitted with two 5-H.P. motors and to fully charge the battery requires 27 units, giving an energy cost per mile (at 1d. per unit) of slightly over ½d.

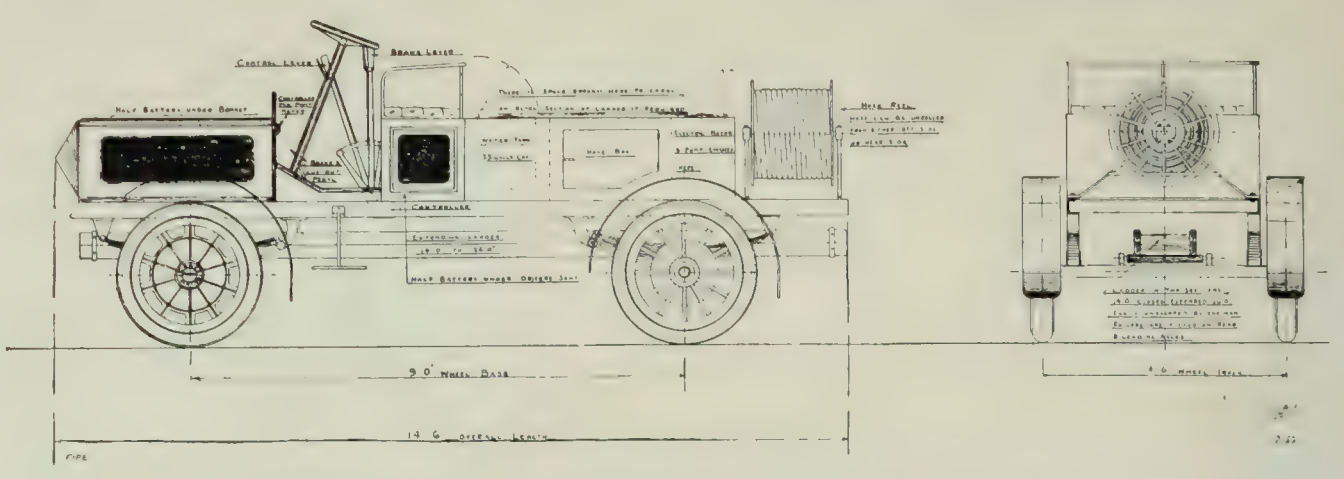
A special Tudor battery is used, the maintenance of which can be guaranteed.

The Cedes Co. has constructed a good many electric vehicles for fire brigade purposes, and we illustrate a "first-aid" car, one of 12, supplied to the London Fire Brigade.



Electric Yard Crane, B.T.H. Works.

These have been in use, night and day, for 2½ years, and have only required nominal repairs. The car weighs over 5 tons, has a tested speed on the level of 27 miles an hour, and a length of run with one charge of 45 miles. These cars have established a record in speed of getting away from a station, 8 to 10 seconds being the time usually required to



Cedes Electric Fire Brigade Car for Provincial Use.

get clear of the station, after the alarm has rung. Another view shows a Cedes electric "turn-table" ladder, several of which are in use in London; these vehicles weigh 6 tons, can run at 25 miles per hour on the level, and have a radius of action of 35 to 40 miles. The 90-ft. ladder is extended by means of a small electric motor fixed at the base, and supplied from the battery which drives the vehicle; this operation occupies 10 seconds, and the motor forms an electric brake while the ladder is being lowered.

A new type of electric fire brigade car, designed by the same firm for use in provincial centres, is illustrated above; it has a speed of 24 miles per hour and an effective travel, on one charge, of 50 miles.

The battery which drives the vehicle also drives a small motor directly coupled to a pump, for first-aid purposes; the vehicle also carries 120 ft. of hose on a reel, 300 ft. of spare hose, a first-aid equipment, a 25-gallon water tank and a 30-ft. telescopic ladder. The whole equipment weighs 2 tons, and two men can look after it, as compared with a crew of four usually required with a petrol-driven "first-aid" car.

Turning to the commercial types of vehicle in use in this country, we recently illustrated and described* a 10-cwt.



Yard Crane, Showing Edison Battery.

Silvertown truck for post office purposes, constructed by the India-Rubber, Gutta-Percha and Telegraph Works Co., which

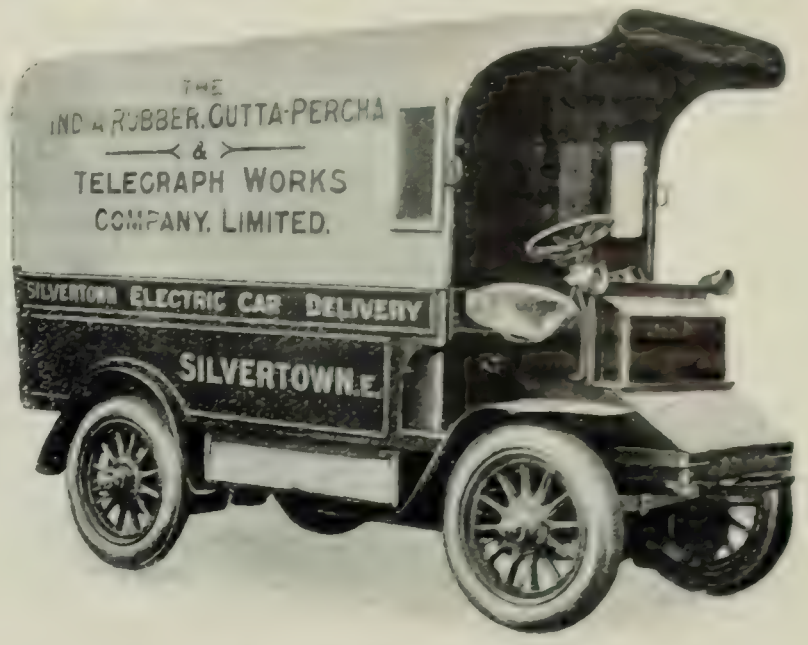
* Electrical Review, August 29th, page 342.

has taken up the construction of the electric truck. We illustrate on this page a 1-ton van by the same firm, a special point of which is that both the front and rear wheels are driven by electric motors, and the controller mechanism is so arranged that either the front or back axle motor or both of them can be used, when all four wheels will be driven.

The motors are clipped on to the tubular casing of the front and rear axles and are bolted to the side of the differential case; owing to the steering movement of the front wheels, universal joints connect the driving axles therewith. One mechanical brake only is fitted on the rear wheels, and its application cuts out the current supply to the motor in such a way as to necessitate returning the control lever to the neutral position before the vehicle can be again started. A series-parallel speed control is provided, and the battery is carried in a crate slung under the frame, and can be easily detached. A safety plug is provided which can be withdrawn by the driver leaving the car and subsequently replaced, but only with the switch open.

The same plug is used in another position if the battery is being charged *in situ*, and in that case cuts out the controller.

As our readers are aware, those responsible for the exploitation of the Edison battery in this country have already entered on a vigorous campaign on behalf of the battery-driven vehicle. Through the courtesy of Mr. J. F. Monnot, who controls the Edison battery interests in this country, we are able to illustrate the demonstration vehicles which his firm is employing, these being representative of both the commercial and so-called pleasure types. We understand that the firm has in hand a good many schemes involving the use of Edison accumulator traction, and at the present time the Arrol-Johnston Co., in conjunction with the above firm, is building 50 three-passenger coupés, equipped with Edison batteries, the first portion of the 1,200 which it is the firm's intention to construct. One of our views shows a coupé of the type referred to, which recently made a successful demonstration trip from Dumfries to London, a distance of 360 miles, charging when necessary *en route*; we understand that this vehicle will be shown by the Arrol-Johnston Co. at the forthcoming Olympia Show. At the present time Messrs. Harrods are using four 1-ton Walker-Edison delivery vans, while Messrs. Liberty have a ½-ton Detroit-Edison delivery van, capable of a speed of up to 16 M.P.H., and 50 to 60 miles run on one charge.



1-Ton Silvertown Electric Truck.



1-Ton Electric Delivery Van, Glasgow Corporation E.L. Department.

In both these cases the charging of the batteries is carried out by the firms in question, who, we understand, are likely to extend their use of the "electric" in the near future.

Another of our views shows the 1-ton Detroit-Edison delivery van in use by the Glasgow Corporation, in regard to which Mr. W. W. Lackie, at the last Municipal Electric Convention, gave such a good account. This is equipped with an Edison 150 ampere-hour battery, but will accommodate a much larger one: the motor is a four-pole series-wound machine, and series-parallel control is provided.

The loaded vehicle will run 33 miles on an ordinary road at 10 miles an hour on one charge; it has covered 6,632 miles since March at a cost for charging current of slightly over ½d. per mile.

A somewhat novel form of electric vehicle, of German construction, has lately been introduced into London by the Torpedo Motor Co. We illustrate a delivery-van of this type, and it will be seen that it is mounted on three wheels



Edison Demonstration Truck at West Ham.

only, the front one being both for steering and driving, with the motor and its gearing built into the hub.

The field magnet system is rigidly fixed to the wheel hub; the armature rotates inside on a fixed axle, in the opposite direction, at five times the speed of the magnet system, being coupled to the latter by a planet gear. The current connection is through slip-rings, and speed control is provided by dividing the battery into two parts, and running on the first speed with the half batteries in parallel (40 volts), and on the top speed with the whole battery in series (80 volts). The controller is worked by the left foot and the brake by the right foot, the driver having his hands free to steer.



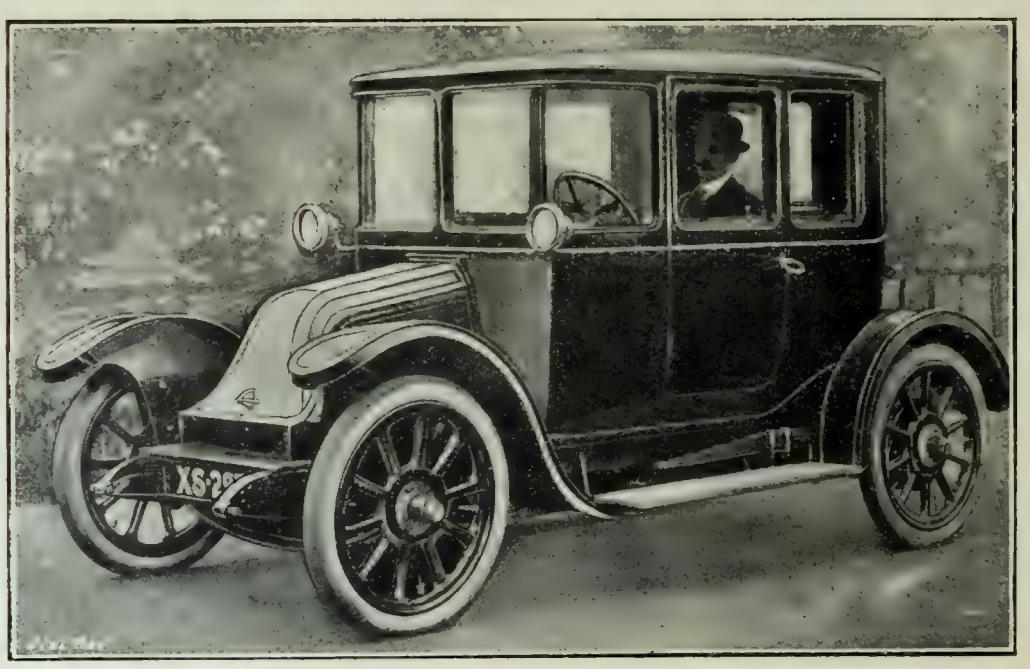
Edison "Pleasure" Type Vehicles for Demonstration Purposes.

A 10 cwt. van of this type will run some 70 miles on one charge of 16 units.

We understand that the Torpedo Co. is also introducing another type of three-wheeled electric for smaller loads, in which the driving motor is fitted above the front wheel, and geared to it through spur and bevel gearing.

Another development is a light "electric-petrol" vehicle, which will shortly be placed on the market by Messrs. F. A. Wilkinson & Partners, Ltd., of Hatfield.

This is essentially a battery car, intended for charging in the ordinary way, but a small petrol engine and special type of motor-dynamo are fitted, by means of which the battery power can be supplemented on hills, and the battery can receive an occasional charge when the car is standing.



Arrol-Johnston (Edison) Coupe.

The engine is also a safeguard in case the battery runs down and no ordinary charging facilities are available. The car is constructed on cycle car lines, with a view to obtaining a moderately-priced vehicle, and weighs only 12 cwt.; it can be used when the pure battery car would be useless owing to lack of charging facilities, and retains the simple control of the electrical vehicle.



Edison Commercial Vehicles for Demonstration Purposes.

Although at present we have only isolated examples of the commercial "electric" in this country, and the great majority of electric battery vehicles of all kinds are found in the London area, there is reason to believe that this state of affairs will be altered before long.

For one thing, numerous British engineers and business men have lately formed their own opinions of the "electric" first hand, during visits to the States; an instance of the trend of events was the announcement of Mr. B. M. Drake, of Messrs. Drake & Gorham, Ltd., at the recent annual meeting of the company, that following on a visit he made to America, his firm had made arrangements to supply electric cars forthwith, and he hoped this might soon develop into a large business.

In the course of a letter to us on the subject, Mr. Drake says:—

> Users of commercial cars informed me that apart from the greater distance covered, the actual working expenses were considerably less than with horses, and the so-called "pleasure" cars were stated to compare favourably with petrol cars, although petrol is about half the price in America that prevails here.
>
> The cars I tried were fitted with new type Edison batteries, which are rapidly coming to the front for traction work. A year ago I was told that the proportion was about one-third Edison to two-thirds lead, whereas at the present moment it is about half and half, and it is anticipated that in a year's time the proportion will be reversed.
>
> I was told that the working cost of a 5-ton commercial vehicle, including depreciation of accumulators, amounted to only 2½d. per ton-mile, and brewers have found that their costs per barrel delivered in the radius come out much lower than with horses.
>
> It is a little difficult to see why this mode of traction has succeeded in America, whereas attempts here in the past have failed; the price for current is higher in America, then her labour is about double, and there is the same competition from the petrol car, in fact, the Ford Co., whose works I visited, are turning out 1,000 cars a day.
>
> In the case of the commercial cars, I think the horses suffer considerably from the heat in summer, and the country is somewhat flatter, but probably the explanation is to be found in the support given by the supply companies to this industry, several of them having erected large garages at their own expense, where cars of

all kinds are sent after the day's work and fetched next day ready for use. They have also "boosting" facilities at different parts of the towns where an Edison car can be charged up while the owner is shopping or having lunch, and thus one of the drawbacks to the electric car, viz., its short running power, is obviated at any rate for town use.

My opinion is that the commercial vehicle will come into immediate use in England for delivery and haulage wherever the roads are good, and I think the "pleasure" vehicles will follow later when charging facilities throughout the country have been arranged. At present they are practically useless for touring purposes, but the moment one can recharge with little more trouble than is necessary to empty a tin of petrol, there is no doubt that the absence of smell and noise, the perfect control, and other advantages of the electric vehicle, will bring it into general use, especially as the tendency for the price of electricity is to go down, whereas that of petrol is bound to go up.

Compared with the petrol-driven machine at the present time, the first cost of the electrical vehicle is undoubtedly high—a fact which has not escaped the notice of the American central-station authorities, who still retain many non-electrical vehicles in service.

Although this may be a small matter for wealthy individuals and companies with ample capital behind them, it is obvious that however low the running and maintenance costs of the "electric," and this is not disputed, the first cost is likely to delay its adoption in very many cases, unless hire and hire-purchase schemes on a large scale can be evolved.

A case in point is the small tradesman who, although unable to purchase outright, would undoubtedly benefit more by the use of the handy electric delivery van, than by using either a petrol or horsed vehicle.

Contract arrangements on a mileage or other basis are meeting with success in the case of the petrol vehicle, and there appears to be no reason why they should not be adopted at the outset in connection with the "electric."

We are aware that this matter has received consideration, but rather with a view to demonstrating the advantages of the "electric" than of meeting the objection of its first cost. However, there is little doubt that, now that practical interest in the subject has been aroused, those who have determined to push the electric vehicle to the front will not rest until adequate means have been found not only for introducing it, but also for securing its adoption wherever possible.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 4th. Coal (800 tons) for the U.D.C. electricity works. Mr. F. Garside, Electricity Works, Laburnum Road.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

December 14th.—Two-sections switchboard, common-battery multiple. See "Official Notices" October 17th.

Hobart (Tas.).—December 1st. Dry cells for the P.M.G. See "Official Notices" October 17th.

Brisbane.—December 17th. P.M.G.: Insulators. See "Official Notices" to-day.

December 31st. P.M.G. Insulators. See "Official Notices" to-day.

Banbridge.—November 3rd. Lighting public streets by gas or electricity for the U.D.C. Particulars at Town Surveyor's office.

Beckenham.—November 10th. U.D.C. 12 months' supply Midland Small Coal. See "Official Notices" to-day.

Bedford.—November 12th. Corporation. (1) 1,000-kw. mixed-pressure turbo-alternator with exciter and condensing plant; (2) water-tube boiler with mechanical stoker and coal-handling plant. See "Official Notices" October 24th.

Belgium.—December 4th. Two electric passenger lifts at the new industrial school. Tenders to Burgomaster, Hotel de Ville, Antwerp. Deposit £40. Some particulars may be seen at Board of Trade, C.I. Department, in London.

Bournemouth.—November 17th. Corporation: Ten bogie electric tramcars.

Bradford.—November 15th. Electrical installation, Technical College, for the Education Committee. City Architect, Town Hall.

Bulgaria.—November 11th. The District Finance Administration, in Sofia, is inviting tenders for 2,000 metres of underground telephone cable with 10 pairs of conductors, and 50,000 metres of rubber-insulated double-conductor cable.

Canada.—Winnipeg.—Telephone line, being part of Greater Winnipeg water supply scheme. M. Peterson, City Hall, Winnipeg.

Dublin.—November 1st. G.N. Railway Co. (Ireland). One year's supply of stores, including a number of electric and telegraph supplies. See "Official Notices" October 10th.

November 17th. Twelve months' supply of stores, for Dublin Electrical Tramway Co., Ltd. See "Official Notices" to-day.

Glamorgan.—The County Council desires to negotiate for the construction and working of five miles of light railway from Ynysforgan to Pontardawe. See "Official Notices" October 10th.

Glasgow.—November 3rd. Caledonian Railway: Six months' supply of stores, including a number of electrical, telegraph and telephone items. A. J. Easton, stores superintendent, 321, Charles Street, St. Rollox, Glasgow.

Grimsby.—November 13th. Corporation: Metal-filament lamps; ¼ to 15 h.p. continuous current motors; ¼ to 15 h.p. motor panels; house fuse boxes and fittings; house service boxes (lead) and fittings. See "Official Notices" to-day.

India.—Allahabad.—Electric generating plant, consisting of oil engines, continuous-current dynamos and storage batteries. Hon. Sec., Allahabad Club, Ltd., Allahabad.

Leicester.—November 3rd. Corporation Tramways. 190 tons of girder tram rails and fish plates. Specifications and form of tender (2½d.) from Mr. E. G. Mawbey, Borough Surveyor, Town Hall.

London.—November 12th. L.C.C. (1) Installation at Colebrook Row Special School, Islington, N. 95 lighting points; (2) installation at County Secondary School, Chelsea, 180 lighting points. See "Official Notices" October 24th.

The L.C.C. invites persons and firms, particularly manufacturers, to have their names placed on the list of those from whom tenders for supply of stores and execution of general maintenance contracts are invited by it. See "Official Notices" October 24th.

Port of London Authority.—November 5th. Various stores including arc lamp carbons and carbon filament lamps. Stores Superintendent, 106, Fenchurch Street, London, E.C.

Battersea.—November 13th. Corporation: Installing arc lamps and metallic lanterns on consumers' premises in connection with hire scheme for one year. See "Official Notices" to-day.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Oldham.—November 10th. Painting of tramway standards and section boxes.

Rathmines and Rathgar.—November 4th. The Council. One 400-kw. generating set (high-speed engine direct coupled to two d.c. dynamos in tandem). See "Official Notices" October 17th.

Rhyl.—November 19th. One 160-kw. Diesel engine set, for U.D.C. See "Official Notices" October 17th.

Spain.—November 16th.—The municipal authorities of Glebe (province of Alicante) are inviting tenders for the concession for the electric lighting of the town during a period of two years.

November 10th.—The municipal authorities of Jaen are inviting tenders for the concession for the electric lighting of the town during a period of 15 years.

The Azores.—January 12th. La Junta Generale du District de Ponta Delgada, Saint Michel, Azores, is inviting tenders for the construction and working of an electric railway between Ponta Delgada and Valle das Furnas, and between Ponta Delgada and Villa da Ribeira Grande. The lines will be laid at the side of the national and municipal roads.

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

Wolverhampton.—November 9th. Corporation: One 4,000-kw. turbo-alternator, condensing plant, and auxiliaries.

CLOSED.

Argentina.—The Government has authorised the Post Office to purchase from Messrs. Duhnkrack, Nellen & Co. 150 tons of No. 7 galvanised iron wire for telegraph lines, at a cost of $17,197·50 m/n.—*Review of the River Plate.*

Australia.—P.M.G.'s Department, Victoria :—

90 miles wire, tinned copper, rubber insulated, cotton covered and braided, No. 22 S.W.G., £3 19s. per mile.
25 miles wire, twisted pair, tinned annealed copper, vulcanised, india-rubber insulated, taped and braided, £13 15s. per mile. Armorduct Manufacturing Co., Ltd.—*Tenders.*

Melbourne City Council.—Insulated copper wire, Messrs. Johnson & Phillips, Ltd., £2,929. *Tenders.*

Sydney.—The following tenders have been received :—Arc lamp winches :—

W. G. Watson & Co. (Verity's Aston), £168.
London Electric, size B, £235; size C, £277; size C, fig. 187, £437.
Warburton, Franki, Ltd., £170.
Lawrence & Hanson, Ltd., £180.
British General Electric Co., £210.
Adler Bros., £320.
A. Guthridge, Ltd., £320.

Wiring and fittings for electric supply for Chippendale Dwellings :

Lawrence & Hanson, Ltd., £578; alternative, £834.
Handley & Lewis, £797.
O'Donnell & Griffin, £825.
Sydney Electrical Engineering Co. (informal), £998.
W. H. Wiles, £1,071. *Aus. Record.*

Basingstoke.—The T.C., on October 23rd, accepted the following tenders in connection with the electricity scheme :—

Coldmarsh & Hanley, Ltd.—Engines, &c., £3,917.
Hart Accumulator Co., Ltd.—Accumulators, £1,408.
Cox-Walkers, Ltd.—Main switchboard, £490.
Johnson & Phillips, Ltd.—Cables and cable laying (about 5½ miles), £3,823.
Herbert Morris & Co.—Overhead travelling crane, £114.

Belgium.—Seven concerns, five German and one each Belgian and French, submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels for the supply and laying of a quantity of telephone cables in the Malines district. The lowest offer was that of Messrs. Felten & Guilleaume, of Mulheim-am-Ruhr.

Bradford.—The Sites and Works sub-Committee of the Technical College Committee has decided to accept a tender for the completion of the electric lighting at the Technical College.

Farnworth.—The Electricity Committee has accepted the tender of Messrs. T. & C. Scowcroft for coal.

France.—The French Post and Telegraph Authorities in Paris have just placed a contract with M. Doignon, of Malakoff (Seine), for the supply of 30 Hughes telegraph transmitters.

Harrogate.—The T.C. has accepted the tender of Messrs. Stones, Ltd., of Ulverston, for a curvilinear steel revolving shutter for preventing sand and grit from entering the machinery at the electricity works, at £30.

Haslingden.—The T.C. has accepted the tender of Messrs. Siemens for the supplying and laying of the cable for the supply of electricity to the Helmshore district.

Heathfield (Sussex).—The tender of Caffyn's Garage, Ltd., of Heathfield, has been accepted for the installation of electric light at Union Church, and for the supply of current from the company's private plant.

Heywood.—The Corporation has accepted the tender of Mr. Bertram Thomas for alterations to the switchboard at the electricity works, and that of Messrs. Wm. Reay & Co. for coal as required during the ensuing six months.

Huddersfield.—The Electricity Committee, after considering the tenders received for H.T. switchboard, recommended that of Messrs. Switchgear & Cowans, Ltd., at £2,259, for acceptance. Tenders were also received from the British Westinghouse Co., Ltd., the British Thomson-Houston Co., Ltd., Messrs. Siemens Dynamo Works, Ltd., and others.

Leicester.—The Tramways and Electricity Committee of the T.C. has accepted the following tenders in connection with extensions at the electricity works :—

Siemens Bros. Dynamo Works, Ltd.—Turbo generator, with reversible rotary converters, switchgear, &c., for the Lero station, and rotary converter switchgear for Aylestone station, £20,018
Clarke, Chapman & Co., Ltd.—Steam-raising plant, for the Lero station, £8,212.
J. Chapman & Sons, Ltd., car-repairing shops, £14,076.

London.—L.C.C.—It is recommended that the offer of Messrs. John Mowlem & Co., Ltd., for the construction, on the underground conduit system, of tramways on the bridge carrying High Street, Wandsworth, over the River Wandle and between the bridge and a point adjacent to Garrratt Lane, on the basis of an addition of 15 per cent. on the rates contained in their tender for the construction of tramways in Bromley Road, be accepted.

It is proposed to accept the tender of Messrs. Chas. Wall, Ltd., at £25,690, for the erection of the third section of the tramways central car repair depôt.

The Walsall Electrical Co., Ltd., has secured the order for the electric charging switchboard for Waterloo Road fire station.

St. Pancras.—The B.C. has accepted the offer of Messrs. Heenan and Froude to supply a wet air filter for the 1,000-kw. Ljungström turbine to be installed at the King's Road station, for £160.

Luton.—The following tenders have been accepted by the T.C. for supplies to the Electricity Department :—

Tudor Accumulator Co., Ltd., traction battery of 250 cells, £1,137, less approximately £170 for existing battery.
Hudson Economiser Co. (1907), Ltd., cooling tower of 170,000 gallons capacity, £839.
J. Facer & Son, South Leicester coal, 13s. 5d. per ton.
Geo. Newbold, Whitwood coal, 13s. 9d. per ton.

Newport (Mon.).—A Committee of the T.C. has recommended the acceptance of the tender of Messrs. Heenan & Froude for a refuse destructor, at £7,967.

Salford.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., at £42 10s. for two additional potential transformers on the extra-high-tension switchboard; also the tender of Messrs. J. Wolstenholme & Son, at £193 15s., for an additional vertical two-stage air compressor for the electricity station.

Sunderland.—Messrs. T. Reid, Ferens & Co. have secured the following installation contracts :—Sunderland : New Gaiety Theatre, Queen's Hall Kinema, Dawdon Princess Hall, Rutland Hall, South Hylton Cinema, Workhouse extensions.

Willesden.—The U.D.C. has accepted the tender of Messrs. Crompton & Co., at £713, for replacing the direct-current switchboard at the Salusbury Road sub-station.

Woolwich.—The tender of Messrs. Jno. Shelbourne and Co. has been accepted by the B.C., at £2,495, for the supply and laying of three 18-in. suction and discharge pipes a distance of 186 ft. along the river bed, and in connection with the condensing plant now in course of erection at the Globe Lane electricity works.

Worthing.—Acting on the recommendation of the Electricity Committee and the resident engineer, Mr. G. Porter, the T.C. on Tuesday decided to accept the tender of Messrs. Mirrlees, Bickerton & Day, Ltd., for a Diesel engine and generator at a total cost of £4,468, £3,785 of this sum being for the Diesel engine and the remaining £683 for a generator by Messrs. Crompton & Co.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, October 31st. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "The Principles of the Steam Engine," by Mr. J. Frew; and "Boiler Inspection," by Mr. G. R. Reid.

Junior Institution of Engineers.—Friday, October 31st. At 39, Victoria Street, Westminster.

North-East Coast Institution of Engineers and Shipbuilders.—Friday October 31st. At 7.30 p.m. At the Literary and Philosophical Society, Westgate Road, Newcastle-upon-Tyne. Annual general meeting.

Batti-Wallahs' Society.—Friday, October 31st. At 7.45 p.m. At Holborn Restaurant. First Smoking Concert.

Salford Technical and Engineering Association.—Saturday, November 1st. At 7 p.m. At Royal Technical Institute, Peel Park. Short Papers.

Institute of Marine Engineers.—Monday, November 3rd. At 8 p.m. Presidential address, by Mr. T. L. Devitt.

North of England Institute of Mining and Mechanical Engineers.—Monday, November 3rd. At 8 p.m. At Chemical Theatre of Armstrong College. Second lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Royal Institution of Great Britain.—Monday, November 3rd. At 5 p.m. At Albemarle Street, W. General meeting.

Society of Engineers.—Monday, November 3rd. At 7.30 p.m. At the Institution of Electrical Engineers, Victoria Embankment. Ordinary meeting.

Rontgen Society.—Tuesday, November 4th. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment. Presidential address, by Prof. A. W. Porter.

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 4th. At 7.30. At Banqueting Hall, Midland Hotel. Address by Prof. E. W. Marchant, chairman, followed by Smoking Concert.

Institution of Civil Engineers.—Tuesday, November 4th. At 8 p.m. At Great George Street, Westminster. Address by the President, Mr. A. G. Lyster. Presentation of Medals.

Institution of Civil Engineers of Ireland.—Wednesday, November 5th. At 8 p.m. At Dawson Street, Dublin. Ordinary meeting.

Chemical Society.—Thursday, November 6th. At 8.30 p.m. At Burlington House, Piccadilly. Papers.

Institution of Electrical Engineers (Yorkshire Section).—Thursday, November 6th. At 7.15 p.m. At Hotel Metropole, Leeds. Reception. Inaugural address, by Mr. W. B. Woodhouse, chairman. Smoking concert.

Institution of Municipal Engineers.—Friday, November 7th. At 2.45 p.m. At 4, Southampton Row, W.C. Presidential address, by Mr. F. Latham. Paper on "Electricity as a By-Product," by Mr. R. J. Spencer-Phillips.

Junior Institution of Engineers.—Friday, November 7th. At 39, Victoria Street, Westminster. Paper on "Experience in the Design and Working on Different Kinds of Fuel of Gas Producers," by Mr. G. E. Lygo.

Manchester Association of Engineers.—Saturday, November 8th. At Grand Hotel, Aytoun Street. Paper on "Recent Developments in Steam Condensing Plants," by Mr. A. E. Leigh Scanes.

Male v. Female Labour.—Mr. Herbert Samuel, interviewed on his return from a tour of investigation of the telephone systems of the United States and Canada, said that in both those countries the policy was adopted, some years ago, of paying equal wages to women and men. The result had been that practically no more women had been taken into the employment of the Post Office in Canada, which was almost closed as a woman's occupation, owing to the fact that men superseded women in many respects in Post Office work. This was also the case, to some extent, in the United States.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, November 3rd.—"A" Company. Technical instruction. 7 to 10 p.m.

Tuesday, November 4th.—"B" Company. Ditto. A meeting of N.C.O.'s will take place at 8 p.m.

Wednesday, November 5th.—Recruits only. Infantry drill and technical instruction, 6 to 10 p.m.

Sergeants' Mess. There will be a meeting of the members of the Sergeants' Mess in their Mess Room, at 7.30 p.m.

Thursday, November 6th.—"C" Company. Technical instruction, 7 to 10 p.m. Meeting of N.C.O.'s at 7 p.m.

Friday, November 7th.—"D" Company. Ditto.

Saturday, November 8th.—Headquarters will be opened from 10 a.m. till 12 noon for the transaction of regimental business only.

(Signed) J. H. S. Phillips, Major.
For Officer commanding L.E.E.

NOTES.

Institution and Lecture Notes.—I.E.E. (Manchester Local Section).—The following is the programme of this Section for the session, which opens on Tuesday next with the delivery of Prof. Marchant's address at the Midland Hotel, Manchester :—

First Half of Session.—November 4th, 1913.—Prof. E. W. Marchant. Chairman's address.

November 18th.—H. H. Perry. "A Two-rate Tariff System without Time-operated Control."

December 2nd.—S. Evershed. "Characteristics of Insulation Resistance, with an Appendix on Insulation Values."

December 16th.—H. C. Gunton. "Employment of Power in H.M. Post Office."

January 13th, 1914.—T. Ferguson. "Train Lighting." (Provisional.)

January 27th.—B. Welbourn. "British Practice in the Construction of High-tension Pole Lines." (Provisional.)

Second Half of Session.—Dates of meetings—February 10th and 24th, March 10th and 24th, and April 7th and 21st, 1914. Probable papers, "The Use of Reactances in A.C. Circuits"; "Electric Furnaces"; "Turbine-driven Auxiliaries"; "The Design of Traction Motors for Alternating and Continuous Currents"; "A High-duty Low-tension Cable"; "The Cascade Induction Motor"; "Experiments on Air-Blast Cooling of Transformers."

Annual dinner.—Friday, February 27th, 1914.

Salford Technical and Engineering Association.—On Saturday, November 1st, a meeting will be held at the Royal Technical Institute, when the evening will be occupied by short papers by members, in competition for a gold medal offered by Mr. W. O. Larmuth. The time allowed for the reading and demonstration of each paper is 12 minutes. Seven competitors will enter the lists. The Committee will adjudicate, the result being made known and the medal awarded at the annual meeting on December 6th.

Institution of Municipal Engineers.—On Friday next the annual general meeting of the Institution will be held at No. 4, Southampton Row, W.C., at 12 noon. In the afternoon the President will deliver an address, and several papers (taken as read) will be discussed, including one by Mr. R. J. Spencer-Phillips, on "Electricity as a By-Product." In the evening there will be a reception by the President, at which the Lord Mayor of London and the Mayors of the Metropolitan Borough Councils will be present.

Institution of Civil Engineers.—On Tuesday last week a dinner was held in the new home of the Institution ; the President, Mr. R. Elliott-Cooper, occupied the chair, and was supported by a number of distinguished members and guests.

Institution of Mining and Metallurgy.—Dr. F. H. Hatch, M.Inst.C.E., has been elected president for the year.

Association of Electrical (Station) Engineers.—A meeting of the London Section was held at Chandos Hall, Tuesday, October 28th, to discuss further the policy of the Association. A very interesting paper was read by Mr. W. E. Russell on "The Passive Policy," which was well received by those present. The supporters of this policy had most to say on this occasion, and during the discussion the fact was made clear that the passive and progressive policies were similar in all but name. Nominations were received for the various offices for the coming year, which matter will be voted on by the whole of the members. It was suggested that the social side of the Association should not be neglected in London, and the Committee hopes to make arrangements shortly for a conversazione.

Electrical Production of Steel.—A few years ago a large plant for the electrical production of steel on the Roechling-Rodenhausen system was erected at the Eich Iron and Steel Works near Leusemburg, which now belong to the Burbach-Eich-Dudelingen United Ironworks. The opinion was entertained by the directors that the plant would yield very favourable results, but it was soon ascertained that their hopes were too sanguine, and that the financial results were very unfavourable. A Esch correspondent, writing to a Frankfort newspaper, now states that a better outcome is expected in the current year, as technical improvements, which have been introduced in the manufacture of the steel, have considerably diminished the pessimistic prospects which formerly prevailed.

The "Point Fives."—A meeting of the "Point Fives" was held on October 17th at the "B & K" Restaurant, Earl's Court Road, S.W., at which Mr. Allen (Wolverhampton) and Mr. A. H. Shaw (Ilford) were elected members. A feature of the evening was an examination of the new type of oven and grill which has been designed by Mr. Downe, and of which 50 are being put through the company's workshops. In the opinion of the members present, the oven has distinct advantages over other designs, especially as regards weight, price, and heat and electrical insulation.

The chairman, Mr. C. S. Davidson, stated that since the introduction at Barnes of the ½d. tariff, some 10 per cent. of the consumers had elected to be charged on the rateable value basis, and they had been inundated with inquiries regarding the hire and purchase of all classes of current-consuming devices. Had the department been in possession of the necessary powers to meet the demand, he was certain that the sales of energy would have been greater, the costs would have been reduced, and the financial result expressed by a very much higher percentage of profit.

The experience gained, however, though small, was significant, and abundantly proved that no matter how low the tariff dealing with domestic supplies, great and lasting expansion could not be anticipated until the supply authorities had power to set up and maintain energetic sales and hire departments.

They found, owing to their inability to hire out cookers, that the cheaper classes of apparatus, such as radiators, were being installed in the proportion of about 100 to one cooker ; so far, therefore, as Barnes was concerned, they were selling cheap units without the anticipated advantage in diversity factor, which could only be rectified by the introduction of a low hiring rate for cookers.

It was decided to co-operate with the A.M.E.E. of London in publicity matters, and that every possible effort should be exerted to bring about a general publicity scheme for the electric supply industry.

The next meeting (January 16th, 1914) will be held at "Tricity House," provided arrangements can be made, and each member may invite one or two guests to the dinner (7 o'clock) and discussion.

Fatalities.—Wm. Donnat, electrical engineer, Stirling, was knocked down by a train while taking a short cut home over the railway, and fatally injured.

Durban.—A native in the employ of Mr. Udal, manager of Kynochs, Ltd., was recently killed electrically. At the inquest Mr. Udal stated that the light in his stables had been out of order for some time, the cause being that the wires were crossed near a tree. He therefore treated the wires as dead, and obtaining a ladder told the native to go up and shake the wires free. Deceased touched the wires with his hands and shouted. Mr. Udal switched off the current and returned to find the man had fallen on the roof. A doctor who was called in pronounced him dead. The chief electrician from the power station said the voltage was 200.

For Sale.—Messrs. Huddleston & Co. will offer for sale by auction, on November 6th, at 16, Long Millgate, Manchester, a large quantity of electrical apparatus, fittings, &c.

The West Hartlepool Corporation Tramways Department has for disposal two 125-kw. Willans-Mather & Platt's generating sets, two 65 kw. Willans-E.C.C. generating sets, steam boilers and other plant. Particulars are given in our advertisement pages.

Appointments Vacant.—Charge shift engineer at the Greenwich generating station, Tramways Department, for the L.C.C. (£250) ; a representative to interview consumers (lighting, heating, &c.) is wanted by a provincial electricity undertaking (35s.) ; electrical mechanician, for Nigerian Government, age 25-40 (£250, passage free, single quarters) ; fitter, for the Cleckheaton U.D.C. (40s.) ; commercial assistant, for Battersea B.C. electricity department (£2 +) ; assistant for Walthamstow U.D.C. Electricity Department (£150). Particulars are given in our advertisement pages.

Kelvin Memorials.—According to the *Times* a marble bust of Lord Kelvin, by Mr. Shannon, A.R.S.A., the gift of Lady Kelvin, was presented to the Royal Society of Edinburgh on Monday last by Prof. Crum Brown, on her behalf. Principal Sir William Turner, who presided over a large gathering, said Lord Kelvin had been 60 years a Fellow of the Society, and was occupying the post of President for a third term of five years when he died in 1907

Light Railways.—The Board of Trade has issued revised rules with respect to applications to the Light Railway Commissioners under the Light Railways Acts, 1896 and 1912. Copies of these rules can be purchased, either directly or through the usual agents, from Messrs. Wyman & Sons, Ltd., Fetter Lane, Fleet Street, London, E.C.

Athletics.—The "Cryolite" Athletic Association has been formed by the London staff of the British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C., with divisions for football, cricket, lawn tennis and swimming.

The Batti-Wallahs.—The first smoking concert of the season will be held to-night, at the Holborn Restaurant (Council Chamber). The President, Mr. J. Snow Huddleston, will take the chair at 7.45 p.m.

Standardisation of Electric Lamps for Motor-Cars.—At a further meeting of the sub-committee of the Accessories Committee of the Society of Motor Manufacturers, appointed to deal with the question of the standardisation of electric lamps for use on motor-cars, another discussion on the subject took place, and it was finally left for the lamp manufacturers to forward to the society their conclusions as to the results of the conference.

Bankruptcy Proceedings.—The first meeting of creditors was held on Wednesday, at the London Bankruptcy Court, under a receiving order made against Mr. Sydney A. M. Rose, described as of 79, Elgin Mansions, Maida Vale. Mr. Egerton S. Grey, Official Receiver, presided.

According to the debtor's statement, he was in the Colonies for 20 years prior to 1907, and for many years acted as chief electrical engineer to Foy & Gibson, Ltd., Melbourne. He also traded in that city as an electrical engineer on his own account for a few years. In 1907 he came to England to exploit an invention for an automatic target. The Rose Automatic Syndicate, Ltd., was formed in the first instance, but that was taken over by the Rose Recording Target Co., Ltd. The latter company went into liquidation, and in January, 1912, the debtor acquired the patents from the liquidator. The Rose Automatic Target Co., Ltd., was next formed with a nominal capital of £35,000. As vendor the debtor received 14,000 fully-paid shares and £2,000 in cash, and he is now acting as technical adviser to the company at a salary of £400 per annum. In addition he has a 40 per cent. interest in the world's patents of the Reinstein Washable Brush. He roughly estimates his liabilities at £900, and values his interest on the various patents at £2,950. Consequently, he does not admit insolvency, and gives as the causes of his temporary embarrassment his inability to develop and dispose of the foreign patents relating to the automatic target, and the prolonged illness of his wife.

In the absence of any offer, Mr. Alexander Nisbet, chartered accountant, 3-4, Lincoln's Inn Fields, W.C., was appointed as trustee to administer the estate in bankruptcy with the assistance of a committee of inspection.

Midland Electrical Engineers' Ball.—This event will be held at the Grand Hotel, Birmingham, on Friday, November 28th; music at 8.15 o'clock, dancing from 8.45 to 2 o'clock. Tickets, inclusive of refreshments, hot supper, &c., are one guinea each, and they can be obtained from any member of the Committee, or from Mr. G. J. Bish, 55, Newhall Street, Birmingham, the hon. secretary and treasurer, who will forward particulars to any of our readers who are interested. A circular has been issued giving particulars of train services between London and Birmingham and Manchester and Birmingham.

Manchester Electrical Workers.—A correspondent writes:—"The members of the Installation Section of the Manchester Electrical Trades Union came out on strike on Monday morning, consequent upon the Electrical Employers' Association refusing to concede an advance of 1d. per hour in wages. About 300 men are affected. The strike will affect a large number of buildings in the course of erection, and delay the installation of electric light. It was stated that several firms had agreed to pay the advance of 1d. per hour, but no communication had been received from the newly-formed Employers' Association."

The Prestige of the Press.—We have followed with great interest the correspondence on the "Prestige of the Press" that has been appearing in the *Times* this week. The editorial comments and declaration of policy we have also closely studied, and we thoroughly approve of the decision of our august contemporary to refuse in future to take advertisements from agencies which supply news, or news from agencies which supply advertisements, but wild horses shall not draw from us all our thoughts. We always have disapproved of the increasing attempts to blend advertisements with news, whether the news came from an advertisement agent or from any other source. The "puff preparatory" and the *quid pro quo* alike are an abomination to all who want the Press to maintain a high standard, and the astonishing thing is that firms of otherwise high repute have, through their organisations or agents, helped to lower the standard, making, at times, demands upon editors which no self-respecting journalist could concede. Our own views on this subject are pretty well known, but we may repeat them in the terms used in a *Times* leader of Wednesday last:—"One of the first things that a newspaper reader has the right to expect is that both the news presented to him, and the editorial comment thereon, shall be impartial, in the sense that they shall be free from any suspicion of influence on the part of interested persons." We need not enter into the details of the absurd, though to us by no means surprising, circular issued by Reuter's Financial Publicity Department, and now withdrawn, nor need we discuss the protests of the different advertising agents, but we certainly do feel justified in asking the *Times* to see whether it cannot change its policy in regard to the reporting of company meetings. We know that it has a notice to the effect that "Reports of Proceedings under the heading 'Company Meetings' are inserted as advertisements, but care is taken to ensure that they be trustworthy." This savours somewhat of an apology to the reader for serving up what may not be quite so trustworthy as such things used to be in the olden days, and we suspect that the editors, in their zeal to maintain a lofty standard, would be far happier if they did not have to publish that notice.

London Electricians' Wages Movement.—We are informed that members of the Electrical Trades Union in the London district met on Tuesday last in the large hall of the Club and Institute Union, Holborn, to consider the final arrangements for their effort to secure an advance of wages, and late comers had a difficulty to find standing accommodation. A resolution was carried instructing the London District Committee to immediately formulate demands on both associated and non-federated employers, embodying 11d. an hour for electrical fitters and wiremen, with a recognised code of working rules, other grades to receive corresponding increases. Among other matters discussed were the measures to be adopted to obtain these objects and a ballot vote was taken,

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. W. H. Taylor has resigned the position of assistant electrical engineer at Walthamstow having accepted an appointment under the Government of Western Australia as chief station superintendent at the new power station at Perth. Mr. G. J. Hollyer has been promoted to the position of station superintendent.

Consequent on the departure of Mr. E. W. L. Nichol to take up a position in London, the Yorkshire Electric Power Co. have appointed Mr. Fred Platt, of Birstall, to the position of assistant superintendent at the company's generating station at Thornhill, near Dewsbury.

Advance of salaries have been given to the following employés at the Middleton Electricity Works:—W. Butterworth, station superintendent; J. Grandidge, outside foreman; P. Ridings, senior shift engineer; and P. Illingworth, second shift engineer.

Mr. W. W. Warren, a charge shift engineer at Greenwich generating station (L.C.C.) since May, 1911, has resigned his appointment.

Tramway Officials.—Mr. F. Eggington has resigned his appointment as principal assistant to the West Ham tramways undertaking. Owing to the vacancy thus caused the Tramways Committee have appointed (1) Mr. W. Hopkins to the post of chief assistant, at a salary of £250 per annum, rising by annual increments of £25 to £300; (2) Mr. A. C. Debenham to be accounts clerk at £200 per annum, rising to £220 by annual increments of £10; and (3) Mr. J. O'Niel to be traffic clerk at £120 per annum, rising by annual increments of £10 to £150. The department now require a traffic superintendent, at a commencing salary of £225 per annum, and the filling of this post has been left to the tramways manager and the chairman of the Tramways Committee.

Inspector J. Campbell, of the Manchester tramways, who has just retired, has been presented with a silver coffee service by the employés of the Oldham Road branch. Passengers on the Rochdale Road section have given him a timepiece.

The *Review of the River Plate* states that Mr. S. C. Marengo, sub-manager of the Buenos Ayres and Pacific Railway Co., has resigned that position, having been appointed general manager of the Central of Buenos Ayres Railway Co. and the Lacroze Tramways Co.

General.—On Thursday last week, at the Arc Works Club Room, Mr. A. J. Hodgson, the former joint manager on Messrs. Crompton & Co.'s electrical engineering works, Chelmsford, was the recipient of a presentation subscribed for by the directors, members of the staff, and some of the employés of the firm. The presentation took the form of a handsome silver salver. Mr. Carleton F. Tufnell presided, and was supported by Mr. E. Reeves (managing director), and Mr. P. G. Cheverton, who acted as hon. secretary to the presentation fund. The chairman said that for something like 20 years Mr. Hodgson had been closely connected with the works, winding up his honourable career in the responsible position of joint manager. During all those years Mr. Hodgson had displayed a loyalty to the company and a zeal in his work which had gained for him the esteem of them all. His gentle courtesy had been unfailing, and his modesty was only equalled by his high sense of honour, while his sympathy and kindness of heart could not fail to have endeared him to all those who had the privilege of working under him. The chairman then read a letter from Mr. Claud Crompton, who wrote regretting his inability to be present, and said that after all the long years that he had worked in friendship and harmony with Mr. Hodgson, as his immediate subordinate, he felt there could be no one so qualified as himself to speak of Mr. Hodgson's great gifts as a manager of men. Those under him, who had known and liked him, had realised to what extent he could be a friend, and, at the same time, a strong master to be obeyed. But he doubted if many realised to what extent Mr. Hodgson had had to face difficulties, and how he had borne them on his own shoulders so quietly that those under him hardly knew they existed. In conclusion, Mr. Crompton wished Mr. Hodgson all happiness in the future. Mr. Hodgson, in reply, said that in the past they had together gone through many difficult jobs; but he could assure them that the one they had put before him was one of the most difficult he had had to deal with. He could not tell them how much he appreciated all the kind words spoken by Mr. Tufnell, and their very great kindness to him in presenting him with the handsome and valuable present. He felt deeply grateful to all, not only because he had such a handsome tray to take away, but more especially because this was a demonstration of the good feeling which had always existed between the members of the same company. The fact that they had always given him their support in every way was constantly before him, and added in no small measure to the very great regret he felt when, last November, he decided that the time had come for him to lay down his duties. He had always

met with the greatest kindness, and he thanked them most sincerely. He could assure them that when one had to break with one's work and with old friendships and associations, it was comforting to feel that one could look back with much pleasure as he did to the time he had had with them. They had had hard times, but these had only gone to strengthen the good feeling between them and bring out the best in them. He sincerely trusted that the good feeling that had always existed between the directors, the staff and the employés would long continue. On the proposal of Mr. Cheverton, a hearty vote of thanks was accorded Mr. Tufnell, who, at the close of a brief response, called for cheers for Mr. Hodgson, which were very heartily given.

The wedding of Mr. W. M. D. Pell, director of Oliver Arc Lamp, Ltd., Engineering and Arc Lamps, Ltd., and the Varley Magnet Co., Ltd. (second son of the late Mr. Bennett Pell, M.I.E.E.), to Miss Evelyn Georgie Sandwith, only daughter of the late Col. Hartley Sandwith, C.B., took place at Horsell Parish Church, Woking, Surrey, on Tuesday last. The honeymoon is being spent in a motor tour through Devonshire and Cornwall.

Dr. O. W. Richardson, F.R.S., has been appointed to the Wheatstone Chair of Physics at King's College, London, in succession to Prof. C. G. Barkla.

The address of Mr. J. S. Raworth is now 12, Beemead Avenue, Streatham, S.W.

Mr. John Hollingworth, B.A. (Cambridge), and B.Sc. (London) has been appointed Assistant Lecturer in Electrical Engineering at the Manchester University.

At Birdwell United Methodist Church, on October 22nd, the marriage took place of Mr. Arthur Kenworthy, chief electrical engineer to the Barnsley Electric Traction Co., and Miss Morris.

Obituary.—A. S. Giles.—We have received the following appreciation of the late Mr. Giles from a correspondent:—"The death of Mr. Alfred Giles, cut off in the prime of life by enteric fever, takes one back to the very beginnings of electrical engineering as we know it now, to the time, in fact, when the the whole thing was in the cradle; it is difficult to realise this was only 30 years ago. Mr. Giles began his working life on the engineering staff of the Edison Co. in London; in the middle eighties, installation work, as far as incandescent lighting was concerned, was largely in the hands of the amalgamated Edison and Swan interests, Siemens Bros., and one or two small private firms, and in the course of his service with the Edison & Swan Co., Mr. Giles had to do with many of the original installations in the country. He remained on the staff of this company through all the changes and vicissitudes of the concern in the early nineties, finally leaving it soon after the installation department was given up. After five or six years on the staff of Thompson, Ritchie and Co., Mr. Giles went to Blackburn as engineer of the Corporation Electricity Department, and held that position to his entire credit, till in 1904 he was appointed engineer-in-chief of the Cape Tramways—by no means a sinecure at the best of times, and just at that period in need of a strong hand. So successful was his control of these tramways, that when in the spring of 1911 occasion arose for a change in the management of the Lisbon tramways, the Eckstein interests transferred Mr. Giles from the Cape to Lisbon as manager and engineer-in-chief of the electric tramways there, a post of great and onerous responsibility. It is no more than the truth to say that his management of the tramways during the troublous times of the past two years in that hornets' nest of warring factions, has been conspicuously successful, and has shown Mr. Giles to be possessed of a wise discretion. Mr. Giles combined in his person sound technical knowledge and shrewd mother wit, leavened with a sense of humour which often helped him over the hard places in life; a hard worker, he was above all things thorough, detested second-rate and 'shoddy' work, and showed to a marked degree that sterling quality of grit one likes to associate with Englishmen, and which he doubtless inherited from his father, a typical Cheshire parson of the old school; he never left a job half done. Those working with him, no matter in what position, soon came to know that he was a man on whom they could rely, and the cordial nature of his relations with both employers and staff was doubtless due in great measure to this knowledge."

The death has taken place at Salisbury of Mr. Malden, who was secretary of the Salisbury Electric Lighting and Supply Co. from its formation.

Several South African correspondents have sent us by the last mail particulars of the motor accident which occurred on October 8th, resulting in the death of Mr. James Herbert Cawthra, the station superintendent of the Victoria Falls and Transvaal Power Co., Ltd. Mr. Cawthra, it appears, left the Rosherville power station in his motor-car about 9 o'clock in the morning in order to proceed to the Simmer Pan power station. As he was driving over the level-crossing between the Simmer Deep and the mine properties, a motor-train carrying passengers ran into his car. The motor-car seems to have been struck by the front of the train, and was hurled along the railway line for about 100 yards. Mr. Cawthra was pitched violently from the car, and killed instantaneously. Mr. Cawthra had been in the country about two years; he was about 45 years of age, and leaves a widow and four children, who are all at present in England, except the eldest son, aged 17, who is a storekeeper at the Rosherville power station. At the time of the accident he was an inmate of the Simmer and Jack Hospital, suffering from blood poisoning in the foot, and he saw his father's body brought into the same hospital without knowing who it was. It appears that Mr. Cawthra had had three motor accidents of a more or less serious nature during the last nine months.

Wills.—The late Mr. W. Thom (Yates & Thom, Ltd., Blackburn) left £12[illegible]59 gross and £120,243 net personalty.

Mr. Frederick Brown, managing director of the Walsall Electrical Co., Ltd., who died in August last, left £2,404 gross and £1,301 net.

The late Mr. A. B. Wilson, a director of the Central Ireland Electric Power Co., left £6,553.

NEW COMPANIES REGISTERED.

Bentham Electric Supply Co., Ltd. (131,740).—This company was registered on October 22nd, with a capital of £1,000 in £1 shares, to carry on at Bentham and elsewhere the business of an electric light and supply company in all its branches. The subscribers (with one share each) are:—C. H. Best, 72, Market Street, Bradford, incorporated accountant; T. B. P. Ford, Low Bentham, silk spinner; E. Ayrton, Low Bentham, silk spinner; J. Parker, Low Bentham, silk dresser; J. Cumberland, Bentham, builder; C. Pullan, 80, King's Arcade, Bradford, engineer; H. H. Casse, 21, Cunliffe Terrace, Bradford, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company. Registered office, Joint Stock Bank Chambers, High Street, Skipton. Solicitors, Gaunt, Foster & Co., Bradford.

Watson, Marsh & Co. (Brondesbury), Ltd. (131,795).—This company was registered on October 24th, with a capital of £1,000 in £1 shares, to carry on the business of designers, manufacturers, exporters and importers of, contractors and factors for, and dealers in, electric light and other electrical apparatus, conduits, dynamo machines, lamps, fittings, and accessories, &c. The subscribers (with one share each) are:—J. B. Marsh, 6, Hoviden Road, Cricklewood, N.W., electrical engineer; M. Cohen, 25, Brondesbury Road, Kilburn, N.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. B. Marsh and M. Cohen (both permanent joint managing directors); qualification of such managing directors, 100 shares. Registered by Alfred H. Atkin, 27-8, Fetter Lane, E.C.

CITY NOTES.

Norwich Electric Tramways Co., Ltd.

The seventeenth annual ordinary general meeting was held on Wednesday at the office, 8, Crosby Square, Bishopsgate, E.C., the Hon. Arthur Brand presiding.

The Chairman, in moving the adoption of the report, remarked that he had very little to add to the information therein given. He was glad to say that the tramways had done better in 1913 than in 1912, and, further, he was extremely pleased to state that there had been a very considerable increase in the earnings up to date in the current year, as compared with the corresponding period last year. Norwich was in a prosperous state, and he hoped that condition of things would continue. It was the intention of the directors to deposit a Bill in Parliament to obtain powers to make some further improvements in the line.

Mr. Geo. M. Chamberlin seconded the motion, and the report was adopted.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Humphrey Pump Co., Ltd.—30,000 ordinary shares of £1 each, 10s. paid, Nos. 1 to 30,000; 100,000 ordinary shares of £1 each, fully paid, No. 30,001 to 130,000; and 25,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 25,000.

And ordered the undermentioned security to be quoted in the Official List:—

London and Suburban Traction Co., Ltd.—Further issue of 166,468 ordinary shares of £1 each, fully paid, Nos. 1,666,674 to 1,833,136; 264,791 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,316,269 to 1,581,059; and £14,893 4½ per cent. mortgage debenture stock.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Scrip fully and partly (65 per cent.) paid for £400,000 5 per cent. second mortgage debenture stock.

And to appoint a special settling day in:—

Marconi International Marine Communication Co., Ltd.—204,066 shares of £1 each, fully paid, Nos. 1 to 114,526, 114,551 to 123,458, 123,589 to 128,688, and 128,729 to 204,200 *ex* dividends paid previous to 1913; and a further issue of 102,028 shares of £1 each, fully paid, Nos. 114,527 to 114,550, 123,459 to 123,588, 128,689 to 128,788, and 204,201 to 306,084.

Western Telegraph Co., Ltd.—After transferring £100,000 to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £45,000 to the provision on account of investment fluctuations, a final dividend of 3s. per share is recommended (making, with the previous distributions, a total dividend of 6 per cent. for the year ended June 30th, 1913), and also the payment of a bonus of 2s. per share, both free of income-tax. The balance of the account is carried forward. The register of transfers will be closed from November 4th to 12th.

Montreal Light, Heat and Power Co.—A dividend of 2½ per cent., being at the rate of 10 per cent. per annum, for the quarter ending October 31st, is announced.

Ferranti, Ltd.

Mr. A. W. Tait (chairman) presided on Friday at Central House, Kingsway, W.C., over the eighth annual general meeting of this company.

In moving the adoption of the report (see Electrical Review, page 624), the Chairman said that the shareholders would observe that the company had again had a satisfactory year. The result of the trading was £59,599, as compared with £51,759 last year, or an increase of £7,840. There was, however, an increase of £3,325 in the general establishment charges (from £22,771 to £26,097), accounted for by the increased turnover of the business, the increase in the charge for income-tax, and the expenses in connection with the repayment of the prior lien debentures and the issue of the five-year notes. There was also included under this head the charge in connection with the Insurance Act, which amounted to £1,085. Repairs and renewals were £6,741, as compared with £5,587, the increase of £1,153 being due to reorganisation in certain of the departments at the works in which extensions had been carried out. The net result was £28,142, as against £24,333, or an increase of £3,809. The interest charges were somewhat different from those of the previous year, owing to the repayment of the prior lien debentures and the issue of the 6 per cent. notes already mentioned. The total interest payable on debentures, notes and loans amounted to £8,146, as against £7,204 last year. The net profits for the year showed an increase of £2,867. The balance of profit for the year was, therefore, £9,996, plus the amount at credit at June 30th, 1912—£12,456—making together £22,452. There had been carried to general reserve account £22,000, leaving a balance to be carried forward of £452. In accordance with the usual practice, £10,000 had been carried to depreciation reserve, which now stood at £56,350. With regard to the amount which had been carried to general reserve account, he would remind the shareholders of the statement which he made last year, that in accordance with the arrangement made in connection with the repayment of the prior lien debentures and the issue of the 5-year notes, the company was not in a position to make any payment to the shareholders until these notes had been redeemed. As they were aware, they fell due in 1917, and, until that period, the profits which the company might make would be accumulated so that the position of the company might be so strengthened that when the re-organisation of its capital took place—as it must do at that time—the directors would be able to put forward a scheme which would enable the company to commence and to continue the payment of dividends on the shares. Because of these arrangements it was felt meantime that nothing should be done with regard to writing down the value of goodwill and patent rights as that adjustment could be made when the reorganisation took place. Turning to the balance-sheet, he would enumerate the principal changes which had taken place in the assets and liabilities. Leasehold land and buildings, standing at a value of £52,560, showed an increase of £2,706 over the previous year. Plant, machinery, tools and fixtures at £120,825, showed an increase of £7,518 over the previous year. The increase on those two items was a very considerable sum, £10,224, and it was due to the new buildings which were erected and the plant installed in connection with the development of the meter department. Those extensions were absolutely necessary to enable the company to cope efficiently with the largely-increased turnover in that department, and he hoped they might now be able to go on for a year or two without considerable addition to their fixed assets. Expenditure on work in hand at £77,118, showed an increase of £16,114 over the previous year; and stock and stores in hand at £21,629 showed an increase of £5,483 over the previous year. The increase in these two items amounted to £21,597, and was to be accounted for by the increase in the company's turnover which he had previously mentioned, and was also due to the fact that a large order was in course of completion at the date of the close of the accounts. Sundry debtors at £66,102 showed an increase of £5,389; and they would observe that a new item appeared, viz., London office fixtures and fittings, £1,373. The directors felt for some considerable time that it was necessary to consolidate the sales administration of the company, and that that could not be done better than by the establishment of a proper organisation in London, from whence the majority of business emanated or was controlled. Cash at bank and in hand was practically the same as last year; and goodwill and patent rights remained at the fixed figure of £69,547. With regard to the liabilities side of the balance-sheet, he had already mentioned the repayment of the balance of the prior lien debentures, and the issue of the five-year notes. They had already redeemed £1,100 of those notes, and a further sum of £1,000 fell to be applied on December 31st. A sinking fund on the first mortgage debentures had been commenced, and they would observe from the account that they had been able to redeem £4,000 of those debentures during the year. A further amount fell to be applied on December 31st, and they hoped to be able to redeem an equivalent amount of debentures. The bankers' loan secured on second debentures showed a decrease of £3,529, and that was due to a special payment which was made in reduction of the loan at the time of the issue of the notes, and because the annual payment of the interest to the sinking fund on the second debentures was more than sufficient to meet the interest on the loan. The application of these sinking funds should gradually reduce the company's indebtedness, and in the course of a few years' time should place it in a very strong position. Sundry creditors stood at £51,238, which was an increase of £15,188 as compared with the previous year. The increase in sundry creditors more or less reflected the increase in the volume of the company's business, but they hoped that by the elimination of any large amount of capital expenditure during the current year to be able considerably to reduce this item. With regard to the business generally, as he had already mentioned, during the year under review the company's turnover was a record since the date of the reorganisation, and the name which the company had established for its manufactures led them to believe that that should be maintained—if not increased. The company was now one of the most important heater manufacturers in the country, and had also a large export business which was rapidly and satisfactorily being built up. In particular he might mention that they had now a well-established business in Canada, and the managing director had paid a visit there during the summer, as had been his custom for some years past. He reported very favourably on the position and prospects, and in order to put themselves in the position for further development in that country they had registered a separate company called the Ferranti Electrical Co., of Canada, Ltd. The whole of the shares of the company would be allotted to Ferranti, Ltd., and when times were better they might be able to make some arrangement which would relieve the company of its large investment there and supply the Canadian company with additional working capital to further its business. The company was also developing lines of electrical cookers and heaters for which there was expected to be a gradually increasing demand in the near future. A great deal of time and money had been spent upon the development of those articles, and they believed that those which were now being put upon the market were decidedly good, and their reception by the trade was encouraging. With regard to the switch department, the directors had for a long time been considering the policy to be adopted in that connection. The carrying out of large switchboard contracts involved, as they knew, considerable locking up of the liquid resources of the company, and business of that kind was not only highly competitive but also carried a fair amount of risk. After deliberation the board had decided that in future that department should devote itself to the perfecting of switch details which were used in considerable numbers on large switchboards, and by specialising in that way the company should be able to build up a remunerative and expanding business with all the large switchboard manufacturers in this country, and probably elsewhere. That did not mean that the company would not continue to do a large amount of switch business, for which it was eminently suited, but referred only to large switchboard contracts. The general switch business in small boards had been growing in an encouraging manner for some time, and it was believed that the change in the policy of that department would show greatly improved results.

Mr. A. B. Anderson (the managing director), in seconding the motion, said he might amplify the chairman's explanation of that which he had seen described in the Press as their new policy. With regard to the meter department, he need say nothing except that, in his opinion, it was most highly satisfactory. The heavy capital expenditure of the last year had enabled them to obtain their output without regular overtime, the first time for four years. It had also removed any risk which there might have been of the very serious pressure on their capacity deteriorating the product. That risk had been avoided. With regard to the switch department, it was some three years since he first began to question very much the desirability of continuing that department as then constituted. At that time competition was at its keenest and trade bad. The decision arrived at was to persevere for some time further with the development of standard lines which they had then initiated, before making any radical changes. That was done and now showed every sign of filling their shops, and more than filling them, without switchboard contracts. Therefore, persistence in everything would have meant continuation of the heavy capital expenditure, which had been a feature of the past few years. While the meter department had fully warranted it, the results of the switch department had not warranted a similar expansion on its behalf. They had, therefore, decided to cut their manufactures to suit their present works capacity rather than embark upon further increase of their works until fully satisfied that it was for the purpose of accommodating profitable work. That would, of course, give them relief from the most troublesome and onerous part of their present business, besides freeing space and capital for the prosecution of repetition lines of manufacture. They had been at a certain disadvantage in switchboard manufacture, because theirs had been of that class which found its competitors amongst the big manufacturers. They anticipated that in ceasing to be switchboard manufacturers they should open up a big market amongst those who had been, until lately, their competitors for their switchgear. They would, he hoped, recognise that while it was easy to cut out with a stroke of the pen a considerable portion of one's turnover, it was by no means so easy to cut down overhead charges accordingly, so that perhaps they would have some little set-back before they felt the full benefits of the change. He might also add that on his recent visit to Canada he found serious depression right across the Continent, but the chairman, nevertheless, correctly represented his views when he said he was confident for the future, in spite of a serious drop in their trade for the past few months. He regarded that as temporary, while the possibilities for the future were incalculable. Amongst the development work which was going on, there was in several lines which they believed would help their output considerably, and while he thought it necessary to mention one or two factors which might have a prejudicial effect upon the current year, he was very hopeful indeed that it would not be long before he found it necessary to recommend a continuance of the policy of expansion which had been the way, and the only way, by which the company had recovered its position amongst electrical manufacturers.

The retiring directors having been re-elected,

Mr. Sugden proposed a vote of thanks to the directors and managing director and staff, and remarked that he was an involuntary preference shareholder of the company. When he had the shares allotted to him, he looked on them as so much waste paper, but now he looked on them as an asset of increasing value.

The motion was carried, and the Chairman, in reply, reiterated his previous remarks as to the value of the company when the capital was eventually reorganised. He could endorse the statement that the staff were loyal and enthusiastic.

Berlin Electricity Works.

The report for 1912-13 of the Berliner Elektrizitäts Werke, A.G., which have a monopoly of the supply business in the German capital, states that the undertaking experienced a further satisfactory development during the year. The increase in the consumption, which rose from 223,000,000 KW.-hours in 1911-12, to 252,000,000 KW.-hours in the past year, was principally due to the enhanced requirements of large consumers. The number of customers advanced from 36,909 to 43,816, or by 28,781 KW., and the equivalent value of the total connections increased to 255,721 KW. Of this total 93,514 KW. were low-tension for lighting purposes, 131,662 KW. were for power, and the balance for high-pressure supply. The maximum demand at any time was 107,150 KW., as contrasted with 94,570 KW. in the preceding year. Owing to the low prices, large consumers are becoming more and more convinced that a connection with large works offers advantages over production on their own account. Preparations are being made with the object of making fundamental alterations in the tariffs, but the bringing into operation of a new scheme is postposed, owing to the uncertainty as to whether the company will remain in possession of the undertaking. It is proposed for this purpose to remove the centre of production to the site of fuel deposits, and lignite mines have therefore been secured in the vicinity of Bitterfeld of such an extent as is rarely combined under a single ownership. The tests made with arc lamps of long lighting duration have led to satisfactory results, and an important advance in public lighting is held in prospect by the introduction of new wire lamps of high candle-power which consume one-half of the energy incidental to the similar lamps hitherto in use. Nothing is mentioned as to the cost of production, but the average sale price realised in Berlin, after deducting the profit share paid to the municipality, declined from 14·75 pfennigs (1·73d.) per KW.-hour in 1911-12, to 14·45 pfennigs (1·69d.) in 1912-13. A steam turbine of 20,000 H.P. was installed at the Oberspree works and a second of similar power at the Rummelsburg works, and no fewer than 40 isolated battery stations were in operation as a result of the increasing requirements of owners of electromobiles. The accounts indicate the following results for the two years :—

	1912-13.	1911-12.
Ordinary share capital	£2,205,000	£2,205,000
Preference shares (4½ per cent.)	1,000,000	1,000,000
Loan capital	2,820,000	2,847,000
Gross profits	975,000	910,000
General expenses	91,000	87,000
Renewal fund	30,000	28,000
Depreciation	252 000	288,000
Net profits and balance forward	568,000	553,000
Reserve fund	27,000	27,000
Profit share of municipal council	196,000	187,000
Dividend on ordinary shares	264,000	264,000
Dividend, per cent.	12	12

The report proceeds to state that the municipal council has exercised its right of giving notice to acquire the company's undertaking on October 1st, 1915, although negotiations are in progress with a view to the prolongation of the concession. An attempt is being made to find a basis for a fresh understanding, and an agreement would be valuable to the company if the operation of the works were assured to it for a long period of years. Should, however, the negotiations fail to reach a conclusion satisfactory to the company, the extensive amount of capital which would become available by the transfer would enable the company to devote its activity to new and profitable enterprises for which preparations have been made for several years past, this observation referring partly to other supply works in which the company is already largely interested from a financial point of view.

United Electric Tramways Co. of Caracas, Ltd.

The directors' report for the 12 months ended June 30th, 1913, states that the net revenue account shows a disposable balance of £9,205, out of which the directors recommend the payment of a dividend for the year of 5 per cent. (less income-tax) on the share capital, which will absorb £8,500, leaving £705 to be carried forward. The profits of the local company (the whole capital of which is owned by this company) for the past year have again shown a gratifying increase :—

	1912-13.	Increase.
Gross receipts	Bs. 1,397,259·07	Bs. 149,853·70
Operating expenses	717,776·02	29,165·88
Net receipts	Bs. 679,483·05	Bs. 120,687·82

At an average exchange for the year, 25·70 = £26,439.
As compared with 25·96 = £21,525. Inc. £4,914.

After adding the balance of profit carried forward from the previous years, viz., Bs. 390,476 to the above net receipts for the year, providing for the mortgage interest payable to this company, viz., £10,200 (= Bs. 257,550), setting aside Bs. 50,000 to reserve and renewal funds, and paying a dividend amounting to Bs. 220,600 (equal to a dividend on this company's issued capital of 5·19 per cent.), the local company are enabled to carry forward Bs. 539,369·22. After making the above provision for mortgage interest and reserve and renewals, the profit for the year is equal to 8·66 per cent. upon this company's issued capital. Notwithstanding an increase in operating expenses, due to the increased traffic, the ratio to gross receipts is less by 3·83 per cent. compared with the previous year, which was 2·38 per cent. less than 1910-11.

The following table of statistics compares the result of the 12 months 1912-13 with the corresponding period 1911-12 :—

	1912-13.	Inc. or dec.
Passengers carried	[illegible]	[illegible]
Car miles run	[illegible]	[illegible]
Percentage of operating expenses to gross receipts	51·37	— [illegible]
Receipts per car-mile	Bs. 1·44	+ Bs. [illegible]
Operating expenses per car mile	Bs. 0·74	+ Bs. 0·[illegible]
Number of cars	44	— 3
Miles of track	1[illegible]	— 1

In compliance with the terms of the trust deed, £990 has been placed to the sinking fund for the redemption of mortgage debenture stock, and £1,100 first mortgage debenture stock has been purchased this year in the market and cancelled. Mr. Wallis reports that all the company's property is maintained in first-class order, and that the prospects for the present year are good. Further short extensions to the tramways are in course of construction, and others are projected.

Allgemeine Elektrizitäts Gesellschaft.

The directors of this Berlin company have issued a communication announcing that the net profits for 1912-13, after deducting general expenses, taxes, interest on loans, and £69,000 as the cost of the last issue of obligations, amount to £1,445,000, which sum has been derived exclusively from manufacturing. This compares with £1,219,000 in the preceding year. At the general meeting on December 3rd, it is proposed to declare a dividend of 14 per cent. on share capital of £7,750,000, as contrasted with 14 per cent. on £6,500,000 in 1911-12. In addition to the provision made for depreciation according to the custom hitherto, it is intended to place £50,000 to the reserve fund, to allocate £75,000 to the national defence tax, and to apply £50,000 to special depreciation for buildings having regard to new extensions. The company's credit at the bank, the communication adds, amounts to £3,850,000, and both the invoiced turnover in 1912-13, and in particular the orders on hand in the new year, show an increase. The appended table indicates the financial progress in recent years :—

Year.	Net profits.	Dividend.	Dividend percentage.	Placed to reserve.
1906-7	£743,000	£600,000	12	£50,000
1907-8	796,000	600,000	12	50,000
1908-9	819,000	650,000	13	63,000
1909-10	821,000	700,000	14	100,000
1910-11	1,107,000	805,000	14	118,000
1911-12	1,219,000	910,000	14	150,000
1912-13	1,445,000	1,085,000	14	175,000

It will be observed that the dividend for 1912-13 is payable on a larger amount of share capital than in the previous year. The imposing bank credit of £3,850,000 compares with £1,875,000 a year ago, and will enable the company to proceed with the development of the undertaking, quite independently of the condition of the money market. Although the directors do not mention the actual turnover in the past year, it is unofficially stated that the value amounted to £22,000,000. Last July, however, the company reported that the turnover and orders on the books in the first 10 months of the financial year surpassed by £4,500,000 the value in the corresponding period in 1912. The value in 1911-12 was not intimated, but the business transacted reached £15,300,000 in 1910-11, and £12,600,000 in 1909-10.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved :—

Haste Pump Co.
Midgley's Electro-Therapeutical Co.
Motor Traction Co., 1905.

The following will be struck off the register at the expiration of three months, unless cause is shown to the contrary :—

Auto-Controllers.
British Electro-Ads.
Electrical Instrument Manufacturers.
Electro-Medical Institute.
Improved Electric Traction.
Mica Boiler Covering Co.
Midget Steam Trap Syndicate.
Phosphor Bronze Co. (registered May 20th, 1874).
Solium Electrical Co.
Wimshurst Hollick & Co.

National Telephone Co., Ltd.—Mr. Justice Sargant decided on July 16th last that the whole of the surplus assets was distributable among the deferred stockholders, but leave was given to the preference shareholders and holders of preferred stock, if they so desired, to appeal against this decision by giving notice not later than the 13th inst. This date having expired and no notice of appeal having been given, there can be no further payment to the holders of preference shares or preferred stock. The liquidator has therefore arranged to make a further distribution to the deferred stockholders, being a further 7 per cent., equal to 1s. 4·8d. in the £, making a total distribution to date of 104 per cent. Subject to certain contingent liabilities, the final distribution will be about 1 per cent., which it is expected will be made in the course of two or three months.

Water Softeners, Ltd.—The directors' report for the year ended June 30th, states, according to the *Financial Times*, that the trading account shows a profit of £8,948, a sum sufficient to defray all working costs, amounting to £5,594, and to provide £3,359 towards administration expenses, depreciation, &c., leaving £728 to be carried to the balance-sheet. Sales of plants have increased to a very satisfactory extent, and the directors are confident that a solid foundation is being established, upon which the number of sales is being, and will be considerably, increased in the future. The directors are now adopting several new processes for working the patents owned, the results from which prove that such expenditure has been fully justified.

Victoria Falls and Transvaal Power Co.—It is stated in the financial Press that the net earnings, including those of the Rand Mines Power Supply Co. for the quarter ended September 30th, amounted to £105,699. This includes the month of July, during which time the Power Co.'s operations were considerably curtailed owing to labour disturbances. The months of August and September show that the number of units sold was in excess of that for the first quarter of the current year, but is not quite up to the average of the second quarter, owing, probably, to the decrease of the native labour and the consequent curtailment of mining development. This, however, is anticipated to be only of a temporary nature.

German Edison Accumulator Co.—It is announced that this company, of Berlin, which was formed in 1906, has decided to dispose of its undertaking to the Accumulator Co., of Berlin and Hagen. The former has a share capital of £150,000, of which the sum of £125,000 is paid, and the purchase price is at the rate of 50 per cent. of the latter, or £62,500, which the Accumulator Co. will be able to provide out of funds already available. As a result of the transfer, the Accumulator Co., which controls the Tudor battery, and which already occupies an exceedingly strong position, will have almost a monopoly of the secondary battery trade in Germany.

Nagpur Electric Light Co.—The report of the directors for the half-year ending June 30th, 1913, states that construction work is rapidly approaching completion, and the contractors expect to be able to hand over the whole installation in working order by the beginning of November next. The boilers and engines were to be ready for testing by October 15th. Electrical energy for street lighting, as also for lights and fans in some of the Government offices and bungalows, will be supplied immediately in accordance with contracts with the Government and the Municipality, and prospects of further connections to private buildings, offices and shops appear exceedingly hopeful.

Reduction of Capital.—Brecknell, Munro & Rogers, Ltd.—A petition for the confirmation of the reduction of capital from £30,000 to £20,000, has been presented, and will be heard on November 11th.

British and Colonial Zoelly Turbine Syndicate, Ltd.—The confirmation of the reduction of capital from £20,000 to £10,000 is now pending. Creditors must send in their claims by December 1st to Mr. F. M. Jeboult, 9, Walbrook, London, E.C., solicitor to the company.

Japan.—No less than £682,500 was invested in connection with electrical undertakings in Japan during September last, £660,000 being in respect of new companies and £22,500 for the extension of old concerns.

British Coalite, Ltd.—The scheme for reorganising the capital, as mentioned in our last issue, was passed at an extraordinary general meeting held in London on October 22nd.

Kaministiquia Power Co.—The directors have declared a dividend on the common shares at the rate of 5 per cent. per annum for the quarter ending 31st inst.

Chloride Electrical Storage Co., Ltd.—An interim dividend of 5 per cent. on the ordinary shares is announced.

Anderston Foundry Co., Ltd.—An interim dividend of 4s. 6d. per share is announced.

STOCKS AND SHARES.

Tuesday Evening.

The relaxation of the stringency in the monetary position, exemplified on Monday by a reduction in the German Bank Rate, was a source of mild satisfaction to the Stock Exchange markets, bringing in its train a quiet improvement in certain investment descriptions. Business is still confined mainly to investors, whose purchases make steady inroads on the piles of securities that came forward so liberally earlier in the month. Fortunately, there has been a breathing space in the rush of new issues, and the relief thus afforded to markets has been welcome and evident. Consols rose sharply, so lending powerful aid in the dissipation of depression.

The Stock Exchange Committee have aroused a good deal of public attention by their own inquiry into the circumstances attendant upon the introduction of American Marconi shares to the Miscellaneous market some 18 months ago. The matter is largely technical, and therefore difficult to explain in black and white. Marconi shares themselves have fallen to $3\frac{1}{16}$ on sales made by people desirous of taking up their proportion of the new capital. Canadians have gone back to 8s. 9d., the recently-issued report leading to realisations, which, it seems to us, are natural enough, having regard to the nature of that report. Americans, in sympathy, are lower at 16s. 6d., and the Marconi market, as a whole, is distinctly dull.

The weakest market in the Stock Exchange has been that for Mexican securities, every day bringing in a fresh torrent of selling orders. Affairs in Mexico have certainly come to a pretty pass; and if it be true that the disturbances were started, and have been financed, by American oil interests, the latter are probably unpleasantly surprised by this time at the turmoil they have brought about, since it has reacted upon American Rails and other things connected with the United States. As we have said previously, it is not only the revolution that is troubling investors, but the fall in the rate of exchange—which, of course, is one direct outcome of the riots—must tell heavily upon the profits of all the companies doing business in the country.

The heavy falls of a week ago in the issues of the utility companies have been continued farther. Mexico Tramways 6 per cent. bonds, for example, are $4\frac{1}{2}$ points down; which the 5 per cent. bonds are $3\frac{1}{2}$ lower and the shares $1\frac{1}{2}$. Mexican Light and Power Preferred at $89\frac{1}{2}$ is 2 down, the 5 per cent. First Mortgage bonds have fallen 3, and the 5 per cent. Second Mortgage bonds a point. To what length the revolutionists may go in the way of wrecking property is the question that is causing considerable apprehension on this side. If they do not damage the assets to any extent, the current quotation of to-day will, six months hence, look exceedingly tempting; but it requires robust courage, not only to buy the securities, but even to suggest that, as speculative investments, they possess any attraction. The Latin-Canadian group, as a whole, is inclined to be dull.

The Mexico Tramways Company has convened a meeting next month for the purpose of raising the present ordinary share capital from 20 million dollars to 30 million dollars, as by this course the company could proceed to issue £1,200,000 three-year 6 per cent. secured Notes, convertible into ordinary shares at par during the currency of the Notes. The directors state that the operations of the Company, and those of the Mexican Light and Power Company, have not been seriously interfered with.

The Shawinigan Water and Power Company announces that it is prepared to receive tenders for the sale to itself of $62,000 of the issue of 5 per cent. Consolidated mortgage bonds due 1934.

Brazilian Traction shares keep fairly steady about 88. Sharp falls occurred in Anglo-Argentine Tramways Preference shares of both classes, on the pressure to sell a few hundred shares of each. There was a recovery to $4\frac{3}{4}$ in the First Preference, and to $4\frac{5}{16}$ in the second, leaving declines on the week of $\frac{1}{16}$ and $\frac{3}{16}$ respectively. United Electric Trams of Monte Video are better, both Ordinary and Preference moving up. Kalgoorlie 6 per cent. "B" Debenture was marked down 8 points to 10-20.

The Electricity Supply section has steadied, and there has been a slight improvement in County of London shares, the Ordinary picking up to $11\frac{7}{8}$. Apart from this, however, the changes are insignificant.

In the Home Railway market, Metropolitans dropped at one time to 42, a fall of $2\frac{1}{4}$, on the denial given to the rumour that the company was going to be taken over by the Great Western Railway. The whole market, indeed, has been weak in consequence of the Royal Commission to inquire into the relations between the State and the railways. This was regarded as a plain hint of nationalisation; and, on the theory that public interest would dwindle more than ever while the inquiry is in progress, prices were put down smartly. Later on, it was pointed out that even nationalisation might prove a good thing for stockholders, and there was a general recovery, in the course of which Metropolitans hardened to $43\frac{1}{4}$, leaving off 1 lower on balance. Districts are flat at $31\frac{3}{4}$, and East Londons have given way. With the exception of these changes, the various Electrical Railway stocks have moved but little. London United Tramways Debenture stock fell 2. British Electric Traction Preferred is again a point down, but the Company's $4\frac{1}{2}$ per cent. Second Debenture improved to $78\frac{1}{2}$.

The Telegraph market underwent further falls, but during the last day or two there has been a certain amount of recovery, though on balance the movements are against holders. Globe Ordinary and Preference are $\frac{1}{4}$ and $\frac{1}{8}$ down respectively. West India and Panama fell to $2\frac{1}{2}$. Commercial Cable Debenture is a point lower. The Eastern group eased off, to recover later. Amongst Telephones, United River Plates are $\frac{1}{8}$ down. New York Telephone bonds lost $\frac{1}{4}$, and American Telephone and Telegraphs are easier, both as regards the shares and the bonds. The National Telephone Company is going to pay a further £7 to holders of the Deferred stock, which will make in all £104 returned, with a prospect of a little more some two or three months hence, so that the final result of the liquidation will be rather better (or less bad) than at one time seemed likely.

The only feature in the manufacturing group is a rise of 3 points in Crompton Debenture, making $5\frac{1}{2}$ points during the last fortnight, and there is still a steady demand for the stock. British Aluminium Ordinary lost part of their recent rise, recovering it, however, to-day (Tuesday). Rubber shares have gone ahead with a rush, particularly as regards the higher-priced issues. The price of the commodity itself is hardening, and there is a profound hope that the Rubber Growers' Association will be able to announce steps, within the next few days, that shall enable the industry to be put on a soundly profitable basis from the point of view of the producers.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 28th.	Rise + or Fall	Present Yield p c.
	*					£ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅜ — 3⅞	..	6 16 2
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	15¾ - 16¾	..	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12½ - 13½	..	4 8 11
Do. 5 % Deb.	Stock	5	5	115 - 119	..	4 4 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 - 101	..	4 9 1
County of London, Ord.	10	5	5†	11⅝ — 12⅛	+ ⅛	4 19 0
Do. 6 % Pref.	10	5	6	11½ - 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½—104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4¾	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	..	7⅞ — 8⅛ xd	..	5 10 9
Kensington (Knightsbridge), Ord.	5	8	8†	7½ — 8	..	5 0 9
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 6
London Electric, Ord. ..	3	2½	..	1½ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 4 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101 xd	—1	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10½	..	5 11 7
Oxford	5	7	6†	5⅞ — 6⅛	..	5 9 10
St. James' and Pall Mall, Ord. ..	5	10	10†	8½ — 9½	..	5 8 1
Do. 7 % Pref	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅜ — 2⅝	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/32 — 1 3/32	..	6 1 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£1	Nil	..	¼ — ⅜	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4⅛ — 4⅜	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	2½	..	7¼ — 7¾	..	5 9 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	105 —110	..	6 7 3
Do. 7 % Pref.	$100	7	7	117 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	0	..	⅝ — 11/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	90½ — 92½	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	1 7/32 — 1 7/32 xd	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102⅝ -104½	+ ½	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.		5	5	70 — 75	..	6 13 4
Mexican Lt. & Power, Common	$100	4	4	55 — 60 xd	..	6 13 4
Do. 7 % Cum. Pref.	$100	7	7	87 — 92	—2	7 12 2
Do. 5 % 1st Mort. Gold Bds.		5	5	79 — 83	—3	6 0 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	70 — 74	—1	6 15 2
Montercy Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	72 — 75	..	6 13 4
Montreal, Lt., H. and Power ..	$100	9	10†	215 —220	..	4 10 11
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	133 —138 xd	+3	4 0 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100⅛—102⅜	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	13/16 — 15/16	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	108 —106	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 —126	—1	6 7 0
Do. Collat. Trust	$100	4	4	91 — 93	—1	4 6 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65 xd	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½—105½ xd	..	5 14 0
Do. Def.	Do.	30/-	..	23½ — 23⅝	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	—1	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9¼ xd	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	— ¼	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8⅛ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	127 —130 xd	..	5 7 8
Do. 8½ % Pref. Stock	Do.	3½	3½	76— 77 xd	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	96½ — 98½	..	4 1 3
Eastern Extension	10	7	7	12¼ — 12⅜	..	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
East and S. Africa Tel. 4 % Mt. Db Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11⅜	— ¼	5 6 8
Do. 6 % Pref.	10	6	6	11¾ — 12½	— ⅛	4 18 0
Great Northern Telegraph ..	10	20	5†	31 — 33	+2	6 1 8
Indo European Telegraph ..	25	13	..	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	3⅝ — 3⅞	— 1/16	5 6 8
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅜ - 8⅝	— 1/16	5 8 9
Monte Video Telephone, Ord. ..	1	6	6	⅛ - 1 3/16	..	5 13 0
Do. 5 % Pref.	1	5	5	7/16 — ½	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98⅛ - 99½	— ½	4 10 6
Oriental Telep. and Elec. ..	1	10	..	1⅛ — 2	+ 3/32	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 18 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9⅝ — 10⅛	..	9 17 6
Submarine Cables Trust	Cert.	6	6	121 —124 xd	..	4 16
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12
United River Plate Telephone	5	8	6†	6⅝ — 6¾	— ⅛	5 16
Do. 5 % Cum. Pref.	5	5	5	6 — 6⅛	..	4 11
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2
West India and Panama Teleg.	10	1¼	..	2⅛ — 2⅜	— ⅛	4 15
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10¼	..	5 18
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9⅝	..	6 8
Do. 5 % Debs.	100	5	5	98 —100	..	5 0
Western Telegraph, Ltd. ..	10	7†	7	12⅝ — 13⅜	+ ⅛	5 4
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3
Western Union 4½ % Fdg. Bonds	$10 0	4½	4½	92 — 95 xd	..	4 14

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Oct. 28th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/8 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 1 1/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12⅜ — 14½	..	..
Do. Do. Deferred	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	48 — 51	—1	5 17 8
Do. 5 % Perp. Deb.	100	5	5	91 — 94	..	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	+1	5 12 6
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	96 — 98	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	6	6†	¼ — 3/4	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 3/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	3/16 — 1/8	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	77 — 82	— ½	5 9 9
London Elec. Railways, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	—2	6 9 1
Metropolitan Railway Consol.	100	1⅝	1½†	43 — 43½	—1	3 14 9
Do. Surplus Lands	100	2¾	2¾†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan District Ord.	100	Nil	..	31½ — 32	— 1½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	1 7/8 — 1 9/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	110 —112	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ⅛	..	Nil
Do. 6 % Pref.	5	3 3/8	1½†	3 5/8 — 3 7/8	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4 5/8 — 4 7/8	— 1/16	5 12 10
Do. 2nd Pref.	5	5⅛	5⅛	4 9/16 — 4 7/8	— 1/16	6 3 11
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	96½ — 98¼	..	4 11 5
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	87 — 89	—1	6 14 10
Brisbane Trams Invt., Ord.	5	8	8†	7¼ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 10 11
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	120 —124	..	6 9 1
Do. Pref. Ord.	100	6	6	108 —112	—1	5 7 2
Do. 5 % Pref.	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100 xd	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4¼	4¼	89 — 92	..	4 12 5
Calcutta Trams, Ord.	5	7½	6†	6 — 6½ xd	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	11/16 — 13/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 13 0
Do. 4 % Deb.	£100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	—8	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4½d.	6	3/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	1 3/8 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	— ½	5 1 6
Mexico Trams Com	$100	7	7	79 — 83	—1¼	8 8 8
Do. Gen. Con. 5 % Bonds	..	5	5	77½ — 82½	—3†	6 1 3
Do. 6 % Bonds	100	6	6	84 — 88	—4½	6 16 4
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5¾ — 6⅛	..	8 2 8
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	—1	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	88½ — 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$100	5	5	100 —103	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	5 — 5⅜	+ ⅛	6 10 3
Do. 6 % Pref.	5	6	6	5 — 5⅜	+ 3/16	5 11 7
Do. 5 % 1st Deb.	100	5	5	96 — 99	—1	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	25/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	2 7/8 — 3	— 1/16	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/16 — 1 5/16	..	..
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½ — 87½	..	5 14 3
B.I. & Helsby Cables	5	10	..	8 — 8½	— ⅛	5 17 8
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Dc. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1/16 — 1⅛	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	5/8 — 40⅜	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	3 — 27	..	16 13 4
Callender's Cable	5	15	..	1 — 11¾	..	6 7 8
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 13/16 — 3 15/16	..	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	..	60 — 65	+3	7 13 10
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 27/32 xd	..	7 2 2
Edison & Swan, A, £8 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 5/16 — 1 7/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7½	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9⅛ — 10½	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/8 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13¼ — 14½	..	5 5 3
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 11 9
Telegraph Construction	12	20	5†	37 — 39	..	6 1
Do. Deb.	100	4	4	96 — 98	..	4 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and similar goods into New Zealand in 1912, are taken from the recently issued official trade figures. Details for 1911 are added for purposes of comparison, and notes of any increases or decreases are added :—

	1911. £	1912. £	Inc. or dec. £
Asphalt.—			
From United Kingdom ...	2,000	6,000	+ 4,000
„ Other countries ...	1,000	4,000	+ 3,000
Total ...	3,000	10,000	+ 7,000
Leather belting.—			
From United Kingdom ...	4,000	4,000	—
„ Other countries ...	2,000	1,000	— 1,000
Total ...	6,000	5,000	— 1,000
Belting other than leather.—			
From United Kingdom ...	27,000	26,000	— 1,000
„ Australia	2,000	1,000	— 1,000
„ United States ...	3,000	2,000	— 1,000
„ Other countries ...	2,000	2,000	—
Total ...	34,000	31,000	— 3,000
Engine packing.—			
From United Kingdom ...	12,000	13,000	+ 1,000
„ Australia	2,000	2,000	—
„ Other countries ...	2,000	5,000	+ 3,000
Total ...	16,000	20,000	+ 4,000
Rubber goods.—			
From United Kingdom ...	3,000	4,000	+ 1,000
„ Australia	5,000	10,000	+ 5,000
„ Other countries ...	2,000	2,000	—
Total ...	10,000	16,000	+ 6,000
Scientific instruments.—			
From United Kingdom ...	6,000	8,000	+ 2,000
„ Other countries ...	2,000	5,000	+ 3,000
Total ...	8,000	13,000	+ 5,000
Rails.—			
From United Kingdom ...	154,000	153,000	— 1,000
„ Belgium	6,000	5,000	— 1,000
„ Other countries ...	3,000	3,000	—
Total ...	163,000	161,000	— 2,000
Telegraph and telephone wire, iron.—			
From United Kingdom ...	11,000	7,000	— 4,000
Electrical machinery.—			
From United Kingdom ...	177,000	274,000	+ 97,000
„ Australia	23,000	33,000	+ 10,000
„ Germany	16,000	27,000	+ 11,000
„ United States ...	31,000	39,000	+ 8,000
„ Belgium	4,000	7,000	+ 3,000
„ Other countries ...	6,000	17,000	+ 11,000
Total ...	257,000	397,000	+ 140,000
Steam engines.—			
From United Kingdom ...	8,000	29,000	+ 21,000
„ United States ...	1,000	—	— 1,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	9,000	31,000	+ 22,000
Gas and oil engines (except for motor-cars).—			
From United Kingdom ...	105,000	149,000	+ 44,000
„ Australia	3,000	6,000	+ 3,000
„ United States ...	20,000	22,000	+ 2,000
„ Other countries ...	2,000	3,000	+ 1,000
Total ...	130,000	180,000	+ 50,000
Boilers.—			
From United Kingdom ...	8,000	6,000	— 2,000
„ Other countries ...	1,000	—	— 1,000
Total ...	9,000	6,000	— 3,000
Other machinery (except agricultural, printing, sewing, textile, &c.).—			
From United Kingdom ...	82,000	76,000	— 6,000
„ Australia	10,000	9,000	— 1,000
„ Germany	2,000	3,000	+ 1,000
„ United States ...	25,000	20,000	— 5,000
„ Other countries ...	3,000	6,000	+ 3,000
Total ...	122,000	114,000	— 8,000
Mining machinery.—			
From United Kingdom ...	22,000	13,000	— 9,000
„ Australia	6,000	5,000	— 1,000
„ Germany	1,000	1,000	—
„ United States ...	11,000	7,000	— 4,000
„ Other countries ...	1,000	—	— 1,000
Total ...	41,000	26,000	— 15,000
Meters: Water, gas and electricity.—			
From United Kingdom ...	27,000	27,000	—
„ Australia	2,000	1,000	— 1,000
„ United States ...	2,000	2,000	—
„ Other countries ...	1,000	—	— 1,000
Total ...	32,000	30,000	— 2,000
Railway and tramway plant.—			
From United Kingdom ...	43,000	38,000	— 5,000
„ Australia	2,000	2,000	—
„ Other countries ...	1,000	5,000	+ 4,000
Total ...	46,000	45,000	— 1,000
Lamps and lanterns.—			
From United Kingdom ...	33,000	35,000	+ 2,000
„ Germany	11,000	15,000	+ 4,000
„ United States ...	15,000	15,000	—
„ Other countries ...	7,000	7,000	—
Total ...	66,000	72,000	+ 6,000

ELECTRICAL EXHIBITION IN GLASGOW.

The Electrical Exhibition which was inaugurated in Glasgow on Thursday afternoon of last week, and which is being held under the ægis of the Corporation of the city, gives promise of being a pronounced success. In a "foreword" embodied in the catalogue of exhibits and exhibitors the promoters explain that the success which had attended the Smoke Abatement Exhibitions in the city within recent years had encouraged them to proceed with this purely electrical venture. The efforts of the promoters were seconded and supported by the British Electrical and Allied Manufacturers' Association, and altogether some 80 stands have been grouped together and the accommodation of the Zoo Buildings, New City Road, Glasgow, has been taxed to the utmost. It is of interest to note that the stands have been erected on a uniform basis by the Corporation, and the appearance of the Exhibition has been enhanced by the fact that an attractive scheme in white, grey and pink has been carried out. Mr. James M. Freer has acted as manager and he has been assisted by Mr. W. W. Lackie, electrical engineer to the Corporation, Bailie W. B. Smith, convener of the Electricity Committee, and the individual members of that progressive Committee.

In the "Foreword" Mr. Lackie gives interesting facts and figures illustrative of the development which Glasgow's electricity department has made. Starting in a small way 21 years ago, with a plant of 500 H.P., the department has now in its several stations plant totalling 50,000 H.P., while a further 17,000 H.P is on order. Ground has been acquired for a new station on the banks of the River Clyde at Dalmarnock, with an ultimate capacity of 130,000 H.P., and plans are in preparation. The Exhibition is wide in its scope, and a well-concentrated effort has been made by exhibitors and promoters working harmoniously together, to demonstrate the uses of electricity. The Exhibition abounds with appliances illustrating the efficacy of electrical illumination for the streets, the home, the factory, the office and for business purposes generally. Many types of electric motors are shown for use in shipyards, engineering shops and factories, and for driving all kinds of machinery. Then there is a wealth of plant for generating electricity in country residences, for the equipment of collieries, and for use on board ship. Telephone installations for all classes of service are to be seen on many stands, while wiring systems, cables, switchboards, elevators, refrigerating machines and electric heaters are open for inspection.

If, however, there is one section more than another in which the Exhibition may be said to be specially attractive to the general public, it is in apparatus for heating, cooking and other domestic uses. In Glasgow the rate for supply for domestic use has been reduced to ¾d. per unit, so that the Corporation's electricity department are hopeful, as a result of the Exhibition, that their revenue from this branch will be considerably augmented. Other domestic appliances displayed include vacuum cleaners, clothes washers, electric irons, knife-cleaners, and electric tea and coffee pots. Appended we give notes on a number of stands in the Exhibition.

Messrs. Siemens Bros. & Co., Ltd., have two stands, which are replete with their many specialities. The "Melda" water pump is on view, as well as the "Stannos" system of wiring, while there is a large collection of telephones, batteries, lighting sets specially suited to country residences, "Zed" fuses, medical apparatus and motors. Messrs. Siemens, it is understood, are taking advantage of this occasion to demonstrate to the owners of country houses that the generating of electric current can be carried out privately

at a cost of slightly over 1d. per unit. There is also shown in operation on these stands a "Siemens-Aster" oil engine set, suitable for use with petrol or paraffin fuel, as well as all classes of cable suitable for bell, lighting, power, submarine and telephone work.

The British Insulated and Helsby Cables, Ltd., have on view the latest type of "Prescot Welder," which has created an exceptional amount of interest and attention since the opening of the Exhibition. Amongst the cable samples shown—and these are numerous—is what is regarded as an interesting development in the shape of an E.H.T. cable, with special strip for detecting the presence of moisture. Gate-end boxes and channel trolley wires of special interest to mining engineers and tramway managers respectively, have been commanding attention on this stand, while Mordey-Fricker meters and new Prescot cable units with porcelain insulation have also been displayed.

The electricity department of Glasgow Corporation have established a useful information bureau at Stand No. 1. Here Mr. M. A. S. Davies, mains department, and other officials, are in constant daily attendance to answer inquiries relative to the supply of electricity from the Corporation. A map, showing the position of existing mains is exhibited, and terms can be quoted, if need be, for the extension of mains with a view to giving a supply to premises where current is not at present available. In addition, all other requisite information, including methods of charging and approximate annual costs, can be readily obtained. Further, the electricity department show at this stand a window of ordinary dimensions lighted by systems suitable for various trades. This, it is felt, will prove popular with merchants particularly keen on having a bright and attractive window display. An automatic device switches in the various systems and turns a drum giving information as to the cost of installing and current costs for one year. Heaters and fans for use in windows for the dissipation of frost and moisture are also on view.

An exceedingly bright and interesting display is that of the Edison & Swan United Electric Light Co., Ltd., Ponder's End. On this stand chief interest undoubtedly centres round the Royal Ediswan drawn-wire metal filament lamp. There are also accessories manufactured at the firm's London works, which include many patterns of holders, adaptors, ceiling roses, plugs, fuses and the popular house service ironclad switch, which is shown both double and triple-pole. Space is allotted to ship, mill and colliery fittings, while specimens are shown of Ediswan heavy service switchgear, including the "W" type circuit-breaker in 1,000 and 2,000 amperes, the "E" pattern breakers, and the latest pattern oil switch. Types of Ediswan heaters (Bastian and Dowsing patents) are also on view, including the Royal heater, which is establishing for itself a measure of popularity.

So far as the electrical contractors are concerned, an innovation has taken place this year, and 18 firms, who are connected with the Glasgow Branch of the Electrical Contractors' Association of Scotland, are showing collectively at Stand No. 61. It is a most attractive display, and the keynote is variety, both of electrical materials and apparatus for lighting, heating, cooking and power. The exhibit reflects great credit on the Committee who have been entrusted with the arrangement of the stall—namely, Messrs. Allan, Primrose, Lindsay and Wright. The exhibiting firms are :—Anderson & Munro, Ltd., ; Arthur, Allan & Ure ; Bennett & Rutherford ; Dow, William ; Grindlay, Ross & Co. ; Haddow & Co. : Hutcheson, Andrew ; Johnston, Park & Co. ; Lindsay, Alexander ; Lowdon Bros. & Co. ; Malcolm & Allan, Ltd. ; Martin & Co., W. C. ; Meighan, James, & Son ; M'Whirter, Wm., & Son ; Potter & Co. ; Primrose and Primrose ; Underhill & Ritchie ; Woodward & Co.

The British Electric Plant Co., Alloa, are exhibiting several of their specialities in connection with colliery equipment. They have, in recent years, made a feature of high and low lift turbine pumps, and they are showing one of their standard D4 size pumps direct coupled to one of their special A.C. motors. This motor is specially adapted for work in mines, and the whole fitting is very compact. The output of the pump is 400 gallons per minute, against a 300-ft. head when running at a speed of 1,500 R.P.M. The company have also developed turbine pumps for boiler feed purposes. A complete set of pump impellers are shown mounted on the shaft, the unique feature being that the whole shaft, where it comes into contact with the liquid, is protected by bronze sleeves. The B E.P. Co. also stage one of their new design of D.C. motors, suitable for pipe ventilation, which has been specially fitted for use in collieries where fresh air can be provided for the motor. Another exhibit is a 20-H.P. single drum haulage with post brake of substantial nature. This gear is fitted with a new mining type D.C. motor with drip-proof cover.

Messrs. Fraser & Borthwick, Glasgow, have at their stand (No. 50) an interesting display of electric light fittings, including the latest designs of Eye-rest system of indirect illumination with Mazda drawn-wire lamps. A comprehensive line of heating and cooking devices with Calorite element is shown. An interesting exhibit on the stand is an automatic starting rheostat of the contactor type.

Mr. David Martin, Glasgow, as representative for Messrs. A. Reyrolle & Co., Ltd., has forward many samples of Reyrolle switchgear of the lighter types. As agent, too, for the Skefko Ball-Bearing Co., Ltd., he has on view numerous examples of patent self-aligning double row ball bearings. The St. Helen's "cab tire" cable is also conspicuously displayed on the stand.

Messrs. James Keith & Blackman Co., Ltd., have a large assortment of steel plate fans as well as a model of a Keith patent mine-ventilating fan (double inlet reversible type). There is further to be seen a portable forge with an electric blower attached.

The Leskole Co. Ltd., have on view at Stand No. 3 a selection of electric distance thermometers, thermo-electric pyrometers, optical pyrometers, steam meters, gauges and mercury thermometers.

Messrs. Simplex Conduits, Ltd., Birmingham, have quite a pleasing show. Their exhibit partly consists of the various component parts of the Simplex steel conduit system of electric light and power wiring, and all the more important accessories and fittings used in conjunction with this system are attractively displayed. An item of outstanding interest at this stand is the "Plexsim" cooker. Demonstrations of cooking by this outfit are given at frequent intervals.

Messrs. G. St. John Day, Ltd., Oldham, have a stand fully occupied with their specialities in "Mumps" patent lampholders. Demonstrations are given.

One of the best-appointed stands in the Exhibition is that of the Carron Co., of Carron. They have on view an extensive and admirably varied range of electrical cooking and heating appliances. Examples are shown of the heavier type of apparatus usually associated with large hotel and restaurant equipment, and the exhibits clearly indicate that the Carron Co. are fully alive to the possibilities in this direction. The attendants at the stands are making a liberal distribution of the appropriately-titled brochure "A Touch of the Switch Does It."

Mr. John D. Mackenzie, Glasgow, is responsible for the exhibits on Stand No. 63. There he has for inspection the many specialities of Spagnoletti, Ltd., London ; the Wardle Engineering Co. Ltd. ; the Crittal Manufacturing Co., Ltd. ; and the Crittal Steel Furniture Co., Ltd.—firms for whom he does business as a representative in Glasgow.

Messrs. W. Naughton & Watson, Glasgow, who specialise in electric motors and the application of these to every type of machinery, show how electrical energy can be adapted with profit and advantage to bakers' whisk and dough-mixing machines, manufacturers' sewing machines, dairy cream separators, wood-working and meat-cutting machinery. They further exhibit a number of drills, fans, and electric light fittings generally for house and factory installations.

The Record Electrical Co., Ltd., of London and Manchester, show measuring instruments of all descriptions, and automatic circuit-breakers and apparatus suitable for commercial and laboratory purposes.

Messrs. Bonham, Scott & Co., Ltd., Anderston, Glasgow, exhibit a series of printing machines, all of which are controlled by motors and controllers supplied by the Adnil Electric Co., Ltd., London. Messrs. Waite & Savile, Ltd., Otley ; Messrs. Elliott & Co. (Otley), Ltd., and Messrs. Aird & Coghill, Ltd., Glasgow, have co-operated with Messrs. Bonham, Scott & Co., Ltd., Glasgow, in securing the exhibits for this stand.

The Morgan Crucible Co., Ltd., sole manufacturers of Morganite and Battersea carbon brushes, have quite an elaborate display at their stand. Morganite packing rings for steam turbine glands, over-pressure discharge apparatus, and carbon powder resistances for lightning arresters, are included amongst the exhibits.

Messrs. Veritys, Ltd., are responsible for a varied show of Aston motors, fans, starters, regulators and dimming switches. One of the enclosed arc lamps exhibited is capable of burning 400 hours with one trimming. On the stand, there is a big array of electrical fittings, while the radiators and heating and cooking apparatus displayed is such as to command more than casual attention.

Messrs. Ferranti, Ltd., are giving prominence on their stand to electrical fires and cooking appliances generally. The display is quite an imposing one. House service meters, electrical measuring instruments, and detail switchgear also find a place in the exhibit.

Messrs. Dexine, Ltd., at Stand 22, give pride of place to the "Dexine" insulator. Car-pole insulators, sleeves, bobbins, brushes, switch handles, &c., are amongst other items of electrical interest shown.

A stand is occupied by the Electric Appliances Co., Ltd., London, in which they set out to advantage the Imperial vacuum suction cleaner.

Various types of A.S. refrigerating machines are advantageously displayed on Stand No. 24 by the Audiffren Singrum Refrigerating Machines, Ltd., of London.

A formidable show of the firm's well-known alloys is made by Callender's Cable and Construction Co., Ltd., while no effort has been spared to keep conspicuously to the front specimens of die cast white metal bearings for motor-car work. At the stand Callender's saloon windows are shown under conditions permitting of the application of hydraulic pressure. Examples of the firm's pumps for hydraulic, vacuum, high and low pressure air working are presented for inspection and the arrangement of the stands is such as permits of Callender's numerous specialities being exhibited to the greatest possible advantage.

Adjoining the space set apart for the Callender's Co. are to be seen the Gese patent electric pulley block and the Marshall patent electric hoist—the manufactures of the Electric Pulley Block Co., Ltd.

Messrs. Richard Pape, Ltd., Belvedere, and the Kalbitum Paint Co., Ltd., Belvedere, also make an attractive display at this point with their wares.

Messrs. Malcolm Campbell, Ltd., confectioners and toffee makers, Glasgow, exhibit a toffee wrapper driven by an electric motor. The machine wraps 4,000 toffees per hour, and the strong recommendation in its favour, from the point of view of the manufacturer and the consumer, is that it saves the sweetmeat from being handled in the process of wrapping. A chocolate melting pan, heated by electricity, is another appliance exhibited here.

The Western Electric Co., Ltd., have on their stand specimens of cables for lighting, power and telephony. There are also on view junction boxes and requisites for cable-laying works both aerial and underground.

Messrs. M. K. Cooper & Co., Glasgow, show models of electric cleaners of the "Regina" type; while Messrs. Falk, Stadelmann and Co., Ltd., London, exhibit principally a range of modern electroliers and period fittings suitable for all purposes.

The Jackson Electric Stove Co., Ltd., London, W., display a varied assortment of cooking apparatus comprising restaurant cooker, toasters, hot-plates, kettles, grills, latest types of domestic cookers, rapid water boilers and urns.

Automatic control gear is specialised in, as their exhibits plainly show, by the Electric Control Co., Ltd., Glasgow.

Quite an imposing show is made at Stand No. 42 by the Union Electric Co., Ltd. Switchgear and instruments of all types are to be viewed, while there is quite a large array of ammeters, voltmeters and frequency meters (Messrs. Hartmann & Braun). Arc lamps in operation and others not working can be seen.

Other exhibitors include the Concordia Electric Wire Co., Ltd., London; Magic Appliances, Ltd., London; the General Electric Co., Ltd., London; Messrs. Berry, Skinner & Co., London; J. Holly Craig, Glasgow; Fyfe, Wilson & Co, Glasgow; Messrs. Yates Bros., Darwen; Messrs. John Dugdill & Co., Failsworth; the Macfarlane Engineering Co., Ltd., Glasgow; and Messrs. Reavell & Co., Ipswich.

Messrs. R. Waygood & Co., Ltd., Falmouth Road, Great Dover Street, London, S.E., show a model of a Waygood automatic electric passenger lift.

The British Westinghouse Electric and Manufacturing Co., Ltd., have at their stand a big collection of appliances and plant. They show very prominently the Westinghouse "Auriga" drawn-wire lamp and the "Dim-a-lite" attachment for use in conjunction with electric lamps.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., have quite an ambitious display at Stand 49. Cables of all types and adapted to all purposes are shown, also numerous accessories. As was to be anticipated, however, much scope is given on the stand to the judicious advertising of the Henley wiring system.

It would be an unfortunate omission not to mention Stand No. 76, where Messrs. Edward & Sons, watch and clockmakers, of Glasgow, show quite a number of pulsynetic electric impulse clocks for use on board ship and in large buildings and institutions. A magnificent range of pulsynetic clocks is shown, while the exhibit also includes a set of electric chimes.

THE SHEFFIELD EXHIBITION.

On Friday last, October 24th, the Fuel, Light and Power Exhibition under the auspices of the Sheffield Branch Smoke Abatement League, was opened by the Lord Mayor of Sheffield (Ald. S. Osborn, J.P.).

The Exhibition buildings are conveniently situated in Townhead Street, near the centre of the city, and lend themselves admirably to the purpose. The object of the promoters is "To draw the attention of the industrial leaders and the public of Sheffield to the possibilities and improvements in the utilisation of fuel." In furtherance of the ideal both electricity and gas must of necessity play an important part, and Sheffield is fortunate in the possession of such admirably equipped and well organised undertakings for the production and distribution of both commodities, as the Corporation electric supply department under the management of Mr. S. E. Fedden, and the Sheffield United Gas Light Co., both supplying their respective products at a price comparing favourably with that charged in any other city or town in the kingdom.

It will be within the knowledge of many of our readers that gas is supplied in Sheffield to the ordinary householder at 1s. 3d. per thousand cb. ft., and for gas engines, it is to be obtained as low as 10d. per thousand cb. ft.

The prices for a supply of electricity are also low, and householders are now supplied at a fixed charge of 10 per cent. per annum upon the net assessment for ratable value plus ½d. per unit consumed, no rental being charged for meters. For power the ordinary price list varies from 1d. to ·6d. per unit, according to quantity consumed, whilst in conjunction with a good load factor a still lower price may be obtained by adopting the alternative rate of £4 per annum per K.V.A. of maximum demand plus ¼d. per unit consumed.

Quoting from the official catalogue, "there is a legend in Sheffield that the blacker the smoke which overhangs the city the deeper will the pockets of its citizens be lined with gold." To whatever extent this may have been true in the bad old days, it no longer holds good. There is less smoke and less fog every succeeding year, and it is not unreasonable to attribute the amended conditions to the enterprise which the leaders of industry in Sheffield have displayed in discontinuing effete and smoke and fog-producing methods in order to take advantage of the more cleanly, hygienic and economical means so opportunely placed at their disposal.

The realisation of a smokeless city may yet be far distant, but better methods of combustion applied to the hundreds of small steam plants in the city, or perhaps better still, the total supersession by electricity or gas, each applied to the work to which it is most suited, will bring the desired result nearer.

The Exhibition is divided in the main into three sections, electricity, gas, and fuel consumption. In the electrical section the electric supply department are making use of the opportunity to bring before existing and potential consumers the many advantages of electricity, and on a large and well-equipped stand are showing examples of almost recently designed apparatus for lighting, heating, cooking, ventilating and power. In conjunction with a local laundry, demonstrations of domestic ironing are given, and grilling, toasting, coffee-making, and all the necessities and luxuries of the home, office and works, which make life possible and pleasant, are in evidence.

The electrical contractors of the city are well to the fore, and Messrs. Marsh Bros., of Orchard Place; Messrs. Coates & Co., of Glossop Road; and Messrs. Denner & Co., of West Street, have each a comprehensive display of electric light fittings and other electrical apparatus principally intended for use in the home.

Messrs. John Walsh, Ltd., general furnishers, of High Street, have a very fine stand, one half of which is devoted to the display of electroliers and other lighting fittings, whilst the other half displays very similar fittings adapted for using gas. They have also equipped a model dining room in oak, lighted and heated by electricity.

Messrs. T. B. & W. Cockayne, Ltd., general furnishers, of Angel Street, have similarly a display of both electrical and gas lighting, heating and cooking apparatus, and have a further stall showing a completely furnished dining room, drawing room, bedroom and kitchen.

Messrs. Makin & Co., Ltd., of Townhead Street, are showing their recently introduced clock-type number sign for the smaller places of entertainment. This sign, on account of its low cost, is expected to supersede the more expensive type at present in use. They have also a display of electric clocks suitable for simultaneous time-keeping in works and other places.

Messrs. G. St. John Day (Patents), Ltd., are showing their improved type of "Mumps" lampholders, and also the ingenious "one-part" holder and accessories, and other secret and key-locking types to prevent the lamps and shades from being stolen.

Demonstrations of cooking by electricity and gas are being given alternatively by expert cookery instructors, the arrangements being in the hands of a Committee of local ladies.

The British Vacuum Cleaner Co., Ltd., are showing their various types of electrically-driven vacuum pumps and cleaners, and demonstrations are given throughout the day.

Messrs. Steinthall & Boydell have a comprehensive display of "Evershed" indicating, recording and testing instruments.

Messrs. Roper & Wreaks, of 112, Arundel Streeet, are the agents for Messrs. R. Hornsby & Son, Ltd., of Grantham, and they show in operation a 17-B.H.P. Hornsby-Stockport gas engine.

Messrs. T. W. Ward, Ltd., of Albion Works, Sheffield, are exhibiting examples of their lathes, drilling machines, slotting machines and shaping machines, all driven by Brooks's motors, one of which is also shown driving a generator, suitable for picture palace work.

The engineering section contains many interesting exhibits demonstrating the economies to be effected in the use of fuel for steam-raising.

Messrs. T. Sugden, Ltd., are showing at their stand complete models of their standard superheaters and accessories, and also a model boiler fitted with an "Excel" water circulator, for which a claim is made of increased steam and the saving of fuel.

Messrs. Meldrums, Ltd., exhibit their mechanical stoker and sprinkling stoker, their refuse destructors for municipal or private use, and various devices tending towards the production of steam without the accompanying nuisance of smoke.

Messrs. Whitehead Bros., Ltd., of Farsley, near Leeds, show a patent furnace for all purposes for which economy in fuel, prevention of smoke and increased capacity are not only claimed but guaranteed.

Messrs. Babcock & Wilcox, Ltd., have in motion a full-sized mechanical chain-grate stoker, and also exhibit models of their water-tube boiler with superheater and chain-grate stoker and of the water-tube marine boiler adapted for land service.

Messrs. E. Green & Sons, Ltd., show a model of their well-known patent fuel economiser.

Mr. J. W. Wilson, of Church Street, Sheffield, is showing various types of coal, gas and electric stoves, geysers and water-heaters and other household requisitions.

Messrs. T. A. Ashton, Ltd., show a selection of Messrs. Fletcher, Russell & Co.'s gas-heated furnaces for forging, melting, annealing, tempering and hardening, specially suitable for use in the Sheffield iron and steel trades. They also include in their exhibit various electrical appliances for domestic use, a petrol air-gas generator and the "Pyrene" fire extinguisher.

At the stand of the British Oxygen Co., Ltd., oxygen metal cutting and oxy-acetylene welding is in operation, in addition to hand and machine metal-cutting apparatus, and other oxygen appliances for medical and industrial use.

The exhibits are well arranged, with ample room for the public to move about and inspect the various stands. First class military bands are in attendance during the afternoon and evening, and good results are anticipated from the enterprise.

A NOVEL CONSTRUCTION IN ELECTRIC WINDING GEAR.

The application of electric power on a large scale to the operation of winding or hoisting in mines and collieries has recently received a great deal of careful attention and skilled design, but it would be a very rash thing to say that finality in design has yet been reached. It is, therefore, of interest to turn to any example involving novel elements of design, particularly if it has been shown that on a large and commercial scale its novel elements have contributed to success. For this reason it would be of value to refer to some large electric double-drum hoists recently installed by the Ray Consolidated Copper Co., at their mines at Ray, near Kelvin, in Arizona, These hoists, situated at their Nos. 1 and 2 main hoisting shafts, have attracted a great deal of attention, not only on account of the heavy loads handled and the large output required from these shafts, but also because of the many unique features of the hoists themselves. The hoist at No. 1 shaft has been in operation about 1½ years, while that at No. 2 shaft has been put into service during the past year. The electric power for operating these hoists, as well as the compressors and other machinery about the mines, is obtained from a generating plant at Hayden, about 19 miles from the mines, at which point a mammoth concentrating plant required by this company is situated. The power is generated by four cylinder triple-expansion condensing engines direct connected to alternating-current generators, and is transmitted to the mine at 40,000 volts pressure.

Each hoist handles loads of ore of 12½ tons, together with skips weighing 16,000 lb. from a maximum depth of 500 ft., hoisting at a speed of 300 ft. per minute. The total load, including the rope on each drum, is approximately 43,000 lb. These hoists, which are claimed to be the most massive of their kind in the United States and handling the heaviest loads, were furnished together with the sheaves, car tipples, &c., by the Wellman-Seaver-Morgan Co., of Cleveland, Ohio, U.S.A., and fig. 1 shows a general view of one of them. The hoists operate with balanced skips entirely, one of the drums being keyed fast to the main shaft, while the other drum is driven by a powerful band friction clutch for adjustment to different levels as required. Each hoist is equipped with an alternating-current motor, driven from a 440-volt, three-phase, 60-cycle supply; the motor has a full-load speed of 430 r.p.m., and is rated at 300 h.p. on a continuous rating. It is fitted with a rope wheel 44 in. in diameter, having turned grooves for 32 1-in. ropes, being connected to the hoist by a rope drive engaging a 13-ft. rope wheel on the pinion shaft of the main hoist, as shown in the illustration.

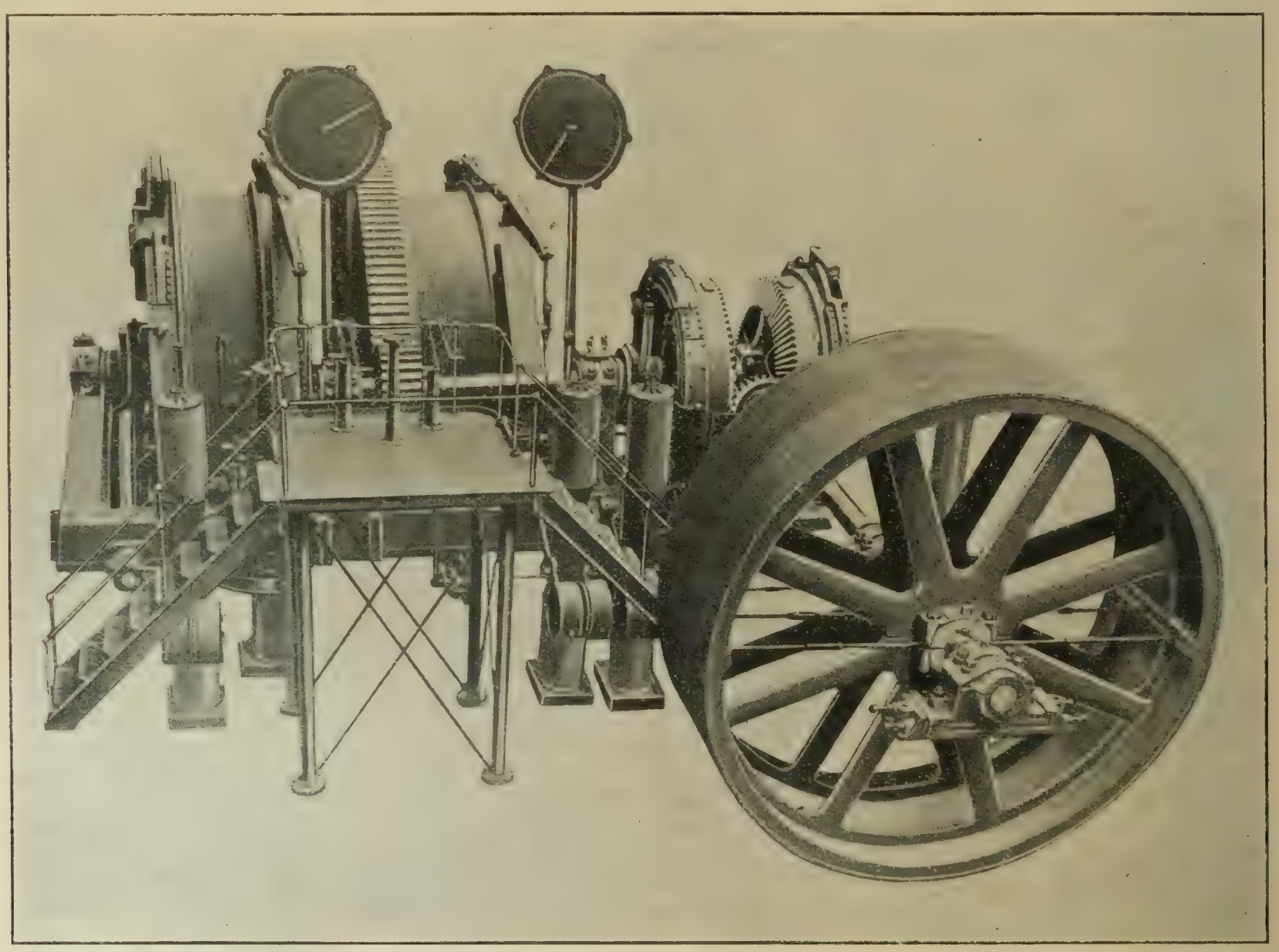


Fig. 1.—Large Electric Hoist at the Ray Consolidated Copper Co.'s Mine, Arizona.

The idea underlying the design of this hoist is that the motor for running a hoist shall operate continuously in one direction, while the drums may be started, stopped or reversed at will. The principal electric loss in hoists operated by alternating-current motors is occasioned by the starting of the motor which, when it is a large one, becomes very serious. It is very desirable, therefore, not to be obliged to start the motor at each trip, because when the motor is run idly the current required by it is very limited, so that the peak losses are very materially reduced. In this type of hoist the load is gradually accelerated by applying powerful friction clutches, the design of this clutch, shown in fig. 2, being in effect a band brake set in motion, which engages as gradually and easily as may be desired.

Each main hoisting shaft is equipped at the bottom with a large ore bin or pocket cut out of the solid rock over which a train of ore cars, each of 5 tons capacity, propelled by an electric locomotive, is run, and the cars are discharged

three at a time into the bin below by means of the rotary car tipple illustrated in fig. 3. These car tipples are rotated by means of the electric motor shown in the illustration. Each bin has at the bottom a measuring pocket which measures a skipful of ore into the skip as it comes to the bottom ready for loading. The gates of this measuring pocket are controlled by hydraulic cylinders operated by the man in charge. A similar ore bin is provided in the steel head frame in the top of the shaft into which the skips are automatically discharged. From these bins the ore is drawn into large gyratory crushers, which reduce it to about the size of 3-in. cubes for shipment to the concentrator. The ore pocket in the mine being nearly full of ore, the hoist motor is accelerated by lowering the empty skip, after which the hoist is started and operated in balance continuously until the bin at the top of the shaft is filled, when the hoist is discontinued for a short period of time. When the concentrator is running to its full capacity, each hoist handles a maximum of 5,000 tons of ore per day, in two shifts of eight hours each.

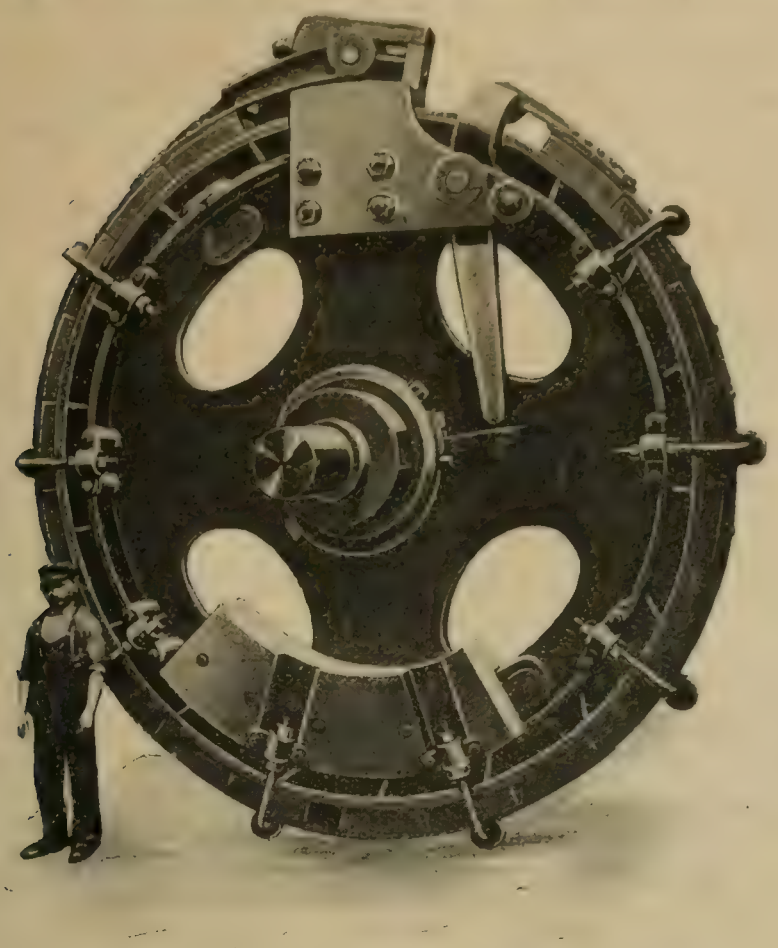


Fig. 2.—Friction Clutch for Electric Hoist.

The power is transmitted from the motor to the hoist by means of a bevel gear driving and reversing system, which is clearly shown in the general view. The pinion, which is of forged steel with machine-cut teeth, engages in two cast-steel machine bevel gears, which are completely enclosed in a steel casing and run in oil or grease. Both these gears are loose on the intermediate shaft, being fitted with bronze bushings of ample proportion, easily removable for renewal, while on the back of each of these gears is a friction ring with which the band friction clutch engages. These clutches, which are similar in design to the large one illustrated, are securely keyed to the intermediate shaft, and are operated by the vertical operating cylinders shown in the foreground, the clutches being applied by weights and released by the operating cylinders. The cylinders are controlled in their movement by a cataract cylinder filled with oil. The power used in the operating cylinder is compressed air taken from the air mains supplying the mine, but an auxiliary motor-driven air compressor is situated in the engine house, which automatically cuts in and provides air for operating the hoist should the mine pressure be shut off or go below a certain predetermined pressure. Both of the clutch operating cylinders are worked by a single lever on the operating platform, and are so connected that, although either clutch can be thrown in at will, both clutches can never be in at the same time, and one clutch must be wholly disengaged before the other can be engaged.

Each hoist is equipped with a safety device to prevent overwinding, which is operated by a hatchway limit switch placed in the hoisting shaft near the top. This device automatically throws out the clutches and applies a powerful post brake, stopping the skip within 6 or 8 ft. of its travel. It has been shown in actual practice that this safety mechanism entirely eliminates the possibility of an overwind. Both in its general features, therefore, and in the care which has been taken in working out the details of its design, it easily ranks as one of the most interesting examples of modern electric hoist practice to be found, and opens up a new phase of this subject.

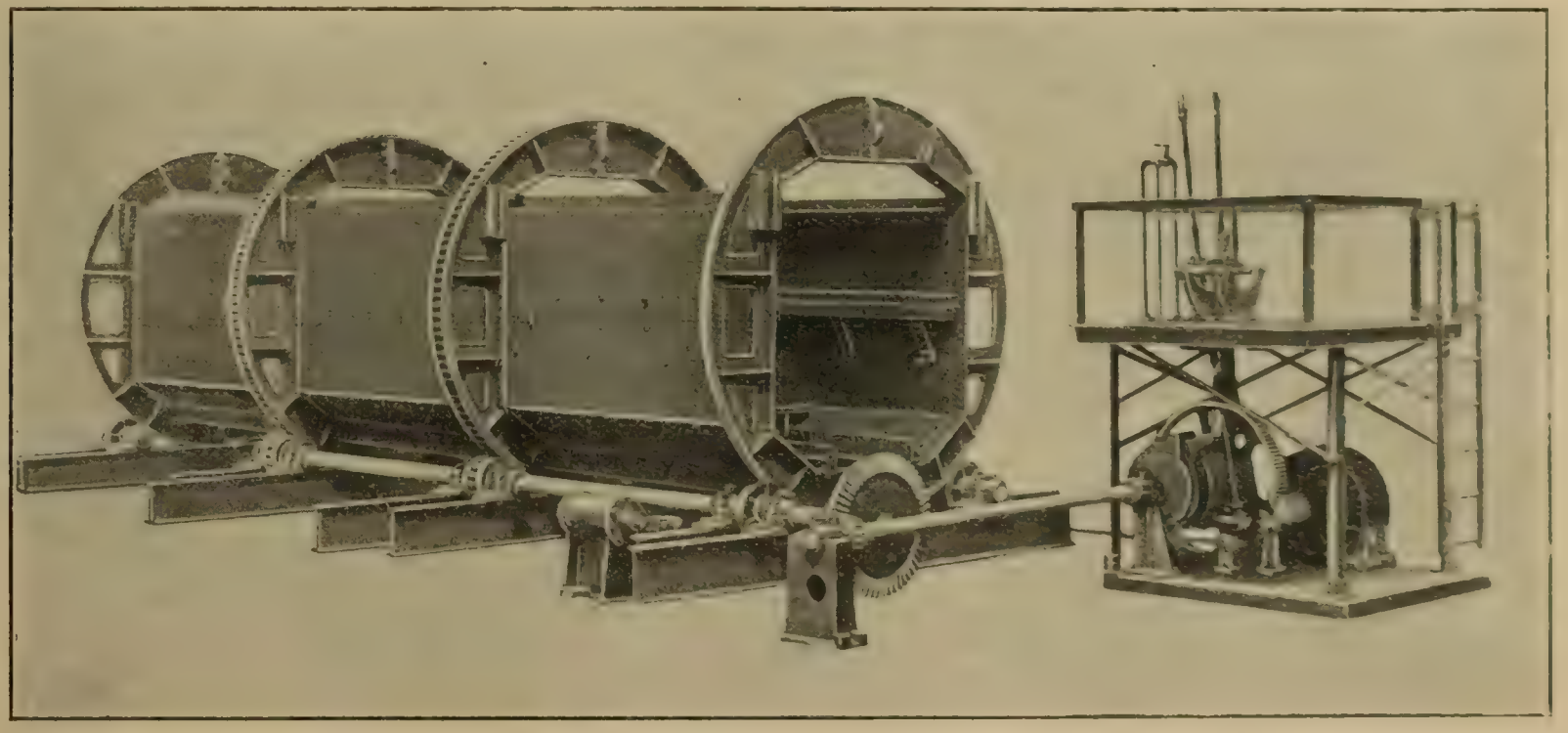


Fig. 3.—Electrically-Operated Car Tipple, at Shaft Bottom.

ELECTRICITY AT THE GHENT EXHIBITION.

(*Concluded from page* 368.)

Without doubt, to France must be given the credit of organising by far the most complete and interesting electrical section in the Exposition. The British electrical exhibits, though good, were very few in number and limited in scope, and the German firms, from whom so much might have been expected, were represented only by a few electric motors on textile machinery and machine tools; by quartz lamps outside the Congo Palace; by tungsten lamps (including some high-c.p. units built into houses of the arc-lamp type) in the Sporthalle; and by a selection of impregnated wooden poles. It is not too much to say that the dignity of the electrical industry was upheld only by the French exhibits in the Palais de France, by the radio-station in the Avenue des Nations, and by the exhibits, chiefly Belgian, in the Palais d'Electricité. The latter hardly justified its name, for though it was an independent building devoted exclusively to electrical exhibits, it occupied but a

small area and contained only a limited range of apparatus. We would suggest that where attendants are so numerous, there can surely be no harm in allowing visitors to walk on to the larger stands. Many of the latter at Ghent contained apparatus and wall diagrams, &c., which could not be inspected from the gangways, but visitors were not allowed to pass behind the boundary-chain unless M. l'Ingénieur were there, and, needless to say, in most cases and at most times he was *not* present. A further hardship inflicted on visitors whose time was limited, and to whom "les Attractions" did not appeal, was the closing of all the national palaces at 6 p.m. (latterly 5 p.m.). Some compensation was certainly to be found in the beauty of the illuminations in the grounds. In a number of the main avenues, tall arc lamp standards were provided with top reflectors, beneath which were arranged concentric rings of 14, 10 and 6 100-c.p. metal lamps; the results obtained put some of the neighbouring arcs to shame, but it is only fair to state that these arcs were by no means of the best types available. In the Park area of the grounds, very pleasing results were obtained by the use of festoons of metal lamps mounted in coloured balloons and artificial flowers, and strung among the trees.

In the French Section, the exhibits of the Soc. Gramme included series D.C. dynamos with commutating poles, and from 3 to 100 KW. output. These machines were characterised by the considerable length of their armature connecting strips, the great number of commutator bars and the exceptionally great distance from the armature to the end of the shaft at the commutator end of the machine; the axial length of the commutator clamping ring and of the shaft beyond it appeared unnecessarily great.

The Soc. Alsacienne de Constructions Mécaniques showed very handsome ranges of D.C. and A.C. motors of open and enclosed and traction and other types. Their wound-rotor induction motors were fitted with a substantial and efficient brush-lifting and short-circuiting gear, and their completely enclosed (double envelope) three-phase motor with forced ventilation attracted much attention. A high-frequency alternator built by this firm was used in the adjoining wireless station.

The exhibits by the Soc. Française pour la Fabrication des Tubes included telescopic and single-piece metal poles for all purposes. The sectional type designed for Colonial use was specially interesting; a hollow pole of square section was shown with bolted-on cross arms, a single cross arm being bent up at both ends to form pins for two glass insulators; each of the two pieces of a longer compound arm bent up at each end to carry in all four insulators; or a hollow square cross bar carrying one or two pins, each of which was extended below the cross arm and turned upwards to form a second pin below the first. The sectional poles of the Nou and Louvroil types appear to be admirably adapted to Colonial telegraphic and field wireless work.

Among the many excellent collections of insulated wires and cables of all types and carrying capacities, mention must be made of those shown by Messrs. Alliot & Rol. C. F. des Cables, C. G. d'Electricité and Devauge Cie. The ingenious "braid" conductors exhibited by the latter firm led us to wonder how soon an enterprising school for misses would include instruction in jointing with the needlework classes in its curriculum.

The uncanny echoes of the brush discharge proceeding from the E.H.T. enclosure equipped by Messrs. Vedovelli, Priestley & Co., proved strongly reminiscent of the "House of Whispers," and led to a number of amusing incidents. The person in charge of this exhibit, while admitting anyone who could produce a card inscribed with the magic word "Ingénieur," denied us this privilege, but for a consideration left us alone for ten minutes before his assistant arrived to close the doors in the lattice screens round the high-tension apparatus. Since the exhibition supply voltage was here raised successively from 220 volts to 6,600 volts and 110,000 volts, a little knowlege and the caution which it inculcated proved a useful thing; the safety of a lay visitor would have depended entirely upon his obedience to a printed notice, which to many would have been unintelligible. The E.H.T. transmission line in this enclosure was about 100 m. in length, and the power transmitted was 100 KW. At the receiving station the pressure was again reduced for lighting and power supply. The H.T. equipment included the necessary lattice towers, link insulators, leading-out wall disks of corrugated glass, and remote-control pressure oil switches capable of interrupting very heavy loads at 110,000 volts.

In the field of electrochemistry, the Soc. Anon. le Carbone, the Cie. Charbons-Henrion and the Cie. Française de Charbons showed extensive collections of carbons in all the forms required for electrical purposes. The Delafon exhibits included a very simple wall set (complete with miniature dry cells) for use in receiving time signals, &c. The complete Leclanché exhibit deserves mention.

The Soc. des Accumulateurs Heinz arranged an excellent exhibit of their accumulators, primary cells and aluminium rectifiers. The Lumière primary cells are built in capacities up to 1,000 ampere-hours (at 12 amperes discharge), and the Heinz accumulators range in size from the smallest ignition cells to the largest central-station and submarine types. In some of the central-station cells, the plates are cast into leaden bus-bars; in other cases, bolted lugs are employed. The submarine cells are encased in brass-bound, heavy wooden boxes. We were impressed by the design and liberal rating of the aluminium rectifiers shown by this firm; the largest standard equipments provide 100 amperes D.C. at 105 volts for 10 hours per diem, and have been applied successfully to the excitation of alternators, charging of accumulators, operation of small motors, projector arc supply and so on.

In the central-station accumulators (1,000-1,500 ampere-hour capacity) exhibited by the Soc. Travail Electr. des Métaux, all the plates of similar polarity in each cell are bolted to through-running brass bars by two brass nuts apiece, and copper links are used between cells. This and equivalent arrangements employed by other manufacturers are very convenient in cells intended for export, but are, we believe, inherently inferior to burned or cast connections. In some traction cells, this firm uses a through brass bus-rod with end nuts, carrying leaden reels between the plate lugs. A boiler tube-cleaner motor also exhibited comprised a D.C. armature and commutator about 1 ft. in length and 4 in. in diameter, mounted in a brass tube between two plate pole pieces, excited by coils coaxial with and at either end of the armature.

The Etab. Keller Leleux exhibited a fine collection of crystalline fractures of electric furnace products, and a model and drawings of the Keller furnace. This exhibit should apparently have been included in the electrometallurgy class, in which were to be found a number of exhibits of electrometallurgical products, including iron alloys, ferrochromes, ferrosicilons, carbide, &c., and electrolytic products, including electrolytic copper, nickel and brass in all forms, and pure metals recovered electrolytically from their ores without roasting or smelting. In the same section were models of Girod and Heroult furnaces; 43 furnaces of the latter type now in use total 198,200 kg. capacity, and 15 which are under construction will have a total capacity of 97,000 kg. An excellent joint exhibit of "French aluminium" included aluminium utensils of all kinds, aluminium castings and stranded aluminium cables. The Soc. des Carbures Métalliques showed a magnificent collection of carbon ingot moulds and heavy electrodes, for electric furnace use, complete with screw plug connectors. The largest electrode shown measured 2,000 × 500 × 500 mm., and weighed 820 kg. (16 cwt.).

In the electric lighting group, the Cie. Gle. de Travaux d'Eclairage presented a collection of photographs of lighting fittings and their glassware; Weissman's *perles* proved to be very striking glass bead shades, festoons and "drops." Over 50,700 metal lamps were installed by this company in the decoration of palaces and avenues in the Exposition. Messrs. Kemmell, Piel et Cie. showed very artistic strip lighting cables and shades, and Cance, Fils et Cie. exhibited an exceptionally well-built type of flexible cable, with lampholders complete; the mounting of the latter appeared to be good both mechanically and electrically. The well-known Bardon arc lamps were well represented; a feature of the distribution board by this firm was the protection of the fuses by tubes of lightly-glazed porcelain, supported only by the fuses on which they were threaded. La Maison Grivolas mounted examples of insulators and remote-control outdoor

H.T. switchgear on a lattice tower and surrounded the latter with Bastian quartz heaters, aluminium castings, switches of all kinds and wooden insulators, &c. The Soc. Française d'Incandescence par le Gaz shows signs of the times in the shape of O.R. metal lamps, in which a filament is hung in loops at right angles to the central stem on radial wires projecting from the latter. The central stem is of white refractory clay, and is supported at its outer end by a glass pin fused in the tip of the lamp, a special feature of which is its high candle-power through the bottom or tip end. "Le Compose Tout Universelle" (Ruthardt et Cie.) is an electric transparency sign, each aperture in which is served by a long strip carried between two rollers and containing all the letters of any desired alphabet, numerals, &c. The message of the sign can thus be changed at will; the apparatus appears to be quite serviceable, and is made in various useful forms.

The Admin. Française des Postes et des Télégraphes showed various types of the Baudot apparatus in operation, including the 1909 double apparatus with special discharge arrangements for use on submarine cables of medium length, and the *quadruple échelonée* system connecting three stations A B C, and giving two *secteurs* between A B, two between B C, and two between A C with automatic retransmission at B. This exhibit included a section of a semi-automatic exchange switchboard as now in use at Marseilles and d'Angers.

Messrs. Ducretet et Roger's fine exhibit in this section included much wireless apparatus. A double arc apparatus was shown for use in radio-telephony over distances up to 30 km. overland, and a group of four microphones piped in parallel to a single mouthpiece, and capable of being connected in parallel or series, was also exhibited for this work. A relay moving-coil galvanometer giving good relay contact when actuated by 0·67 microamp., and hence suitable for use in stationary radio-stations, and a Pollak telephonic relay for use in public halls, were among the exhibits which justly claimed attention on the stand.

Dr. Glover's "physiological" (nose and mouth) double-microphone instrument for long-distance telephony was exhibited, and is claimed to be very effective. However this may be, the instrument certainly aggravates the hygienic problem, and we should have expected a doctor to have taken this into account in developing an improved design. The Ancel exhibits included a radio-receiving set on marble wall slab for "municipal or administrative use" (the latter exhibit looked the part). In the Ancel three-style drum recorder, one style is actuated by, say, the Eiffel Tower signals, one is connected to the clock controlled, and one to an electric tuning fork (beating $\frac{1}{100}$th sec.). The wall board exhibited for use with this recorder and with ear pieces is probably the most elaborate of the many equipments which have been introduced in this connection during the past few years.

The Cie. Gle. Radiotélégraphique exhibited standard 1·5-KW. and 2·5-KW. sets for use in yachts and larger vessels, and other radio-apparatus.

The Ste. Française Radio-Electrique exhibited its transmitting and receiving apparatus for radio-telegraphy and telephony in an annexe behind which was erected a 75-m. pylon of light lattice construction (by Schmid, Bruneton and Morin). The musical spark system was employed in conjunction with the S.F.R. resonance alternator, for which very high efficiency is claimed. The "musical" spark made life more or less unbearable in the adjacent hall, but its note was undoubtedly very pure. Among other apparatus this firm exhibited some excellent ship sets and a small set, designed for fishing-vessels, which was very neat but which, we should say, was too delicate and complex for use by the average skipper or mate. The mule-pack radio equipment designed for military purposes appeared to be exceptionally useful. Special sets designed for amateur, naval and aerial use were also exhibited; the aeroplane equipment weighing 35 kg. is claimed to have an effective range of 150 km.

The wireless station in the Ave. des Nations worked in conjunction with an aerial suspended from a 100-m. square lattice mast weighing 10 tons; the handsome appearance of this mast was largely due to a lattice wood sheathing, on which platforms were built at intervals. The transmitting apparatus was erected in a bungalow of "colonial" construction (fireproof fibre compo wall slabs and roofing on steel lattice and netting). An oil-driven alternator in an adjacent bungalow provided the necessary power. During the Exposition this station was in more or less regular operation in public wireless service. The Soc. Ind. de T.S.F. showed an interesting collection of transmitting and receiving apparatus designed for use on aeroplanes, automobiles, &c., and characterised by their high sensitivity and light weight. An interesting type of telescopic mast capable of pneumatic elevation to a height of 50 ft. or so, by aid of a foot pump, was exhibited.

The Soc. Belin's exhibits included an automatic time signal emitter (similar to that in use at Paris), and examples of the ingenious and beautifully-made Berlin telephotographic apparatus with portable transmitter, permitting a telephone message and picture to be sent simultaneously from an ordinary telephone station. About 25 sq. in. of picture can be transmitted in 4 minutes over a 1,100-km. line; examples of telephotographic reproductions were shown. An extremely interesting collection by the Soc. Ind. des Téléphones included a Routin regulator, an electrostatic balance for telegraphy over H.T. lines on the Gacogne system, very fine heavy switchgear for accumulator control, as well as an 8,000-ampere single-pole automatic circuit breaker, and an isolating switch of the same capacity with contact clamping bolts.

Messrs. Hamm exhibited, in addition to telephonic and signalling apparatus, a particularly neat poulie-pompe (a centrifugal pump, the housing of which is bolted directly on to the motor frame, and the runner of which is carried on the extended motor shaft). This pump is suitable for many domestic and industrial purposes, and is built in standard sizes up to a capacity of 10,000 litres per hour through 10 m. lift, or 5,000 litres per hour through 30 m. lift. The charging board exhibited by this firm was of very good but rather extravagant design, which brings us to a noticeable characteristic of many French switchboards for small installations, viz., beautiful design and construction, but lavish expenditure of space and material, and a lack of general robustness and "strength where it is wanted."

To a commissaire de police de Paris must be given credit for a miniature electric projector suitable for attachment to any revolver, and showing a black spot (at ranges up to 65 ft.) at the point where the bullet will arrive.

Some remarkably fine exhibits were to be found in the instrument section. So well known are Carpentier instruments that it is hardly necessary to do more than mention them: those shown included double instruments indicating KW. and K.V.A. individually and p.f. at the intersection of the pointers, and a Ferrié wave meter of similar design. Da & Dutihl exhibited an excellent series of instruments. Messrs. Darras showed a perforator for high-speed telegraphy, and a neat box apparatus for receiving time signals and suitable for travelling purposes. The Beaudouin lamp is surely the *modèle de luxe* of small projector arcs (though whether it is a commercial proposition is another question) and the precision high-sensitivity electrometer by the same maker offers many advantages, including complete visibility of working parts at all times. The Collot, Longue exhibit included many interesting pieces of apparatus, among which may be mentioned the Abraham *rhéographe* and the Abraham and Villard electrostatic voltmeter (5,000-15,000 volts). M. Pellin showed very fine optical instruments, and to conclude an all-too-brief review of this section, Thurneyssen exhibited some X-ray tubes and radio-active apparatus, and Prin a synchronised printing chronograph recording minutes, seconds and hundredths of a second.

Palais d'Electricité.—A special feature of this hall was its electrical illumination, which was produced by a comparatively small number of frosted lamps, hung in festoons from the roof girders, and by loops of Weissman "perles" in the angles of the stall portieres, as well as by an electrically illuminated fountain.

The Soc. des Ateliers de Constr. Electriques (Charleroi) exhibited a collection of apparatus, including a powerful motor-driven point-shifting gear for railway use; a high-tension three-phase oil switch with maximum cut-out and time limit; motors of all types; a neat design of three-phase rotor rheostat (with three concentric arcs of seven contacts in the 7-H.P. size); and a neat ironclad knife

switch and fuse with pilot lamp, withdrawing switches and fuses complete and leaving the box dead.

The Soc. Anon. de Téléphonie Privée had a good show of telephone sets of good design, and the Admin. des Télégraphes de l'Etat Belge showed a retrospective collection of Morse apparatus provided with Van Rysselberghe anti-inducteur apparatus for simultaneous telephony and telegraphy. An interesting stand, devoted to the subject of wireless telegraphy in the Congo, was equipped with a certain amount of apparatus historical in this connection, and with literature and photographs describing and illustrating the work already done. The Belgian Congo has already in service a well-distributed network of 14 stations, and it is hoped that within 18 months direct wireless communication will be established between Brussels (Laeken) and Boma (6,300 km., including 600 km. oversea and 2,500 km. over African sands), eliminating all dependence on cable companies. *L'Expansion Belge* denounces as a *canard* the rumour that such communication has already been effected. The Union des Exploitations Electrique en Belge provided an excellent

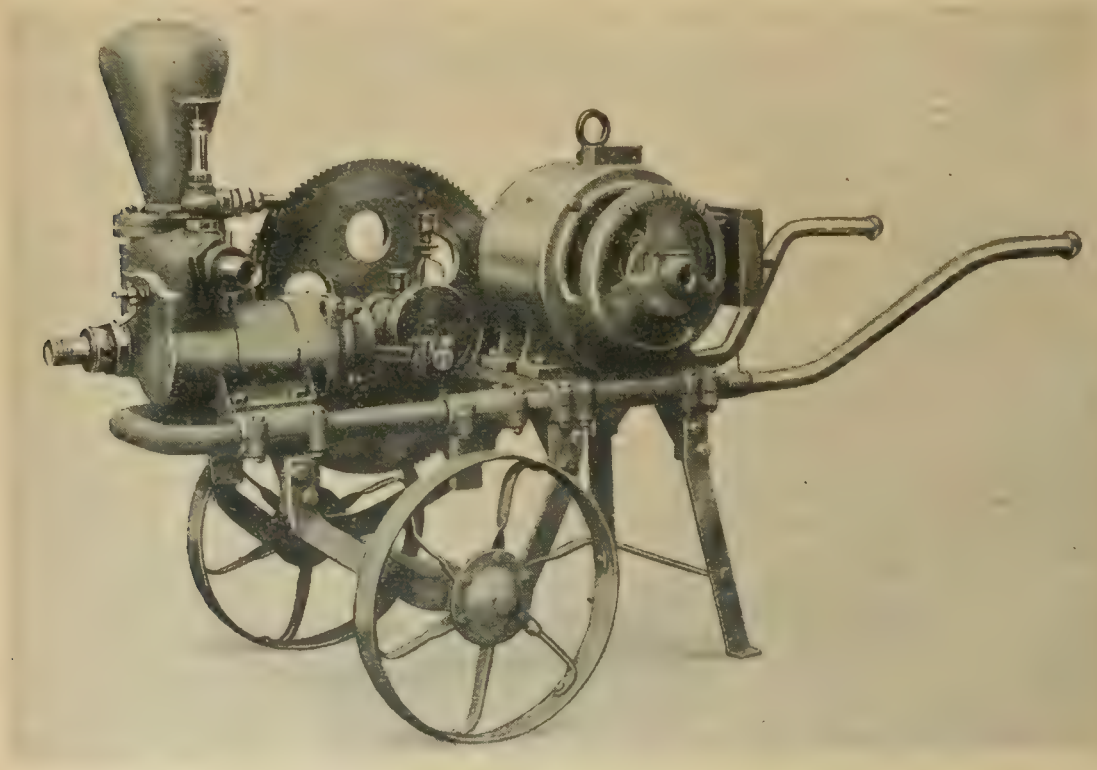


Fig. 1.—A Portable Electrical Pump.

collection of domestic electrical apparatus, supplemented by striking posters and a well-designed meter-board for demonstration purposes.

The Tudor Co. supplied a large collection of their well-known cells of all types and sizes; Vanderstuyft, a 1,500-ampere, 10-volt electrolytic dynamo with double commutator; and Boens lightning conductors arranged to receive time signals. The Atel. Jaspar illustrated well the electric driving of lifts and machine tools, and showed a contactor-type switchboard. The Bell & Antwerp Telephone Co.'s interesting exhibit included private exchange boards and a complete range of telephone instruments and accessories, including collector microphones for use in public halls, &c. There were also exhibited the well-known Marconi field and ship stations. Finally, in concluding remarks which barely outline the wealth of electrical material exhibited by France and Belgium, to which less than justice was done by the method of its arrangement, attention may be drawn to L'Industrielle d'Accumulateurs' large exhibit of cells, most noticeable among which was the export type in which each plate was attached by a leaden bolt and nut to a leaden bus-strip, thus facilitating the packing of the component parts for transport.

British Association, 1914.—The British Association for the Advancement of Science has now issued its programme of arrangements for the Australian visit, also for the meeting which opens at Havre on August 4th, by invitation of l'Association Française pour l'Avancement des Sciences. Readers who are interested in either of these meetings will be able to obtain full information by writing to the Secretary at Burlington House, London, W.C.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Handy Movable Crow-Bar.

An extremely ingenious crow-bar has been devised and patented by Mr. Robert H. Lasch, of 33, Bolsover Street, London. As shown in the accompanying fig. 2, it is provided with broad runners, which enable it to be used not only for lifting, but also for transporting heavy goods, without necessitating the use of trucks or rollers. Owing to the shape of the shoe, it is not liable to shift or slip when pushing or pulling a load, and the rollers provide a fulcrum which is always ready and cannot capsize; moreover, the effect of the rollers is to cause a tendency to glide towards the load. By its use time and labour are saved, and breakages avoided.

Portable Electrically-Driven Wine Pump.

The I.R., G.P. and Telegraph Works Co., Ltd., of Silvertown, have recently designed a pump specially for dealing with grape juice containing husks and pulp. The pump body and plunger are of gun-metal, with copper air vessel, a relief valve being fitted with a by-pass to prevent damage to the pump in case of a stoppage in the delivery pipe.

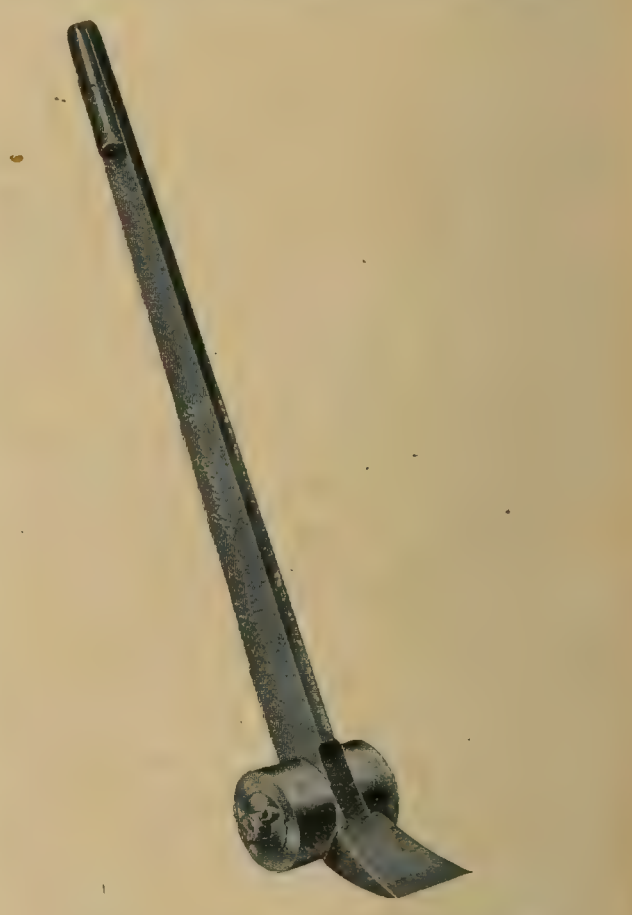


Fig. 2.—"The Handy" Movable Crow-Bar.

The pump (fig. 1) is fitted with hose unions on suction and delivery, and has a capacity of 12,000 litres per hour against a head of 35 ft. The motor is a "Silvertown" F.E. 2 type, capable of developing 2 B.H.P. when running at 1,000 R.P.M., and drives the pump through machine-cut spur gear.

The total weight of the set, complete with motor starter, is $5\frac{3}{4}$ cwt., and being carefully balanced on the trolley it is easily transportable by one man, while, at the same time, it is perfectly stable in use. The set is, of course, suitable for pumping liquids other than grape juice and the motor can be supplied suitable for any standard voltage, and either direct or alternating current.

In addition to the above, the pump can be supplied, driven by a petrol or paraffin engine, and is thus serviceable in places where electricity is not available.

The "Wireless" Cable Tester.

Messrs. Edwin A. Mansfield & Co., of 12, Beckenham Road, New Brighton, are introducing an inductively operating testing set for locating faults in cables and wiring.

Briefly, it consists of a sending apparatus—a small cabinet which will contain sufficient battery power for ordinary work, and is provided with a clockwork interrupter in the line circuit—this is coupled up to the circuit which it is desired to test. A portable detector coil coupled up to a telephone receiver is provided for exploring the route of the supposed faulty cable, the fault being, of course, usually detected by the cessation of the hum in the receiver.

The induction method of testing by means of alternating or interrupted currents is probably well known to our readers; the Mansfield apparatus is the result of some years' experience, having met with considerable favour in the States, where the Western Electric Co. alone has 68 of these testers in use.

Two battery circuits are provided in the B type tester, permitting the use of 4 to 6 or 10 to 15 cells for average testing and high-resistance testing—the latter useful in the case of a shorted twisted pair

The apparatus is also adapted for finding lost pipes, and many gas and water companies, both in America and this country, have adopted it.

An Illuminated Thermometer.

An illuminated thermometer, known as the "Karmos," has been introduced by the Karmos Electrical Co., of 30, Gordon Street, Glasgow, which consists of an ordinary thermometer mounted on a window in the base, which latter contains a small dry cell and glow lamp with a button switch, for giving the necessary light. The device is suitable for use in normally dark or dimly lighted situations, such as cellars, ships' holds, &c.

An Ediswan Heater.

We illustrate in fig. 3 a new Ediswan heater for this season's trade, by the Edison and Swan U.E.L. Co., of Ponder's End. It is

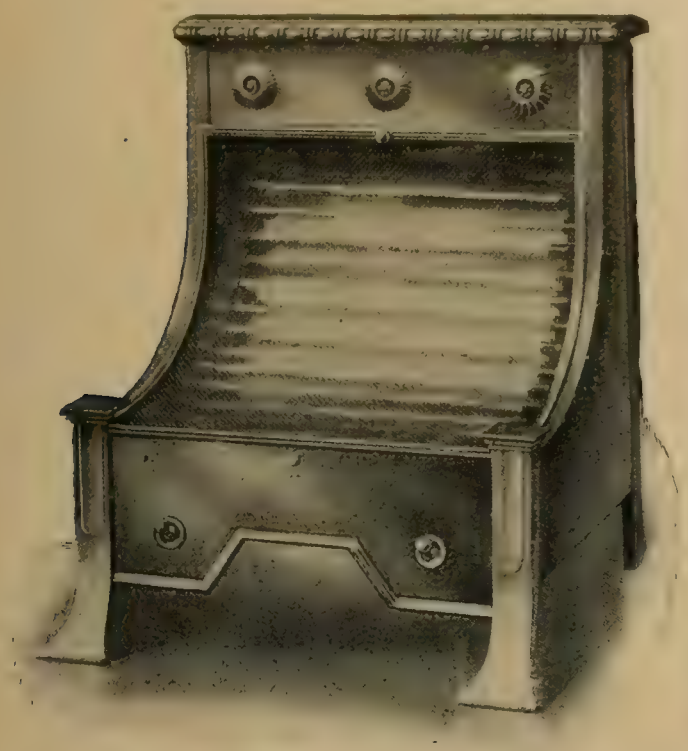


Fig. 3.—New Ediswan Heater.

finished in oxidised silver, and fitted with two switches, 12 glowers, and 2 yards of flexible wire. The consumption is 1 and 1½ units per hour, according to the degree of heat desired.

'Tricity Cooking at a Bazaar.

The whole of the cooking for the Children's Hospital Bazaar, held recently at Derby, was arranged by Mr. T. P. Wilmshurst, the borough electrical engineer, to be done electrically by means of Tricity cookers. Some 280 dinners were cooked and served during the four days the bazaar lasted, with a total consumption of 291 units, which, at the rate of 1d. per unit, at which current is supplied for cooking purposes, works out at approximately 1 unit, or 1d., per dinner served.

The demonstration aroused considerable interest, and a special feature was that all the cooking was done in close proximity to the visitors who dined, which would have been impossible with any other method of cooking, owing to the heat and smell.

The following apparatus was used:—Three duplex cookers, five extension cookers, one double and one single oven, and a selection of utensils for heating, boiling, &c.

It is interesting to learn that the lady controlling the refreshment stall expressed the opinion that the cooking would not have been such a success if it had not been for the electric apparatus, and that everyone who saw the cooking expressed satisfaction therein; it is also gratifying to know that the stall cleared £130 after all expenses had been paid, almost entirely from meals.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Practice" writes: "I should be glad to have your legal contributor's opinion with regard to the liability of a supply company in the following cases:—

"(1) If a line having no lightning arresters be struck by lightning and a motor connected to it is damaged.

"(2) The failure of one main of the supply causing damage to motors connected; the failure of the main might be a simple break or an earth fault; it being understood that the liability mentioned above refers to the breakdown of the motor or its controller.

"I should also like to know whether a failure of one leg of a three-phase supply comes under Clause B, Board of Trade Regulations (Electric Lighting Acts, 1882 and 1888)."

*** As to (1), Clause 11 of the Board of Trade Regulations for securing the safety of the public provides that: "Where any portion of any electric line or any support for an electric line is exposed in such a position as to be liable to cause injury from lightning, it shall be efficiently protected against such liability." Clause 35 of the same regulations provides that: "If the undertakers make default in complying with any of the preceding regulations, they shall on conviction be liable to a penalty not exceeding £10 for every such default, and to a daily penalty not exceeding £10. The recovery of a penalty under these regulations shall not affect the liability of the undertakers to make compensation in respect of any damage or injury which may be caused by reason of the default." The regulations made under the Act of 1888 further provide that: "Any electric line or any support therefor exposed to liability to injury from lightning shall be efficiently protected against such liability."

As to the first question, it therefore seems as if the liability of the undertakers is clear if they fail to take precautions to prevent damage by lightning. As to the second question put by "Practice," the liability of undertakers is expressly reserved by Sec. 77 of the Electric Lighting (Clauses) Act, 1899, which provides that the undertakers shall be answerable for all accidents, damages and injuries happening through the act or default of the undertakers, or of any person in their employment, by reason of, or in consequence of, any of the undertakers' works, and shall save harmless all authorities, bodies and persons by whom any street is repairable, and all other authorities, companies and bodies collectively and individually, and their officers and servants, from all damages and costs in respect of those accidents, damages and injuries. This does not mean, of course, that undertakers are liable, even in absence of negligence. To fix them with liability for a defective main it would have to be shown that they had neglected to inspect or repair and renew a cable, or had omitted to take obvious precautions to prevent accidents of the kind described.



Fig. 4.—'Tricity Cooking Apparatus at a Bazaar.

"Electric Supply" writes: "We have been approached by the owners of a large estate to supply electricity to such estate. The estate is situate in three parishes, one parish being supplied by this company and in its area, the other two by another company. I shall be glad if you will kindly inform me whether it is possible for my company to give a bulk supply with mains, &c., in its own area, such supply to be taken all over the estate, parts of which are outside our area. The owners of the estate propose laying all the cables on the estate. It is not the intention of the owners of the estate to charge per meter, but to charge per kw. demanded per annum."

*** Prior to the Electric Lighting Act, 1909, it would have been impossible for "Electric Supply" to acquire any right to supply outside his own area. That Act, however, confers wide powers upon the Board of Trade to permit of external supply. By Sec. 6, "where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may, if the local authority within whose district the premises are situate, and the undertakers, if any, authorised to supply electricity to such premises consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit. Provided that, if in the opinion of the Board any consent required by this sub-Section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given." This section goes on to specify the conditions in which the Board will exercise this power. It will be seen that the request must come from a consumer. Whether the Board has power to move at the request of the undertakers is somewhat doubtful. Mr. Knowles in his "Law Relating to Electricity," states that "The powers under this section could be very conveniently requisitioned by the occupiers of premises in the neighbourhood of the mains connecting the area of supply with a generating station outside that area." Whether the Board will make liberal use of their powers in this respect is doubtful, in view of the opinion of the Joint Committee of 1898, that, when a local authority or company, having power to supply current within a certain area of supply, seeks to obtain land compulsorily for a generating station outside that area, "it should not be allowed, except when Parliament or the Board of Trade decide otherwise, to supply from that generating station any area outside the area of supply of such authority or company."

With the co-operation of those undertakers who supply in the other areas, it is possible that something might be done by agreement; but it does not seem very hopeful.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,035. "Replacement fuses and/or switches for electric circuits." G. O. Donovan. October 13th. (Complete.)

23,046. "Antiseptic guard for mouthpieces of telephones and the like, and the fixing appliances." F. Lewis. October 13th.

23,057. "Electrical hot plates." J. Esson. October 13th.

23,110. "Electrical switches." L. Hulbert. October 13th. (Complete.)

23,113. "Receivers adapted for wireless telegraphy." H. Abraham. (Convention date, October 18th, 1912, France.) October 13th. (Complete.)

23,127. "Electric motor starters." H. J. Norballe and J. L. Lawson. October 13th.

23,137. "Automatic telegraph transmitters." E. Thompson. October 13th.

23,188. "Electric arc lamps." Siemens-Shuckertwerke G.m.b.H. (Convention date, February 4th, 1913, Germany.) October 14th. (Complete.)

23,202. "Electric pocket lamps." W. Kaliwasser. October 14th.

23,218. "Electrical cooking apparatus." R. S. Downe, W. Travis and Brompton and Kensington Accessories Co., Ltd. October 14th.

23,247. "Electrical switches or circuit-breakers." F. B. Holt and E. O. Moller. October 14th.

23,277. "Magnetic motor." E. W. Fuller. October 15th.

23,281. "Air filters for electric generators." Heenan & Froude, Ltd., and W. Wheal. October 15th.

23,332. "Electric relay." W. R. Sykes Interlocking Signal Co., Ltd., and R. W. Tarrant. October 15th.

23,336. "Automatic selecting devices for telephone systems." Siemens and Halske Akt. Ges. (Convention date, October 17th, 1912, Germany.) October 15th. (Complete.)

23,340. "Means for operating gas valves from a distance." Marconi's Wireless Telegraph Co., Ltd., and C. P. Ryan. October 15th.

23,342. "Terminals for high tension electric apparatus." F. Coates and A. Reyrolle & Co., Ltd. October 15th.

23,386. "Electric hair wavers or curling appliances." C. M. Holmquist. October 16th.

23,388. "Vibration damper for use with incandescent, electric, or gas light, arc lamps, or any illuminant of a fragile nature, the efficiency and life of which would be increased by isolation from external vibration." W. P. Taylor and J. Willis. October 16th. (Complete.)

23,444. "Electric switches." J. H. Tucker and J. A. Crabtree. October 16th.

23,449. "Electric protective systems." E. G. Waters. October 16th.

23,452. "Shade supporting devices." E. C. R. Marks. (Benjamin Electric Manufacturing Co., United States.) October 16th. (Complete.)

23,457. "Casing and capping for use in connection with electric wiring." B. S. Anderson. October 16th.

23,478. "Electrical signalling apparatus." G. Dearle. October 16th.

23,486. "Fittings for electrical conduits." Barton & Sons, Ltd., A. Barton and R. E. Barton. October 17th.

23,487. "Fittings for electrical conduits." Barton & Sons, Ltd., and A. J. Harper. October 17th.

23,492. "Electrical cut-outs or fuses." L. A. Waller and E. D. Rodway. October 17th.

23,517. "Apparatus for controlling electric current." A. Schnorr. October 17th.

23,525. "Electrical cooking apparatus." R. S. Downe. October 17th.

23,527. "Electric water-heaters and the like." R. Weaving and Ferranti, Ltd. October 17th.

23,535. "Instruments or apparatus for registering telephone calls." J. S. Foley, W. Hill and H. Hackett. October 17th.

23,543. "Electric motor and other lamps." J. Collins and Optalyte, Ltd. October 17th.

23,553. "Apparatus for exhibiting pictures, advertisements, and the like." W. J. Mellersh-Jackson. (Elektro-Reklame G.m.b.H., Germany.) (Addition to 5,029/13.) October 17th. (Complete.)

23,557. "High-frequency alternators." Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. October 17th.

23,565. "Telephone exchange systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) October 17th.

23,570. "Synchronised electrically-controlled clocks." C. E. O'Keenan. (Convention date, October 25th, 1912, France.) October 17th. (Complete.)

23,587. "Single-lever combination of electric switches." A. G. Farmer. October 18th.

23,601. "Caps or mouthpieces for telephonic transmitters and other sound instruments." A. Marr. October 18th.

23,640. "Electric signalling systems for railways and the like." T. D. Parr. October 18th.

23,649. "Electric incandescent lamps." C. P. Elieson. October 18th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Means for Automatically Equalising the Load on Electric Tramways or Railways. B. J. G. Bergman. 14,846. June 25th.

Dynamos for Lighting Vehicles. S. L. Price. 19,345. August 23rd. (February 24th, 1913.)

Musical Instruments with Electrically-Operated Vibratory Sounders. M. L. Severy and G. B. Sinclair. 19,868. August 30th.

Manufacture of Solid Bodies from Metallic Powders. H. Leiser. 22,041. September 27th. (October 2nd, 1911.)

Electric Switches. H. H. Berry and W. J. Markham. 22,118. September 28th.

Means for Electrical Alarm Signalling in Connection with Steam Engines and Machinery. T. H. Hill. 22,412. October 2nd. (Cognate application, 29,832 of 1912.)

Means for Controlling Electrically-Operated Mechanisms and the Like. H. H. R. Green. 22,646. October 4th.

Safety Electric Lamps, more especially intended for use in Mines. W. H. Hanson, H. L. Langston and Electrical Power Storage Co. 22,738. October 5th.

Electric Supply Systems. P. Young. 22,852. October 7th.

Brush Holders for Dynamo-Electric Machines. J. H. Holmes. 22,985. October 8th.

Driving Gear for the Armature Shafts of Magneto-Electric Igniting Apparatus for Internal Combustion Engines. S. K. Thoresen and O. R. Olsen. 24,691. October 28th.

Transmission of Photographs and other Pictures by Means of Ordinary Telegraph and Telephone Apparatus. U. Ellero. 24,768. October 29th.

Indicating Apparatus for Indicating the Speed of a Vessel irrespective of a Tide or of a Current. A. G. Noble. 25,487. November 6th.

Electric Motors. G. E. Thomas. 26,396. November 18th.

Method of, and Means for, Holding Tubes, Rods, Bars and other Articles in Position to be Electroplated. G. P. M. Lee and W. A. Brame. 26,765. November 21st.

Regulation of Electric Installations and Systems. Akt.-Ges. Brown, Boveri & Cie. 27,069. November 25th. (February 3rd, 1912.)

Dynamo-electric Brakes for Electric Motors. Etchells, Corgdon & Muir, Ltd., and F. Muir. 27,482. November 29th.

Electrolytes for Galvanic Batteries. W. H. Lowe. 27,634. November 30th.

1913.

Apparatus for Controlling Synchronous Motion Electrically from a Distance. Siemens-Schuckertwerke Ges. 687. January 9th. (August 2nd, 1912.)

Electrical Terminals. J. W. Record. 763. January 10th.

Galvanic Cells having Gelatinous Electrolytes. J. A. E. Achenbach. 832. January 10th.

Magneto Apparatus for Use especially in Connection with Internal-combustion Engines. "Mafam" Motor Apparate Ges. 1,093. January 14th. (February 3rd, 1912.)

Selective Signalling System. R. N. Hill. 2,612. January 31st. (March 21st, 1912.)

Means for Interlocking Electric Switchgear with Lids of Boxes. H. Hirst and J. Strachan. 2,636. February 1st.

Miners' Lamps. T. Heaton. 4,707. February 24th.

Electrically Heated Igniters for Internal Combustion Engines. H. Royer. 7,302. March 27th. (March 30th, 1912).

Supervisory Circuits for Telephone Systems. Siemens & Halske Akt. Ges. 7,531. March 31st. (March 30th, 1912. Patent of Addition not granted.)

Regulation of Electric Motors. Allgemeine Elektricitäts Ges. 7,896. April 3rd. (April 3rd, 1912.)

Receiving Arrangement for use in Wireless Telegraphy and Telephony. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 8,821. April 15th.

Electrical Relay Arrangements. A. N. Hovland. 10,472. May 3rd. (May 6th, 1912).

Timing Devices for Operating Electric Switches and other Apparatus. S. Chiger. 10,559. May 5th.

Apparatus for Winding Electrical Machines. Maschinenfabrik Oerlikon. 14,633. June 24th. (June 24th, 1912.)

Reels for Laying Field Telephones and the Like. J. Baudisch. 17,563. July 31st. (October 9th, 1912.)

Trade Union Assistants and Evening Classes.—There appears to be no limit to the action which Trade Unions will take to "protect the interests of their members," and the inconvenience and bad feeling created by strikes and disputes have now found their way into the technical instruction class-rooms. At Bradford, where technical classes in nearly every trade are in existence, the student apprentices of one trade have been called out by their Union because of the attendance of clerks who are employed at the places where the apprentices work. It appears that previously the students attending this particular class were all Trade Unionists, but latterly the education authorities have considered that it was in the interests of sons of employers, clerks and others, that they should have an opportunity of obtaining a technical knowledge of the trade with which they were connected, in order to fit them for their future positions. Four costing clerks were admitted to this particular class this session, and, upon this being brought to the notice of the Union concerned, and the subsequent refusal of their request that these youths should be suspended from the classes, they have called out the two instructors—both Trade Unionists—and the other students to the number of about 30. This action has been described as despotic, and tyrannical it certainly is, as it precludes persons who desire to learn a trade from doing so, among them the sons of employers, who could hardly become members of the Union. There has been some suggestion that Union apprentices in other classes should take similar action, and, if this is done, the whole of the classes will be dislocated.

Flour-Mill Driving.—In a paper by Mr. R. B. Creak on "Modern Flour-Mill Machinery," read before the Institution of Mechanical Engineers on Friday last, the author stated that the continuous load was an excellent one for economical steam driving. Electric driving was making some headway, but it could be demonstrated that energy must be supplied at something like 0·4d. per B.T.U. before electric power could compete in price with steam. There was no field for individual driving, as the machines must start and stop and run together as a complete plant. The usual plan where electric driving was adopted was to put down a motor for driving the wheat-preparing plant, one for driving the roller-shafts on the bottom floor, and one for driving the upstairs line-shafting. There were about a dozen flour-mills driven by electric power at present in this country, and these reported very favourably on the system. Greater regularity of speed was one of the claims made for electric driving. This was a matter of very great importance where so many separations were effected by the use of delicately-adjusted air-currents. Variations in line-shaft speed became greatly exaggerated when dealing with fans driven from them at high speeds. A considerable saving in space was made by the abolition of boiler house, economiser, house and chimney stack.

THE

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

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THE VALUE OF A SENSE OF PROPORTION.

AN interesting exposition of modern conditions of warfare told in narrative form appeared some time ago, in which was given a picture of the general in command studying the grouping of the opposing forces by means of flags placed on a map of the war area. In response to an expression of horror from one of his subordinates on the receipt of news of a reverse at one portion of the firing line, the general exclaimed: "Proportion, gentlemen, proportion; it is not worth even moving a flag." Experience has amply shown the fact that in the actual progress of a fight the hardest thing of all to preserve is this sense of proportion, although it is one of the most important aids to victory. We well remember, during the progress of the Russo-Japanese war, reading that in one of the fiercest battles regiment after regiment, and battalion after battalion, flung themselves through the millet fields only to be beaten back again, for the purpose of securing a small eminence of almost insignificant value, simply because this was the only thing which could be seen above the waving heads of the millet, and so possessed a kind of magnetic attraction to the opposing forces.

It would be well if this great quality of the sense of proportion could be acquired and maintained, both individually and collectively, by the men who direct the operations of the great forces which we are wont to mass under the title of electrical engineering. In times past, strenuous conflicts have been waged over points which, in the light of cooler judgment and subsequent experience, have proved to be comparatively valueless and insignificant. A great deal of human strength and human brains, as well as vast sums of money, have been sacrificed, thanks to the lack of proportion. Obviously it would be invidious to particularise, but the giving of a few general cases may not be without advantage.

We all probably know some firm or another which, starting in a general way to manufacture articles in common request, has suddenly taken up a speciality and devoted its strength to the new venture. We are not attempting to discourage specialisation on rational lines, and with an adequate reserve to guard against the heavy contingencies which always are associated with specialisation, we believe that success may be reaped, but it is at the risk of putting all one's eggs in one basket. The particular invention or adaptation may be thoroughly sound and satisfactory; it may even for a time obtain a ready sale, but it is not safe to build on this. Sooner or later an improvement is sure to arise; sooner or later a modification in some other industry using the special apparatus may develop, and with it the security of the venture vanishes. In the meantime, the firm manufacturing this speciality has lost its sense of proportion; it thinks this particular production is a gold mine and that there is nothing else to touch it; it does not provide for con-

tingencies either by putting plenty of money to reserve or by keeping up its general manufacturing lines, with the result that in many cases disaster follows.

Let us take for another example the case of a man who has received a general training and becomes an efficient man of the type which would in the medical fraternity be referred to as a "good general practitioner." This man very often by a stroke of what appears to him inspiration, or by grouping of circumstances, finds himself in a specialised position. He may have developed a really useful and novel idea. He may have been given charge of an engineering operation of a highly specialised nature, or he may have been thrust into some particular combination of engineering with another industry or commercial pursuit. Owing to the specialisation, his income rises and he looks upon himself as a made man. At this point his greatest peril lies. The man who is tasting success, especially if such success comes suddenly, is very apt to forget that a very slight turn in the wheel of fortune may leave him deprived of everything he possesses, and unless he has a very good sense of proportion, it is extremely likely that sooner or later he will feel the pinch. We could cite cases—more than one is at present in our mind—in which men who have rendered service to the community in research and discovery, which could only be described as glorious, have found themselves in most distressing circumstances. Philosophy is poor consolation in such cases. Practical sympathy would be much more to the point, but can very often not be administered without causing severe damage to *amour propre*. At any rate, one can do all that lies in one's power to urge young men in our profession to guard themselves against letting their undoubted genius cause them to lose their sense of proportion. The man who finds himself at any time debarred from falling back, if necessary, into the groove of the general practitioner is in a dangerous position.

Yet another word may be said, and we say it with some hesitancy, as we feel that it may be open to serious challenge. We feel, however, that the time has come when the electrical engineering industry should carefully examine its general position with a due sense of proportion. Mathematical precision cannot, of course, be attained, the problems are too complex, but a general suggestion may be made. In the first place, electrical engineering is becoming more and more a matter of finance. We know a great deal about the scientific possibilities, and, given a certain problem, we can usually solve it in an engineering manner. The majority of engineers, however, when confronted with the financial aspects of a problem, are often amazingly ignorant. By this we do not mean how much it is going to cost to build and maintain a certain plant, but we refer to those wider economic problems which lie at the base of every industry. Lack of knowledge on these points explains why the commercial man has usually the whip hand over the technical expert. Can it be fairly said either that our technical colleges and universities pay adequate attention in the training of our engineers to matters of commercial economics, or that our representative engineering institutions deal at all seriously with the business side of our profession?

If a due perception of this point could be gained, very much more would follow clearly which at present is foggy with doubt and discussion. Branches of engineering such as the gas and electrical professions, to quote only one instance, are armed and rival camps, whereas they ought to be co-operative forces, and would be if the knowledge of commercial economics had sufficient influence to produce a proper sense of proportion. Coming closer, we have in our own ranks dissensions which, at times, are apt to become almost rancorous between electricity supply engineers, electrical plant manufacturers and others. As a final word, is it not possible that a large amount of the devastating strife which at present exists between capital and labour in our own industry as in others, arises simply and solely from an absolute blindness on both sides to a sense of simple proportion?

Ultra-Violet Rays.

Any stick—even a dirty one—is good enough to beat a dog with; and the enemies of the electric light have never been fastidious as to their choice of weapons when they have had an opportunity of dealing it a foul blow. Therefore we are not surprised to find the ultra-violet ray bogey resurrected from time to time, although the spectre has been laid repeatedly. We must admit, however, that we are surprised to meet with an oculist who is not aware of the elementary facts with regard to ultra-violet rays.

In an interview with a Birmingham oculist, a reporter of the *Birmingham Daily Mail* was informed "that incandescent gas was less hurtful to the eyes than the electric light, on account of the ultra-violet rays of the latter," and this opinion was given a prominent position in the issue of that paper for October 30th. Although the fact is probably well known to all our readers, it is necessary once more to state that ultra-violet rays cannot penetrate even a thin layer of glass. The flint glass of which lamp bulbs are made is practically opaque to these rays; and even the atmosphere absorbs them to a considerable extent. Every incandescent electric filament, whether of carbon, tantalum or tungsten, is necessarily enclosed within a glass bulb, for if it were exposed to the atmosphere while incandescent, it would be instantly destroyed by burning; hence it is a physical impossibility for any incandescent electric lamp to emit the least trace of ultra-violet rays. Arc lamps are also invariably provided with glass globes completely surrounding the arc, and therefore are equally guiltless of the emission of ultra-violet rays. The same is true of mercury-vapour lamps. The question whether such rays are produced by the filament or the arc is wholly immaterial, for even if they exist within the bulb or globe, they cannot possibly pass through the glass screen which is *always* interposed between the luminous source and the observer.

It is, therefore, an incontrovertible fact that electric lamps, of whatever kind, never emit ultra-violet rays. The matter has been experimentally investigated by many scientists, and the facts have been established beyond doubt or question.

The Lead Position.

The main course of movements in the lead market continues one of firmness, though there are interludes when the tendency becomes rather listless and when prices show a halting tendency. These reactionary moments are, however, only what are to be expected, and they occur principally when a little speculative material has to be realised. There is never any particular wish to make things easy for the speculator who takes a hand in lead, and the consequence is that it is not an easy market to deal in. When the suspicion once gains ground that an outsider wants to realise his holdings, there is an almost unanimous recession on the part of buyers, with the result that the material to be liquidated is parted with under reactionary conditions. A very healthy indication lately has been the marked disposition for the price of far forward deliveries to creep up more nearly towards the level of the nearer dates. This probably arises in part from two causes, first, the lessened disposition to sell forward lead by those whose operations in this direction have for a long time cost them dear, and second, to a trifle more inquiry for distant material. These two factors operating conjointly have contributed to give the market a sounder appearance, and the future is regarded as being more assured. All the news to hand from Mexico fully bears out what has been stated in these columns from time to time. The hopes entertained a month or so ago that the country was settling down to more peaceable conditions have been dispelled again, and as far as can be gathered the position at the big Torreon smelter is just as bad as ever. It is difficult to understand how industrial operations can be carried on at all in the midst of the human butchering which is going on, and of the ceaseless conflict between

mutually destructive forces. These have been making a dead set at each other in the Torreon district, and their attentions to each other have destroyed all chance of the early resumption of lead shipments from there to Europe. The continued absence from the market of Mexican lead is inevitably tending to stiffen up prices, because of the scarcity which manifests itself as the result, but yet the world manages to scrape along somehow, though as far as can be ascertained the reserves are down to a very low ebb. The price, however, pretty well reflects the position, and while it is hardly likely values can advance very much with the poor general trade reports, and the flabbiness of sentiment generally owing to talk of the trade reaction, there is yet no reason why consumers should anticipate any material relaxation in the rates ruling at present for lead. As has been pointed out above, the best informed market opinion is disposed to look for a prolonged period of scarcity, as is indicated by the reduction of the premium which immediate and near deliveries command over forward, and this is hardly likely to be accompanied with any material relief in the position as regards prices. Consumers are taking material as sparingly as they can manage to do, and their reserve stocks must be quite inconsiderable, for the policy of hand to mouth buying has been persisted in now for many months. While the export demand, which a few weeks ago assumed rather considerable proportions, has subsided to a certain extent, there is yet for all that a steady inquiry for material for shipment, and the interest taken by Russian buyers continues. From the inquiries which have been made lately among the electrical people, consumption there seems to remain pretty well as good as ever, but there is still the same slackness and indifference experienced in connection with the building trade, where naturally the season of the year acts as a deterrent upon fresh enterprise, while this section is, of course, influenced by the quiet condition of general trade. The consumption by the electrical trades is regarded as being likely to continue good for quite a time yet, not only in this country but also on the Continent and in America. The supply of material in the United States is, of course, being affected by the Mexican trouble, but the price there is regarded as being rather low, and any alteration for the better in the industrial outlook might easily have quite a sharp influence upon the market.

Australian Trade and Industry.

The Australian Government has recently appointed an Inter-state Commerce Commission to inquire into all matters concerning the trade and industry of the Commonwealth. It is one of the duties of this Commission to inquire into the conditions under which Australian manufacturers work, particularly in relation to the competition which they have to meet from imported goods and the effects of the existing rates of Customs duty. As a preliminary to its investigations, the Commission has dispatched to existing manufacturers a list of 29 questions, which it apparently expects to have answered. It would be difficult to think of a question which is not included in this schedule, and it is most unlikely that anyone but a practised statistician could give the necessary replies. Not satisfied with this, however, the Commission has also prepared a list of questions to manufacturers "who desire to have the tariff modified to suit some industry that they have in prospect." This list is even more exacting than the other, and to give an adequate reply would require a knowledge of manufacturing and distributing conditions all over the world. If the Commission is successful in obtaining satisfactory replies to its questions and can tabulate the results, its report will prove a mine of valuable information, not only for Australian interests, but for the whole of the manufacturing world.

In this connection, the Board of Trade is informed by the Trade Commissioner in Australia that the Commission will be prepared to consider evidence at an early date with regard to the operation of the tariff and the preference accorded to British manufactures. It is accordingly recommended that British firms having representatives in Australia should at once communicate with those representatives if there are any matters that they may wish to submit for the consideration of the Commission. His Majesty's Trade Commissioner will be ready to render whatever assistance he properly can in connection with the matter. Whilst firms locally represented will thus be in a better position to place their views before the Commission, inasmuch as their representatives will be able to give oral evidence if called upon, it has been ascertained that the Commission will be prepared also to consider the sworn affidavits of British firms which are not represented locally. Any such affidavits should be forwarded to His Majesty's Trade Commissioner, Melbourne, either directly or through the Board of Trade. It is understood that the Commission is likely to attach more importance to representations from individual firms affecting their particular business than to general representations from trade associations or Chambers of Commerce.

From previous experience we know that the Australian Government is well disposed towards British goods, and that, after a natural consideration of Australian interests, it is prepared to give a preference to our goods in competition with foreign. It will, therefore, be well for our manufacturers to study the tariff rates of duty which they now have to pay in Australia, and to make such representations as they may deem necessary. It is, of course, impossible to say what the result of such representations may be, but apparently the British Trade Commissioner is in close touch with the Government, and will be prepared to back up any arguments which may be placed before him, and which seem to be reasonable, having in view the protection of Australian interests and the safeguarding of the revenue.

The Electrical Industry and the I.E.E.

At the opening of the new session of the Institution, with advance copies of the chairmen's addresses raining upon us, we are struck with a certain feature which more or less prominently characterises them all. They all look to the future. We have already commented upon Mr. Vernier's weighty remarks on the larger aspects of electricity supply and the requirements of electric traction on our railways; Mr. Proctor concerned himself more with local considerations, but evinced a similar interest in coming developments, and an optimistic view as to the rapid growth of "other uses" of electricity. In passing, we may say that we see no immediate reason to anticipate the arrival of a 50-candle, 200-volt, 25-watt lamp for a long time to come, and there is no need for supply engineers to worry themselves unduly on this score. Dr. Marchant, in his striking address, of which we give an abstract in this issue, also looked ahead, and while uttering a serious warning as to the inevitable result of starving the rising generation of electrical engineers, supported Mr. Vernier's forecast of the coming electrification of our railways. Last to hand is the address of Mr. Woodhouse, who appropriately follows Mr. Vernier's essay on the generation and distribution of electricity with a consideration of the better utilisation of the energy of coal, while he foreshadows a period when, by centralisation and co-operation, electricity will play a predominant part in the distribution of energy.

We are all, in fact, looking forward to see what the future will bring forth, and we are looking to the Institution of Electrical Engineers, rescued from the danger of becoming a purely scientific body with a falling membership and a dwindling influence, and reinvigorated with new blood and progressive ideas, to lead the whole industry along the lines of sound and enlightened development towards the fulfilment of Dr. Ferranti's ideal. We hope and expect to see the Institution taking vigorous and determined action towards raising the status of the profession and improving the position and prospects of its younger members; keeping a keen watch on legislative and administrative proposals, and acting fearlessly and promptly in the interests of the industry when the need arises; promoting research, co-operation and invention, and in every possible way exerting itself in the cause of progress and reform. So shall it become, as prophesied by Mr. J. F. C. Snell, the premier engineering institution of the Empire.

D

ELECTRICAL ACCIDENTS IN MINES.

From the reports of H.M. Inspectors of Mines we find there were in 1912 11 fatal accidents and 33 non-fatal accidents in which the persons injured were disabled for more than seven days, due to electricity. Of these only one fatal accident occurred in Scotland, which Mr. Walker, H.M. Inspector for the district, states: "is a record for the Scotland division and reflects great credit on all whose duty it was to supervise the electric plant at the mines." We are in complete accord with this, but we are not quite so sure about what follows: "It is, I think, to some extent due to the good work which is being and has been done by the Association of Mining Electrical Engineers in Scotland, and which has resulted in a better class of colliery electricians, from all points of view, being employed at the majority of the mines. These officials, I find, as a rule, take an intelligent interest in the installations under their charge, with the result that the supervision is more careful than was the case in former years." We have no doubt the Association will be very pleased indeed with the compliment, and, in fact, it was quoted by the President in his address at the annual general meeting held at Birmingham on October 3rd and 4th last, as proof that the Association was doing good work, but apparently it was the only proof he could produce, and it scarcely agreed with the plaints in the rest of his address. With this, however, we propose to deal on some other occasion; in the meantime it is interesting to note that Mr. Walker also says: "Credit also must be given to the new Electricity Special Rules, and the excellent memorandum drawn up by the Committee who drafted the rules, and it must be gratifying to the Committee that their labours to obtain safer working in mines appear to have begun already to bear fruit," and we are inclined to give much more credence to this extract than to the former. Mr. Walker might have added that it was credit very easily obtained, as it was a remarkably easy task to draft rules insisting upon better plant being installed and better maintenance. There is, we think, ample evidence of this in the Inspector's previous reports, from the number of notices given to owners to put their installations in order, to comply with the new rules.

The fatal accident occurred at Kenmuir No. 3 Colliery on September 4th, 1912, and caused the death of a coal-cutting machine-man. Three-phase current at 440 volts, supplied by the Clyde Valley Electric Power Co. from a sub-station, was used, and deceased received a shock from the machine owing to the plug connection between the trailing cable and the machine being wet, due to water falling on it from the roof of the seam, thus allowing leakage to the machine frame. The frame of the machine was connected by a length of 7/20 cable to the gate-end box, and then by a length of 19/18 cable to an earth plate at the surface, a distance of about 600 yd., and there was also an intermediate earth-plate in the sump at the shaft bottom. Mr. Nelson, H.M. Electrical Inspector, visited the colliery and investigated the accident, and was of opinion that the probable cause of the frame becoming electrically charged was that the end of the earth-wire at the surface was fastened to a short length of old rail, in a very rusty condition, buried about 3 ft. in the ground, *so that it was rust rather than metal which was making contact with earth*, and the connection with the earth cable was poorly made. *The latter was so slack that some earth had forced itself between the head of the bolt and the web of the rail.* The plate in the sump it was not possible to examine in position, but it was explained that it merely dipped into the water, and, in these circumstances, it is not difficult to account for its failure. (The italics are ours.) We should think not, and we might ask who was, and what was the training of, the competent electrician in charge? We say *was*, as surely anyone calling himself an electrician, and responsible for such a state of things, could scarcely expect to be retained. Mr. Walker goes on: "It is explained in the memorandum issued with the Electricity Special Rules that earth plates should be sunk in the ground and not simply immersed in water." But how is an earth plate to be sunk in solid rock, and what was the use and object of an intermediate earth plate? and how was it attached? It is practically useless to fix earth plates underground.

As the wet conditions at the colliery were such as to require strict compliance with the special rules, Mr. Walker requested Mr. Nelson to inspect the remainder of the plant, and he "reported that to provide adequately for safety, much remained to be done in improving the standard of insulation"; Mr. Walker then informed the owners that if they did not voluntarily bring all the plant up to the required standard, he would be compelled to give them formal notice to do so, with the astonishing result that "they then decided to stop the working of the seam, as the quantity of coal remaining to work, in their opinion, did not justify the very moderate outlay which would have been necessary." Now, was that real Scotch frugality or "pique," or a little of both? And what value did they place upon the lives of the workmen?

As regards the non-fatal accidents, of which there were nine, Mr. Walker says: "an analysis shows that three were due to abraded cables, in circumstances in which it is reasonable to say that a metallic covering in each case would have prevented the abrasions. Other three were due to failure of insulation of trailing cables. Trailing cables, I fear, *do not always receive the care they require*, nor the close periodical examination which is imposed by Electricity Special Rule 14 (i). The remaining three accidents were due in a greater or less degree to *casual and careless methods of working.*" (The italics are ours.)

1. A pony driver received a shock from an unarmoured electric cable, which was suspended by means of pieces of sail-cloth attached to nails driven either into props, or pieces of wood let into the strata at the side of a road.

His pony was taking a full load of coal along the road from the face to a siding; the tub was made of iron, and was fitted with a door at one end which was hinged at the top, and when about 20 yards from the siding the cable was caught on one of the hinges, with the result that the insulation was damaged, and the tub came in contact with the copper core and became "live." The current passed along the tail chain to the pony, and it was killed, while the driver, who was walking between the pony and the tub, received a shock and was burnt. Another driver heard him shout and gave an alarm, and the current was switched off by a fireman, who, on going to the driver's assistance, found he was unconscious. Fortunately, the fireman was trained in "first aid," and at once started artificial respiration, and after half an hour the injured youth regained consciousness, and ultimately recovered. The fireman deserves great credit for the promptitude with which he started artificial respiration and for persevering with it; he has the satisfaction of having, in all probability, saved the driver's life; if artificial respiration had not been immediately resorted to it is highly probable he would have succumbed to the shock he received.

A small fall had taken place from the roof of the road and displaced one of the pieces of wood driven into the strata, and thus allowed the cable, which prior to this occurring was 20 in. from the tub, to come in contact with it. If the cable had been protected by a metallic covering, it was probable that the accident would have been prevented.

2. A pony driver received an electric shock when driving a pony on an underground road. He was taking in an empty tub, and when passing a gate-end box near the face, the tub was derailed and struck the box; at the same time the edge of the tub wheel cut the cable, which was not protected by metallic covering, and caused a short circuit. The gate-end box was placed on the pavement in a small recess near the face, and in the ordinary course of working the tub rails were about 14 in. clear of the box, but, owing to the rails being slewed out of position, the box was considerably nearer the rails when the accident occurred.

This is another instance where armoured cable would, in all probability, have prevented an accident which might easily have had fatal results. The owners of the colliery have since introduced double-armoured cables throughout the mine.

3. A coal-cutting machine-man was slightly burned by the insulation of a trailing cable being damaged by a stone falling from the roof on to it.

4. A coal-cutting machine-man was slightly burned on his arm by a failure of the insulation of a trailing cable.

He was lying by the side of the machine tightening a nut on one side of the haulage pinions, his arm resting on the trailing cable, when the current short-circuited.

5. A coal-cutting machine-man was burned on his left arm when he and another man were making a temporary joint in a concentric cable, the insulation of which had failed two days before. The electrician stated that he had switched the current off and intended to return to the place to make a permanent joint, but other important work intervened and he did not get back. He saw the machine-man, and, as the latter had often been present when joints were being made, told him to make a temporary joint to get the cutting machine started. A piece of wire was being wrapped round the armouring, when there was a flash, and the machine-man's left arm was slightly burned.

Repairs of this kind should only be undertaken by competent electricians, and not by ordinary machine-men, but these men could easily have satisfied themselves before beginning the work that the cable was dead, as the switch was only 150 yards away, and they should have done so.

6. The plug of a trailing cable had become fastened in the socket of a coal-cutting machine, owing to a screw in the plug coming loose in the socket; an assistant electrician was sent to the machine to take out the plug and adjust the screw so as to allow a spare machine-man to complete the cut during the next shift. While he was working at the machine the spare machine-man came in and switched on the current by putting the other end of the trailing cable into the gate-end box, with the result that the electrician was severely burned about his left hand.

The accident was caused by want of care on the part of the injured man, as he failed to put up a notice provided for that purpose, warning persons not to put in switches as men were working on the line at the gate-end box, and also on the part of the machine-man, who, before he switched on the current, should have gone forward to the machine to see that no one was working at it.

The fireman, too, showed a great want of care in not informing the machine-man that the electrician was working at the machine.

In cases of this kind, it is desirable that the manager should make a rule that anyone working at the electrical part of the coal-cutter should first withdraw the fuses at the gate-end box, and keep them in his possession until the work is completed, and also that the current should not be switched on at the gate-end box until the machine-men have been to their respective machines and ascertained that all is ready and everyone is clear.

7. A bencher was burned on his right hand. He was reaching over an unarmoured cable suspended at the side of a horse haulage rope to get a link which was on a ledge of rock, and in doing so touched the cable and received a shock. The fireman was coming towards him, and found the injured man on the cable; with considerable promptitude he seized a coat lying near and hooked it round the man's arm, and pulled him from contact with cable, and then applied artificial respiration, with the result that he recovered in a few minutes.

After the accident it was found that the insulation of the cable was chipped off, probably by a piece of stone falling from the roof or sides, for a length of $1\frac{1}{2}$ in., and a small area of the copper core was bare. If the cable had been protected by armouring, it is probable that this accident also would not have occurred.

8. A drawer, finding a trailing cable was in his way, picked it up to move it, and, owing to the insulation being damaged, his hand was slightly burned. The trailing cable had only been in use six weeks, but appeared to have been roughly used.

9. The coal-cutter machine-man received a slight shock. A short developed between two cables inside the machine, with the result that the frame of the machine and the rails on which it ran became "live," and the injured man received a shock. The earth wire, owing to carelessness on the part of the man in charge of the machine, had not been coupled up to the frame of the machine, and it is, therefore, fortunate that the accident did not terminate fatally.

(To be continued.)

ECONOMISING TRANSFORMER MANUFACTURE.

The improvements effected in insulating materials during recent years have made possible higher voltages in transformers; improved magnetic irons have reduced core losses so far that an efficiency of 99 per cent. can be realised at full load in large transformers; and improved methods of cooling have reduced the weight of transformers per KW. output and the cost of their manufacture. Future improvements in efficiency will be of minor interest to users of electrical apparatus, owing to the larger wastages occurring in other directions, but they will be of importance to manufacturers since, other things being equal, a slight difference in efficiency may determine the placing of an order with one firm or another.

In view of the important advances which have been made in the above directions, it is surprising how little attention

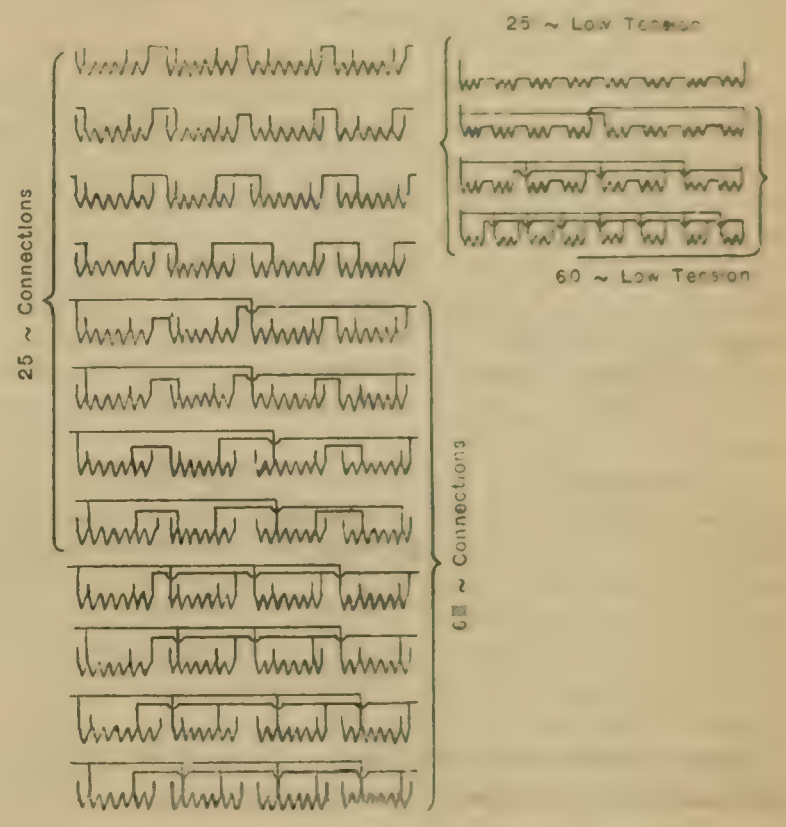


Fig. 1.

has been given to the production of transformers adaptable to supplies of different frequencies. By producing transformers more flexible in this respect, much of the expense at present imposed on manufacturers by the necessity of stocking non-interchangeable apparatus would be avoided, and quick delivery would be facilitated. Obsolescence charges rapidly reduce the value of stock apparatus, and have frequently been responsible for stifling improvements.

The voltage ratings usually available in transformers stocked for operation on a certain frequency are:—H.T., 2,200/1,100 volts; L.T., 450/220/110 volts. This range

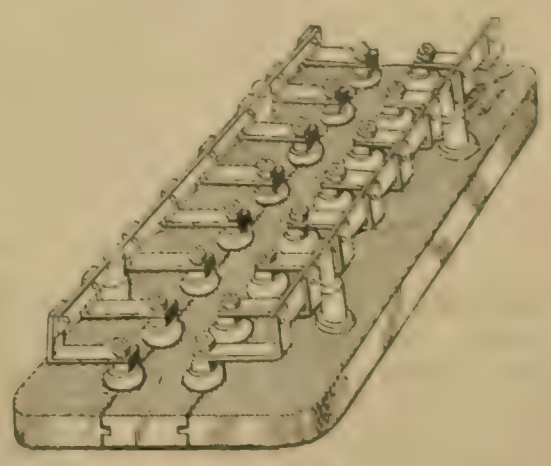


Fig. 2.

covers fairly well present-day lighting and motor circuit needs, but much greater flexibility can be obtained by arranging transformers for multi-frequency operation.

With a view to examining the possibilities of this practice, Messrs. Thornton & Goldman* recently adapted a number of

* *Electrical World*, 61, pp. 402 *et-seq.* 1913.

self-cooled and water-cooled 25-cycle, 13,200/4,480-volt transformers to operation on 60-cycle supply. The necessary alterations in connections are shown in fig. 1 herewith; these can easily be made on the connection-board of the transformers (see fig. 2). Owing to the parallel connections of the coils, the number of pressures obtainable in the secondary is one less for 60-cycle than for 25-cycle operation.

In changing from the series 25-cycle connection to the parallel 60-cycle connection, the ratio of turns in series is as 2 : 1, hence the ratio (flux at 25c/flux at 60c) = (60 × 1/25 × 2), *i.e.*, the flux density is increased in the ratio 5 : 6 by the change from 25 to 60-cycle operation. The eddy losses vary with $(c)^2$ and $(B)^2$, while the hysteresis loss varies with (c) and $(B)^{1.6}$, hence the core loss is greater at 60 than at 25 cycles, and care must be taken that the efficiency guarantee is not sacrificed. The limitations with respect to saturation are at 60 cycles, so far as concerns heating and efficiency of the transformer, but where new alloy steels are used, the magnetising current (dependent primarily on saturation) sets the limit, hence the flux density at 25 cycles is generally the governing feature.

The resistance of the windings, as connected for 60-cycle operation, is one-fourth that for 25-cycle operation, so that the load may be doubled for the same copper loss. In self-cooled transformers the tank radiation limits the permissible iron and copper loss, and, since the core loss is increased at 60 cycles, the copper loss must be decreased. The total core and copper loss was practically unaltered when a 25-cycle, 500-KW. transformer was operated at 750 KW., 60 cycles. By an examination of its design, it was determined that a 500-KW., 25-cycle transformer should be able to operate at 750 KW., 60 cycles, hence tests were made at this rating.

In water-cooled transformers, the temperature rise is kept down by the combined action of tank radiation and cooling-water circulation. By doubling the water supply, a 25-cycle, 750-KW. transformer can be operated at 1,500 KW., 60 cycles, with practically the same temperature rise, but increasing the load and water circulation still further would produce a steep temperature gradient and lead to hot windings and short life.

A summary of commercial test and heat-run data relating to self-cooled and water-cooled transformers is given in Table I,

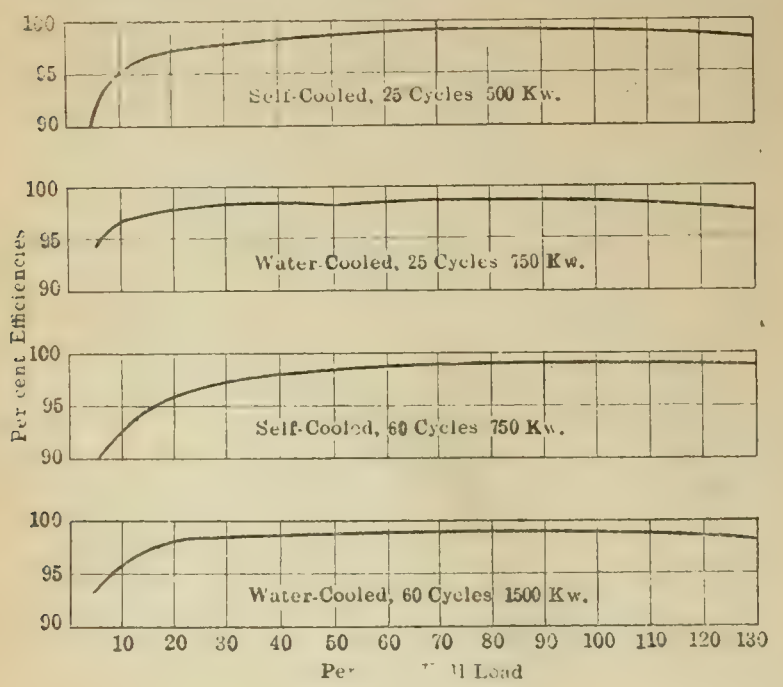


FIG. 3.

and the load efficiency characteristics of the two types of transformers at the ratings selected are shown in fig. 3.

Changing the connections from 25 to 60-cycle operation doubles the P.D. between turns; though the breakdown pressure between turns of modern transformers is usually over 2,000 volts on test, the fact remains that the insulation between turns is the weakest point in modern transformers, and doubling the P.D. to which it is subjected would probably increase appreciably the frequency of breakdowns.

Adding more insulation, or substituting a little more mica in place of paper, would not only enable a 13,200/4,480-volt, 25-cycle transformer to be used at these pressures on 60-cycle supply, but might even allow of operation at twice these pressures on 25-cycle supply. The core losses would then be rather high, but it would be the greater magnetising current which would limit the pressure increase permissible.

By actual tests, Messrs. Thornton & Goldman verified that a single transformer could operate at all the following ratings :—

	Self-cooled.	*Water-cooled.*
25 cycles at 13,200/4,480 volts or not over 26,400/8,960 volts	500 KW.	750 KW.
60 cycles at 13,200/4,480 volts	750 KW.	1,500 KW.

This result is secured by adapting the transformer to multi-frequency operation and by providing water-cooling in certain cases.

In this country the frequencies concerned would usually be 25 and 50 cycles, but from the accompanying data the necessary modifications can easily be deduced.

TABLE I.—COMMERCIAL TEST AND HEAT-RUN DATA.

	Self-Cooled.		*Water-Cooled.*	
Commercial Tests.	500 KW. at 25 ~	750 KW. at 60 ~	750 KW. at 25 ~	1,500 KW. at 60 ~
Core loss at normal voltage (watts) ...	3,100	6,200	3,150	6,200
Exciting current at normal voltage (%)	10	4	5	2
Full load copper loss (watts)	4,690	2,415	9,670	9,670
Full load impedance drop (%)	4·15	4	—	—
Regulation (%) ...	1·1	—	—	—

Heat-run Data.	*Full load.*	150% *load.*	*Full load.*	150% *load.*	*Full load.*	150% *load.*	*Full load.*	150% *load.*
Duration of test (hrs.)	24	2	24	2	12	2	12	2
Galls., water per min.	—	—	—	—	3·5	3·5	6·5	6·5
Temperature (°C.) Room	18	14·6	15	16·5	18	16	14	13·5
Tank—top ...	24	32	25	25	12·5	20	16	22
Tank—bottom ...	12	18	10	11	6	12	6·5	11
Oil surface ...	30	39·5	31	32	15	25·5	18	27
Water—entering	—	—	—	—	13·5	15·5	12·5	12
Water—leaving...	—	—	—	—	20·5	23	19	18
Primary coils * ...	41	56	40	45·5	34·5	54	40	55
Secondary coils *	40	56	40	45	34	42	35	45

* By resistance measurements.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Extra-High-Pressure Cables.

It is with considerable interest that I have read your abstract of Mr. Charles Vernier's address in Newcastle, and in substantiation of the author's remarks on extra-high-tension underground cables, the following particulars may be of interest.

As regards the 45,000-volt three-core three-phase cables referred to in the address, it will be of interest to state that the manufacturers of this cable have lately also supplied a two-mile length of 60,000-volt three-core three-phase cable; naturally both of these cables were not commercially possible with dielectric thicknesses approximating in any way to those specified by the British standard specification on account of, as so ably stated by the author, the excessive cost of lead and armour.

However, the dielectric thickness for the 60,000-volt cable was only ·59 in.; the manufacturers are further able to substantiate Mr. Vernier's proposition by accepting the 11,000-volt British standard specification for 20,000-volt supply; for 11,000-volt cable the thickness of dielectric they employ is ·236 in., which they have used for the last 10 years; this cable they pressure test to 40,000 volts, and they guarantee a minimum break-down test of 100,000 volts.

As regards shaped conductors, they are also in agreement with Mr. Vernier's remarks, as they will only accept these thinner dielectric thicknesses for round conductors; for shaped conductors they require a thicker insulation, which does away with the advantage of shaped conductors. Also as regards dielectric thickness in relation to core section, in this their tendency is in exactly the opposite direction to the

British Standard Specification, inasmuch as they increase the thickness of dielectric as the section of the cable decreases.

I think it was Dr. François Borel who, in an address to the Swiss Society of Electric Engineers, first drew attention to the important factor of surface core tension as determining the dielectric thickness of extra-high-tension cables, and went so far as to suggest that when very high tensions were employed with consequent small copper sections, "it may be necessary artificially to increase the diameter of the conductor by supplying it with a jute core, or preferably placing a thin lead sheath over the copper." This latter method would have the dual advantage of—

1. Increasing the diameter of the conductor, thereby reducing the surface tension per unit area.

2. Supplying a smooth surface under the dielectric; this would not only be better in offering a smooth surface for the paper to slide over, but also would obviate the tendency of small brush discharges, say from the six points of a seven-strand conductor.

In conclusion, the cable manufacturers should be more than grateful to Mr. Vernier for once again drawing attention to this important subject.

E. Coates, M.I.E.E.

London, W., *November 1st*, 1913.

Remarkable Motor8Records.

I am pleased that the designer of the motors has, as I intended, written a letter in yours of October 31st. Taking the letter point by point, I may say that I did not assume him to be the writer of the original article, the last paragraph implying the negative more or less clearly. Regarding the figure "160" I "imported," the article states that "without any very drastic change, &c., a machine can be built to give with ease more than twice customary full load." I therefore, I now confess, apparently unjustifiably assumed 2 × 80 to be 160.

The designer now states that the motors were designed to do 120 B.H.P. at 650 R.P.M., whereas the article gave the rating as 80 B.H.P., again as 120 B.H.P. at 230 to 650 R.P.M. on full and half field respectively, implying "shunt variation." Again, it compares them with "other machines of 120 B.H.P. at 230 R.P.M." Surely this makes it clear that the claim is 120 B.H.P. at 230 to 650 revs. on full and weak field. Therefore, as regards the "nature of the design," I must maintain that if, as you state, there are "no very drastic changes in the design," the ordinary laws still hold good, and the time required for the rise to final temperature still occurs when rate of heat generation equals rate of radiation, this being governed by factors—first, energy radiated per time and per temperature unit; secondly, energy-storing capacity of machine per unit increase of temperature. Unless there are "very drastic changes," the relation of above quantities will not be very materially altered, from ordinary practice.

Moreover, to get a minimum time to reach final temperature is it not pretty obvious the machine will be "essentially a copper machine?"

I am sorry to have to confess myself still of the opinion that a commercial competitive machine of this size and speed cannot be built with an efficiency much greater than 87 per cent., "tested" mark, not catalogued. I have carefully re-read the original article, and as a result wish to emphasise my previous remarks.

I hope this letter will make my position clear, that in "criticising" I am trying to get definite justification for printed statements, for the benefit of myself and in "the best interests of the industry," to use your original words. I hope in this discussion I and the writer of the last letter do not get off the "well defined road" or "beaten track" on to "side tracks." On the publication of test data and cost per B.H.P., I shall be the most eager to compliment, and to express my sorrow for my presumption.

At present I am more sceptical than at first.

W. Rae Joss.

Harrogate, *November 3rd*, 1913.

[The reference to "customary full load" related to the customary load of *other* machines of the same size. The machines are still running.—Eds. Elec. Rev.]

Recording Pens.

Following upon the new principle suggested in the interesting paper by Mr. Kenelm Edgcumbe, that the "grapher graphs," it will be readily seen that this gentleman "advers" that, among other things, the modern tendency is towards "some graphers" employing the bucket type of recording pens.

Fig. 3A, on page 650 illustrates the old or tubular type of "Dittmar" pen, and calls for no further comment.

Fig. 3B, however, calls for some explanation in order to differentiate it from the other, and to account for its proved superiority in action. The two parallel dotted lines in the figure indicate a groove, pressed in the side of the bucket, which conveys the ink to the marking point of the pen. The path taken by the ink is, therefore, visible, and this improved and patented form of construction also facilitates the starting and cleaning of the pen.

A. Dittmar.

Shooter's Hill, *November 3rd*, 1913.

Travelling Representatives.

It is a great relief to know that you do not take any responsibility for the views of your contributors, for I have never read such nonsense as that expressed in "Anti-Traveller's" letter. As an old hand "on the road," it is quite evident to me that his knowledge of up-to-date business methods is nil. If representatives are not necessary, why on earth is every manufacturing firm so anxious to obtain the services of those men who know the best buyers and are competent to interest them and sell their goods? Surely not from a mistaken sense of philanthropy! Now-a-days it is more necessary than ever to have good men who are able, by their personality, to procure business, as amongst a large number of first-class firms manufacturing dynamos, motors, &c., there is little to choose in price or quality, and it is up to the representative alone to get the business. The writer might mention that in about eight years he has increased the turnover in this district for his company 800 per cent., the majority of the business being done more or less "on personality."

Traveller.

Cost of Living in India.

I would ask those of your readers who have had experience of life in Calcutta to kindly inform me of the facts regarding the effects of the climate on a British subject, social conditions, and cost of living. In short—is the country desirable to a British subject? and lastly, I seek a word of advice on the matter of remuneration, engagement pending.

A Young Engineer.

[Articles on the cost and conditions of living in India appeared in our issues of May 10th, 1907, and October 18th, 1912; see also letter, November 29th, 1912.—Eds. Elec. Rev.]

Electric Cooking for the Smaller Consumer.

In reply to the letter of Mr. T. Birkett, in which he offers some welcome criticism on the article which I wrote on "Electrical Cooking for the Smaller Consumer," I should like to state that Mr. Birkett has quite missed the point of that article. If he will carefully read the same again, he will see that I do not blame the manufacturer to any extent for not providing the necessary apparatus, I merely state that he will have to provide a cheaper and more efficient apparatus, and that it may be that he will require some urging to discard the present patterns which are selling well, but which will hardly at present meet the cases I mentioned.

The whole object of the short article was to insist that the present attitude of the station engineer with a few cookers on his mains is one which will shortly land him into difficulties unless the cooking load amongst the smaller consumers is cultivated. The figures which I gave for the cost of lighting and cooking with gas at 2s. 6d. a thousand cb. ft. are actual figures, and the bills from the gas company were sent to the Editor as proof of the correctness of the prices and costs mentioned. In many places the cost of gas is con-

siderably below the figure mentioned, and the necessity for an electric oven, which shall be more efficient than the present type, is in such places much greater than where gas is comparatively high priced. I have always admired the manner in which the Simplex people have come forward with a low-priced and highly efficient cooker, and shall be glad to hear from them through the editor, though just at present I cannot offer to subject one of their ovens to a test.

In conclusion, I shall be glad if Mr. Birkett will bring forward the best set of costs for 12 months' use of one of their cheaper stoves; the stove to have done all the cooking for 12 months for a family of six, and the actual bills to be sent to the editor of the REVIEW. If at present this is not possible, then I am sure that if Mr. Birkett will put forward the best results which his firm are prepared to guarantee in order to compete with the circumstances named, the readers of the REVIEW will be very thankful to him.

The Writer of the Article.

THE SOUTH-WESTERN RAILWAY CO.'S ELECTRIFICATION SCHEME.

WE have received the following details of the South-Western Railway Co.'s scheme for electric traction, the outline of which was published in our issue of December 13th last.

Within the last few days work in connection with the electrification of the suburban lines has been commenced at Teddington, and a few notes, therefore, descriptive of the scheme will be interesting, especially to London readers.

The power house will be situated at Wimbledon, immediately to the east of Durnsford road sidings, and adjacent to the main line.

The foundations will be sufficiently far advanced for the erection of the steel structure to be commenced at the end of this year. The building will consist of two main bays forming a boiler house and turbine house, with a switch house attached, and will be 260 ft. long by 210 ft. wide.

There will be two chimney stacks at the west end, each 236 ft. high and 13 ft. 6 in. internal diameter.

A line will be constructed and carried on a viaduct from a point near Durnsford Road Bridge, up into the roof of the boiler house, from which coal may be dumped from wagons direct into bunkers over the central firing floor.

The boiler house will contain, when completed, 24 boilers, each capable of a normal evaporation of 20,000 lb. of water per hour, and of supplying steam at a pressure of 200 lb. per sq. in., and with a superheat of 200° F.

Coal from the overhead bunkers will descend through shoots into mechanical stokers driven by electric motors; economisers will be fixed in the main flues for heating the feed water for the boilers.

The turbine room, when completed, will contain six steam turbines coupled to 5,000-KW. three-phase alternators, which will run at 1,500 R.P.M., and will generate current at 11,000 volts.

There will also be two auxiliary steam turbines coupled through gearing to 400 KW. direct-current dynamos for supplying power for the power house lights and auxiliary motors.

The switch-house will have three floors and will contain all the switchgear for controlling the main generating plant and the outgoing feeders. The main oil switches will be controlled from a desk erected on a balcony on the first floor of the switch-house overlooking the turbine house and will be electrically operated.

Below the turbine house a basement will contain surface condensers, with the necessary air and circulating pumps, together with ten hot wells and boiler feed pumps.

A 40-ton overhead electric travelling crane will span the turbine room for overhauling purposes.

The current generated at 11,000 volts at the power house will be transmitted to nine sub-stations by three-core paper-insulated, lead sheathed and wire armoured cables, and these will in most cases be supported on posts beside the line and will be so arranged as to afford a duplicate supply to every sub-station.

Sub-stations will be erected at Waterloo, Clapham Junction, Raynes Park, Hampton Court Junction, Barnes, Twickenham, Kingston, Sunbury and Isleworth.

The buildings, with the exception of that at Clapham Junction, will be 50 ft. wide and from 65 ft. to 103 ft. long, and will consist of a machine bay and a switchgear bay. At Clapham Junction the sub-station will be located on platform under the gangway.

Each sub-station will contain static transformers and rotary converters, together with the necessary switchgear, for transforming the three-phase high-tension current to direct-current at 600 volts, in which form it will be used by the trains.

Two sizes of converters will be used, the larger having a continuous capacity of 1,875 KW., at Waterloo (4), Clapham Junction (3), Raynes Park (2), Barnes (2), and Twickenham (3), and the smaller, having a continuous capacity of 1,250 KW., at Hampton Court Junction (2), Kingston (2), Sunbury (2), and Isleworth (2).

From the sub-stations, direct-current at 600 volts will be delivered to a conductor rail which will be laid along the line 16 in. from the running rail and at such a height that the contact surface will be 3 in. above rail level.

The rail, of which considerable quantities have been delivered, is of special steel having a resistance of about 6¾ times that of copper of the same length and cross-sectional area, and weighs 100 lb. per lineal yard. It will be supported by insulators fixed on the sleepers and will be bonded across the joints by four flexible copper bonds expanded into holes drilled in the rails before delivery.

Current will be collected from the rail by means of cast-steel collector shoes hung from the trucks, and the return side of the circuit will be formed by the running rails, which will be bonded across the joints by two flexible copper bonds.

For the first section of the electrified lines, 84 train units are being provided. Each unit will consist of three compartment type coaches, and will be equipped with four motors, each of 275 H.P., together with the necessary control apparatus; these motors will be the largest ever mounted on a passenger coach.

A special motor truck, carrying two motors, will be fixed under each end of the train unit, the remaining trucks being of the company's standard pattern.

The control apparatus will be of the relay automatic multiple unit type providing for uniform acceleration, and controlling from the front driving cab all the motors on a train of any length.

Every train unit will have a driving cab, containing control apparatus for two motors, at each end, two luggage vans and seating accommodation for 190 passengers.

New running sheds and repair shops for the electric trains will be built at Wimbledon, adjacent to the power house, and additional sheds will probably be provided at Hampton Court, Fulwell and Hounslow.



RAILWAYS IN LONDON AND VICINITY TO BE WORKED ELECTRICALLY BY THE S.W. RAILWAY CO.

It is the intention to commence electric working on the Kingston "roundabout" line first, and it is hoped that this line will be in operation before the end of next year.

Electric services on the Hampton Court and Shepperton branches and on the Hounslow Loop line will be added as soon afterwards as possible.

Dust Fires.—Fires in coal mines occasioned by the ignition of coal dust have a parallel in the ignition of sugar dust, which caused the destruction by fire of the Michahelles sugar factory in Hamburg recently—a factory which is among the largest on the Continent. The factory is to be rebuilt on an enlarged scale, and equipped with the latest machinery and improvements, including an electric generating station of its own, and, for the prevention of fires in future, with a most up-to-date electric ventilating system. Firms with specialities of this kind would do well to get into communication with the firm of Gebrüder Michahelles in Hamburg.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Weston Miniature Precision Instruments.

The Weston Electrical Instrument Co., of Audrey House, Ely Place, E.C., have placed on the market a new line of miniature D.C. instruments, made on the same principles and with the same high grade of workmanship as their larger patterns. We have examined a number of these little instruments, and cannot speak too highly of the skill with which they have been designed, or of the manner in which they are constructed ; they are made in a great number of ranges and combinations of ammeters, volt-meters, and volt-ammeters, portable and switchboard types, and battery testers, but are all alike in the main essentials. The scale arc subtends 110°, and the length of the scale is 2·6 in. ; the movement is dead-beat and practically instantaneous, and friction is reduced to the minimum with hardened polished pivots and sapphire-jewelled bearings.

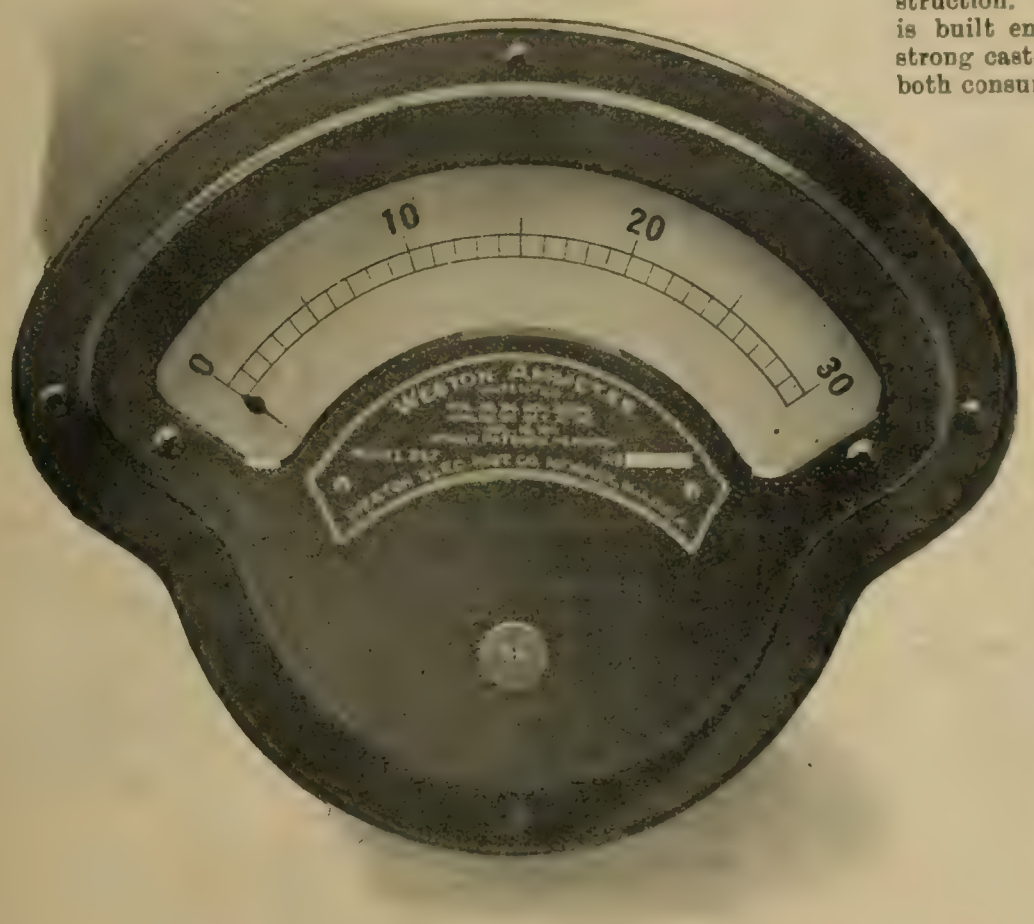


Fig. 1.—Weston Switchboard Ammeter.

The instruments can all be left continuously on full load without overheating or appreciable error, and are practically unaffected by changes in room temperature ; the voltmeters have a resistance of about 100 ohms per volt, and the volt-ammeters 50 ohms per volt. Provision is made for adjusting the pointer to zero, from outside. The cases are of steel, finished dead black



Fig. 2.—Weston Portable Volt-Ammeter.

and dust-proof, and the instruments are all self-contained up to the 50-ampere size. The parts are made accurately to gauge and interchangeable, and the moving system is so light that the instruments are sent by post, and can be mounted on vibrating supports such as the dash-board of a car, without fear of their being injured.

We illustrate the switchboard ammeter, fig. 1, full size, to show the actual appearance of the instrument, which weighs 10·9 oz., and is 1·1 in. deep. Fig. 2 shows a portable volt-ammeter on a reduced scale, having three current and three pressure ranges ; the case is of the same size as before, but in this type a base-board is used to carry the terminals. The instrument measures 4·6 × 4·4 × 1·5 in., and weighs 15 oz.

The battery testing voltmeter is provided with a detachable contact spike and screw terminal, but otherwise resembles fig. 1.

We understand that these miniature instruments have proved so popular in the United States during the past two years that it has been impossible to introduce them here until now, the demand there having exceeded the supply. It is interesting to add that Dr. Weston, who first placed his high-grade instruments on the market in 1888, is an Englishman by birth, and remains to this day a staunch British subject.

Watchman Circuit-Breaker.

The advantages of automatic circuit-breakers over fuses in power service, or even in large lighting services, are widely appreciated, but the obstacle in the way of their more extensive use has always been cost. Messrs. Switchgear & Cowans, Ltd., of Salford, have produced a circuit-breaker which, while very low in price, possesses all the features approved in high-class circuit-breaker construction. The "Watchman," as their new circuit-breaker is called, is built entirely on the metal-and-mica principle, enclosed in a strong cast-iron case, and, being operated by a free handle, it protects both consumer and supplier of power from damage to their property



Fig. 3.—The Watchman Circuit Breaker with Cover Removed.

through closing the circuit on an overload or dead short. Bow-shaped laminated copper brushes, renewable auxiliary contacts and carbon breaks are further details which help to make the "Watchman" a sound breaker. It should commend itself to station engineers because it can be set to operate instantaneously at a definite current, which does not vary as time goes on ; because, if instantaneous action is not desirable, adjustable delay may be obtained by the application of Statter's patent time-lag, in which case the "Watchman" acts like a fuse, except that the amount of lag is under control ; because adjustment having been made, the cast-iron case may be sealed. These circuit-breakers are kept in stock in two sizes, 30 amperes and 150 amperes, drilled for 7/8 conduit, and ready for immediate delivery.

Electric Warehouse Truck for G.W. Railway.

According to the *Railway News* the Great Western Railway Co. has recently purchased a Buckwalter warehouse truck for use at its Swindon works. The truck has a carrying capacity of 4,000 lb., and in steering all the wheels are controlled simultaneously, the turning radius being such that it can run round a post, the man on the truck keeping his hand on the post all the way round. A series-wound enclosed 24-volt motor is fitted, and either an Edison or lead battery—the battery being carried on springs from the frame of the truck, and so arranged that it can easily be exchanged for a spare. A platform for the driver, with a controller and pedal brake, is provided.

These trucks have been largely adopted in America for baggage and goods transport in railway stations, warehouses, works, &c., and are being introduced by the Railway Track Supply Co. (of Great Britain), 81, Gracechurch Street, E.C., who are the agents for this country.

Pipe-Ventilated Motors.

Electric motors are frequently called upon to work in situations where the surrounding atmosphere is far from favourable to the insulation, to the commutation, and to the brush gear, or where it is imperative that they should be protected from explosive gas or dust.

In those situations where motors must be protected from the atmosphere, two alternatives present themselves, (*a*) total enclosure

and (*b*) pipe-ventilation. Total enclosure is a very costly form of protection, and cannot be applied to large motors (of reasonable dimensions); pipe ventilation is the cheaper alternative for small motors, and the only solution for large ones.

In the past trouble has been experienced with some designs of pipe-ventilated motors on account of the fact that a lower pressure existed inside the motor than outside, and, in consequence, oil has been sucked from the bearings into the interior of the machines. In a new line of pipe-ventilated motors which have been designed by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., special attention has been paid to this point.



Fig. 4.—60-h.p. Three-phase Squirrel-Cage Pipe Ventilated Motor.

The motors have been designed specially for pipe-ventilated work, and represent the latest practice in this direction.

Considerable interest attaches to the construction of the bearings of these motors. To avoid the suction of oil, which has been previously mentioned, the bearing is completely separate from the casing, a special bracket being provided. A clear space of air surrounds the shaft where it enters the bearing, so that no suction of oil can possibly take place. The slip rings of motors with wound rotors are specially designed to exclude dust, great care being

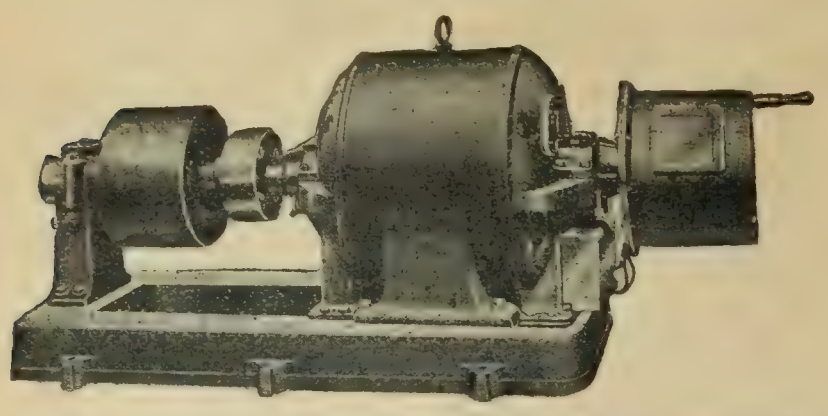


Fig. 5.—250-h.p. Three-phase Slip-ring Pipe Ventilated Witton Motor.

exercised at those points where the short-circuiting bar passes through the slip-ring cover, in order to make the protection against dust thoroughly effective.

The success which has attended the design of these motors is evidenced by the fact that one firm of cement makers has placed two successive repeat orders for the complete electrification of cement works after the first mill had been in operation for a considerable period. To this one firm alone over 7,000 h.p. of pipe-ventilated motors, together with dust-tight liquid starters and other gear, has been supplied by the General Electric Co.

Rolled Steel Gears.

A recent issue of the *Motor* contained an article by Mr. Henry Sturmey descriptive of an American process by which gears of all kinds — spur, helical, herring-bone, bevel and even worm—may be rolled into shape from hot blanks, with not only a remarkable saving in time and some saving in material, but also an improvement in strength; whilst, by means of the process, the production of gears from some alloys of great hardness—silico-manganese steel, for instance—which has not hitherto been accomplished, becomes possible.

In the ordinary way gears are cut from blanks and a great deal of metal wasted, but under the new process, the size of the blank is only equal to that of the pitch line of the teeth, and during the process of rolling the metal required for the formation of the teeth is pressed up out of the body of the blank, so that virtually all this metal usually wasted is saved, as the accuracy of the process is such that gears are produced concentric on both pitch and outside diameter, within ·002 in. and ·003 in. variation, and the diameter will vary, plus or minus, only ·003 in. on an 8-in. gear.

For ordinary machine work the gears can be run in an abrasive mixture for a few minutes, while for the highest class work they can be ground.

From chemical and physical tests carried out, it appears that the rolled gear shows an increased tooth strength of 22·3 per cent. in its normal state and 10 per cent. after being carbonised and re-hardened. The process has been under development since 1909.

The Kesnor Automatic Motor Starter.

Amongst other motor control apparatus, Messrs. Thomas Kesnor & Co., Ltd., of Watford, Herts., have recently developed a line of automatic starters for D.C. motors up to 20 B.H.P. and 500 volts. We illustrate one of these in figs. 6 and 7; it consists of a single-pole main switch and a rheostat operated by a solenoid, and can be controlled by push buttons, pedal or float switches, &c. When the starting button is pressed, the solenoid is energised, and begins to pull up the core; it first short-circuits the starting button, of which it then becomes independent; next it closes the main switch, which is held on by a no-volt coil in series with the motor shunt, and cuts out the starting resistance step by step; this process completed, it allows a catch connected with the main switch to lock the starter in the "pull-on" position so long as the

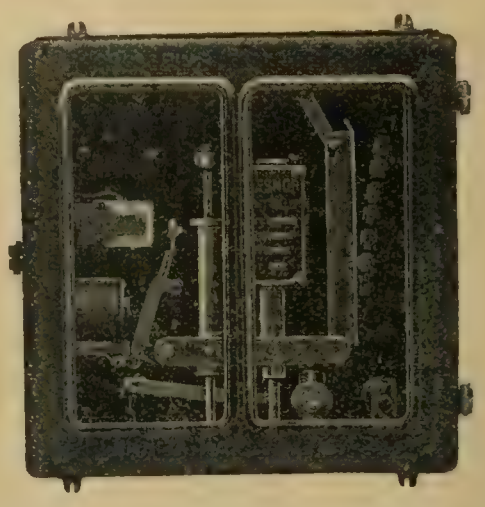


Fig. 6.—Kesnor Automatic Motor Starter.

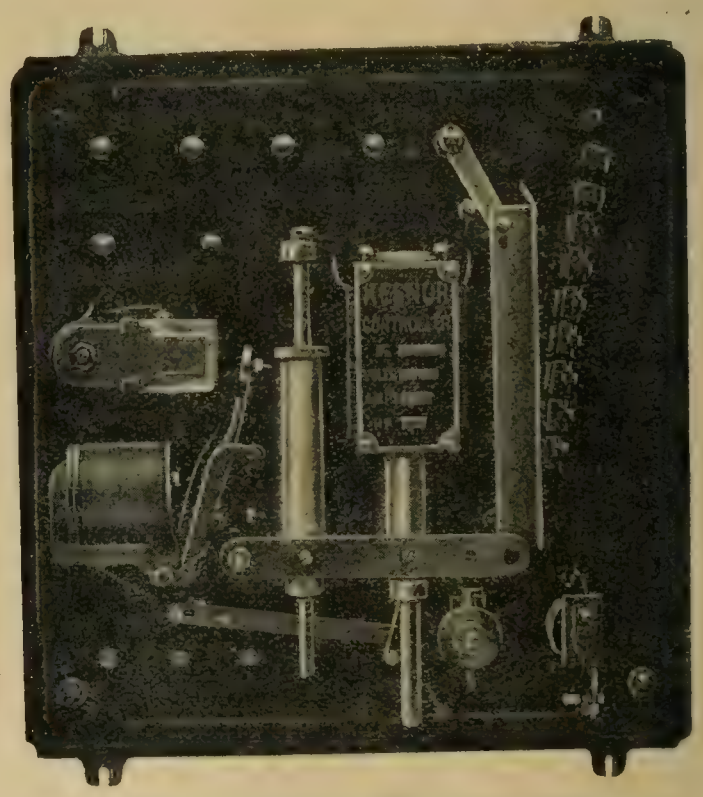


Fig. 7.—Starter Without Cover.

main switch remains closed; and, finally, an electromagnetic trip switch opens the circuit of the solenoid, leaving the starter maintained in the "pull-on" position by the no-volt coil, which consumes only from three to five watts.

The switch is opened by short-circuiting the no-volt coil with a push-button or other convenient device, when the starter at once comes into the original position, and the control circuit is closed again ready for use. Overload release can be provided if desired.

It is claimed that the starter is extremely economical, as the solenoid is only in circuit for a few seconds at starting; the rheostat contacts are carbon blocks working against a copper bar with a revolving motion and flat face-to-face contact over their whole surface. The main switch can only be closed when the whole of the resistance is in circuit, and the starter is completely foolproof. A glazed hinged iron cover is provided. Other Kesnor specialities are a patent elevator controller, push-buttons and relays, gate locks and other elevator fittings.

The Metric System.—The adoption by the Board of Trade of the metric carat of 200 milligrams, in place of the old English carat—which, in harmony with our other brain-twisting units, was defined by the trade by the extraordinary relation 151½ carats = 1 oz. troy—marks another step towards the rationalisation of our weights and measures. The old carat was equal to 203·5 milligrams.

LEGAL.

Sunderland District Electric Tramways, Ltd., *v.* Newcastle-upon-Tyne Electric Supply Co. and the County of Durham Electric Power Supply Co.

In the Chancery Division Mr. Justice Sargant on Friday, October 23rd, heard a motion in this action, by which the plaintiffs sought an injunction to restrain the defendants from cutting off the supply of electrical energy to their trams.

Mr. Mark Romer, K.C., with Mr. Wheeler, on behalf of the plaintiffs, said that he was asking his Lordship to continue an injunction which had been granted *ex parte*, and which had so far saved these tramways from being stopped.

Mr. Martelli, K.C., who represented the defendants, said that they had no desire whatever to stop the plaintiffs' tramways, but they had been supplying the plaintiffs for a very considerable time with electric energy, and had not got any payment for it. The question between the parties was really one of price, and the plaintiffs had paid the defendants nothing since January last, though they had gone on taking their electrical energy from them. According to the defendants' calculations the plaintiffs owed them £1,800, and even deducting £700, which was the amount the plaintiffs disputed that they owed, there would be still due and owing to the defendants a sum of £1,100. If this injunction was to be continued, he asked that there should be a speedy trial, as it was not fair that the defendants should be kept out of their money longer than could possibly be helped. On any footing they were entitled to £1,100.

Mr. Justice Sargant said he did not see how he could go on preventing them from cutting off the supply unless they were paid for it.

Mr. Martelli said that was all they desired.

Mr. Romer said the plaintiffs were anxious to pay for the supply, and had been so for a long time, and he objected very strongly to Mr. Martelli making these remarks if the motion was not to be gone into. If Mr. Martelli desired to make such statements, he must put in some evidence. He had no objection to the motion standing over to enable the defendants to file evidence.

Mr. Martelli said that if his Lordship could see his way to give them an early trial, the defendants were quite willing to go on supplying the energy until the trial.

His Lordship asked whether it was a case that could be heard without pleadings.

Mr. Romer thought it would be better to have pleadings.

Mr. Martelli thought it was a case that might have been hurried on, the injunction being continued in the meantime, and the plaintiffs undertaking in damages.

His Lordship said that of course he had not yet heard the evidence before him, but it was very unlikely that he would compel the defendants to go on supplying this electrical energy unless they were paid for it.

Mr. Romer said that the plaintiffs were quite prepared to pay the price that they had been paying during the last three years. The defendants said they wanted more, and would cut off the supply unless the plaintiffs paid more. The plaintiffs would be content if defendants would go on supplying at the old rate.

Mr. Martelli said that they were quite willing to go on supplying on those terms until the trial if the time was reasonably short. They would go on supplying on those terms up to Christmas.

His Lordship said he was prepared to hear the action before Christmas.

Mr. Romer thought he would like to know more about the case before assenting to a speedy trial. It was an important question, and one that ought not to be rushed on, and he suggested that the motion should stand for a week to enable the plaintiffs to see the defendants' evidence. They were quite willing to pay for the supply at the original rates.

Mr. Martelli assented to an adjournment, and the motion was directed to stand over until to-day (Friday).

Osram Lamp Works, Ltd., *v.* Yorkshire Incandescent Electric Lamp Co.

In the Chancery Division on Friday, Mr. Justice Astbury heard this case on a motion for an injunction.

Mr. Lunge, for the plaintiff company, said the motion was for an injunction to restrain the defendants from infringing two patents that were the subject of an action before Mr. Justice Warrington. Mr. Froest, who appeared for the defendants, had now agreed with him to give an undertaking in the terms of the notice of motion.

Mr. Froest said the circumstances were these :—The defendants were charged with infringing these lamps. It was true that they had made a certain number of lamps, but they had not made the filaments, which they obtained from manufacturers in Germany in the assurance that they did not infringe either of the patents When the question was raised by the commencement of this action, at considerable expense the defendants went over to Germany to get the manufacturers to demonstrate to them the process by which the filaments were made under their agreement. The manufacturers there flatly refused to do so. In these circumstances the defendants had absolutely abandoned the manufacture altogether, and they had no intention to further continue the manufacture of any lamps from squirted filaments. He was prepared to give an undertaking in the terms of the notice of motion, and they would probably be able to settle the whole matter so that his Lordship would not be further troubled with it.

Mr. Lunge : The order might not be drawn up for 10 days, in order to enable us to make it perpetual.

His Lordship said the order could be made perpetual if the parties agreed, in the meantime the undertaking would be in the terms arranged.

Osram Lamp Works, Ltd., *v.* The Osira Light Works.

This case was again mentioned upon motion to Mr. Justice Joyce, in the Chancery Division, on Friday, October 31st. In the previous week Mr. Lunge had moved for an injunction on behalf of the plaintiffs, but some question having arisen with regard to the identity of the lamps alleged to have been sold by defendants in infringement of plaintiffs' patent, the matter stood over. Now Mr. Lunge said that both parties had agreed that the motion should stand over without prejudice to plaintiffs' right to press the motion in case the negotiations now going on came to nothing.

Cable Accessories Co., Ltd., *v.* Wardle Engineering Co.

Before Mr. Justice Joyce in the Chancery Division on Friday, October 31st, plaintiffs, of Britannia Street Works, Tividale, Staffs., moved in the matter of the Patents and Designs Act, 1907, against the Wardle Engineering Co. Mr. Tangye, on behalf of the plaintiffs, said there was a motion to rectify the register by the removal of a design for a form of electric light reflector.

His Lordship : Who is against you ?

Mr. Tangye : No one.

His Lordship : On what ground do you propose to rectify ?

Mr. Tangye : Anticipation. The design was registered in 1910. and the defendants brought an action against us for infringement. The writ was issued on April 15th, but the defendant committed suicide by craving leave to discontinue, and now comes the counter-blast.

Proceeding, Counsel said he had uncontradicted evidence of anticipation, and the defendants had written saying that they would not oppose the application.

His Lordship : You may take the order.

Elland District Council *v.* Harling.

Judgment was delivered at the Halifax County Court on Friday, October 31st, by his Honour Judge Longstaffe, in a case where the Elland District Council claimed £21 8s. 1d., from a carrier named John Harling, of Elland, for damage to an electric light standard on Elland Bridge. The facts of the case were that whilst the defendant was crossing the bridge on March 18th last with his horse and cart the vehicle collided with the standard, which stood partly on the pavement and partly in the road, and knocked it down. His Honour, in delivering judgment for the plaintiff Council, said the only point to decide was one of liability. He was not told what right the plaintiffs had to place the standard where it was. The standard had stood in the same position for a number of years, and the defendant had used the bridge frequently. The defendant could not shelter himself behind the fact of any trespass on the part of the Council. He ought to have taken pains to see that the rear of his cart did not collide with the standard. If the standard was so rotten that it tumbled to pieces, he thought it was time the Council put up a proper standard. He refused to allow costs.

Colliery Electrician Fined.

James McNeil, colliery electrician, Wishaw, appeared before Sheriff Shennan, at Hamilton, and admitted a contravention of the Mines Act. The complaint bore that he had, in Dalzell and Broomside Colliery, between March 15th and April 16th, failed to make a thorough examination of all the electrical apparatus in the said colliery (including the testing of earth conductors and metallic coverings for continuity) as often as necessary to prevent danger. After hearing a statement by an agent in extenuation of the offence, the Sheriff imposed a fine of £2, with the option of 10 days' imprisonment, remarking that he hoped the case would be a warning to others.

A. G. Hudson & Co. *v.* Barnard.

In the City of London Court, on Monday, before his Honour Judge Lumley Smith, K.C., plaintiffs, electrical engineers, 8, Well Court, Bow Lane, E.C., sued Mr. E. Barnard, solicitor, 15, Finsbury Circus, for £61 16s. 10d. for electrically wiring the defendant's house at Bexley Heath. Mr. Wertheimer appeared for the plaintiffs, and Mr. Stuart Bevan for the defendant. Defendant admitted owing £44 18s. 1d., which had been paid into Court.

Mr. Wertheimer said that the defendant told the plaintiffs that all fittings and wires would be supplied by himself, and plaintiffs' business was simply to fit up the installation. A good many things were bought from the General Electric Co., Ltd. Defendant made an appointment to go there with Hudson, the plaintiff, so that the defendant could select the fittings himself. The goods that were ordered in that way were debited to the plaintiff. There was a substantial discount allowed in the trade to persons who were in it, but not to people who were outside of it. It was generally 20 per cent., and 5 per cent. in the electrical trade. When the electrical fittings had been supplied and all the work done, defendant said, "I am not going to pay you for these fittings," and

he tried to get a big discount from the General Electric Co. The company said they were a wholesale house, and that they could not supply the members of the public at wholesale prices. Then it was arranged that the General Electric Co. should charge the plaintiff, and that he would thus get the discount allowed. When the account was sent in by the General Electric Co. defendant was not satisfied, as he wanted 33 per cent. discount off Osram lamps, while the members of the trade only got 20 per cent. The General Electric Co. said they could not allow that, that they would get into trouble with other houses in the trade, that they were a wholesale house, that they had supplied the goods to the plaintiff, who must pay for them, and then, of course, the plaintiff would get the discounts. Plaintiff had paid the General Electric Co., and now wanted the defendant to recoup him, but not less the discounts. Plaintiff's undertaking was to wire the house, and he was to be paid £34 10s. plus £2 3s. for extras. Defendant now said he bought direct from the General Electric Co., but the company denied that.

Mr. Bevan said the defendant had sent his cheque direct to the General Electric Co. after deducting the discount, and they kept it for a month, but on the instigation of the plaintiff the company sent it back to the defendant and took the payment from the plaintiff, which they were quite unauthorised to do.

Judge Lumley Smith pointed out that at present the defendant had got his fittings and had paid no one for them.

Mr. Bevan said the plaintiff had been paid for all the wiring he did.

Judge Lumley Smith: How is the plaintiff to get his money back?

Mr Bevan: He had no business to have paid it.

Judge Lumley Smith: Must he lose his money?

Mr. Bevan said the plaintiff must arrange that with the General Electric Co. Defendant was defending the case on principle.

Mr. Wertheimer said that was why the plaintiff had brought it. It was a matter of great importance to the trade. Every firm in the trade would be boycotted if they gave a solicitor 33 per cent. discount on Osram lamps.

Mr. Hudson was called, and said the General Electric Co. gave him 20 per cent. on lamps, and the defendant wanted 33 per cent.

Mr. Bevan said the General Electric Co. had supplied the defendant for years, and had given him the usual trade discount, and the defendant resented the plaintiff interfering between him and the company.

Plaintiff: The General Electric Co. do not give discounts to private customers.

Judge Lumley Smith: Most wholesale houses say that they will not deal with private people, but they always do so.

William Venus, sub-manager of the accessories department of the General Electric Co., said he remembered the plaintiff coming with the defendant to select fittings, which were supplied. His company supplied their goods through contractors and not to private persons. If they supplied to private persons it would be at retail prices only. They allowed 5 per cent. for cash or 2½ monthly to retail customers. The defendant wanted to take off 33 per cent. and 5 per cent. for cash for Osram lamps. They only allowed the trade 20 per cent. and 5 per cent. As the defendant did not pay the full amount of the account they returned his cheque. They had never debited the defendant with the goods. In cross-examination, he said they would not have treated the defendant as a trade customer without the introduction of the plaintiff or someone in the trade, and then the man in the trade would get the discount.

Mr. Bevan: If Mr. Barnard had come in and said, "Charge these to my account," the contractor would get nothing?—Witness: We should make some other arrangement. The contractor would have had his account credited with the discount. If we supplied Mr. Barnard with the fittings at retail prices and Hudson carried out the work, the contractor would get the discount from the goods.

You would give him a commission?—Yes.

If Mr. Barnard had come in and ordered the goods, and said, "I have a friend in the trade, you have always given me the trade discount before," you would have given it to him?—Not unless he had proof to that effect.

Time after time the year before last did you not serve Mr. Barnard with electrical goods?—I served Mr. Barnard with many things, but not in the name of Barnard, as you will see. They were in the name of Crowdy, of Swindon. He is entitled to trade terms, and he is a motorman. I see hundreds of customers in the course of a week.

You supplied him on his saying he knew Crowdy?—If a customer comes in with a bill with a trade discount off, we cannot dispute the fact that he is in the trade. We cannot say he is not in the trade.

Judge Lumley Smith said he observed that the bill was made out to Crowdy and that "Barnard" was at the top.

Mr. Bevan: You were content in the past days to serve the defendant under the protection of Mr. Crowdy, and give him the trade discount?—Yes, thinking Mr. Barnard was Crowdy. I knew at a later date that he was not Crowdy when he brought the bills and showed the trade terms.

Judge Lumley Smith said if the defendant succeeded in that action, the General Electric Co. might sue him for the discounts he had received. He did not say they would succeed, but there would be the risk.

Mr. Bevan said the defendant would rather pay the retail price to the General Electric Co. than have that sort of thing going on by which the plaintiff attempted to rig the thing to get the discount when he was not entitled to it.

In re-examination, Witness said he believed the plaintiff was the buyer, and not the defendant, when they came to him.

Mr. Thomas, chief accountant to the General Electric Co., Ltd., was called to give evidence as to the custom of the electrical trade in regard to discounts for private customers and other people in the trade, when Mr. Bevan objected.

The Witness said they never allowed the same discount to private customers as to those in the trade. There was a Contractors' Association to which all wiring contractors belonged, and if his company gave any outsider a trade discount, the contractors would naturally complain to the Association.

Mr. Wertheimer: And you would be boycotted?—Witness: Absolutely.

In cross-examination, the Witness said he would supply a private customer, but the man in the trade who introduced the customer, would get the discount.

Mr. Bevan: A trade introduction gets a private person trade terms?—Yes.

Judge Lumley Smith: What does the trade introducer get. Does he get anything? Supposing a man says, "I am introduced by Crowdy," and he gives an order, would you allow him the trade discount?—If this customer wanted to pay cash and he took the goods away, if we were doubtful whether this man was to have the discount we would get into communication with Crowdy, but if we had an understanding with Crowdy that he wanted his customer to have the trade discount, we would charge it under Crowdy's name and let the customer have the discount.

Otherwise you would send Crowdy a credit note?—Yes.

The defendant, Mr. Barnard, said he had bought various goods from the General Electric Co. during the past few years. Crowdy had mentioned the General Electric Co., but he also knew the company quite apart from Crowdy. He had had many dealings with the company, as well as with other electrical companies. Venus always knew he was Barnard and not Crowdy. In fact, he used to chaff Venus about his name. He was running in and out buying different goods for experiments and for electric lighting. He was a practical electrician in an experimental way for his own recreation. With regard to the goods sued for, he made no appointment to meet the plaintiff. Plaintiff could not supply him, and he had made up his mind to deal with the General Electric Co. He examined the fittings he wanted and bought them. Hudson had no authority to pay the company. In cross-examination witness said he did not expect to get the trade discount.

Mr. Wertheimer: Why did you take off the discount?—In their account they offered the discount.

You took the trade discount off?—Yes, I had always been allowed it. I paid the bill in the ordinary way.

Judge Lumley Smith said the question in dispute was whether defendant bought the fittings of the General Electric Co. or whether the plaintiff did. Everybody who had his house wired for electric light went to choose the fittings. On the whole he believed the defendant bought the fittings direct from the General Electric Co. The rest of the case was a scramble for the discount. Venus wanted it for the plaintiff, and he invoiced the goods to Hudson, and Hudson pocketed the discount. On the whole he believed the defendant was in the right. Hudson had not satisfied him that he sold the fittings or was entitled to charge for them. That was all he had to decide. Whether the defendant would have to pay the full amount without the discount was no business of his (the Judge's). The result was that the £44 18s. 1d. paid into Court was enough. Plaintiff would have his costs up to October 31st the time of the last payment into Court, and defendant would have the general costs of that day's trial.

BUSINESS NOTES.

Trade Announcements.—The "K.S.B." Manufacturing Co., of Sheffield, have opened a branch office at 11, Queen Victoria Street, London, E.C., where they will hold a stock of their Klein pumps, fittings and other specialities. Lists have been received from the firm.

The head office of the Tudor Accumulator Co. will, on Monday next, 10th inst., be removed to 3, Central Buildings, Matthew Parker Street, Westminster, S.W. Telephone: 2,600 Victoria.

Messrs. John Boyd & Son, electricians, have transferred their office and showroom from 57, Chapel Street, to 5c, Hoghton Street, Southport. The workshops in the rear of 57, Chapel Street are retained by the firm.

Messrs. James Booth & Co., Ltd., of Sheepcote Street Tube and Rolling Mills, Birmingham, have appointed their Mr. Aldam as joint agent with Mr. Prideaux, who for a long period has acted as their agent in London. This alteration has been necessitated by the growth of the London business. The above gentlemen will carry on the agency at 95, Hatton Garden, E.C., under the style of Prideaux & Aldam. Telephone: "Holborn, 4738."

U.S. Tariff Revision.—We have received from Messrs. R. F. Downing & Co., tariff experts, a copy of a pamphlet which they have just published, giving the United States duty rate on every article mentioned in the old United States Customs Tariff, and comparing this in a parallel column with the duty under the new tariff which became a law on October 4th. Manufacturers and exporters among our readers who wish to send goods to the United States can have a copy of this useful 90-page publication free on application to the firm at 17 and 18, Garlick Hill, London, E.C.

Lead.—In their report dated November 1st, Messrs. James Foster & Co. state:—"Closing prices last were, October, £20 1s. 3d.; November, £19 12s. 6d.; December, £19 2s. 6d.; and January, £18 12s. 6d. We have had a heavy appreciation in values this week, the closing prices being, October, £20 12s. 6d.; November, £20 10s.; December, £20; and January, £19 10s., or a rise of 10s. to 17s. 6d. per ton on the week. There is no relief to the continued scarcity of prompt lead, and although there is a large quantity due at the end of next week, little of it will come on to the market, but it will relieve pressing necessities. The export demand continues, and a large business has been done right up to January. Consumers have bought freely October shipment load, and some of them are in desperate straits for want of immediate supplies. The position of lead supplies grows more serious every week. It is generally attributed to Mexico, and although, no doubt, the practical stoppage of smelting in that country for several months has added much to a position already serious, it must not be overlooked that for two years past we have had a constantly recurring difficulty in meeting the requirements of consumption. As we have frequently stated, the world's production of lead has in the 10 years ending December, 1912, increased by only 3·5 per cent. per annum which in itself is quite sufficient to account for the fact that all the large stocks in public warehouses here and elsewhere (in London and New York alone in 1911 there were about 50,000 tons in warehouses), as well as the normal stocks in consumers' hands, have gone into consumption. The market closes very strong with prices at the top of the week—English lead, £21."

Argentine Tramcar Lighting.—The accompanying illustration shows the interior of one of the coaches belonging to the Anglo-Argentine Tramway Co. We understand that all cars belonging to this company have been fitted with Osram lamps of the standard 100-volt type, manufactured and supplied by the General Electric Co., Ltd., of London.



Argentine Tramcar Lighting.

Edison Electric Vehicles.—Owing to extending business, Messrs. Edison Accumulators, of 49, Old Bond Street, London, W., have taken larger premises and have secured the whole of the building, 1, King Street, and 2 and 3, Duke Street, St. James', which embraces an area of 12,000 sq. ft. These premises will be known as Edison Building. The firm are exhibiting a 2-ton van at the Brewers' and Allied Trades Exhibition at the Agricultural Hall, which opened on Saturday, the 1st inst., and at the Motor Show at Olympia, on the stand of Messrs. Arrol-Johnston, of Paisley, they are showing a three-passenger Edison accumulator car, built by them, and a number of similar vehicles outside for demonstration purposes. On the new premises mentioned above, showroom accommodation is provided for displaying the various types of pleasure and commercial cars, especially the latter. In regard to the progress being made with vehicles equipped with the Edison battery, a repeat order has been received from Messrs. Liberty for two more vans. This firm has proved the advantages of the electric vehicle. Amongst new customers may be mentioned Messrs. Pullars, of dye work fame, who have placed an order for a 1-ton van for use in the London area. The Stratford Co-operative Society have also placed an order for a 1-ton van, and in addition the Ilford Borough Council has ordered a tower wagon for use on its tramway and lighting systems.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LI., No. 202. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for October, 1913, contains the following papers:—High-tension Continuous-current Traction, by L. Gratzmuller; Single-phase Traction, by M. Latour; Railway Electrification Problems in the U.S.A., by H. Parodi; Electrification Schemes of the Midi Railway, by E. J. Jullian; Electrification of the French State Railways by A. N. Mazen; Petrol-electric Motor Vehicles, by J. B. G. Damoiseau; Transmission of Electrical Energy by Continuous Current on the Series System, by J. S. Highfield; Electric Transmission of Energy by Alternating Currents at very High Pressure, by M. Leblanc; Neon Lighting, by G. Claude; Mechanical Devices in Telephone Exchanges, by W. Slingo; Wireless Telegraphy and Time Signals, by Commandant G. A. Ferrie; Electric Locomotives, by F. Lydall; Efficiency of the Polyphase Induction Motor, by A. K. Erlang; Compensation Apparatus for Telephonic Measurements, by A. K. Erlang. Also "List of Members and Officers 1913."

"*Journal* of the Society of Engineers." Vol. IV, No. 10. October, 1913. London: The Society. Price 1s. 3d.

"Abstract of Current Decisions on Mines and Mining, October, 1912, to March, 1913." By J. W. Thompson. Washington: Government Printing Office.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 8. October, 1913. New York: The Society.

"*Journal* of the American Institute of Architects." Vol. I, No. 9. September, 1913. Washington: The Institute. Price 20 cents.

"Science Abstracts." Vol. XVI, Part 10. October 27th, 1913. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

Messrs. Wm. Dawson & Sons, Ltd., of Cannon House, Bream's Buildings, London, E.C., have issued a new booklet, in which are set out very clearly the subscription rates for a host of British and foreign journals. We are sure that this list should be of service to many of our readers at home and abroad.

"Natural Sources of Energy." By A. H. Gibson. 1913. London: Cambridge University Press. Price 1s. net.

Works Extension.—In the accompanying picture we show a part of the extension recently carried out at the works of Messrs. Reyrolle & Co., Ltd., Hebburn-on-Tyne. It is a large well-lighted shop, used for the erection of ironclad and armoured switchgear. The extension was necessitated by the increased demand for Reyrolle switchgear embodying the "complete enclosure" principle, with which they have done so much in recent years.



New Switchgear Shop at Reyrolle's.

Bankruptcy Proceedings.—John Dale Nixon (trading as J. D. Nixon & Co.), electrical and mechanical engineer, 65, Mill Street, Crewe.—The adjourned public examination of the above debtor was held on Friday last at the Court House, Edleston Road, Crewe. In answer to the Official Receiver, debtor stated that the ranking liabilities amounted to £1,291, and the assets were estimated to realise £118. He admitted that through bad book-keeping he had omitted to schedule the names of 12 creditors, but the Official Receiver said the amounts were not large. The debtor said that prior to March, 1910, he had not been engaged in business on his own account. For some years prior to that date he had been in the employ of various firms at different periods, carrying on business as electricians and motor manufacturers, and had also been in the employ of the L. & N.-W. Railway Co. In March, 1910, he commenced in business on his own account in Mill Street, Crewe, under the style of J. D. Nixon & Co., without capital. He had never possessed any capital of his own. His father lent him £30 at starting, and he advanced him further sums from time to time—altogether £432. His sister also lent him £200, but they had no interest in the business. No one but himself had any interest in the business. He was on the wrong side from the commencement, and his debts, amounting to £1,293, had been contracted with knowledge of his position. He thought there was an opening at Crewe for an electrical and mechanical engineer, and he had gone on trading in the hope that the business would improve. The Official Receiver pointed out that his books had been imperfectly kept, and the debtor admitted it. He had never attempted to ascertain his financial position. He had lost certain counterfoil receipts since July, 1912, and had no record of his receipts since that time. The entries he had given in his cash

statement were extracted from his bank pass-book. During the two years for which particulars were asked, he had expended £2,272. There was a sum of £194 which he could not account for. He admitted he had "cut" prices in order to get contracts. He put his losses on contracts at £180, and he had paid £200 in law charges. The Official Receiver called attention to various loans made to the debtor, and losses on certain contracts, and asked him if the figures quoted did not point to reckless trading. The debtor admitted they did. He attributed his failure to loss on contracts, want of capital, heavy law costs paid in respect of actions brought against him during the past 12 months for the recovery of the amount of trade goods supplied, and insufficient profit to meet general expenses. There were 38 creditors for fittings, batteries, and ironmongery, &c., supplied, amounting to £616; 10 creditors for cash for work done, repairs, &c., amounting to £34; and three creditors amounting to £643. The Official Receiver said the debtor had not complied with the order of the Court to furnish proper accounts. The examination was, therefore, adjourned *sine die*.

HERBERT WILLIAM WILSON, 28, Alder Road, West Derby, Lancaster, consulting engineer, &c.—In this matter accounts have now been filed, and according to these there are net assets of £6,070 to meet liabilities ranking at about £4,930, the estate disclosing a surplus of over £1,100 on paper. At one time the debtor carried on business in partnership with others as consulting, mechanical and electrical engineers, but a deed of dissolution had been entered into. The deed provided that one of the other partners should realise the assets, and this same partner was to discharge all the firm's liabilities, the partners being entitled each to draw a stipulated weekly sum so long as there was any surplus standing to their credit in a balance-sheet prepared at the date of the deed already referred to. When all the partnership assets were realised the partnership creditors were to be paid, and the balance was to be utilised to repay each or any of the partners any sum that might be standing to his credit in the capital account, and the net balance was to be divided among the partners in the same proportions as the net profits to which they were each entitled. Apparently, however, the debtor's interest in this partnership had been charged in favour of several fully secured creditors. The debtor does not admit insolvency, and states that his present position has been brought about by advancing money to others. One creditor for over £38 is a cable manufacturer, and the account in question is for goods supplied. The following are creditors:—

Foster, J. H., Liverpool ..	£100	"Bankers," Liverpool	£125
Hannay, A. M., Liverpool ..	30	Richard & Co., Liverpool ..	33
Abbott, J. F., Liverpool ..	45	Barrell & Co., Liverpool ..	92
Patchell, W. H., London ..	20	Jackson, F. W., Liverpool ..	20
Wilson, M., Llandudno ..	1,430	Gultone, G. G., Prenton ..	85
Atkinson, R. E., Liverpool ..	100	Higson, P., Manchester.. ..	25

FRANK HUCKS, of 75, Willingdon Road, Eastbourne.—At the London Bankruptcy Court last week, before Mr. Registrar Hood, an application was made for discharge in this case. The Official Receiver reported that the receiving order was made on June 4th, 1913, on the debtor's own petition. The liabilities expected to rank against the estate for dividend were returned at £777, and the assets were estimated to produce £52. It appeared from the bankrupt's statements, that having previously been in employment he, in October, 1908, commenced business as an electrician, electrical engineer and contractor, at his father's office in James Street, Camden Town, removing in May, 1910, to 18, Charing Cross Road, W.C. From February, 1911, until February, 1913, he carried on business from his private house at 2, Adelaide Road, Hampstead. In May, 1912, he formed a company for the purpose of making aerial flights, and he was employed by that company at the date of the receiving order at a salary of £171 per annum, together with the use of a house at Eastbourne. He alleged his failure to have been caused through losses on contracts owing to his having underestimated their cost, and to ill-health in 1911. The Official Receiver reported that the debtor had committed the following offences against the Bankruptcy Act:—The bankrupt's assets were not of a value equal to 10s. in the £ on the amount of his unsecured liabilities; the debtor had omitted to keep proper books of accounts; and he had continued to trade after knowing himself to be insolvent. The discharge was suspended for two years.

CHARLES LEWIS, electrical engineer, of Seymour Grove, Old Trafford, Manchester, applied to Judge Mellor last Friday for his discharge in bankruptcy. It was stated that since the receiving order in January last, £410 had been paid to the Official Receiver, which enabled all the creditors to be paid 20s. in the £, with interest at the rate of 4 per cent. and left a small surplus after meeting all costs. His Honour granted the discharge.

Catalogues and Lists.—THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—Catalogue of 92 pages containing full descriptive particulars, with excellent illustrations in colour, of their various types of meters for all conditions of service. They include C.C. ampere-hour and watt-hour meters; S.P. A.C. meters; polyphase meters; pre-payment, two-rate and other meters for special systems; and testing apparatus and equipment. Some pages at the end are occupied with notes on testing meters, method of calibration, and diagrams of service line connections.

MESSRS. SIEMENS BROS. & CO., LTD., Electric Appliances Department, Caxton House, London, S.W.—Reprint No. 542A contains a full description, with excellent illustrations (interior and exterior views) of their boiler-feed disk water meters for hot water.

MESSRS. W. A. WALBER & CO., 38, Victoria Street, London, S.W.—Catalogue No. 31 (16 pages) contains particulars of the "Victor" and "Vilvalle" oil, gas and petrol engines, horizontal and vertical types, for electric lighting, pumping and other service. Constructional details, sizes, speeds, weights, dimensions, code-words and prices are given.

THE BASTIAN ELECTRIC HEATING SYND., LTD., 185, Wardour Street, London, W.—A cosy and homely postcard showing toasting operations in progress with the aid of the "real red heat" of a Bastian heater. The same picture is being reproduced as a showcard measuring 18 in. × 14 in., and contractors and others interested should write for copies.

THE ENDOLITHIC MANUFACTURING CO., LTD., 61½, Fore Street, London, E.C.—Specimen list of labels in ivory, bone, metal, &c., for electrical and motor-car purposes.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—Catalogue (No. 11,012) of 80 pages, containing illustrations and particulars of a wide range of electric light supplies—incandescent lamps, lampholders, ceiling roses, switches, cut-outs, switch and fuse-boards, meters, wires and cables, conduit and fittings, &c. Prices are set out in detail. A separate supplementary list of four pages deals similarly with some electric light and power accessories—main switches, ironclad cut-outs, and other manufactures.

MESSRS. MITCHELLS, ASHWORTH, STANSFIELD & CO., LTD., 23 and 24, Old Bailey, London, E.C.—Illustrated circular, giving extracts from a number of users of their "Mascolite" for reducing vibration, &c., of engine foundations, &c.

MESSRS. ADNIL ELECTRIC CO., LTD., Adnil Building, Artillery Lane, London, E.C.—Monthly stock list of C.C. and A.C. motors, dynamos, and portable electric tools. These lists will be forwarded regularly on application.

MESSRS. STEEL TUBES AND CONDUITS CO., Alice Street, Keighley.—Price leaflet respecting "Stacc" continuity fittings, and stamped steel slip fittings; also one relating to tests of these fittings.

Dissolutions and Liquidations.—THE PURE LUBRICATING OIL CO., LTD.—This company is winding up voluntarily, with Messrs. C. J. Marshall, of Effingham House, Arundel Street, London, W.C., and C. E. Peczenik, of 11, Pancras Lane, London, E.C., as joint liquidators. A meeting of creditors was called for November 6th at 11, Pancras Lane, London, E.C.

CLIVE & CO., electrical engineers, High Street, Sutton Coldfield.—Messrs. E. G. Todd & L. A. Evans have dissolved partnership. Mr. L. A. Evans will attend to debts and carry on the business.

THE ACCESSORIES MANUFACTURING CO., LTD., 11, Dean Street, London, W.—A meeting of creditors is called for November 14th at 9 and 10, Pancras Lane, E.C. Statements of claims to be sent to Mr. H. A. McCann, the liquidator, at that address.

OZONAIR, LTD.—This company having gone into voluntary liquidation for the purpose of reconstruction and sale to a new company, whose prospectus is referred to in our "City Notes" to-day, a meeting of creditors is to be held on November 14th at 96, Victoria Street, S.W. Mr. T. S. Wederell is liquidator. The business will be continued at 96, Victoria Street, S.W.

FRANCIS READE & CO., 35, The Broadway, Church End, Finchley.—Messrs. F. S. Ashdown & C. H. M. A. Vere have dissolved partnership. Mr. C. H. M. A. Vere will attend to debts and carry on the business under the same style and at the same address.

Japan.—A large and increasing trade is taking place in electrical machinery and apparatus in Japan, the imports during the first half of the current year showing an increase of no less than £1,900,000 over the similar period of 1912.

LIGHTING and POWER NOTES.

Argentina.—The municipality of Coronel Dorrego will shortly call for tenders for public electric lighting.—*Review of the River Plate.*

Atherton.—The General Purposes Committee having considered a letter from the L.G.B., as to the scale of charges for the supply of electricity for power purposes, is revising the scale so that the prices charged shall in all cases be brought up to the limit allowed by the present agreement with the Tramways Co. A letter has been received from the Tramways Co. with regard to the terms of the proposed new agreement, and the Committee has decided that until the expiration of 12 months from the date of signing the new agreement the Council will not raise its prices for electricity above the limit allowed by Clause 21 of the present agreement, other than in accordance with the approved new coal clause.

Australia.—A scheme for generating electricity for the railways and for metropolitan lighting purposes was recently laid before the Institute of Engineers by Mr. Edmiston, a Perth engineer. The scheme involves a capital expenditure of £1,776,000, and an annual cost of £200,000, for the production of 60,000,000 units, at an average expense of four-fifths of a penny per unit. Mr. Edmiston suggests that the State should control the scheme, working it in connection with the tramways service, and electrifying several railway lines. The electricity would be generated at Collie coal mines, 130 miles from Perth. Mr. Edmiston estimated the cost of Collie coal at the pit mouth at 4s. a ton. The Perth Corporation now supplies electricity for lighting at 6d. per unit.—*British Australasian.*

The Kempsey (N.S.W.) Municipal Council has decided to raise a loan for the purpose of establishing an electric supply plant in the

town. The estimated cost of the scheme is £6,500.—*Commonwealth Engineer.*

The Newcastle (N.S.W.) Municipal Council has obtained a loan of £5,000 for the purpose of extending the electric lighting scheme.

The Silvertown Co. has purchased a site at Daylesford (Vic.) for the erection of a power house and plant for an electric supply scheme. Operations for the installation will commence immediately. The plant will be in duplicate. Every effort will be made to complete the work before the end of the year.—*Tenders.*

The Williamstown (Vic.) Municipal Council proposes to raise a loan of £42,000 for various works, including the installation of electric power plant.—*Commercial Intelligence.*

Barrow.—The T.C. has agreed to a recommendation of the Electricity Committee, permitting the electrical engineer to advise the Grange U.D.C, with regard to an agreement into which it proposes to enter with a private company for the laying of cables and supply of electricity to its area.

Bath.—Street Lighting.—The T.C. has decided that where new E.L. mains are laid in any street the gas lamps in use shall be converted to electricity, at a cost of about £1 15s. per lamp.

Bexley.—Proposed Bulk Supply.—With reference to the proposed bulk supply of electricity from Woolwich, it was reported to the U.D.C., on October 29th, that the offer, as placed before the Council, was not beneficial, and that if the Woolwich Council liked to make more reasonable terms, Bexley would, in all probability, close with them.

Bispham (near Blackpool).—The U.D.C. is holding an electrical exhibition during the week commencing November 3rd.

Blean (Kent).—Workhouse Lighting.—The B. of G., on October 28th, decided to have an estimate of the cost of providing an E.L. installation at the workhouse prepared by Mr. F. E. Lewis, of Canterbury.

Bridgend.—The auditor's report on the Council's electrical undertaking for the year ended March 31st, shows a net loss of £5, as compared with a net profit of £304 in the preceding year. Notwithstanding this, a sum of £140 was transferred from the profit and loss account to the relief of the rates, leaving a balance of £1,143 to the credit of the undertaking.

Burnley.—Electricity has been installed at the Corporation ice works and cold stores. Messrs. Hy. Wallwork, of Manchester, have carried out the work.

Chorley.—The T.C., on October 31st, decided that consideration of the recommendation of a Sub-Committee appointed to consider the proposed application of the Lancashire Electric Power Co. for a prov. order, be adjourned to a special meeting.

Connah's Quay. — Proposed E.L. Scheme. — The U.D.C. has received a report on an E.L. scheme from Mr. A. J. Leigh, electrical engineer, of Northwich, and has decided to discuss the matter in committee.

Continental Notes.—Austria.—A serious fire occurred last week at the central station of the Austrian General Electrical Co. The fire caused damage estimated at over £50,000, and was only extinguished after two hours' work.

The Austrian Ministry of Agriculture has made a grant to the City of Marburg of the water rights on the River Drau for 9 km. from the Felber Island upwards. The locality is specially favourable for hydro-electric purposes, and some 20,000 H.P. will be obtainable. The City of Graz has joined forces for the execution of the scheme and participation in its benefits.

Spain.—A large plant for the manufacture of nitric acid and other nitrated products by means of the Birkeland-Eyde process, is being established in the province of Lerida by the Sociedad Iberica del Azol. The works will require electric energy to the extent of 25,000 H.P., but the company has contracted to take a total of 75,000 H.P. from the generating station of the Compania Barcelonaise, in Catalonia. The new concern will not only produce fertilisers for agricultural use, but also material for the manufacture of dynamite and other explosives.

Poland.—The Gesellschaft für Elektrische Unternehmungen, of Berlin, is in negotiation for the establishment of a large central electricity station to supply a number of small towns and districts to the west and south-west of Warsaw. A separate company will be formed under Russian law to exploit the undertaking.

Norway.—A power station is being built by the mills at the Tistatos, on the Tista River, which will generate electricity for all the mills in the neighbourhood.—*Board of Trade Journal.*

A 4,000-H.P. turbine set has been ordered from Germany for the Bergen municipal electrical works.

Belgium.—In order to meet the ever-increasing demand for electric power, a new 6,500-H.P. engine and dynamo is being installed at the generating station connected with the works of the Cockerill Co. at Seraing.

The Compagnie de l'Electricité de l'Est de la Belgique is at present supplying current for lighting and power purposes to 13 small towns and villages, and is in negotiation with reference to supplying 14 others. The high-tension mains of the company have a length at the present time of 43 miles, while the low-tension network extends to 80 miles.

France.—La Société des Forces Motrices de la Cere is engaged on the construction of a large hydro-electric generating station at Laroquebrou (Cantal). A dam will be built to collect the water of the River Cere, which will then be conveyed by a canal about a mile long, and through 20 miles of tunnel, in order to secure a fall of about 1,150 ft. The installation is estimated to cost about £800,000, and the electrical energy generated will be utilised for the manufacture of nitrate of soda.

Coxhoe (Co. Durham).—Proposed E.L. Scheme.—The East Hetton Colliery has informed the P.C. that it hopes to be able to supply electricity to the villages in the district within two or three months, and the Coxhoe, Cornforth, Kelloe and Cassop Councils have decided to confer with the object of adopting a joint scheme.

Darlington.—L.G.B. Inquiry.—Mr. T. C. Ekin held an inquiry on October 29th, into the application for sanction to borrow £21,190 for extensions to the electricity undertaking. The town clerk said the output last year had reached a total of nearly 4,000,000 units; the capacity of the plant had been increased to 2,435 KW. last year, and they were at present putting down an additional set of 1,000 KW. They were now supplying over 1,300 consumers, which included the majority of the large works in the town, and the motors connected represented a total of 4,534 H.P. They had shown a surplus each year, including the first complete year of working; last year the surplus amounted to £5,295. The gross profit for the last 10 years had averaged more than 10 per cent. on the capital outlay, and last year it was over 13 per cent. The total cost per unit, excluding interest and sinking fund, was ·51d. last year. The increase in output for the year ended March last, was over 1¼ million units, and the increase for the six months ended September last was nearly three-quarters of a million units. The maximum capacity of the generating plant, including the batteries, and allowing one set as spare, was about 1,900 KW., and the maximum output last winter was 2,015 KW.; this year the maximum output would probably reach 2,400 KW. The new plant in respect of which the application was being made, consisted of a 1,000-KW. turbo-alternator, with condensing plant, two rotary-converters, high and low-tension switchgear and an extension of the building to contain the high-tension switchgear, also a water-tube boiler, a Green economiser, two superheaters for existing boilers, a boiler-feed pump, and a water-softening plant. The application also included the provision for mains extension and transformers. With respect to the latter, the item of £1,500 included proposed transformer sub-stations and switchgear, as well as the transformers themselves. The new plant is to be on the high-tension three-phase A.C. system. As it was necessary that the plant should be installed in time to meet the coming winter's demand, tenders had been accepted and the work was in hand. There was no opposition.

Darwen.—The Electricity Committee has decided to supply electricity for lighting and power purposes to Spring Vale Paper Mill.

Dewsbury.—Domestic Tariff.—The T.C. has decided that from January 1st, 1914, an alternative system of charging be adopted, on the basis of 15 per cent. per annum on the rateable value of the consumer's premises, and ¾d. per unit for electricity consumed for domestic purposes only. Consumers adopting this alternative system must use heating or cooking appliances on the following scale:—Rateable value not exceeding £30, 2 KW.; rateable value of £30, and not exceeding £50, 3 KW.; rateable value over £50, 4 KW.

Gillingham (Kent).—Residents in the Hempstead and Wigmore districts of the borough have petitioned the T.C. for a supply of energy for lighting, and the Council has decided to ascertain the probable demand and the cost of affording a supply by means of an overhead cable. Mr. L. Hewitt, having asked for terms for current for lighting and power at a proposed screw factory to be established in the town, the Council has decided to give a supply for power at 1½d. per unit on a minimum of 50,000 units per annum with ordinary rates for lighting.

Glasgow.—The report of the convener of the Electricity Committee and chief engineer, Mr. W. W. Lackie, on their American visit, when they inspected the power plants and works at Montreal, Toronto, Niagara, Chicago, Pittsburg, New York, Boston and Schenectady, has been issued. Information was sought with a view to obtaining the most modern practice in connection with extensions to the Glasgow undertaking, in connection with which it is proposed to build a new generating station on the Dalmarnock Road site, to accommodate 10 13,000-H.P. units. The report details the extraordinary progress in electrical supply in the places visited, in connection with lighting and power, and mentions that over 3,000 electric broughams are in use in Chicago. As a result of the visit much information has been obtained as to the design and operation of power plants of the size contemplated for the new station at Glasgow, also valuable suggestions for the future development of the use of electricity in the area.

Gloucester.—The R.D.C. has given permission for the City Council to supply electricity to houses in the parish of Longford.

Harrogate.—L.G.B. Inquiry.—Mr. T. C. Ekin held an inquiry, on October 31st, concerning the application of the T.C. for sanction to borrow £9,439 for extensions at the electricity works. There was no opposition.

Hoyland (near Barnsley).—The borough electrical engineer of Barnsley having reported on the development of the Council's E.L. order, the surveyor has been instructed to confer with him as to the details of the proposed scheme, and a canvass is to be made at once of the prospective consumers.

Heywood.—Bulk Supply Inquiry.—On November 1st and 2nd a B. of T. inquiry was held in London into the proposal of the Heywood Corporation to obtain a bulk supply estimated at 2,000,000 units per annum, from the Bury Corporation, to which arrangement the Lancashire Electric Power Co. has refused its consent. Both the Bury Corporation and Power Co. submitted terms to the Heywood authorities, who approved the Corporation's offer. Mr. H Lloyd, K.C., for the Power Co., said the question at issue was simply whether the consent of the company to the agreement had been reasonably withheld. The company was a pioneer in the provision of electricity, and if the public was to be asked to contribute money to such enterprises, it should be asked to do so upon fair terms. The offer of the company was fair and reasonable. Mr. C. D. Taite, engineer and manager to the Power Co., said he did not see any possibility of the estimates given by Bury being achieved. Bury was not in the habit of charging its own customers cost price, even though it was offering light to Heywood at that price. It was a new method of municipal trading to charge persons outside the municipality less than those within. Mr. Keen, replying, said that Bury Corporation was entitled to decide whether it could fulfil this agreement without any loss. If Bury chose to make a loss to the ratepayers so that Heywood could benefit, surely the Power Co. could not say nay.

Holmfirth.—Proposed Loan.—The D.C has resolved to apply to the L.G.B. for sanction to borrow £7,500 for the purpose of installing electricity in the district.

Huddersfield.—The B. of G. was recommended by the Crosland Moor Committee, at its last meeting, to install electric light throughout the estate, at an estimated cost of £700.

Ilford.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of £4,100 for the erection and equipment of a sub-station for the supply of current to the Goodmayes district. It has also been decided to apply to the B. of T. for consent to supply current to Wanstead U.D.C by overhead lines.

Inverurie.—Proposed E.L. Scheme.—The T.C. has received an offer from an Aberdeen firm to submit a scheme for the lighting of the town with electricity.

Japan.—It is proposed to divide the Tokio Municipal Electric Bureau into two sections, one to deal with electric tramways and railways, and the other with electric lighting.

Llanelly.—A series of electric cooking demonstrations and lectures were carried out at the end of October under the auspices of the Llanelly and District Electric Light and Traction Co., Ltd. The lectures, which were arranged by Messrs. Gillespie and Beales, were given by Mr. F. S. Grogan before attentive audiences. The lecturer created general interest in bringing forward the claims of electric cooking, and in demonstrating the results obtained with the "'Tricity" cooker.

London.—L.C.C.—The Finance Committee has recommended the Council to sanction the borrowing by the Fulham B.C. of £5,000 for mains and plant.

Hammersmith.—Loan for Coal Storage.—The B.C. proposes to provide storage for at least 6,000 tons of coal, in order to protect the electricity supply from interference through fluctuations in coal supply. A loan of £15,000 is being applied for.

Lurgan.—Proposed E.L. Scheme.—At a special meeting of the T.C. a report by Messrs. Woodside & Co. on the proposed E.L. scheme was considered. They estimated the cost at £11,338. Mr. T. W. Bloxam, of Belfast, the Council's consulting engineer, said that, in his opinion, the Council was justified in going on with the scheme, which he estimated to cost £11,980. The town clerk and the town solicitor have been instructed to promote the necessary order.

Manchester.—The City Council has agreed to promote in next Session the Bill to secure powers for the erection of a new generating station at Davyhulme, to acquire the undertaking of the Trafford Power and Light Co., and to incur other expenditure; this matter was mentioned in our issue of October 24th.

Market Weighton.—On October 29th, Mr. Charles Pullen, of Bradford, attended the meeting of the P.C., and explained the E.L. scheme which he proposed to carry out. He stated that the cost would be about £1,500, and current would be supplied at 6d. per unit. The Council decided to offer no objection to a company being formed.

Morecambe.—At the last meeting of the T.C. a suggestion was made that the gas and electricity undertakings should be controlled by one committee, but after discussion nothing definite was decided upon. A resolution was moved that the electrical engineer should prepare a scheme for the illumination of all the shelters and bandstands during the season, and for the provision of two illuminated fountains on the promenade, and this was carried.

Penketh.—Mr. A. J. Leigh has been appointed consulting engineer in connection with the electrification of the Penketh tannery; this is the largest tannery in the country, and it is interesting to note the rapid progress being made in this direction.

Salford.—Loans and Extensions.—At a meeting of the T.C. on October 29th, approval was given to the recommendations that borrowing powers be sought to the extent of £13,500 for electricity purposes. The Manchester Ship Canal Co. has given notice that an additional supply of approximately 750 kw. will be required for No. 9 Dock, and the total estimated cost of affording the supply is £15,000, made up as follows:—Land for sub-station, £2,000; sub-station building, £2,000; two rotary converters, £4,500; one three-phase switchboard, £1,000; one continuous-current switchboard, £1,000; mains (for which borrowing powers have already been obtained), £4,500. As the price of energy is 1⅛d. per unit for the first million units, and 1$\frac{1}{16}$d. for all over, it is expected that the financial results will be favourable. Borrowing powers amounting to £10,500 are to be sought for this work. Councillor McDougall, at the T.C. meeting, said this was one of the most profitable contracts which the Electricity Committee had on hand. In regard to the other matter, borrowing powers for £3,000 are to be sought for affording a supply of three-phase energy in the Ordsall district. The demand for electricity for power purposes in that district continues to increase, and it has been decided to meet the demand by laying H.T. mains from the Frederick Road works to a transformer sub-station in Ordsall, where it will be reduced to low-pressure three-phase current. The estimated cost is as follows:—Land and building, £1,000; two transformers of 500 kw. capacity each, £800; H.T. and L.T. switchgear, with cable connections outside buildings, £1,200—total, £3,000.

Shildon.—The U.D.C. and the representatives of the Northern Counties E.S. Co. have discussed the agreement for public lighting, and the question of the company being allowed to take current from an outside source for a period beyond that of the four years agreed upon. The Council has now passed a resolution to the effect that the agreement of December 31st, 1900, as to the company obtaining current from any other company be suspended for a period of 12 years, on condition that at the end of three years when the company's new plant comes into operation, the company will reduce the charges to private consumers in the district from 5d. to 4½d. per unit.

Shipley.—Street Lighting.—The D.C. is contemplating the purchase of new arc lamps for the improvement of the lighting of the Bradford to Keighley main road where it passes through the Council's area.

South Africa.—The business of the Uitenhage Electric Lighting and Power Co. is to be purchased by the T.C., at the price of £30,000.—*African Engineering.*

St. Anne's.—Amongst new clauses added to the St. Anne's Improvement Bill is one by which the Council seeks power to obtain an extension beyond 1917 to supply current to the Tramways Co.

Stourbridge.—Messrs. Jones & Attwood, of the Titan Works, who have recently added an electrical department, are holding an electrical exhibition this week.

Todmorden.—L.G.B. Inquiry.—An inquiry has been fixed for November 17th in regard to the application of the T.C. to borrow £5,000 for purposes of the electricity undertaking.

Tyneside.—Electric Coal Conveyors.—Three electrically-driven band conveyors for the shipping of coal into vessels, have recently been brought into operation at the Tyne Improvement Commissioners' river staiths at North Shields. Each of the belts is worked by a 20-H.P. electric motor, and the travelling, lifting and slewing of the machine are effected by independent motors of smaller power. The maximum height from which coal can be shipped by means of the conveyor at No. 5 staith is 46 ft. above high water or ordinary spring tides. In the case of the conveyors at Nos. 1 and 2 staiths, the maximum height is 39 ft. The heights measured above low water of ordinary spring tide level are 15 ft. more than the figures given. The conveyors have been constructed by the Commissioners' staff, the motors being supplied by the Sunderland Forge and Engineering Co., Ltd. The Tyne Commissioners have now six band conveyors in use at the Albert Edward Dock and the river staiths.

Weston-super-Mare.—The U.D.C. has decided to have the Boulevard lighted by suspended electric lamps of high candle-power.

Wigan.—Proposed Loan, &c.—It has been decided to reduce the price of current for heating and cooking is from 2d. to 1d. per unit.

Application is to be made for sanction to borrow £8,000, the amount of the tenders accepted for the installation of a new turbine and accessories at the electricity works.

Wimbledon.—The Corporation Electricity Department has been holding a series of demonstrations and lectures on cooking by electricity, by Mr. F. S. Grogan, of the British Electric Transformer Co., this week. Two lectures have been given daily, commencing on Tuesday last, and the series closes to-day with those at 3.30 and 7.30 p.m. respectively.

The Electric Lighting Committee has decided to make a fixed charge, from the end of the September quarter, of 3½d. per unit for electricity used principally for lighting purposes in shop premises within the borough.

Worksop.—Workhouse Lighting.—The B. of G. has appointed a committee to consider and report upon a specification drawn up by Mr. Crowther, electrical engineer to the U.D.C., for the installation of the electric light at the workhouse.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—At a meeting of the Tramways Committee tenders were opened for the electrical equipment of six new cars, and it was agreed to accept the offers of the Brush Co. for its inter-pole type motors, and the British Westinghouse Co. for controllers and electrical equipment. It was agreed to bring the proposed doubling of the Market Street line before the Harbour Commissioners and to apply for powers to run motor-omnibuses from Bridge-o'-Don to Tarbethill

Trailer Cars.—The L.G.B. has informed the Tramways Committee that it has no objection to the running of trailer cars, providing that suitable arrangements are made for turning at the termini.

Australia.—The total electrical output in connection with the Sydney tramways (N.S.W. Government) for the year ended June 30th was 89,113,036 KW.-hours, of which the alternating-current supply was 78,090,695 KW.-hours and the direct current 11,022,341 KW.-hours, being a total increase over the figures for the previous year of 11,578,757 KW.-hours, or 14·93 per cent. Thirty-three miles of high-tension transmission cable have been laid underground from the new power house at White Bay to the various sub-stations; a high-tension transmission line, 4¾ miles in length, has been erected between Manly and Collaroy Beach sub-stations, and 48 miles of low-tension feeder cable has been erected at other places. In connection with the existing lines, 22 miles of trolley wire on the City system and 2 miles at North Sydney have been renewed.—*Commonwealth Engineer.*

The Prahran (V.) City Council has approved the proposal to construct electric tramways from Prahran to Clifton Hill, at an estimated cost of £115,270.—*Australian Mining Standard.*

According to the Melbourne *Age*, the Municipal Tramways Trust Bill has been adopted by the Joint Municipal Tramway Conference at Caulfield.

Burnley.—The tramways manager has reported that the period during which the B. of T. consented to the use of a goods wagon on the tramways had expired. The town clerk was instructed to apply to the Board for consent to continue the use of the wagon. The Committee has received a petition from 28 drivers and 21 conductors against a reduction of working hours from 60 to 56 per week, and has adjourned the matter.

Canada.—A first batch of 150 'buses have been built in this country by the Associated Equipments, Ltd., and Daimler Co. to the order of the Canadian Auto-'Bus Co., of Montreal. All the 'buses are electrically heated and lighted.

The Vancouver Council is considering immediate action in the purchase of the B.C. Electric Railway. The company's franchise does not expire until 1919, but Mr. Glover has stated to Mayor Baxter that the company will consider any reasonable proposition. —*Canadian Engineer.*

Continental Notes.—France.—Some experients are at present being carried out on the Metropolitan Railway in Paris with a new system of automatically-regulated traction known as the S.T.A.R., controlled by the Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont.

Switzerland.—It is estimated that about 80 per cent. of the railway carriages on the Swiss State Railways are now equipped with electric lighting. The dynamo system is mainly in use, being fitted on about five-sevenths of the carriages, while the remaining two-sevenths having the battery system.

According to the *Daily News*, the Government intends to transform all the national railways to electric traction. As a beginning £1,560,000 will be required for the electrification of the St. Gothard Railway to Lucerne, Lugano and Milan.

Hungary.—The electrification of the great State railway lines has been resolved upon by the Hungarian Government, on account of the constantly rising price of coal. Trials have already been made on the electrified Waitzen to Gödöllö section, but owing to the distance which the hydro-electric powers had to be brought, the results were not considered conclusive. Further trials will be made on a line not yet chosen, which offers better means of studying the problem. Technical experts of the Hungarian State Railways are now prosecuting inquiries abroad, the Bavarian electrical railways being the first object of their inspection.

Dewsbury.—At the last meeting of the T.C., the Tramways Committee reported that an interview had taken place between the town clerk and Mr. Garcke, of the B.E.T. Co., with regard to the latter granting the Corporation running powers over its lines from the Market Place to Willans Road, in connection with the tramway extension to Dewsbury Moor. Mr. T. Myers said it had been suggested that a deputation should wait upon the company, but this had not been done, and the company had submitted fresh terms; these, however, were not acceptable to the Corporation, and seeing that the National Electric Construction Co., Ltd., which was to construct the new tramway, wished to abandon its part of the compact, the Corporation was in the same position as it was two years ago. He suggested that the Electricity and Tramways Committee should propose some scheme which the Corporation could carry out itself. Mr. J. E. Kilburn said that the reason of the present negotiations was that the National Co. suggested that the Dewsbury Moor trams could be more economically worked by the B.E.T. Co., and it should not complain if terms were arranged between the Corporation and the B.E.T. Co. The minutes of the Committee were eventually approved

Edinburgh.—At a meeting of the T.C. last week, notice of motion was given to remit to the Tramways Committee to consider and report as to the desirability of approaching the Edinburgh and District Tramways Co. with the object of ascertaining on what terms it is prepared now to terminate its lease with the Corporation, and of preparing a scheme for taking over the whole undertaking, and, further, with a view to securing joint municipal control of the systems in Edinburgh and Leith, to consider the desirability of taking the necessary steps for the constitution of an Edinburgh and Leith Tramway Commission.

Gosforth-on-Tyne.—The Coroner's inquiry into the accident on the Gosforth-Wallsend route of the Tyneside Co.'s system on October 18th, which resulted in the deaths of two men, was concluded on October 30th so far as the death of William Walter Amis was concerned. A verdict was returned of accidental death due to a collision in a dense fog, and the jury recommended that indicators be placed on all single lines between loops throughout the company's system.

Japan.—The Hokushin Electric Railway Co. is the name of a new concern, which has just been formed in Tokio, with a capital of £150,000, to construct a new electric railway, having a length of about 20 miles.

Lancaster.—The T.C. has approved of the suggestion that powers be applied for to run motor-'buses in the portion of the town not served by the tramways, but adjourned the scheme for the request for powers to be coupled with other schemes requiring Parliamentary sanction.

London.—L.C.C.—The Highways Committee has recommended the Council to promote powers for the extension of the tramways from Farringdon Road terminus to Ludgate Circus, from Aldgate terminus to Mark Lane station, from Aldgate to Aldgate station, and from Lee Green to Eltham. The total length of single track is 5 m. 7 f., and the estimated cost £125,880.

Leeds.—The Corporation tramways department has inaugurated a motor-'bus service between Moortown and Shadwell. The vehicle is a petrol-electric 'bus, costing about £850, and capable of accommodating 28 passengers.

New Zealand.—The report of the Christchurch municipal tramways for the year ended March 31st, shows that the net earnings were £54,532, against £49,976 for the previous year, an increase of £4,556. The net surplus was £1,930, against £2,709. The number of passengers carried was 16,060,441.—*Commonwealth Engineer.*

Oxford.—Tramway Scheme Approved.—The General Purposes Committee has approved the report of the Tramways Committee recommending that the scheme of the National Electric Construction Co. for the electrification of the tramways be approved. The scheme provides for petrol-electric cars in the centre of the town, and trolley cars or motor-'buses elsewhere.

Quarry Bank.—At the monthly meeting of the Brierley Hill U.D.C., a communication was received from the Quarry Bank Council enclosing a resolution passed by it to the effect that it thought the time had now arrived when Messrs. Balfour, Beattie & Co. should give a definite statement as to their intentions of utilising their powers in relation to the Quarry Bank and District Light Railway Transfer Order, 1912. Mr. Williams stated he understood that the company had another 12 months in order to complete its obligations. It was, he contended, important that there should be tramway communication between Rowley Regis, Quarry Bank and Brierley Hill. The Council decided to support the action of the Quarry Bank Council, and to forward a similar resolution to Messrs. Balfour, Beattie & Co.

Rotherham.—The T.C. has decided to double the tramway track from the junction of Frederick Street to the pumping station, at an estimated cost of £23,857.

It has also been decided to take up and relay the tramway track in Fitzwilliam Road, and the Council invites tenders for the supply of rails and points required.

Salford.—In the next Parliamentary Bill renewed application is to be made for powers to run motor-'buses in connection with the tramways undertaking.

Southend-on-Sea.—New Loans.—The T.C. is applying to the L.G.B. for a loan for the purchase of additional tramcars for the pier, and the tramway is to be extended at a cost of £2,175.

South Yorkshire.—Powers are being secured for a big project to link up by a tramway the colliery villages between Barnsley and Mexborough, involving the construction of a line extending 15 miles, and a proposal for the electric lighting of both the route and the district. The Urban Councils of Wombwell, Wath-on-Dearne, Bolton-on-Dearne, and Tharnscoe are the promoters. Mr. Stephen Sellon is the engineer, and the promoters also have the advice of Mr. J. B. Hamilton, general manager of the Leeds tramways. Application is being made to the Light Railway Commissioners, while in respect of the electric lighting undertaking a prov. order will be obtained. It is expected the works will be put in hand towards the end of next summer.

Todmorden.—At the monthly meeting of the T.C. it was reported that there was a net profit from the motor-'bus service during the past six months of £485.

Sunderland.—Interrunning Scheme Abandoned.—The Tramways Committee has decided not to proceed with the proposed prov. order to grant powers to the Sunderland and District Electric Tramways Co. to run cars into the borough. It is understood that the reason for the revocation of the Committee's former decision is that the company would not give an undertaking that the cars running into the borough should not have outside advertisements, or indemnify the Corporation against any action that might be taken by advertisers who had contracted with the Tramways Committee.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephony.—The new scale of charges for telephone calls between France and the United Kingdom came into force on Saturday last. For the purpose of the tariff, each country has been divided into three zones. In the first British zone are included the Southern and South Midland counties, in the second the rest of England and Wales, and in the third Scotland and Ireland. The majority of the towns in France admitted to the Anglo-French telephone service are situated in the first French zone; the principal exceptions are Belfort, Cherbourg, Dijon, Epinal, Le Mans, Limoges, Lyons, Nancy, Nantes, St. Etienne and Tours, which are included in the second zone, and Bordeaux and Marseilles, which are situated in the third zone. The following table sets forth the new tariff :—

For a call of three minutes during the day from—	To a town in first French zone.	To a town in second French zone.	To a town in third French zone.
A town in first British zone ...	4s.	6s.	8s.
A town in second British zone ...	6s.	8s.	10s.
A town in third British zone ...	8s.	10s.	12s.

The charges for single calls between the hours of 9 p.m. and 7 a.m. in summer, and between 9 p.m. and 8 a.m. in winter, will be three-fifths of the charges stated above. The period of winter comprises the months from November to February, inclusive. The charges for subscription calls effected at fixed times every night for a period not shorter than one month will also be reduced, the new rates being based on the revised tariff for calls during the day.—*Times.*

Norway.—The Post and Telegraph Department has had plans worked out for the erection of a system of wireless telegraph stations around the whole coast from Christiania to the Swedish frontier in the south, and the Russian frontier in the north, which are to be placed at certain distances from each other, so that communication can always be maintained between two or three stations. According to the plans, there will in all be 14 stations in addition to the big Marconi station under construction, of which some have already been in operation for several years. Of those already completed may be mentioned the station at Röst, which is the last of the Lofoten Islands, and that at Ingö, which was specially built for wireless communication with Spitzbergen. The most northerly station will probably be erected at the town of Vardö, in Finmarken. This station will be equipped with sufficient power to be able to keep up connection with the Ingö station on the one side, and with the Spitzbergen station on the other; it will be of immense importance, not only to the Norwegian coast steamers, but to the international tramp steamers, of which hundreds pass Vardö on their journey to and from Archangel and all other places in the White Sea. The Russian Government is said to have prepared a similar scheme for building wireless stations along the whole Murman coast, from the Norwegian frontier to the White Sea in the first instance, and from there along the northern coast of Siberia, as far as the climatic conditions will allow of it. The Vardö station will thus be connected with the Russian stations as well as those before mentioned. As regards the wireless station at Christiania, it was at first intended to build it on one of the hills behind the town, but this plan met with so much criticism in the Storthing, that the necessary money was not granted, and it had to be given up. Experts have recently visited several places nearer to the coast for the purpose of finding a more suitable site.

The first conversation by telephone between Christiania and Harstad took place a few days ago, marking the completion of a section of the big scheme of connecting Christiania by telephone to Hammerfest, Vardö and Vadsö in the north. The distance between Christiania and Harstad, which is situated somewhat to the south of Tromsö, is about 500 miles. The main line to Tromsö will be completed in the near future, and be opened for the use of the public.

Postal Servants.—On Tuesday the National Joint Committee of the Postal and Telegraph Servants was received by the Postmaster-General to discuss the position raised by the Holt Committee's report. The interview was private, but Mr. Samuel will grant the Committee a further interview on November 13th, at which a public statement will probably be made.

Telephone Rentals.—At the Dublin Court of Appeal last week it was decided that the Crown was entitled, in the case of bankruptcy, to recover the full amount of telephone rentals payable under agreements made between bankrupts and the National Telephone Co., as the Crown was not bound by the Bankruptcy Acts.

The Telephone Service.—Mr. Herbert Samuel on Monday said that he had come to the conclusion, after making some study of the telephone services in Chicago, New York, and Seattle, and in several of the towns in Canada, that their telephone service was distinctly more efficient than our service in this country was as yet—not, he believed, than our service would be. This country was ahead of the United States in the development of the automatic telephone service, and contracts for exchanges of the total value of nearly £100,000 were being placed.

Trans-Atlantic Wireless Telegraphy.—The Marconi Co. announces the inauguration of the duplex system between Canada and Ireland.

World Wireless.—It is announced that a scheme for the encircling of the world by a chain of wireless stations is in course of development by the Marconi Co.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 14th.—Two sections switchboard, common-battery multiple. See "Official Notices" October 17th.

Hobart (Tas.).—December 1st. Dry cells for the P.M.G. See "Official Notices" October 17th.

Brisbane.—December 17th. P.M.G.: Insulators. See "Official Notices" October 31st.

December 31st. P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. Specifications (£5 5s.) from Agent-General for Victoria, on or after November 10th. Consulting engineers, Messrs. Merz & McLellan, 32, Victoria Street, S.W.

Austria.—Lemberg.—November 17th. Tenders are required for the following mechanico-electrical machinery for (1) the Royal railway erection shops at Lemberg :—Form A: One 90-ton locomotive turn-table, rails (12 m. long) electrically driven; one 80-ton electric travelling crane, with two 40-ton motor-travelling screw jacks, capable of raising and transporting locomotives complete; one electric three-motor 3-ton erection travelling crane; two three-ton and 5-ton two-motor travelling screw-jacks for hanging railway; one electric light and power three-phase (220-volt, 50 periods per second) installation. (2) For the smiths' shop, Form B: One electric three-motor travelling crane, 6 tons capacity, with transmission lines. (3) For the tool-making shop, Form C: One gas-tempering stove, with accessories. (4) Form D: Locomotive wheel making arrangement, with electric equipment for constant current at 300 volts. Particulars, drawings, &c, as per Forms A, B, C and D, from Abteilung für den Zugförderungs und Werkstattendienst, K.K. Staatsbahndirection, Lemberg.

Beckenham.—November 10th. U.D.C. 12 months' supply of Midland Small Coal. See "Official Notices" October 31st.

Bedford.—November 12th. Corporation. (1) 1,000-kw. mixed-pressure turbo-alternator with exciter and condensing plant; (2) water-tube boiler with mechanical stoker and coal-handling plant. See "Official Notices" October 24th.

Belgium.—December 1st. The municipal authorities of Neufchateau are inviting tenders until December 1st for the concession for the electric lighting of the town.

January 26th. Six electric cranes on the Bassin-Canal extension. Tenders to Burgomaster, Hôtel de Ville, Antwerp. Deposit £800. Some particulars in French can be seen at Board of Trade C.I. Department in London.

Bournemouth.—November 17th. Corporation: Ten bogie electric tramcars.

Bradford.—November 15th. Electrical installation, Technical College, for the Education Committee. City Architect, Town Hall.

Canary Islands.—November 28th. The Spanish Post and Telegraph Authorities in Madrid are inviting tenders for the concession for the working of the telephonic system in the town of Las Palmas, Canary Islands, belonging to the State during a period of 15 years.

Dublin.—November 17th. Twelve months' supply of stores, for Dublin Tramway Co., Ltd. See "Official Notices" October 31st.

(*Continued on page 751.*)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Next week the new session of the Institution will commence in London—at several of the provincial centres it has already been opened. Some indication of the features which will probably mark the proceedings may be gathered from the chairmen's addresses and the official programme.

The former strongly reflect the policy of the "broader view" inaugurated by Dr. Ferranti, by their references to the non-technical interests of the Institution and its members, and this feature was emphasised in the speech of the President, Mr. Wm. Duddell, at the annual dinner of the Western Local Section the other day. It seems clear that the Institution has felt impelled—whether by the merits of the question or by the formation of new societies outside the Institution—to give serious consideration to the status and salaries of its younger members. Another point to which the chairmen have referred is the coming electrification of our railways, and though the conversion of the main lines may still be somewhat remote, their remarks on the subject clearly indicate their conviction that it will not be long delayed, and that when it does arrive it will prove of the utmost importance to the electrical industry in this country.

That this view is shared by the Council of the Institution is abundantly manifest in the programme for the second half of the session in London, which contains no fewer than eight papers on subjects connected with the electrification of railways. Whether so large a dose of one special kind of medicine will be relished by the members may be open to question, but it leaves no doubt as to the Council's views on the tendency of the times, and we trust that the papers and the discussions thereupon will bring forth an abundant store of information from those best qualified to speak, which will aid in the accomplishment of the huge task which lies before our engineers. There is probably no other country in the world where the railway traffic is so dense, the runs comparatively so short, and the prospects of a good return on the outlay required for the conversion of the railways so favourable. The resurrected feud between A.C. and D.C., unfortunately, may cause delay, as it has already done, but we hope that a way will be found, in the interests of the whole community, as well as of the electrical industry, to overcome this obstacle. The question is of so much importance that it would afford ample justification for the appointment of a Royal Commission to inquire into the merits of the rival systems. The adoption of common standards for main-line work is undoubtedly a matter of the first importance.

We published portraits and biographical sketches of Mr. Duddell, who has been elected for a second year of office as President, and Mr. A. M. Taylor, Chairman of the Birmingham Local Section, in our issue of November 8th last year. Below we give some notes on the careers of the new Chairmen of Local Sections.

Mr. Chas. Vernier, M.I.E.E., who is this year's chairman of the **Newcastle-on-Tyne Local Section,** was born in London in 1877. His early technical education was received at the Regent Street Polytechnic, but at the age of 14½ he commenced a three years' apprenticeship with Messrs. Reyrolle, then located in London. During these and subsequent years, Mr. Vernier continued his studies both at the Polytechnic and the City and Guilds Institute, Finsbury, being a bronze medallist in electrical engineering in connection with the former institution in 1894, whilst he also passed the Honours grade in the same subject, in connection with the last-named college, in 1896.

In that year Mr. Vernier was appointed electrician to the Brockie-Pell Arc Lamp Co., with whom he remained for two years, and subsequently, in a search for further experience, and upon the recommendation of Mr. Reyrolle, was appointed by Mr. Charles H. Merz, who was then chief engineer of the Cork Electric Tramways and Lighting Co., an assistant engineer with that company, for whom he supervised the relaying of the cable network and the installation of public street lighting in the City of Cork from June, 1899, to the end of 1900.

Mr. Vernier was then offered an appointment with the Newcastle Electric Supply Co., Ltd., to supervise the laying of the distributing networks in Newcastle and district, and for the past 13 years has been responsible for the bulk of this work in connection with the company's operations.

As our readers are, no doubt, aware, Mr. Vernier's experience in the matter of cables, both underground and overhead, is unique in this country; he controls the whole of the cable work connected with his own and allied companies, which includes some 40 distributing networks.

He was elected an Associate Member of the Institution of Electrical Engineers in 1904 and a Member in 1911, and contributed a paper to the Institution in 1911 on the "Laying and Maintenance of Transmission Cables"; his address as chairman of the Section was reprinted in abstract in our last issue.

Mr. William B. Woodhouse, M.I.E.E., chairman of the **Yorkshire Local Section,** was trained at the Finsbury Technical and University Colleges, London, subsequently serving an apprenticeship with the India-Rubber, Gutta-Percha and Telegraph Works Co., at Silvertown. A varied engineering experience included his return at a later date to Finsbury as a lecturer. In 1901 he was engaged at Wallsend in the development of the Newcastle-on-Tyne Electric Supply Co.'s power scheme, which was the first of its kind in this country, and two years later he was appointed manager of the Yorkshire Electric Power Co., the development of which undertaking has thus been under his control for 10 years. Mr. Woodhouse is also engineer and manager of Electrical Distribution of Yorkshire, Ltd., a company working 15 electric lighting undertakings, and of the Yorkshire Waste Heat Co., whose first waste heat station has recently been set to work, both these companies being intimately associated with the Power Co.

Mr. Woodhouse has contributed greatly to our understanding of the problems of electricity supply to the textile industries, which bulk so largely in the extensive area covered by his company. He is the author of various papers of engineering interest, and as an engineer he probably has a wider knowledge of electricity supply in Yorkshire than the great majority of his colleagues in the same industry.

Mr. H. Faraday Proctor, M.Inst.C.E., M.I.E.E., the well-known city electrical engineer of Bristol, is this year's chairman of the **Western Local Section,** in the formation of which last year he took a leading part.

Mr. Proctor hails from Tyneside; he was born in Newcastle-on-Tyne in 1867, and spent the first 25 years of his life in the neighbourhood—this period including his engineering apprenticeship with Messrs. Henry Watson & Sons, and training at the Armstrong College.

Leaving the above firm some time after the completion of his apprenticeship, Mr. Proctor joined the Newcastle-on-Tyne Electric Supply Co. as assistant engineer, remaining there until the close of 1892, when he took up his present appointment as chief engineer and general manager of the Corporation Electricity Department, Bristol.

It will be seen that Mr. Proctor has had charge of the Bristol undertaking from the very commencement, but his connection with municipal work has meant far more than 21 years of Corporation service, as he was one of the founders of the Incorporated Municipal Electrical Association, and is, in fact, the only representative who has been a member of the Council of that body continuously since it was formed some 18 years ago.

Mr. Proctor was President of the I.M.E.A. in 1898-9, and has been an indefatigable Hon. Secretary during the last eight years; he was also elected a Member of Council of the I.E.E. in 1910, being the first to be so elected by the general body of the members of the Institution.

Mr. J. A. Robertson, M.I.E.E., who is the new chairman of the **Scottish Local Section,** is the Consulting and Resident Engineer to the Burgh of Greenock. His earlier experience was obtained with the Stirling Corporation and with Messrs. Denny Bros., the Dumbarton shipbuilding and engineering firm.

During his 11 years' stay in Greenock he has been responsible for the erection of the Dellingburn power station and refuse destructor, and has introduced the three-phase



Chas. Vernier, Newcastle.



E. W. Marchant, Manchester.

CHAIRMEN OF LOCAL I.E.E. SECTIONS.



J. A. Robertson, Scottish.



Photo. by] [Protheroe, Bristol.

H. Faraday Proctor, Western.



Photo. by] [Bacon & Sons, Leeds.

W. B. Woodhouse, Yorkshire.

H.T. supply with sub-stations on consumers' premises. As our readers are aware, the Greenock electricity department has gone ahead very rapidly of late, and practically all the large works take their whole supply for both power and lighting from the Corporation ; in fact, the "units sold per head of population" in Greenock are about the highest in the country. The latest development is, of course, the extended supply to Port-Glasgow, where seven shipbuilding



Photo. by] *[Norman Dewar, Dublin.*

G. M. Harriss, Dublin.

firms have become large consumers, whilst the provisional order for the area will also be worked by the Greenock authorities.

Mr. Robertson is consulting engineer to several other Scottish burghs, and has contributed several papers to the *Proceedings* of various engineering societies.

Prof. E. W. Marchant, D.Sc., M.I.E.E., the chairman of the **Manchester Local Section**, and David Jardine Professor of Electrical Engineering at the Liverpool University, was born in 1876. He graduated in London, taking honours in both mathematics and physics, and was awarded the Granville Scholarship at the D.Sc. examination. On leaving college, Prof. Marchant served a works apprenticeship, and subsequently held the position of superintendent of the Blythswood Laboratories, Renfrew, N.B.

After a brief period at the Finsbury Technical College in 1901, he was appointed lecturer in Electrotechnics at University College, Liverpool, and is the first holder of the chair of Electrical Engineering at the University, which was founded in 1903 through the generosity of Mr. David Jardine.

Prof. Marchant has contributed numerous papers to the *Proceedings* of the Institution of Electrical Engineers and other scientific societies ; it is interesting to note that he was associated with Mr. Duddell, President of the Institution, in the development of the oscillograph. Recently he has interested himself in wireless telegraphy, an excellent equipment having been provided at Liverpool University.

Mr. Geo. Marshall Harriss, M.Inst.C.E.I., M.I.E.E., who has been elected chairman of the **Dublin Local Section**, is an engineer of wide experience both in this country and abroad. Originally a pupil of Mr. Thomas Tomlinson, he accompanied that gentleman to Queensland in 1884, and was engaged at Messrs. Babbidge's and the Queensland Railway Carriage Works ; subsequently he superintended the erection of the first quartz-crushing plant on the Croydon goldfield.

Returning to England in 1891, he joined the staff of Messrs. J. E. H. Gordon & Co. as outdoor assistant on the works of the Crystal Palace District electricity supply station. He afterwards became resident engineer of the Bray electricity works, and was appointed township electrical engineer in 1896, upon the purchase of the undertaking by the Bray Commissioners. He retained this position until 1900, when he accepted an appointment with Prof. George Forbes to act as that gentleman's representative in Ireland, and resident engineer to the Carlow Electrical Works, where he had a fairly extensive practice as consulting engineer, principally in connection with the development of water powers for electrical work. Mr. Harriss acted as resident engineer to the Irish International Exhibition throughout its run, and afterwards joined the staff of Mr. W. M. Murphy on railway construction in the Gold Coast Colony, taking charge of the first 20-mile section of the Accra Akwapim Railway, which included the laying-out of the Accra terminus, all the buildings, and the erection of the telegraph and block system of signalling throughout.

After two years in West Africa he was appointed electrical engineer to the Dublin United Tramway Co., which position he still holds. He is the author of papers on the lighting of small towns, railway construction in West Africa, &c.

Sir Joseph Swan, F.R.S.—The Electrical Review tenders its heartiest congratulations to Sir Joseph Swan, F.R.S., on the occasion of his eighty-fifth birthday. Notwithstanding his great age, Sir Joseph's interest in scientific pursuits in his laboratory at Warlingham, Surrey, shows no languishing. For a full account of this famous electrical veteran's career and his many inventions, we refer our readers to our issue of November 24th, 1904.

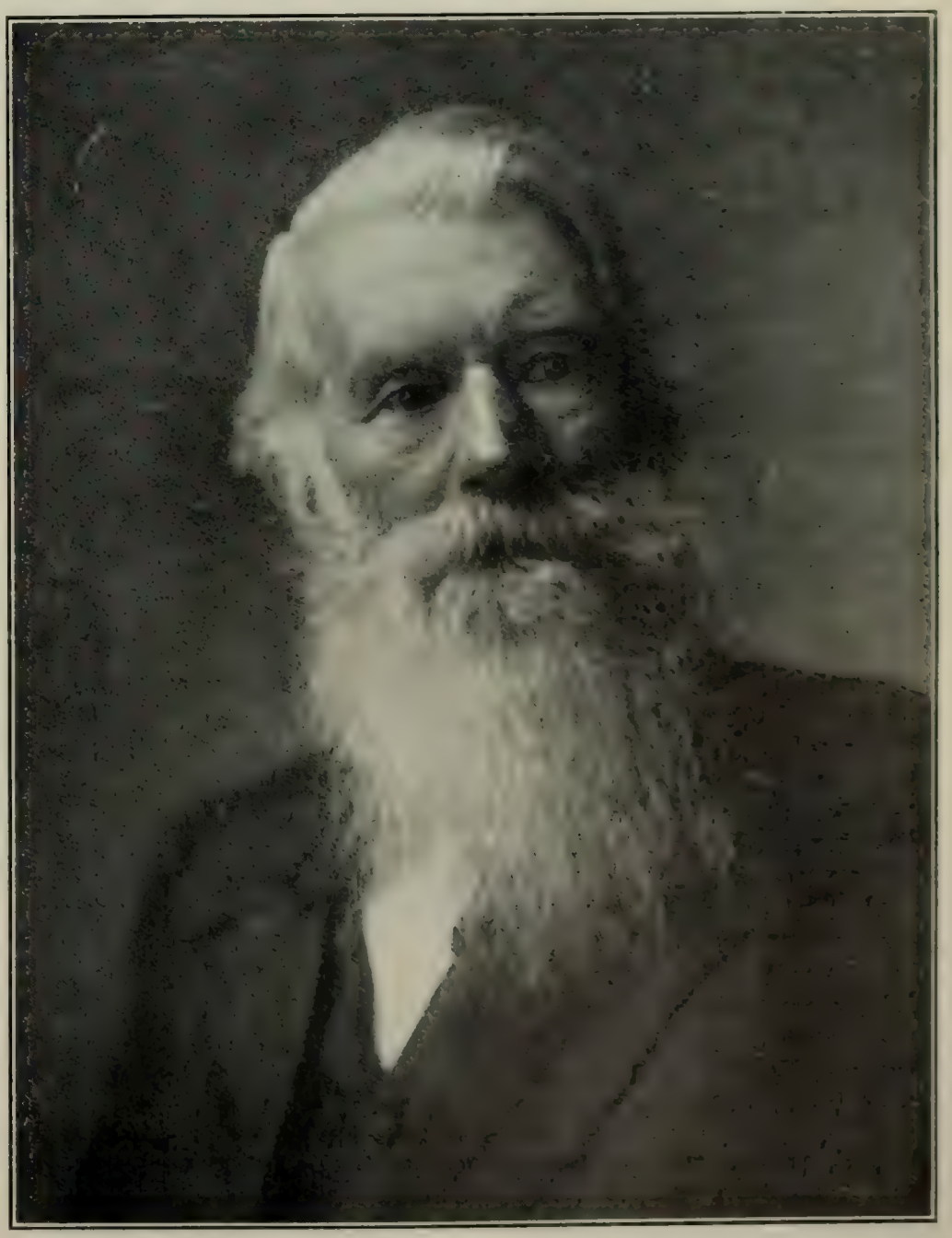


Photo by] *[Swaine.*

Joseph W. Swan

THE STERLING TELEPHONE CO.'S NEW OFFICES.

The removal of the Sterling Telephone and Electric Co., Ltd., from Upper Thames Street to Tottenham Court Road, marks the accomplishment of a further stage in the career of this prosperous concern, regarding which a few particulars may be of interest to our readers. From the commencement the company has confined its attention exclusively to telephones, bells and allied apparatus, including magneto exploders, and has hammered away steadily at this class of business without yielding to the temptation to widen the scope of its operations, with the result that it has gained a position in the front rank of the telephone industry of this country.



Public Office of the Sterling Co.



Showroom at Telephone House.

The credit for the remarkable progress made by the company and the high reputation of its products is due entirely to the founder and managing director of the company, Mr. Guy Burney, though he would be the last to claim it for himself, alleging that the success which has been attained is due to the loyalty of a devoted and proficient staff. Mr. Burney, while describing himself as a commercial engineer and not a telephone expert, nevertheless possesses an intimate and exhaustive knowledge of every phase of the telephone industry apart from public exchange installations, with which his company has not concerned itself, and combines with his technical ability a commercial acumen which enables him to gauge correctly the tendency of the moment, and to forecast the needs of the future.

The company sprang from very modest beginnings; it was established in London as an off-shoot of the Berliner Telephone Works, in 1900, the offices being situated in Queen Victoria Street: larger accommodation soon became necessary, and in 1904 new offices and a warehouse were taken in Upper Thames Street. The development of the business rendered it necessary to increase the capital and extend the range of activity of the firm, and therefore it was converted into a private limited liability company in 1909.

Mr. Burney had always cherished the hope of establishing works in this country, and under the new conditions he was able to realise this laudable ambition; before the end of the same year (1909) a large factory at Dagenham had been equipped with plant for the manufacture of telephones, &c., and was soon in full swing. Last year we paid a visit to the Dagenham works, which by that time had been very considerably extended beyond their original capacity, and in our issue of April 12th, 1912, we published a fully illustrated description of the factory. Large orders for the British and Colonial Governments have been carried out or are now in progress at these works, which also turn out a great variety of telephones, &c., for domestic, office and workshop use.

The last-named branches have, in fact, formed the foundation of the company's business, for it was by the adaptation of existing patterns of telephones to suit English conditions that Mr. Burney succeeded in popularising the telephone and creating a demand for instruments for domestic use. The company has led the way in this branch of industry by introducing many novel features, and has done a great deal towards developing the domestic market, which was previously almost non-existent. In particular, it claims to have been the first to put on the market in commercial form an intercommunication telephone with multiple levers and interlocking movements, a pattern which has proved exceedingly popular, and has been very widely adopted.

The Sterling Co., however, has confined its attention wholly to the manufacture and supply of its apparatus; it has never undertaken to carry out any installation work, but has loyally supported the contractor, rigidly refusing to grant any discount whatever except to trade customers. In this respect the company sets an excellent example to all manufacturing concerns; it is well known that failure to observe this rule has led to incessant disturbance and bitter feuds in the various trades from time to time.

The object of the new establishment, with its extensive range of show-windows and showroom, is to popularise the telephone by bringing it directly under the notice of the public; and in this respect the permanent exhibition of apparatus which has been organised by the company at



Repair Shop.

the new Telephone House is admirably calculated to achieve its purpose.

The display in the windows is so striking that it cannot fail to attract the attention of the passer-by; and the showroom presents an extraordinary variety of apparatus, mounted on a novel background which sets off the finish of the instruments to great advantage. The lighting of the windows is an object lesson in the art. The company claims that the exhibit is unique in Europe, and we have no doubt that its claim is justified.

With many of the patterns exhibited in the showroom, our readers are already familiar; others are not yet ready for publication, but we may draw special attention to a complete new range of ferrocased telephones, the cases being of drawn steel, which present an exceptionally handsome appearance, besides being compact and robust. These are made throughout at the Dagenham Works, as indeed are nearly all the instruments exhibited; the necessary tools are now being made for the remaining patterns, and in the course of a few months the whole of the company's apparatus will be made at Dagenham.

The company is not content with the present achievements; Mr. Burney is convinced that there is still an enormous scope for the development of the domestic telephone —not only the Parlyphone, which is so easily installed on any existing bell circuit, but also the more elaborate and expensive patterns of intercommunication telephone, &c.—and he is determined to prosecute his campaign in this field. One of the greatest obstacles to success in this connection is the present attitude of the telephone authorities in this country, in striking contrast to that of the German officials. Here, the Post Office will not permit any apparatus whatever to be connected with its exchanges except those which it supplies, whereas in Germany, provided that the pattern has been approved, private intercommunication telephone systems are commonly connected directly with the exchange system, so that a subscriber can not only communicate with any of his own stations without the aid of an operator, but can also get through to any other subscriber on the Government system. Difficulties have, of course, been met with in devising suitable apparatus, but these have been completely overcome, and in point of fact the system is very widely used in Germany, where it is very popular and is, of course, approved by the Government. We need not here go into the details of the apparatus employed; suffice it to say that it is efficient and adequate for all the requirements, and that the British Post Office telephone authorities have been kept acquainted with its development and progress, but that they still decline to permit any instruments to be used on exchange circuits except their own stereotyped patterns.

We cannot believe, however, that this reactionary attitude can prevail for long, in view of what has been done abroad; the Postmaster-General, Mr. Herbert Samuel, is probably the most efficient and progressive Minister who has ever occupied that office, and has repeatedly expressed his determination to press on the popularisation of the telephone service in every possible way. It may be that under the stress of making up for the time lost through the transfer of the system to the State, the staff has not been able as yet to contemplate the further development of facilities for using the service; but there is no doubt that they must come sooner or later, and the sooner the better.

We give some views of the new offices, showroom and repair shop at Telephone House, which have been fitted out with excellent judgment and good taste; the establishment also comprises large store-rooms, packing rooms, &c., and repair shops, enabling special work to be done without the necessity of reference to the Dagenham Works. We may conclude with the suggestion that Telephone House is worth a personal visit, if only to see how office work is facilitated by the complete and costly installations of intercommunication telephones, pneumatic tubes, good lighting (the semi-indirect illumination is not only exceptionally satisfactory, but has been found more economical than direct lighting), and efficient organisation.

Lamp Making in Austria.—The Watt Elektrische Gluhlampenfabrik Gesellschaft is the name of a new company which has just been formed in Vienna, with a capital of £80,000, to acquire and carry on the Watt electric lamp works in the city.

GLASGOW ELECTRICAL EXHIBITION.

In addition to the firms named in our last issue as displaying manufactures at this Exhibition the following call for mention:—

At Stand 32, Messrs. A. Schonfield & Co. of Glasgow are showing a large variety of their patent hygienic Hestia stoves, which they guarantee for five years, and which are supplied in 1, 2 and 3 units. These stoves are being exhibited in conjunction with their automatic temperature control device (Grundy system) for the automatic control of temperature in rooms. This system can also be applied to gas and steam heating. The saving claimed to be effected by means of this apparatus is 70 per cent. Installations of this heating system have been carried out for H.M.'s Offices of Works and other large concerns.

Messrs. Thomas Kesnor & Co., Ltd., of Watford, have an exhibit at Stand No. 51, which chiefly consists of electric motor control apparatus, more particularly of the automatic type, including the well-known Kesnor patent elevator controller, service controller for dinner lifts, &c., car switches, push buttons, limit and direction switches, gate locks, door contacts, &c. A special feature is their new automatic motor starter. Messrs. Kesnor also exhibit their ticket-issuing machines for picture theatres, equipped with electric counters, which can be fitted in the manager's office or other convenient position outside the pay box.

Messrs. Watson & Whyte, of Glasgow, have a stand whereon they are displaying the manufactures of the Crypto Electrical Co., the British L.M. Ericsson Manufacturing Co., Ltd., and Messrs. John C. Fuller & Sons, Ltd., for whom they are sole agents in Scotland.

Messrs. Ross & Co., of Glasgow, are showing incandescent lamps, cooking and heating apparatus, &c.; the Scottish Vacuum Cleaner Co., of Glasgow, exhibit vacuum cleaners; Messrs. Thomas and Bishop, of London, show their Cling-surface for belts, Permac commutator compound, &c.; the Telephone, Lighting and Power Co., of Glasgow, have an exhibit of telephones on view; Messrs. Wood & Cairns, Ltd., Edinburgh (agents for the Electrical Co., Ltd.). have a comprehensive exhibit of motors, dynamos, switchgear, heating and cooking apparatus, electric signs, clocks, &c.

The British Electric Heater Co., Ltd., Glasgow, exhibit electric geysers, electrically-heated towel rails and bath tanks: electric signs are shown by Messrs. Forrest & Sons, of Anderston; Messrs. E. H. Judd & Co., of Glasgow, show starters, controllers, &c., the manufactures of Messrs. Brook, Hirst & Co., Ltd., and Allen, West and Co., for whom they are sole agents in Scotland; the Jandus Arc Lamp and Electric Co., of London, exhibit their arc lamps; Messrs. Kelvin, Bottomley & Baird, Ltd., Glasgow, have an interesting collection of electric heaters and radiators, electrically-heated table plate, electric tea and coffee pots, toasters, irons, &c.; Messrs. Le Carbone, with dynamos and motor brushes, and the Nicholson and Clipper Co., Ltd., of Manchester, with belt fasteners, patent locking lampholders, girder clips, &c., complete the list.

CONTRACTS OPEN.

(*Continued from page 746.*)

France.—November 15th. The French Post and Telegraph Authorities in Marseilles (Rue Colbert) are inviting tenders for an installation of semi-automatic telephones at the General Post Office in Marseilles.

November 15th. The Municipal Authorities of Compiègne (Oise) are inviting tenders for the supply of a reserve steam engine and dynamo of a capacity of 120 KW. for the local water pumping station.

Grimsby.—November 13th. Corporation: Metal-filament lamps; ¼ to 15 H.P. continuous-current motors; ¼ to 15 H.P. motor panels; house fuse boxes and fittings; house service boxes (lead) and fittings. See "Official Notices" October 31st.

November 13th. Fine slack coal (about 11,000 tons), for the Corporation Electricity Works; Mr. W. A. Vignoles, electrical engineer.

India.—Allahabad.—Electric generating plant, consisting of oil engines, continuous-current dynamos and storage batteries. Hon. Sec., Allahabad Club, Ltd., Allahabad.

London.—November 12th. L.C.C. (1) Installation at Colebrook Row Special School, Islington, N. 95 lighting points; (2) installation at County Secondary School, Chelsea, 180 lighting points. See "Official Notices" October 24th.

Battersea.—November 13th. Corporation: Wiring of shop premises in connection with hire scheme, for one year. See "Official Notices" to-day.

Hammersmith.—November 14th. Corporation: Arc lamps for fixing on consumers' premises, to work two in series on single-phase A.C., 50 periods, 110 volts. See "Official Notices" to-day.

L.C.C.—November 26th. Installation, 140 lighting points, at Hammersmith Trade School for Girls, Lime Grove. See "Official Notices" to-day.

(*Continued on page 752.*)

Manchester.—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" to-day.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Rainhill (near Liverpool).—November 24th. Wiring and fittings for new ward, Lancashire County Asylum. See "Official Notices" to-day.

Rhyl.—November 19th. One 160-KW. Diesel engine set, for U.D.C. See "Official Notices" October 17th.

Spain.—The municipal authorities of Zumaya (Province of Guipuzcoa) have just invited tenders for the concession for the electric lighting of the town during a period of 16 years.

November 17th. Tenders are being invited by the Spanish Post and Telegraph authorities in Madrid, for the concession for the working during a period of 15 years of the telephonic system in the town of Toledo, belonging to the State.

November 18th. The municipal authorities of Chamartin de la Rosa (province of Madrid) are inviting tenders for the concession for the electric lighting of the town during a period of six years.

November 18th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working during a period of 15 years of the telephonic system in the town of Alcoy (province of Alicante), belonging to the State.

Swansea.—Harbour Trust. Three portable hydraulic or electric cranes, fixed jibs, and three with jibs fitted with compensating luffing gear. Deposit £3 3s. Mr. T. Strick, Clerk, Harbour Offices.

The Azores.—January 12th. La Junta Generale du District de Ponta Delgada, Saint Michel, Azores, is inviting tenders for the construction and working of an electric railway between Ponta Delgada and Valle das Furnas, and between Ponta Delgada and Villa da Ribeira Grande. The lines will be laid at the side of the national and municipal roads.

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

Warrington.—November 14th. Telegraph materials and carbons for a year, for the Cheshire Lines Committee. Stores Superintendent, Cheshire Lines, Warrington.

Wolverhampton.—November 9th. Corporation: One 4,000-KW. turbo-alternator, condensing plant, and auxiliaries.

CLOSED.

Australia.—Home Affairs Department :—

Generating plant at North Head Quarantine Station, Sydney, £1,404.—G. Weymouth Pty., Ltd.

External Affairs Department :—

Electric light apparatus, for N. Territory, £330.—Siemens Bros.—*Tenders*

Bacup.—The Electricity and Tramways Committee has accepted the tender of the Expanded Metal Co., Ltd., for expanded metal screen, suggested by the L.G.B. Inspector at the Stacksteads sub-station.

Belgium.—Five concerns—three German, and one each Belgian and French—submitted tenders last week to the Municipal authorities of Ixelles, Brussels, for the supply of a quantity of armoured low-tension cable, the lowest offer being that of the Société A.E.G. Union Electrique, of Brussels.

Canada.—OTTAWA.—The contract has been awarded the Canadian General Electric Co., Ltd., by the Ottawa and Hull Power and Manufacturing Co., for two water wheel type alternators each of 6,750 K.V.A., 120 R.P.M., 2,300 volts and also for two transformers, each of 6,750 K.V.A., 2,300/12,000 volts.

WINNIPEG.—The contract has been awarded Messrs. C. H. Simpson & Co., for the power house and heating plant of the new Parliament buildings.—*Canadian Engineer.*

Constantinople.—The Aster Engineering Co. has lately received an order for a batch of four-cylinder 14-H.P. marine engines to temporarily drive dynamos by belts, and subsequently be installed in boats.

Ipswich.—The Corporation contract for meters for 10 amperes and upwards has been received by Messrs. Chamberlain and Hookham, Ltd.

Leigh.—November 20th. Supply of coal (approximately 4,000 tons) for the electricity works for a year. Particulars from Electrical Engineer, Albion Street, Leigh.

Leyton.—The following tenders have been received by the U.D.C. for the supply of 1 mile of '05 single-core cable :—

R. R. Todd .. .. (accepted)	£130	Siemens Bros. & Co.	£152
Western Electric Co.	135	General Cable Mfg. Co.	160
Standard Cable Mfg. Co.	136	W. T. Glover & Co.	160
W. T. Henley's Co., Ltd. ..	145	Electrical Eng. and Equip. Co.	169
B.I. and Helsby Cables, Ltd. ..	146	Connolly Bros., Ltd.	196
Union Cable Co., Ltd.	146	Pirelli, Ltd.	210
Johnson & Phillips, Ltd.	150	General Electric Co.	210
Callender's Cable, &c., Co. ..	150		

Limerick.—The Corporation has placed an order with the Premier Accumulator Co., Ltd., for a battery, booster, balancer, switchboard and milking booster, &c.

Lisnaskea.—The order for the switchboard for the electricity works at Lisnaskea, Ireland, has been placed with the Walsall Electrical Co., Ltd.

London.—BERMONDSEY.—The following tenders have been received by the Borough Council for a supply of feeder panels :—

	£ s.		£ s.
Universal Electrical Co. (accepted)	97 10	Johnson & Phillips, Ltd. ..	141 0
Record Electrical Co. (voltmeters £2 10s. each extra) ..	104 5	Electrical Apparatus Co. ..	168 0
Eckstein, Heap & Co., Ltd. ..	123 0	Crompton & Co. (voltmeters £2 7s. each extra)	171 0
General Electric Co.	125 0	Siemens Bros.	172 0

The Council has also accepted a quotation from the Reason Manufacturing Co., Ltd., for demand indicators for feeder pillars.

SOUTHWARK.—The B.C. has accepted the tender of Alfred Blackmore & Co. for a supply of 6,000 tons of coal to the electricity station, at 14s. 3d. per ton, and 6,000 tons, at 13s. 9d. per ton.

L.C.C.—The Highways Committee has accepted the tender of the Société Anonyme Usines et Aciéries, of Allard, Belgium, for the supply of 200 cast-steel driving wheel centres for electric cars at £1 4s. 6d. each.

The Committee also accepted the tender of Messrs. Pinchin, Johnson & Co., Ltd., for 500 gallons of a special heat-resisting grey enamel for treating plough bases, at 8s. 6d. per gallon. Experiments made with this enamel proved very satisfactory, and it is the Committee's opinion that all the plough bases in use should be treated with it at the earliest possible moment, particularly in view of the approaching winter.

The Metropolitan Asylums Board has accepted the tender of the Electric Contracts and Maintenance Co., at £32 10s., for the installation of temporary fire alarm and telephone systems at the Lower Southern Hospital.

HAMMERSMITH.—In connection with the construction and erection of the coal storage and transportation scheme, the Electricity Committee recommends the acceptance of the following tenders :—

J. Mowlem & Co.—For construction of five coal storage tanks, £10,393.
Fraser & Chalmers.—Coal hoppers, weighing machine, and mixing tank at Chancellor's Wharf, £658.
Gwynnes, Ltd.—Pumping plant at Chancellor's Wharf and electricity works, £922.
Fraser & Chalmers.—Electric crane, rail track and conveying plant, £2,429.
British Mannesmann Tube Co., Ltd.—Pipe work, jointing material, &c.

The B.C. Electricity Committee has accepted the tender of Messrs. W. Cory & Son for the supply of Seven Sisters hard dry coal for the electricity works, at 12s. 9d. per ton.

Maidenhead.—The T.C. has accepted the tender of the the Crynant Colliery Co. for 1,000 tons of coal for the electricity works, at £1 1s. 4d. per ton.

Manchester.—The Electricity Committee has accepted the following tenders :—

E. Green & Sons, Ltd.—For renewal and replacement work to economisers at Bloom Street Station.
The British Thomson-Houston Co., Ltd.; the Brush Electrical Engineering Co., Ltd.; and Siemens Bros. Dynamo Works, Ltd.—For requirements of lamps during the period ending June 30th, 1914.
E. Cleaton Fees & Co. and the Vacuum Oil Co., Ltd.—For supplies of transformer and colza oil for the period ending June 30th, 1914.
Ferranti, Ltd.—For H.T. switchgear.
Johnson & Phillips, Ltd.—For supply of cable.

The Committee has accepted the offer of the Keighley Corporation for the purchase and removal of a 150-KW. motor generator.

The Education Committee has accepted the tender of Messrs W. P. Theermann & Co., Ltd., for electric light installation at the Municipal School of Domestic Economy.

The Paving, &c., Committee has accepted the tender of Messrs. E. M. Evans & Sons for the supply and fixing of the necessary cables, wiring and lamps for the electric lighting of the new offices at Great Bridgewater Street Yard.

Skipton.—The contract for the electric work at the new Premier Picture Palace has been secured by Messrs. H. Green & Co., Cononley.

Wimbledon.—The B.C. has accepted the tender of the Foster Engineering Co., Ltd., at £62, for the supply of a 75-KW. electric transformer, also the tender of the British Electric Transformer Co., Ltd., at £52 12s. 6d. for a 50-KW. transformer.

FORTHCOMING EVENTS.

Manchester Society of Model Engineers.—Thursday to Saturday, November 6th to 8th. Exhibition of Engineering Models. At Coal Exchange, Market Place.

Institution of Municipal Engineers.—Friday, November 7th. At 2.45 p.m. At 4, Southamp on Row, W.C. Presidential address, by Mr Horace Boot (President Elect), not by Mr. F. Latham, the present president, as stated in our last issue. Paper on "Electricity as a By-Product," by Mr. R. J. Spencer-Phillips.

Junior Institution of Engineers.—Friday, November 7th. At 8 p.m. At 39, Victoria Street, Westminster. Paper on "Experience in the Design, and Working on Different Kinds of Fuel, of Gas Producers," by Mr. G. E. Lygo.

Manchester Association of Engineers.—Saturday, November 8th. At Grand Hotel, Aytoun Street. Paper on "Recent Developments in Steam Condensing Plants," by Mr. A. E. Leigh Scanes.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, November 10th. At 7 30 p.m. At Armstrong College. Paper on "Steam Boiler Working in Electrical Power Stations," by Mr. J. W. Jackson.

Institute of Marine Engineers.—Monday, November 10th. At 8 p.m. Fuel Test.

Institution of Mechanical Engineers (Graduates' Association).—Monday, November 10th. At 8 pm. Paper on "Modern Methods of Steam Raising," by Mr. R. D. McGroarty.

Institution of Post Office Electrical Engineers.—Monday, November 10th. At 6 p m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Telephone Engineering Economics," by Mr. H. A. Smith.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, November 11th. At 8 p m. At 207, Bath Street, Glasgow. Ordinary meeting. Address by Mr. J. A. Robertson.

Association of Engineers-in-Charge.—Wednesday, November 12th. At 7.45 p.m. At Marconi House, Strand, W.C. Paper on "Wireless Telegraphy," by Capt. H. Riall Sankey.

Diesel Engine Users' Association.—Wednesday, November 12th. Ordinary meeting.

Faraday Society.—Wednesday, November 12th. At Burlington House, W. 4.30 p m., Tea; 5 p.m., Papers on "Passivity of Metals"; 6.30 p.m., Dinner at Trocadero; 8 p.m., Reading of Communications in abstract, followed by discussion.

Concrete Institute.—Thursday, November 13th. At 7.30 p.m. At 296, Vauxhall Bridge Road, S.W. Presidential Address by Mr. E. P. Wells.

Institution of Electrical Engineers.—Thursday, November 13th. At 8 p.m. At the Institution, Victoria Embankment. Address on "Pressure Rises," by Mr. W. Duddell, F.R.S.

Greenock Electrical Society.—Friday, November 14th. Paper on "Electric Tram-Car Equipment," by Mr. S. James, and visit to depôt.

Junior Institution of Engineers.—Friday, November 14th. At 8 p.m. At Victoria Station Restaurant. Smoking Concert. Saturday, November 15th. At 8 p.m. Visit, Saltley Gas Works, Birmingham.

Northampton Engineering College Engineering Society.—Friday, November 14th. Discussion on "The Future Sources of Energy."

Physical Society of London.—Friday, November 14th. At 8 p.m. At Imperial College of Science, S.W. Papers on "Thermal Conductivity of Mercury by the Impressed Velocity Method," by Mr. H. R. Nettleton, B.Sc. "Polarisation and Energy Losses in Dielectrics," by Mr. A. W. Ashton, D.Sc. A Lecture Experiment to illustrate Ionisation by Collision and to show Thermoluminescence, by Mr. F. J. Harlow, B.Sc.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, November 15th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Wireless Experiments," by Mr. J. R. Laird.

North-East Coast Institute of Engineers and Shipbuilders (Graduates' Section).—Saturday, November 15th. At 7.15 p.m. Paper on "Centrifugal Pumps," by Mr. A. Temple Thorne, B.Sc.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, November 10th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, November 11th.—"B" Company. Ditto.

Wednesday, November 12th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, November 13th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, November 14th.—"D" Company. Ditto.

Saturday, November 15th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Captain R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Death of Sir William Preece.—It is with profound regret that we learn, as we go to press, that Sir William Preece passed away somewhat suddenly at his home at Carnarvon yesterday (Thursday) morning.

Sir William, as our readers know, had been in very indifferent health for some time past, but it was only last week that he really began seriously to fail.

The deceased gentleman was born in 1834.

Lamp Litigation.—From an announcement appearing in our advertisement pages to-day, it will be observed that the Osram Lamp Works, Ltd., have issued a writ against Pope's Electric Lamp Co., Ltd., of Willesden, for infringement of two specified metal-filament lamp patents. In another announcement Pope's Electric Lamp Co. advise the trade and public that their indemnity for infringement of patent continues to hold good, and they are defending any action.

Electric Clocks at Montreal.—A system of self-winding electric clocks, 69 in number, is to be installed at the new City Hall, Montreal.—*Commercial Intelligence.*

Electric Time Service.—The London Hospital was provided with no fewer than 192 eight day clocks of every variety of size and quality, and consequently enjoyed 192 different standards of time; hence the proposal to equip the Institution with the "Synchronome" system of electrical time service was welcomed. Some 200 dials have been installed in connection with a controlling pendulum automatically synchronised every hour from Greenwich.

The inauguration of this electrical time service was marked by a little ceremony on Monday last, when the Hon. Sydney Holland and the other Governors of the hospital gathered round the controlling pendulum in the telephone exchange room at the entrance hall to see the first time signal arrive at 4 p.m., and to hear Mr. F. Hope-Jones, the inventor of the system, briefly describe the installation and explain its operation. On the completion of the work the clocks throughout the Institution had been set to 4 o'clock, and the pendulum was held to one side by means of an electro-magnet controlled from Greenwich Observatory. Precisely at 4 o'clock the pendulum was released and sent out its first impulse to the 200 dials, advancing them half a minute.

Every safeguard against accident that foresight can suggest has been supplied, and even the possibility of severance of the line wire during building alterations has been provided against. This protection is secured by means of a device designed by Mr. H. Dudley Tuffrey, the contractors' manager, which upon a disconnection or other irregularity in the line immediately cuts the faulty section out of the circuit.

The method of synchronisation is worthy of mention. According to whether the minute hand is before the 60th minute, or on or after it, so the Greenwich signal is directed through one of two electro-magnets whose functions are to put a small weight on a tray on the pendulum rod if the clock is slow, or take it off if fast. Consequently the clocks are kept within a fraction of a second of the mean time regulator at Greenwich Observatory.

The work has been carried out by the Synchronome Co., Ltd., under the supervision of Mr. Oatley, the surveyor of the Hospital, who has introduced into this installation a special type of dial for the wards, inserted in the walls and waterproof.

Fatalities.—On October 29th, George Barton (59), a contractor's labourer at Hyde, was employed on some repairs at the Cheshire Cheese Hotel, and was carrying a bucket of cement down to the cellar. At the head of the cellar steps was a door which was open, and the catch penetrated the casing of a live electric wire. By some means the current passed through Barton's body, killing him instantly. Another workman who was in the cellar ran to Barton's assistance, and he also received a shock, but fortunately in his case the result was not serious.

An inquest was held at Manchester on Monday regarding the death of George Draffan (26), electrical engineer, of Barton. Draffan, who was employed by the Lancashire Wire Co., of Trafford Park, was sent on October 4th to examine an electrical travelling crane, which had been reported as out of order. He was examining the installation which controlled the lifting and lowering apparatus when he overbalanced, and fell to the concrete floor, a distance of 19 ft. The current, it was stated, had been shut off before the accident, and to a person who visited him in hospital Draffan said he did not receive any electric shock, but overbalanced. A verdict of accidental death was returned.

According to a London newspaper, one man was killed and another injured by an explosion at the British Thomson-Houston works, Rugby, on Monday. Jack Kendal, a fitter, and George Gamble were working in a room where hydrogen gas is purified when an explosion occurred. Kendal was killed immediately, and Gamble was badly shaken and dazed.

On Saturday evening last, at the Empire Theatre, Cradley Heath, the death occurred of Frederick Clarke, who was employed there as stage carpenter and electrician. An employé discovered him lying in the stokehold at the back of the theatre. In his hand was an electric lamp. Attempts were made to restore animation by means of artificial respiration, but without success. His arms and chest were badly burnt. An inquest was held on Monday, and it was stated that deceased had had seven years' experience. John Cartwright, a checker, said he missed Clarke at seven o'clock on Saturday evening, and found him in the stokehold, lying on his face with an electric lamp, which he had fixed up that afternoon, in his hand. Witness had to switch off the current at the main before the lamp could be removed. The hot-water pipes were against the door of the stokehold, and deceased would have to touch them. The pressure was 200 volts. Dr. T. M. Tibbetts, who had made a post-mortem examination, said there were signs of hæmorrhage at the heart, and the lungs and kidneys were congested. The muscles of the left arm were contracted. The burns were not sufficient to cause death, and there was no evidence of disease to prove fatal. Death, in his opinion, was due to an electric shock. A verdict of "Accidental Death" was returned.

Radium Purchase.—The Radio-Active Oxygen Institute, of London, has purchased two grammes of radium from M. Paul Samter, of Paris, for curative purposes. The Institute has been undertaking the treatment of patients with radium emanation for the past 18 months. The value of the purchase just made is over £60,000.

The Diesel Engine Users' Association.—A new Association has been formed, under the name of "The Diesel Engine Users' Association." The next meeting will be held on Wednesday, November 12th. Any engineer interested in the running of Diesel engines may obtain full particulars as to membership, &c., from the honorary secretary, Mr. A. C. Gilling, Electricity Works, Epsom, Surrey.

Association of Electrical (Station) Engineers.—A meeting organised by the Bradford Section (Mr. H. C. Hughes in the chair) was held at the Old George Hotel, Leeds, October 29th, at which gentlemen representing stations at Leeds, Batley, Keighley, Dewsbury, York and Bradford were present. This being the first meeting of the Association held at Leeds, Mr. R. D. Spurr, of the Bradford Section, explained at length the objects and policy of the A.E.S.E., and a number of questions were asked and answered. It is expected as a result of this meeting that the number of members in this district will be largely augmented. Other meetings will be arranged shortly at Bradford and Huddersfield.

A meeting of the Manchester Section was held at the Manchester School of Technology (Mr. Townley in the chair), on October 30th. Mr. T. S. Wallis read a paper on the subject of "Scientific Measuring Instruments," which was very well received, and evoked an interesting discussion.

On Monday last the Birmingham and Midlands Section held a general business meeting at the Y.M.C.A., Birmingham. Mr. E. A. Gordon, the hon. secretary for this district, having resigned, Mr. J. A. Cook was elected in his place. A similar meeting was also held at Grimsby on October 30th.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The programme for the ordinary meetings of the Institution (London) is as follows:—

November 13th. The President. Address on "Pressure Rises" (experimentally illustrated).
November 27th. S. Evershed. "The Characteristics of Insulation Resistance."
December 4th. Dr. G. Klingenberg. Address on "Electricity Supply in Large Cities."
December 18th. H. C. Gunton. "The Employment of Power in H.M. Post Office."
January 8th, 1914. H. R. Speyer. "The Development of Electric Power for Industrial Purposes in India."
January 22nd. Sir Oliver Lodge, D.Sc., F.R.S. The fifth Kelvin Lecture.

Papers on the following subjects are in preparation for the second half of the session:—

"Some Railway Conditions Governing Electrification."
"Electrification of Railways as Affected by Traffic Considerations."
"Difficulties of the Electrification of Existing Termini and Goods Yards and the Effect of Existing Rolling Stock on the Main Line Electrification Problem."
"Generation of Electrical Energy for the Purposes of Main Line Traction."
"The Design of Traction Motors for Alternating and Continuous Currents."
"Rolling Stock and its Design and Influence on the Energy Consumption of Trains."
"Electric Locomotives."
"Electric Signalling on Railways."
Also a discussion on "Electric Battery Vehicles."

The twelfth annual dinner of the Glasgow Section is to take place on December 11th, at the Grosvenor, Glasgow. The chairman of the Section (Mr. Robertson) is to deliver his inaugural address on Tuesday next, 11th inst. On December 9th Dr. Klingenberg will give an address on "Electricity Supply in Large Cities." On January 13th Mr. H. C. Gunton will read his paper on "The Employment of Power in H.M. Post Office." The Students' Section began its proceedings on October 7th with an address by its chairman, Mr. A. Page. On December 2nd there is to be a paper by Mr. John Menzies on "Some Electrical Troubles I Have Met in Mines." On February 6th, Mr. D. J. M'Kellar will deal with "Wireless Telegraphy," and on March 3rd, Mr. H. A. Stewart will take as his subject "The Maintenance and Repair of D.C. Plant."

The opening meeting of the session of the Manchester Section was held in the Midland Hotel, Manchester, on Tuesday, 4th inst., when Prof. E. W. Marchant (Liverpool University) delivered his inaugural address. The meeting afterwards took the form of a smoking concert, at which an excellent programme was gone through. There were about 120 members present.

Junior Institution of Engineers.—The programme of this Institution includes papers on "Maintenance (Electrical)," by Mr. T. A. St. Johnston, to be read on November 21st, and "Patent Protection," by Mr. A. Abbey, to be read on November 28th. The presidential address by Sir Boverton Redwood, Bart., &c., will be delivered on December 5th.

A Local Section of the Institution, with Manchester as its centre, was inaugurated at a meeting held at the Victoria Hotel, Manchester, on Friday last. Over 60 engineers were present, representing many branches of the industry, the majority of whom signified their intention of joining the Section. Mr. W. A. Tookey, a vice-chairman of the Institution, presided, and said that some of his friends had suggested that Manchester was already well supplied with engineers' societies; but the Junior Institution of Engineers was unique, in that it embraced all engineers, and he claimed that membership would prove of great benefit to the individual. The proposition to send a requisition to the Council asking to be allowed to form a local section was carried *nem. con.*, and the following were appointed officers: Mr. C. H. Prichard, chairman; Mr. Maurice Hird, vice-chairman; and Mr. F. G. Hatch, hon. secretary, the latter appointment to be confirmed by the Committee.

Association of Mining Electrical Engineers.—At the opening meeting of the session of the Yorkshire Branch, the President (Mr. H. C. Jenkins) said that members should endeavour to broaden their knowledge of electricity, because at all mining disasters the first question asked was whether electricity installed underground was the cause. Electricity was made the scapegoat wherever possible, and it was the duty of the mining electricians to disprove this charge. Mr. John Bantham, electrical engineer at the New Sharlston Collieries, Wakefield, gave a paper on "Testing Transformers for Colliery Work." He attributed a good number of colliery accidents to the ignorance of men in charge of machines. The transformer testing plant cost about £35, and had saved his colliery £150 a year.

The opening meeting of the winter session of the Notts and Derbyshire branch was held at Eastwood on Saturday last. The members were given an opportunity of inspecting the electrical power station at Moor Green, which supplies six collieries in the district. Officers were elected, including as President, Mr. L. G. F. Routledge, Eastwood; secretary, Mr. F. Cusworth, East Kirkby.

Northampton Engineering College Engineering Socety.—On Friday last a paper on "Military Engineering—Bridging," was read by Mr. Douglas C. Goodswin.

Institute of Marine Engineers.—Last week the Lord Mayor laid the foundation-stone of the new headquarters of the Institute.

Royal Institution.—The eighty-eighth Christmas Course of Juvenile Lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. H. H. Turner, F.R.S., his title being "A Voyage in Space." The lectures will be experimentally illustrated.

North-East Coast Institution of Engineers and Shipbuilders.—The Hon. Sir Charles A. Parsons, president, at the annual meeting on October 31st, discussed recent advances in marine engineering. Dr. Föttinger had informed him that the aggregate H.P. of his hydraulic gearing ordered within the last 12 months was about 100,000 B.H.P. Electrical gearing had, however, made small progress. Besides the U.S. collier *Jupiter* and the Canadian vessel *Tynemount*, he understood that in America several fire floats of about 800 H.P. had been equipped with electrical gear for working the propeller, fire pumps and other machinery. The use of mechanical gearing had considerably extended during the year, and the H.P. on order or at work now exceeded 400,000 B.H.P.

Manchester Electrical Dispute Settled.—We gather from the *Manchester Guardian* that in this dispute between the Electrical Trades Union and the Electrical Employers' Association, the men demanded an extra 1d. per hour on the present rate of 9d. The employers offered to submit to arbitration or to give an extra ½d. per hour to come into force on the first day in January. A member of the Executive Committee which represents 27 Manchester employers pointed out that the month's notice would be unreasonably short and would involve loss on existing contracts; the present minimum wage is 39s. 6d. per week, and the extra ½d. offered would bring the rate up to the London standard, which is the highest in the country, and not applicable to Manchester conditions.

A joint meeting of the employers and operative electricians on November 4th agreed to an advance of ½d. per hour, providing work is resumed immediately; rules are to be drawn up providing for six months' notice of any change.

Lighting Control Examinations.—The enterprising competition set on foot by Messrs. A. P. Lundberg & Sons has enlisted the interest of many competitors, and the results of the September examinations are announced in our advertisement pages to-day; it will be seen that the candidates hail from all parts of the country, and even from the Continent. We understand that the working of the papers, especially those of the advanced grade, has not been an easy matter for the candidates, and there is evidently plenty of scope for further investigation of the subject. The possibilities of control were certainly not fully realised before Messrs. Lundberg took the matter in hand, and their efforts to promote the study of this subject, and thus to increase the convenience and attractiveness of electric lighting by making full use of one of its unique advantages, are worthy of commendation.

Railway Accident.—On Wednesday the news arrived of still another grave railway disaster, this time in France. According to the *Pall Mall Gazette*, "The mail van was smashed to atoms, the gas tanks exploded, and the wrecked compartments caught fire." The report goes on to say that charred bodies were recovered, and it was almost impossible to identify the dead owing to the way in which they had been burned. About 40 lives were lost, and many persons were injured.

Whist Drive.—A whist drive promoted by the South Lancashire Tramways Co. took place at the club rooms, Howe Bridge, on Wednesday night, October 29th, between 50 and 60 persons taking part.

Stealing Lamps.—A youth named Clifford Jones (17), described as a fireman, was bound over by the Swansea magistrates on Tuesday for stealing 39 electric lamps from the Public Library, Market and Swansea Y.M.C.A.

Appointments Vacant.—Arc lamp repairer, for Newport Corporation; assistant electrical engineer, for Fareham U.D.C. (35s.); overhead lineman, for the Kirkcaldy Corporation Tramway Department. Particulars are given in our advertisement pages.

Inquiries.—The makers of automatic switchgear for the operation of an occulting electric incandescent port light, and makers of the "Kanson" tungsten lamp, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. P. E. RYCROFT, electrical engineer to the Heston and Isleworth U.D.C., has had his salary increased from £400 to £425 per annum, rising by annual increments of £25 to £500. He was appointed in July, 1906, at a commencing salary of £300, and reached his maximum three years ago. In recommending the increase, the Electricity Committee directed special attention to the fact that during the last three years station extensions, exclusive of mains, &c., had been carried out to the extent of £10 000, and that had a consulting engineer been engaged, fees of about £500 would have been payable; and they could not speak too highly of the manner in which Mr. Rycroft carried out his duties, and of the special attention given by him to the matter of securing new customers.

MR. C. B. CRIPPS has resigned his position with the L.C.C. tramways, to take up a better position with the Aldershot U.D.C.

At the last meeting of the Gloucester City Council the question of having one general manager for the tramways and electricity undertakings was discussed, and a recommendation of the sub-Committees, that MR. CORSON, at present manager of the electricity works, should be appointed engineer and general manager of the light railways undertaking as well as of the electricity undertaking, if satisfactory arrangements could be made, and that such arrangements should include the appointment of some person to undertake the general duties of traffic manager under the supervision and control of the general manager, was carried. A larger Committee was thereupon appointed to further consider the matter and formulate and submit for consideration a scheme for giving effect to the recommendation.

On October 30th, at the Stoke-on-Trent Electricity Works, MR. TURNBULL, who was leaving to take up the position of electrical engineer at Aylesbury, was presented with a Spod Comport by the works staff. Mr. T. Hall, works foreman, who made the presentation, referred to Mr. Turnbull's work as secretary of the Department's Engineering Society.

General.—MR. C. F. VENNDT, who has been connected with the Great Northern Telegraph Co., Ltd., of Denmark, for more than 43 years, and superintendent of the London station since 1876, will retire from active service at the end of this month. Mr. L. T. Obel has been appointed as his successor from November 1st.

The following are the results of the municipal elections in Yorks so far as they concern the electrical trade:—J. LAW, electrician, the Labour nominee in the South Ward, Halifax, was defeated by the retiring Conservative councillor by a majority of 457; and HARMAN VISGAR, electrical engineer, unsuccessfully contested the Central Ward, Leeds, in the Conservative interest, and by his defeat the Liberals gained a seat.

MR. JOHN BELL SIMPSON, of Bradley Hall, Wylam-on-Tyne, has, through the Lord Mayor of Newcastle-upon-Tyne, given £10,000 to various local charities. A little while ago Mr. Simpson gave £10,000 towards the endowment fund of Armstrong College, Newcastle. Mr. Simpson is well known in the electrical world, being chairman of the Newcastle and District Electric Lighting Co., Ltd., and of the Waste Heat and Gas Electrical Generating Stations, Ltd., and a director of the Cambridge Electric Supply Co., Ltd., Scarborough Electric Supply Co., Ltd., Parsons Marine Steam Turbine Co., Ltd., &c.

Newspaper reports state that MR. T. A. EDISON is suffering from a breakdown in health.

COUNCILLOR ALEX. SINCLAIR, chairman of the Swansea Electric Lighting and Tramways Committee, was re-elected on the Swansea Council, on November 1st, for the Ffynone Ward, gaining a record majority of 196 for the Municipal Reformers over Mr. Dyson Jones (Progressive). Councillor Sinclair has been 16 years on the Swansea Borough Council.

MR. W. L. DEES has resigned his position with Woolwich Borough Council to take up an appointment as reserve shift engineer with the Mersey Electric Railway, Birkenhead.

MR. J. W. LAW, for many years representing Messrs. Crompton and Co., Ltd., in the South Wales district, has commenced business on his own account at Chancery Chambers, Rutland Street, Swansea.

NEW COMPANIES REGISTERED.

Fuller Accumulator Co., Ltd. (131,919).—Registered November 1st, by Tarry, Sherlock & King, 17, Serjeants' Inn, E.C. Capital, £65,000 in £1 shares (20 per cent. preference). Objects: To carry on the business of electrical and general engineers, &c., and to adopt agreements (1) with G. Fuller, G. J. A. Fuller and L. Fuller, and (2) with John C. Fuller & Son, Ltd. The signatories (with one share each) are:—G. J. A. Fuller, Badwell Cottage, Draycot Road, Wanstead, electrical engineer; F. J. Gordon, 7, Tennyson Avenue, Wanstead, electrical engineer; E. W. Clarke, Beechcote, Vicarage Lane, East Ham, electrical engineer; W. F. Moorcroft, 11, St. Dunstan's Road, Forest Gate, E., clerk; T. Jones, 46, Newport Road, Leyton, foreman; C. G. Wood, 82, Wanstead Park Avenue, Wanstead Park, E., electrical engineer; W. J. Brooks, 124, Richmond Road, Leytonstone, clerk. Minimum cash subscription, 2,000 shares. The first directors (to number not less than three or more than seven) are G. Fuller, L. Fuller, G. J. A. Fuller, and F. J. Gordon; qualification (except first directors), £500; remuneration (except managing director), £200 each per annum.

Coventry Electric Cable Co., Ltd. (131,[illegible]).—This company was registered on October 28th, with a capital of £[illegible] in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—E. T. Pierson, 17, Hertford Street, Coventry, chartered accountant; G. E. Bailey, 44, Kensington Road, Coventry, clerk. Private company. Table "A" mainly applies. Registered by E. T. Pierson & Son, Coventry.

Ozonair, Ltd. (131,[illegible])—This company was registered on October 29th, with a capital of £[illegible], in £1 shares, [illegible] 7 per cent. participation preference, to acquire the business, assets and undertaking of Ozonair, Ltd., to acquire any invention relating to the production, treatment, application, supply and generation of electricity and gas, and apparatus therefor, in particular in relation to improvements in apparatus for [illegible], purifying and other treatment of atmospheric air, and to adopt an agreement with the said old company and T. S. Wedderell, the liquidator thereof. The subscribers (with one share each) are:—J. E. Way, 23, Waverley Avenue, Peckham Rye, S.E., clerk; J. H. Jones, 212, Totterdown Street, Tooting, S.W., clerk; A. T. C. Warbey, 57A, High Street, Kingsland, N.E., clerk; W. T. Bond, 61, Tyson Road, Balham Hill, S.W., clerk; F. W. Feetum, 6, Evesham Road, Newington Green, N., clerk; C. S. Hume, 91, Kentnor Road, Lower Tooting, S.W., clerk; L. P. Weber, 66, Mervan Road, Brixton, S.W., clerk. Minimum cash subscription 12,500 shares. The number of directors is not to be less than three or more than seven; the first are H. E. Salt, T. J. Anderson, S. Gillatt, F.C.S., and E. L. Joseph, M.I.E.E., F.C.S.; qualification, £200; remuneration, £100 each per annum (chairman, £150), and a percentage of the profits. Registered office, 96, Victoria Street, S.W.

Electric Lighting and Engineering Co., Ltd. (131,[illegible]) This company was registered on October 24th, with a capital of £[illegible] in £1 shares, to take over the business of an electrical engineer and contractor, and dealer in articles, apparatus and things used in connection therewith, carried on by J. O. Rhodes, as "The Electric Lighting and Engineering Co.," 137, Duke Street, Liverpool. The subscribers are:—J. O. Rhodes, 145, Duke Street, Liverpool, engineer; H. Shipland, 9, Cook Street, Liverpool, consulting engineer; P. Marsh, 9, Cook Street, Liverpool, solicitor. Private company. The number of directors is not to be less than two or more than seven; the first are J. O. Rhodes, H. Shipland, and P. Marsh (all permanent); qualification, £50; remuneration, 10 guineas each per annum. Registered by Richardson, Marsh & Co., 19, Cook Street, Liverpool.

Metals Decoration, Ltd. (131,905).—This company was registered on October 31st, with a capital of £3,000 in £1 shares (1,500 preference), to manufacture and supply metallic ware made by stamping, spinning, or by electro-deposition; to acquire chemical or electrochemical and metallurgical processes, or processes in any manner relating to the production of metal ic ware and decoration and ornamentation of metallic or other substances, to carry on business as smelters, refiners, casters, rollers, assayers and manufacturers of and dealers in minerals, metals and ores, electricians, engineers, &c., and to adopt an agreement with S. O. Cowper-Coles. The subscribers (with one share each) are:—Major M. J. W. Pike, 144, St. James' Court, S.W.; Col. F. Cochrane, 84, Cathcart Road, S. Kensington, S.W., retired. Private company. The number of directors is not to be less than three or more than six; the first are Major M. J. W. Pike, Col. F. Cochrane and S. O. Cowper-Coles; qualification, 100 shares; remuneration as fixed by the company. Registered office, 1 and 2, Old Page Street, Westminster, S.W.

Imperial United Lamp Co., Ltd. (131,924.)—This company was registered on November 1st, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, lamps, fittings and accessories, electricians, engineers, manufacturers of electrical appliances, &c., and to adopt an agreement with J. C. Moth. The subscribers (with one share each) are:—E. C. Lauderdale, 85, London Wall, E.C., solicitor; J. C. Moth, York Mansions, York Street, S.W., secretary. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, £100; remuneration as fixed by the company. Registered office, Caxton House, Westminster.

Simplex Insulators (Bourke's Patent), Ltd. (131,771).—This company was registered on October 23rd, with a capital of £3,000 in £1 shares, to carry on the business of electrical and mechanical engineers and contractors, manufacturers of, and dealers in, electrical apparatus, &c., and to adopt an agreement with D. C. Glen and A. M. B. Grahame for the acquisition of the patents and rights referred to therein. The subscribers (with one share each) are:—D. C. Glen, 46, Queen Victoria Street, E.C., engineer; J. W. F. Grahame, 20, Bucklersbury, E.C., chartered accountant. Private company. The number of directors is not to be less than two or more than five; the first are D. C. Glen and A. M. B. Grahame (both permanent, subject to holding £100 shares). Registered office, 20, Bucklersbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brown & Parsons (1913), Ltd.—Particulars of £600 debentures, created October 13th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Manaos Tramways and Light Co., Ltd.—Trust deed dated October 6th, 1913 (supplemental to trust deed dated October 20th, 1909), to secure £100,000 debentures, part of an authorised series of £500,000, charged on concession by the State of Amazonas on the electric services of the State, including tramway and lighting system in the City of Manaos, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Metropolitan Trust Co., Ltd., Gresham House, Old Broad Street, E.C.

F. L. Mitchell & Co., Ltd.—Particulars of £200 debentures, created October 10th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—A notice of the appointment of F. Halsall, of 104, King Street, Manchester, as receiver or manager, on October 17th, 1913, under powers contained in instrument dated December 9th, 1908, has been filed pursuant to Sec. 94 of the Companies' (Consolidation) Act, 1908.

E. Brook, Ltd.—A memorandum of satisfaction in full on October 17th, 1913, of deb. dated October 18th, 1912, securing £3,000, has been filed.

Varley Magnet Co., Ltd.—Issue on June 24th, 1913, of £600 debentures, part of a series of which particulars have already been filed. (Notified October 18th.) Particulars of £1 000 second debentures created October 1st, 1913, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

James Keith & Blackman Co., Ltd.—Issue on October 28th, 1913, of £50 debentures, part of a series of which particulars have already been filed.

G. Weston & Son, Ltd.—Debenture dated October 17th, 1913, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. Perks, Dolanog, Rhyl, Flint.

Dent & Co. and Johnson, Ltd.—Mortgage debenture dated September 19th, 1913, to secure £500, charged on company's undertaking and assets. Holders: E. Dent & Co., Ltd., 61, Strand, W.C.

Power Plant Co., Ltd.—Debenture dated October 22nd, 1913, to secure £5,000, charged on factory and works at Yiewsley, West Drayton, including fixtures and machinery and company's other assets. Holders: E. M. Hall, Bar House, Fleet Street, E.C.; and E. D. Vaisey, 89, Threadneedle Street, E.C. This debenture ranks *pari passu* with £7,000 prior debentures.

Walton & Clough, Ltd.—Mortgage dated October 4th, and as collateral security thereto, a debenture dated October 14th, 1913, to secure £472, charged on £635 due to company and the company's undertaking and property, present and future, including uncalled capital. Holders: Croft, Perkins, Ltd., Empire Works, Thornbury, Bradford.

Marbro, Ltd.—Issue on October 14th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Charles Haseler & Sons, Ltd.—Debenture dated October 15th, 1913, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Trafford, Lea House, Gravelly Hill, Birmingham.

Cleveland and Durham Electric Power, Ltd.—Trust deed dated October 6th, 1913, to secure £250,000 5 per cent. debentures, charged on freehold lands, and buildings at Middlesbrough and Seaton Carew, shares and debentures, &c., in the Cleveland and Durham County Electric Power Co., Northern Counties Electricity Supply Co., Ltd., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C., and A. F. Pease, 92, Northgate, Darlington.

Shipston Electrical Co., Ltd.—Particulars of £300 debentures, created October 16th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

Gent & Co., Ltd.—A memorandum of satisfaction to the extent of £1,000 of first mortgage debentures, dated January 5th, 1904, securing £17,000, of which £10,000 was outstanding on June 26th, 1909, has been registered.

British Empire Lighting and Construction Co., Ltd.—Deed of indemnity dated October 24th, 1913, to secure any moneys for which the mortgagees may become liable under a guarantee for £500 to the company's bankers, charged on company's undertaking and property, present and future. Holders: M. J. Johnson, The Hall, and W. Gilding, Swineshead, near Boston; M. Watchorn, Donington, near Spalding; and F. S. Robins, Wyncote, Boston.

CITY NOTES.

Monte Video Telephone Co., Ltd.

Mr. Charles Lock (chairman), presided on October 29th, at Winchester House, E.C., over the twenty-fifth annual meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 671), the Chairman said the value of their property stood in the books at £191,000, as against £195,000. A sum of £15,000 had been written off for depreciation, whilst they had added £10,900 as capital outlay. Other items of the balance-sheet did not call for much comment. Stores were rather more than last year, as they found it more convenient to meet sudden demands to keep rather a larger stock of instruments and apparatus in store. Investments were £4,000 more, and as he had said at previous meetings they showed a slight increase over cost price. Bills receivable were £1,000 more than last year, and their cash resources were £7,019, as against £6,138 last year. On the other side there was little change from last year. The profit and loss account showed a very considerable increase in subscriptions over last year. The figures were £69,000 odd as against £61,556 over the previous year. Unfortunately working expenses in Monte Video had gone up to almost the same extent, being £41,549 as against £35,484. The profit for the year was £25,833, as against £25,719 last year, or a difference of about £700 in favour of this year. The increase in the working expenses was due to three or four causes. In the first place they were always under the necessity of dealing with a certain number of removals of instruments from one place to another caused partly by moving and partly by building operations. Another cause was the necessity they were under of transferring a good many of their wires from two of their exchanges to a new one. But perhaps the most important cause for the increase was the necessity for repairing the very considerable damage done by the storm which occurred in March last, and which their manager reported was the severest ever experienced in the River Plate since the formation of the company. It blew down a number of their poles and wires, and it took them two months to repair the damage caused. They were continually subject to storms, which not only caused considerable interruption to the subscribers' communications, but also caused difficulty when it came to renewing the wayleaves, for people who had suffered damage did not care about having the weight of the company's wires resting on their buildings. Their local administration had pointed this out to the authorities, and they, recognising the reasonableness of the request, had acceded to them laying two sections, of about a mile in length, underground. They would pursue the policy of laying the wires underground wherever it was practical. That brought him to the question of underground installation which they had so often talked about at these meetings. For years past they had been desirous of installing an underground system with the object of improving the service and giving the public the benefit of the most modern and up-to-date appliances known. It was not their fault that this had not been done. Their service, he believed, was as good as it could be made under the conditions, but they felt if they could go underground that they could give a better service, and they were always prepared to do so. But in this connection the Government had from time to time talked of installing their own system, and recently a Bill had been introduced into the House of Deputies authorising the Government to establish its own telephone system. One of the deputies raised the contention that the company had no concession for its business, and that when the Government had installed its own system, which would take about four years, they could then calmly order the company to remove their poles and apparatus without receiving any compensation whatever. He need hardly say that the board did not share that view. Even were it the fact that they had no concession, they would not admit the justice of the contention that they should receive no compensation, having regard to the fact that for years they had provided the best telephone service which they were allowed to give, and had incurred a large capital expenditure in doing so—an expenditure heavier than that represented in the balance sheet, because in years gone by they had written off considerable sums from capital account. However, they had taken the best legal opinion they could get, both in Monte Video and in London, and that opinion confirmed the view that the board always held, which was that they not only had a good and valid concession, but that it was one which was perpetual in character. Therefore they considered they had a strong claim for compensation. Still he thought it better to look at it from a business point of view, and he believed the Government must recognise that in putting down a new system such as would meet the requirements, it would mean an expenditure of anything between two and three million dollars, and that was not an easy sum to raise in these days. He ventured to think the Government would have to pay considerably for the accommodation—greater, perhaps, than the amount of profit they could hope to realise by working their own system. These were considerations which he thought must commend themselves to the business instincts of the Government in Monte Video, and they placed considerable reliance on the spirit of fair-play which they were justified in expecting from a civilised Government. At the same time it was well to state that the company were willing to fall in with any reasonable suggestion for the benefit of the public in Monte Video, and were at all times ready to come to a fair arrangement which would meet the reasonable aspirations of the Government and fulfil public requirements, and at the same time safeguard the company's interests. During the year they had received a visit from the manager in London, and had discussed all the problems which affected their property in Monte Video. Whilst in London, Mr. Powell reported fully on the physical conditions of their system, and called attention to the necessity of renewing the switchboard at the central exchange, and aided by the expert advice of Sir John Gavey, they were taking steps to do this. They had been somewhat liberal in their appropriation to the depreciation account in the past, and to meet this expense, they were reducing the amount written off the depreciation and carrying £8,500 to the renewal fund.

Mr. J. G. Le Marchant seconded the motion.

Mr. Snell complained of the action of the Government, which he characterised as scandalous. For years the company had been in the position of having the sword of Damocles hanging over their head. He hoped that a full report of the chairman's speech would be published in Monte Video, so that the public there should know the position. If it came to fighting, he was sure the board would have the thorough backing of the shareholders.

The Chairman said a report of the meeting would be sent to Monte Video. The Government Bill would have to go before the Senate, and they would take care that the views of the company were thoroughly represented in that chamber.

The report was carried, as was also a motion for the payment of a final dividend on the ordinary shares, making 6 per cent. for the year.

A hearty vote of thanks to the board and staff, proposed by Mr. Kingsbury, concluded the meeting.

Metalite, Ltd.

An extraordinary general meeting of this company was held at Salisbury House, E.C., on Thursday, October 30th, Mr W. Stewart presiding, for the purpose of confirming the special resolution adopted at an extraordinary general meeting held on October 13th.

The Chairman, in proposing that the resolution should be confirmed, said that as they were aware, at the extraordinary general meeting, held there on October 13th, the resolution as set out in the notice of October 4th last was duly passed by a large majority. That day's meeting was a formal one, to confirm such resolution with a view to carrying out the scheme of reconstruction of which they approved. The directors would be immediately communicating with the larger shareholders, with a view to forming a strong committee to take in hand the negotiations now existing, and to decide as to the *personnel* of the new board. The first mortgagees, the bankers, had granted a further extension of time to November 30th next, in order that the new company might be registered and the scheme completed. They were, however, indebted to one of their largest shareholders who had during that week paid a certain sum of money to the mortgagees in order to bring about this desirable extension. As he dealt *in extenso* with the position at the first meeting, he would formally move that the resolution set out in the notice be confirmed.

Mr. Bentley, in seconding the motion, said that was simply a confirmatory meeting, and, as the chairman had told them, if it had not been for the generosity of one of their largest shareholders, they would have been placed in a very difficult position. They hoped to get the scheme of reconstruction completed by the end of November.

The motion was adopted.

Edison and Swan United Electric Light Co., Ltd.

The directors' report for the year ended June 30th, 1913, says that after providing for interest on both classes of debenture stock, and depreciation upon freehold properties and plant at the same rate as heretofore, but before allowing for special depreciation on these and other assets, there is a loss of £4,752. The net result after providing for the various depreciations shown in the accounts is a credit balance on revenue account of £1,036, which is carried forward. This result is very disappointing, but has arisen principally from the fact that the manufacture and sale of metal lamps during the whole of last winter was to a great extent suspended in consequence of difficulties which had arisen between the owners of the patents relating to drawn wire lamps and this company. The directors are, however, glad to report that all matters in dispute have now been satisfactorily arranged and the company is manufacturing and selling all classes of metal lamps. Since the company commenced the manufacture of this type of lamp some few years ago, the cost at which they can be produced has been very materially reduced, and the board have therefore had made a careful valuation of the whole of the lamp stocks, and have written them down to approximately present manufacturing cost price.

The value at which various other assets appear in the books of the company has been closely examined, and in order to provide for the special depreciation necessitated by the closing of the Benwell factory, and of the company's own printing works in Maiden Lane, the writing off of obsolete plant and stocks, expenditure on foreign branches, and reduction in value of sundry investments and other minor assets, it has been necessary to provide a sum of £48,014. The reserve account amounting to £45,000, together with an amount of £3,014 out of the sum brought forward from last year, has been allocated for this purpose. The whole of the lamp manufacture has now been concentrated at Ponder's End, and the stocks transferred there from the South Benwell works, which have now been closed down, and the board have had the property valued in view of its disposal. The directors are advised that the amount at which the Benwell property now appears in the books should ultimately be realised. The Queen Street premises, of which the company hold a long lease, have been found unsuitable for the business and steps are being taken to let this property. The lease of 123 and 125, Queen Victoria Street, has therefore been acquired; these premises offer great advantages for carrying on the business, there being a showroom on the ground floor which the directors believe will prove to be admirably suited for the purposes of the company's trade. The premises in College Hill used as a showroom and stores will be finally closed as soon as the new premises in Queen Victoria Street are ready for occupation. The whole of the stores department hitherto carried on there, together with the staff, have been transferred to the Ponder's End works. These changes have enabled the board to make very considerable economies without loss of efficiency, and the result of this policy should materially benefit the earnings during the current year. The directors' fees have also been largely reduced. A gentleman well known in the electrical world has been engaged as sales manager, and from the large experience which he will bring to bear upon this department, coupled with a comprehensive scheme of advertising which has been inaugurated, the directors are looking for considerable expansion in this direction. From the various economies which have been made, together with the increased business likely to accrue from the reorganisation of the sales department and advertising, the board are of opinion that the prospects for the current year are distinctly favourable. Mr. Henry Wolfenden, the late chairman of the company, retired from the board in March last, and at the request of an influential body of shareholders, the board elected Mr. Charles Jermyn Ford as director and chairman. Mr. William Murray, owing to pressure of other business, has also retired from the board. Mr. C. E. Hunter and Mr. E. Gimingham, who have been connected with the company for many years, have been elected technical directors, and shareholders will be asked to confirm these appointments. Mr. Ellice-Clark retires from the position of directors and offers himself for re-appointment.

The annual meeting is to be held at Winchester House, E.C., on Tuesday next.

R. & J. Dick, Ltd.—The directors' report for the year to August 31st last shows a net profit of £71,628, plus £4,198 brought forward. The directors propose to write off goodwill account, £10,000; to write off development account, £8,000; to place to preference dividend reserve fund (making it £30,000), £14,932; to pay a dividend of 4 per cent. on the ordinary shares, less income-tax, and to carry forward £11,473.

Bahia Tramway, Light and Power Co.—It is announced that in view of the resolution of the debenture-holders agreeing to sell the company's undertaking to the Municipality of Bahia at a price which would not suffice to repay the principal of the debentures in full, the coupon for the interest due on November 1st next cannot be paid.

Karachi Electric Supply Corporation, Ltd.—The *Sind Gazette* states that the capital invited by Messrs. Forbes Campbell & Co. for the Karachi Electric Supply Corporation, Ltd., has been over-subscribed, though the period for which the subscription list was to remain open has still some days to run.—*Englishman*, October 4th

West India and Panama Telegraph Co., Ltd.—The directors have announced a dividend of 1s. 6d. per share on the ordinary shares for the past half-year.

Prospectuses.—*Ozonair, Ltd.*—The list of applications was opened on October 31st in a public issue of 15,000 7 per cent. participating preference shares offered at par. The nominal capital of the company is £40,000 divided into 20,000 participating preference shares (non-cumulative) of £1 each, and 20,000 ordinary shares of £1 each. 18,000 of the ordinary are to be issued credited as fully paid, and include full payment to the vendor company of the purchase price of Ozonair, Ltd. 2,000 ordinary and 5,000 participating preference shares are held in reserve. After the ordinary shares have received a dividend at the rate of 7 per cent. both classes rank rateably in any further distribution. The business and specialities of Ozonair, Ltd., are so well known to our readers that they call for little reference now. The new company is formed to take over that company's business, goodwill, patents, &c., as a going concern, from October 1st. It has been registered to provide adequate capital to cope with the increasing business, and the agreement for sale provides for the new company to pay all the old company's liabilities. A report by Mr. W. J. Dibdin, F.I.S., F.C.S., in regard to the Ozonair systems of water purification and ventilation, and one by Mr. W. Duddell on the general merits of the business, including its apparatus and processes, accompany the prospectus. From Mr. Duddell's report it appears that during the seven years of the company's existence practically all the profits, together with the sum of about £5,000, have been employed in developing and extending the business. Mr. Duddell anticipates a considerable demand for ozone for various purposes, and a large sale for the company's apparatus. No part of the purchase price will be paid in cash; 15,150 ordinary shares will be credited as fully paid, these including 1,000 in respect of goodwill. 2,850 ordinary shares will also be credited as fully paid in respect of the contracts with the vendor company for services rendered in conection with the formation of the company. The The directors attach great value to the foreign rights. The present issue, after payment of preliminary expenses, will provide about £11,500 additional working capital. The services of Mr. E. L. Joseph, the managing director, have been secured for 10 years.

The Fuller Accumulator Co., Ltd.—This company is inviting subscriptions from November 7th to November 17th for 10,000 8 per cent. cumulative participating preference shares of £1 each. The company has been formed to acquire the accumulator patents, business, factory, &c., of Messrs. John C. Fuller & Son, Ltd., of Bow, as a going concern. An abridged prospectus will be found in our advertisement pages to-day, from which it will be seen that the vendors will receive as purchase consideration 5,000 of the preference shares of £1 each, and 45,000 ordinary shares of £1 each. Figures are given as to turnover and net profits, and the estimated contract sales for 1914 are put at £50,000, and for 1915 £100,000.

Mexico Tramways Co.—Shareholders will be asked at a meeting called for November 20th, at Toronto, to approve of an increase of the capital stock of the company, from 20 to 30 million dollars. It is stated that the operation of the tramways and of the Light and Power Co.'s system has not been seriously interfered with during recent events, for the gross and net earnings both show satisfactory increases, but political conditions have unsettled the credit of many Mexican undertakings, and it is at present practically impossible to sell any securities of the company at a reasonable figure. For this reason the company is continuing its loans, which it will pay off as early as convenient from the sale of three-year 6 per cent. secured notes recently created. These notes confer the right to convert to ordinary shares at par during the currency of the notes, and it is chiefly to provide for such conversion that the above increase in capital has been proposed.

Yates & Thom, Ltd.—For the year ended August 9th the directors report a net profit, after providing for depreciation of plant and machinery, interest on mortgage debenture stock, and £2,000 to write down investments, of £9,021, plus £6,621 brought forward. It is proposed to pay a half-year's dividend on the preference shares to September 1st, 1913, less tax, to transfer to reserve fund £2,500, and to carry forward £6,928. The fire in June last caused a serious interruption of the business. The works will very shortly be fully restored. Under the circumstances the directors do not see their way to recommend a dividend on the ordinary shares.

Delagoa Bay Development Corporation, Ltd.—The report for the year ended June 30th, 1913, states that the net revenue from all sources in Lourenço Marques during the year was £28,578. The number of tramway passengers carried was 1,007,996, a decrease of 72,745 on the previous year, but owing to the economies due to the joint working of the tramways and electric light stations, the profits from these sources show an increase as compared with the results for the preceding year. The chairman gave fuller information respecting the undertakings in his speech at the meeting held in London on October 31st.

United Electric Tramways Co., of Caracas, Ltd.—Col. Ivor Phillipps (chairman) presided at the seventh ordinary general meeting of the above company, held on October 30th at the company's offices, Dashwood House, E.C. The proceedings were not open to the Press.

West African Telegraph Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum for the half-year ended June is announced.

Craigpark Electric Cable Co., Ltd.—The directors have declared an interim dividend of 6 per cent. per annum on the preference shares for the half-year ended September 30th.

City of Buenos Ayres Tramways, Ltd.—A quarterly dividend of 1s. 3d. per share is announced.

Cleveland and Durham Electric Power, Ltd.—With reference to our report of the meeting of this company in our issue of October 24th, Mr. Andrew Gemmell, of Ovingham-on-Tyne, writes:—

"The incomplete report of my remarks at the annual meeting of the Cleveland Power Co., held on the 20th inst., is somewhat misleading to your readers, giving me the appearance of having made a dogmatic statement without the support of facts. I said:—'Whoever may have benefited by the waste heat scheme, it has not been the shareholders of the Cleveland Co. When the chairman says that the waste heat scheme has reduced costs, results contradict him, as profits are far below the prospectus estimate, which did not include a waste heat scheme. The financial schemes, the waste heat scheme, and the bulk supply scheme in seven years have all failed to produce 1d. dividend to the ordinary shareholders, and none is in sight, while £58,000 preference dividend is still in arrear.'"

Western Telegraph Co., Ltd.—The directors' report for the half-year ended June 30th, 1913, states that the revenue for the period amounted to £450,822, and the working expenses to £184,264. After providing £16,373 for debenture stock interest, and £8 822 for income-tax, there remains a balance of £241,363, plus £33,817 brought forward, making a total of £275,180. A quarterly interim dividend, amounting to £31,189 has been paid, £100,000 transferred to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £45,000 to the provision on account of investment fluctuations. The directors now recommend a final dividend of 3s. per share, making with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving a balance of £37,008 to be carried forward. The dividend and bonus will be payable on November 13th.

Companies to be Struck off the Register.—The following companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

Electric Power Plants.
La Régionale Electrique de l'Orne.
Oil Fuel.
Titan Electric Co.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Bell Telephone Co. of Canada, Ltd.—Further issue of $6,250,000 5 per cent. bonds, 1925.

Cape Electric Tramways, Ltd.—The directors have declared a dividend of 5 per cent., free of income-tax.

STOCKS AND SHARES.

Tuesday Evening.

AGAIN there is nothing pleasant to write about. In fact, markets seem to get worse week by week, and any little improvement turns out too often to be merely temporary. The two immediate causes of trouble are money and Mexico. The first is becoming stiffer. Capitalists who wish to lend money on good security can get 5 per cent. upon that of Consols, which is enough to tempt a great many people to utilise their cash in this way rather than invest it in the markets or to leave it on deposit with their bankers at 3½ per cent. The prospect of a rise in the Bank Rate has once more become imminent; and all securities which are affected by Lombard Street are feeling the pinch.

Events connected with Mexico march so rapidly day by day that what stands written on Tuesday evening may be badly out-of-date on the following Friday morning. At the moment, the possibility of intervention by the United States into the Mexican imbroglio is viewed as a matter of the gravest importance and anxiety. The fear is, of course, that should the United States send troops to deal with the situation, as suggested by the reported presentation of an ultimatum, the Mexican revolutionaries might start work upon the railways, power stations, oil machinery, and every other sort of damageable property belonging to a foreigner. For this reason, the market in many things Mexican has been demoralised; and some stocks, regarded six months ago as sound securities of their class, have not only undergone alarming shrinkage in value, but are, to all intents and purposes, unsaleable even at the current levels.

Home Rails are in a dismal condition. The silly scare of nationalisation has passed, only to be succeeded by another spasm of tremors lest the labour difficulty should break out again in an acute form. There was a meeting last Sunday night of Midland men, who adopted a far from pleasant attitude because of some trouble that arose over a shunter on the system, and this was used as a lever wherewith to depress prices more than ever.

Amongst Electric stocks, Metropolitans especially suffered, falling 4 because of the realisation of relics of a stale bull account in the market. Districts, for a reason somewhat similar, have shed 3½ points. Underground Electrics maintain a tolerably firm front, the only noticeable movements being declines of ¼ in the £10 shares and of 1 in the 6 per cent. Income Bonds. These latter, by the way, are dipping to a price at which they will appear rather attractive to the speculative investor, for the return upon the money is net, and not subject to Income-Tax. While the Tubes and the London General Omnibus Company are doing so well, the interest on these bonds is fairly secure; but, of course, it is only comparatively recently that the full 6 per cent. has been paid, and if the local authorities happen to campaign against the 'bus company, they might make a sensible inroad into its present profits.

English Electricity Supply shares are amongst the firmest in the House, the movements on the week being insignificant. Small falls occurred in Charing Cross Preference, County Ordinary, Westminster Preference and Metropolitan Ordinary. But in these cases the declines were no more than ⅛, and improvements of this fraction were secured by Metropolitan Preference and Oxford shares. Urbans are a shade easier, so far as the nominal quotation is concerned, though actually there is little change. Some of the Debenture stocks are a point or so higher. The Edison & Swan report had no effect upon prices, but, of course, its unsatisfactory showing has made the market in the issues more limited than ever. The loss of £4,800 goes against a profit of £10,400 last year, and is due to the dispute with owners of patents relating to drawn wire lamps. The dispute is over now, according to the report, and probably a cheerful view of the outlook will be taken at the meeting. Other manufacturing shares are exceedingly quiet. British Aluminium Ordinary, after their quick rise, reacted 1/32, and there were small falls in India-Rubber Ordinary and Preference shares. Beyond these, there is nothing of importance to notice.

Stocks and shares in the Telegraph and Telephone list are also steady on the whole. Reuters shares eased off to 9¾, upon the unfortunate circulars recently issued by the company, which have aroused the wrath of those to whom the honour of journalism is so precious. That the company was ill-advised to issue such circulars is manifest enough, and they have been withdrawn by the board. Marconis went back ⅛ by reason of the general weakness of markets. Canadian and American Marconis are dull. West India and Panama Ordinary shares remain depressed, but the 1st Preference are ⅛ better. The Eastern and the Anglo-American groups maintained most of their prices with a considerable amount of strength.

The falls in the Mexican group range from 2 to 7 points, these following, of course, upon other heavy declines during the past few weeks. Prices of shares and bonds alike have literally slumped. Some are simply nominal. The yields at present prices are worth looking at, if only from curiosity. The moot point is, how far the United States will go in its threatened intervention, the matter requiring the utmost delicacy in its conduct. But it is to be noticed that prices in the railway issues have hardened substantially from the lowest; and even amongst the utility issues there was some recovery. Para Electric Railways are flat, a drop of 5s. taking the price to 5½, this being due to the depression that has befallen all things Brazilian. United Electric Trams of Monte Video are also easier; but, on the other hand, the Anglo-Argentine Debentures are rather better.

The Rubber share market shed part of its strength, thanks principally to the all-round weakness of markets. This, however has not dimmed the high hopes raised as to the probability of the Rubber Growers' Association offering practical, and practicable, suggestions for dealing with the difficulties which surround the industry at the present time; and if markets, as a whole, were to take a turn for the better, no doubt that for rubber shares would move with the rest.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	Oct. 29	3,482	+ 318	42	41,458	+ 3,200	..	..
Blackpool-Fleetw'd	Nov. 1	2,139	+ 472	17	27,911	+ 4,676	8	..
Bristol	Oct. 31	3[illegible],711	+ 3,096	..	£5[illegible],608	+ 48,033	30·5	..
*Brit. Elec. Trac. Co.	,, 24	161,788	+ 12,477	..	..	..	429·8	1·25
Chatham and Dist.	,, 30	3,925	+ 402	43	40,469	+ 2,568	14·98	..
Cork	,, 30	2,006	+ 139	43	21,853	+ 670	5·89	..
Dublin	,, 31	16,913	—5,506	..	241,103	—13,429	54·25	..
Hastings	,, 30	3,793	+ 246	..	..	+ 3,454	19·3	..
Lancashire United	,, 29	6,561	+ 1,100	43	87,322	+ 8,054	42	3
Llandudno-Col. Bay	,, 24	946	+ 65	47	16,871	+ 1,433	6·5	..
London United ..	,, 24	25,570	+ 2,109	..	272,666	+ 4,570	..	..
Tyneside	,, 22	2,226	+ 146	17	9,157	+ 625	11	..
Anglo-Argentine ..	,, 28	221,311	+ 1,828	..	2,377,031	+ 181,85[illegible]	..	..
Auckland	Sept. 26	19,943	+ 1,445	..	..	..	25·42	1·51
Brisbane	Sept.	25,690	+ 2,890	..	232,768	+ 51,674	..	..
Calcutta	Nov. 1	16,978	— 861	..	..	+ 8,854	..	..
Kalgoorlie, W.A. ..	Sept.	3,068	..	..	28,447	..	20·5	..
Madras	Oct. 31	8,503	+ 205	..	85,782	+ 2,541	15·25	1
Montevideo ..	Sept.	27,870	+ 109	..	344,301	+ 26,483	..	..
Cen. London Rly.	Nov. 1	20,685	—1,376	44	212,340	+ 6,783	6·78	·4
City & S. Lon. Rly.	,, 1	11,285	—1,081	44	122,840	—11,687	7·26	..
Dublin-Lucan Rly.	Oct. 31	459	— 72	43	2,789	— 24	7	..
L'pool Overh'd Rly.	,, 26	6,705	+ 424	..	73,783	+ 5,614	6·6	..
London Elec. Ry. Co.	Nov. 1	55,135	—1,720	44	595,385	+ 810	21·25	..
Mersey Railway ..	,, 1	9,151	— 182	44	98,466	+ 4,888	4·5	..
Metropolitan Rly.	Oct. 26	71,852	+4,408	43	787,279	22,224	29·25	3·5
Met. District Rly.	Nov. 1	52,868	— 305	44	568,537	+17,602	25	..

* Includes railways and tramways.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 4th.	Rise + or Fall −	Present Yield p c. £ s. d.
Bournemouth & Poole, Ord. ..	* 10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	— ⅛	5 2 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅜ — 3⅞	..	5 16 2
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	15⅜ — 16⅜	..	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 8 11
Do. 5 % Deb.	Stock	5	5	116 —120	+1	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 101	..	4 9 1
County of London, Ord. ..	10	6	5†	11½ — 12	— ⅛	5 0 0
Do. 6 % Pref.	10	6	6	11½ 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½—104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	96 — 99 xd	..	4 11 0
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	8 8 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 88	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	7⅞ — 8⅛ xd	..	5 10 9
Kensington & Knightsbridge, Ord.	5	*	*	7½ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	8½ — 8¾	— ⅛	5 6 —
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	+ ⅛	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	+1	4 1— —
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10½	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 —
St. James' and Pall Mall, Ord. ..	5	10	10†	8½ — 9½	..	5 8 1
Do. 7 % Pref	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅞ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 11/16 — 1 13/16	..	6 1 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅝ — ¾	— 1/32	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2¾	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4½ — 5	— ⅛	4 10 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	..	7¼ — 7½	..	5 9 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$.00	7	7†	105 —110	..	6 7 3
Do. 7 % Pref.	$100	7	7	117 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91½ — 93½	..	6 8 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	1/32 — 3/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.		5	5	65 — 70	—5	7 2 10
Mexican Lt. & Power, Common	$100	4	4	50 — 55	—5	7 5 6
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	—7	8 4 8
Do. 5 % 1st Mort. Gold Bds.		5	5	72 — 77	—6	6 9 10
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 70	—4½	7 2 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	70 — 72	— 6½	6 19 0
Montreal, Lt., H. and Power ..	$100	9	10†	212½ —217½	..	4 12 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25 xd	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 —104 xd	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	133 —138	..	4 0 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	100⅛ —102⅛	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	13/16 — 15/16	..	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 —126	..	6 7 0
Do. Collat. Trust	$100	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½—105½	+ ½	5 13 9
Do. Def.	Do.	30/-	..	23½ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6¾ — 7¼	..	6 12 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅛ xd	+ ⅛	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 —129	—1	5 8 6
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12½ — 12¾	..	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	..	..	..
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	+ ⅛	4 17 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	— ½	6 2 8
Indo-European Telegraph ..	25	13	5†	56½ — 58½ xd	..	5 11 1
Mackay Companies Common ..	$100	5	5	82 — 86	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	3½ — 3⅝	— ⅛	5 10 2
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅞ — 3	— ⅛	5 13 4
Monte Video Telephone, Ord. ..	1	5	6	⅞ — 1 xd	— 1/32	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞ xd	— 1/32	6 8 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	96⅜ — 97¼ xd		4 12 1
Oriental Telep. and Elec. ..	1	10	10†	1⅝ — 2 xd	+ 1/32	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 15/16 — 1 31/32 xd	— 1/32	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9½ — 10	..	10 0 0
Submarine Cables Trust	Cert.	6	5	121 —124 xd	..	4 16 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6½ — 6¾ xd	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 1/16 — 1 1/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅜ — 2⅝	..	4 15 3
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ — 10¼	+ ⅛	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9½	..	6 3 1
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12⅝ — 13⅜	..	5 4 3
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	£100	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs. 5

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 4th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12½ — 14	— ½	..
Do. Do. Deferred	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb.	100	5	5	90 — 93	—1	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78 xd	..	5 15 5
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	—1	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	96 — 98	—1	5 2 0
Do. Do. 1903	100	5	5	96 — 98	..	5 1 9
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 1/8	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	¼ — 3/8	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 1/8	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	77 — 82	..	5 9 9
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	—1	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Metropolitan Railway Consol.	100	1⅝	1⅝†	39 — 39½	—¼	4 2 3
Do. Surplus Lands	100	2¾	2¾†	58 — 60	—1	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan District Ord.	100	Nil	..	28 — 28½	—3½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5
Do. 4 % Prior Lien	100	4	4	93 — 95 xd	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 1 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3½ — 3¾	— ⅛	Nil
Do. "A"	1/-	..	..	7/16 — 9/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	110 —113	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	88 — 89	—1	6 14 10
Yorkshire (West Riding). Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	3½ — 4	+ ⅛	..
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 5/16	..	6 3 11
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	+ ½	4 11 0
Do 5 % Deb.	100	5	5	98½—100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S & Trams, Pref.	10	6	6	10¾— 11½	..	5 4 4
Do. 4½ % Deb	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	83½— 85½ xd	—2	7 0 4
Brisbane Trams Invt., Ord.	5	8	8	7½— 7⅝ xd	+ ¼	5 3 3
Do. 5 % Pref.	5	5	5	4⅞— 5⅛ xd	..	4 13 0
Do. 4½ % Deb	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	119 —123	—1	6 10 1
Do. Pref. Ord.	100	6	6	106 —110	—2	5 9 1
Do. 5 % Pref.	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	90 — 93	+1	4 11 5
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	11/16 — 13/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅜	..	4 13 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92 xd	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½— 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	—1/32	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½— 98½	..	5 1 6
Mexico Trams Com	$100	7	7	73 — 77 xd	—4½	9 1 10
Do. Gen. Con. 5 % Bonds	..	5	5	72 — 77	—5½	6 9 10
Do. 6 % Bonds	100	6	6	78 — 82	—6	7 6 4
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5½ — 5⅝	— ½	8 13 10
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	5	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½—100½	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	83½— 90½	..	5 10 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	—2	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5¼	— ⅛	6 13 4
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	93½— 96½ xd	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½—100½	..	4 9 7

MANUFACTURING COMPANIES.

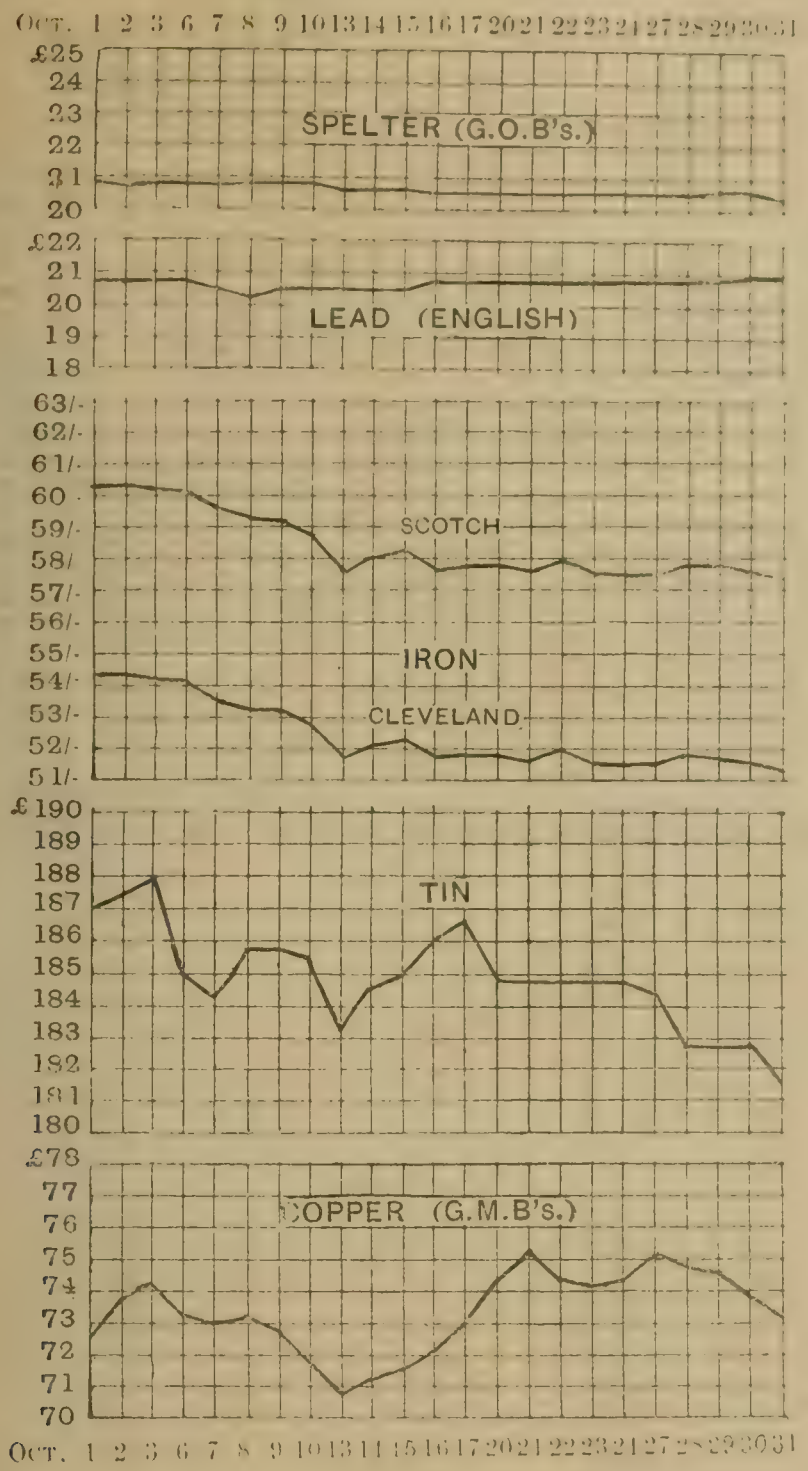
Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	2⅞ — 3	..	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 15/32 — 1 17/32	—1/32	..
Do. 6 % Cum. Pref.	1	6	6	1 13/16 — 1 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½— 87½	..	5 14 3
B.I. & Helsby Cables	5	10	..	8 — 8⅛	..	5 17 8
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	5/16 — 1⅛	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½— 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½— 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾— 11½ xd	..	6 10 5
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	8 1/16 — 8 3/16	..	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	61 — 66	+1	7 11 6
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 25/32 xd	..	7 2 2
Edison & Swan, A, £8 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1¼ — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9¾— 10¼	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12½— 13	..	5 15 5
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	5	13¼— 14	..	5 7 2
Do. Pref.	10	5	5	9½— 10	— ⅛	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

METAL MARKET.

Fluctuations in October.



E.T.B.I. Dramatic Performance.—Last year the Electrical Trades Benevolent Institution funds benefited to the tune of £50 by the performance arranged by the Garrick Dramatic Society, and we are sure that all subscribers and well-wishers of the Fund will be pleased to hear that a second performance is to be given by the same Society on Saturday, November 22nd, at the Royal Court Theatre, Sloane Square, S.W., at 8 o'clock p.m. This time they will give "The Voysey Inheritance," by special permission of the author, Mr. Granville Barker. Last year the Benevolent Institution should only have benefited by the tickets which its own members disposed of, but the amount handed over was very much in excess of what was due under the arrangement, the percentage on the number of tickets thus disposed of being very much below the £50. In view of this circumstance, it is to be hoped that the members of the electrical industry will give the present movement still better support than last year. The event will afford the opportunity of simultaneously enjoying an excellent performance and aiding the funds of an equally excellent institution. The prices for admission are :—Orchestra stalls, 10s. 6d. ; dress circle, 7s. 6d. ; upper circle, 4s. ; pit stalls, 4s. and 3s. ; gallery (by ticket), 1s. Private boxes may be secured by arrangement. Tickets may be obtained from Mr. F. B. O. Hawes, the secretary, 18, Park Mansions, Vauxhall Park, S.W. ; or from Mr. L. G. Tate, 20, Bucklersbury, E.C.

Trenching through Stone.—To accommodate electric power cables which will cross the River Seine on the 300-year-old Pont Neuf, Paris, a trench 4 ft. wide and 7·5 ft. deep is being cut through the solid masonry and flint-rock concrete of the bridge structure with the aid of helicoidal wires and abrasive powder. The section trenched in this way, 550 ft. in length, was found to be too hard to be attacked by tools, while explosives were excluded for fear of weakening the venerable arches. Four parallel wire cuts were made in each of the three sections, each roughly 200 ft. in length. An 18-H.P. motor operated the continuous-belt cutting wires, which were held taut by weights, while abrasive powder was fed into the kerfs.—*Electrical World.*

WIRELESS TIME SIGNALS AND TAXATION.

We have received the following letters from Mr. F. Hope-Jones, who, on behalf of the watch and clockmaking profession, has led the opposition to the proposal of the Postmaster General to tax the users of the wireless time signals. As the British Government cannot even claim that it has incurred any expense by issuing these signals, which have been left to foreign initiative and organisation, the injustice of levying a tax upon those who merely wish to receive the signals for professional purposes is patent.

COPY.

General Post Office, London.
October 22nd, 1913.

Sir,—With reference to your letter of July 17th last, and subsequent interviews on the subject of licences for the reception of the time signals by wireless telegraphy, I am directed by the Postmaster-General to inform you that, although the conditions upon which such licences can be issued have not yet been definitely decided, it is probable that an annual royalty may be charged, in addition to the fee of £1 1s. already asked for in respect of the expenses involved in the issue of the licence. Licences cannot be issued until a decision is arrived at, but meanwhile applicants are being authorised to proceed with the installation of their apparatus, provided that they will make a deposit of £3 3s. (or £2 2s. if the fee of £1 1s. has already been paid), and will undertake to conform to the conditions of the licence when it is issued, or to dismantle their apparatus without delay should they find themselves unable to accept the conditions. The deposit will be refunded should they decide not to proceed with their applications.

I am, Sir, your obedient servant,
(Signed) E. W. Farnall.

F. Hope-Jones, Esq., M.I.E.E.,
Synchronome House,
32-34, Clerkenwell Road, E.C.

[COPY.]

Synchronome House,
32 and 34, Clerkenwell Road, E.C.
October 22nd, 1913.

Wireless Telegraphy.

The Secretary,
General Post Office, E.C.

Dear Sir,—I beg to thank you for your letter of the 20th inst., but I greatly regret to hear that the idea of charging an annual royalty for the reception of time signals is even contemplated.

The question being still undecided, it is my duty to put before you as concisely as possible the grounds upon which the watch and clockmaking profession in this country claim permission, if not the right, to listen to the International Service of Time Signals.

They are necessary to the advancement of the science of accurate time measurement.

They do not in any way conflict with your department's service of telegraphic time signals, which latter are intended for another purpose altogether, viz., the physical synchronisation of clocks, and which have no pretensions to the same high degree of accuracy.

The clockmakers of other countries, *e.g.*, France, are freely permitted to listen to them, and refusal here would unfairly handicap the profession in the markets of the world, and would tend to a restriction of trade.

The international code of signals is designed for the accurate comparison of chronometers and clocks, and, as such, is intended for the use of the watch and clockmaking profession, consequently they would consider it a great hardship to be debarred from benefiting from it. Their powerful Trade Associations will concentrate upon a strong protest, and they will never rest until they secure freedom to listen to the pulse beats which are their very life, well knowing the harmlessness of so doing.

On the grounds of mere expediency, I suggest it would be well to realise—

1. That the Wireless Telegraphy Act of 1904 did not contemplate any such service, and in view of its many well-known deficiencies, your interpretation of it is likely to be called in question, if acute resentment is aroused by such a proposed interference with the liberty of the subject in the exercise of his profession in an obviously harmful manner, and

2. That refusal would almost certainly result in evasion of the law by the unauthorised setting-up of simple receiving apparatus capable of taking the Paris and Norddeich signals.

If the signals were transmitted from the Greenwich Observatory a small charge to meet the expenses might be levied with some appearance of justification, but unfortunately the British Empire elected to take no part in the organisation or transmission of the World's Time Signals, hence the proposal to tax those who desire to listen to them will appear to the watch and clockmaking profession of this country as preposterous and as futile as a tax on taking their time from the stars. I suggest there is no more reason for your denying them the use of their ears, than the use of their eyes.

In the hope that these views will commend themselves to you and that you will pardon the freedom with which they are expressed,

I beg to remain, yours faithfully,
(Signed) F. Hope-Jones, M.I.E.E., M.Brit.Hor.Inst., &c.

TUNGSTEN LAMPS OF HIGH EFFICIENCY.

(*Continued from page* 698.)

In the second paper the authors state that by making use of the foregoing principles they have been able to construct practical tungsten lamps which, starting at an efficiency of about 0·4 watt per candle, have run over 2,000 hours, the average efficiency during life being better than 0·5 watt per candle. This improvement has been reached only in lamps taking large currents.

The early experiments with lamps containing nitrogen at atmospheric pressure were made with ordinary single-loop filaments of 0·005 and 0·010 in. diameter placed in long heater lamp bulbs. These lamps were set up on life test at such a voltage that the temperature of the filament was 2,850° also.

The results indicated clearly the desirability of using a filament of large diameter. Thus doubling the diameter increased the efficiency from 0·65 to 0·56, and increased the life from 90 to 300 hours. The life of the filament is determined largely by the loss of tungsten from the filament by evaporation, and has been found to be dependent on the relative decrease in diameter caused by this evaporation. The relative lives of very small wires in nitrogen are nearly proportional to the squares of their diameters.

It is, however, not desirable to use filaments of very large diameter if similar results can be obtained with smaller ones. The current taken by a filament increases approximately with the three-halves power of the diameter. Unless very low voltages are used, the power consumed with the larger wires is so great that only very high candle-power lamps can be made. Therefore it was of vital importance to increase the effective diameter of the filament without decreasing its resistance, and various methods of doing this were tried. The method which has thus far proved most satisfactory is to wind the filament into the form of a tightly coiled helix.

The filament is designed so that the amount of sagging during life will be perceptible, but not enough to cause too great a change in the characteristics of the lamp. If, during the life of the lamp, any part of the filament should, for any reason, evaporate more rapidly than the rest, so that the filament becomes somewhat thinner, this portion will have less mechanical strength than the rest and will therefore sag more rapidly. The helix will therefore open out wherever the filament becomes thin or becomes overheated. This will cause increased heat loss both by convection and radiation, and thus prevent local overheating or spotting. The use of helically wound filaments increases the life of the lamp many times beyond the life that would be obtained with a straight filament running at the same efficiency.

In ordinary lamps about 20 per cent. of the energy radiated from the filament is intercepted by the glass and causes heating of the bulb. In the nitrogen lamp, beside this radiated heat, there is an additional amount of heat carried to the bulb by convection—an amount varying with the type of lamp and ranging from 6 to 40 per cent. of the total input. The convection currents carrying this relatively large amount of heat travel vertically upwards from the filament and strike a relatively small area of the bulb, which thus tends to become greatly overheated. Unless special precautions are taken, this overheating will cause the liberation of enough water vapour to cause attack of the filament and consequent blackening of the bulb. It is thus highly desirable, in ordinary cases, if small bulbs are to be used, that the filament should be placed in the lower part of the bulb. This has the further advantage that it allows sufficient surface of glass in the upper part for the deposition of the tungsten nitride.

For a similar reason it is generally desirable, although not necessary, to make the bulbs with their height considerably greater than their horizontal diameter.

By special design of the bulb, satisfactory lamps have been made with bulbs of only one-half to one-third as large a volume as that of evacuated lamps of the same wattage. This means that for bulbs of the same volume, the nitrogen lamps give roughly from five to ten times the candle-power of evacuated lamps. The bulbs of such lamps naturally run much hotter than those of ordinary lamps. The upper parts of the bulbs are often 100 to 200° C. or more, while the lower parts are sometimes much cooler than this, although closer to the filament.

Several special varieties of heat-resistant glass have been used for the bulbs, making considerably smaller ones possible, as well as rendering it easier to get rid of water vapour.

For some of the larger size lamps which take heavy currents (20-30 amperes) it has been necessary to devise special types of lead-in wires. Platinum has been discarded entirely, even in the smaller sizes. Several types of heavy-current leads have been successfully used. Most depend on the use of special alloys which have the same coefficient of expansion as the glass. Bulbs of special glasses into which tungsten or molybdenum wire can be sealed directly, have also been used.

With very large wires (0·020 to 0·040-in. diameter), which take 20-60 amperes, the efficiency may reach 0·40 watt per candle, and probably even better, and yet give a life over 1,000 hours. A lamp taking 60 amperes and giving 6,600 C.P. at 0·40 watt per candle has been successfully run. It will probably be worth while, in some cases, to use nitrogen in low-current lamps, even if an efficiency no better than that of vacuum lamps is obtained, in order to gain certain other advantages of the nitrogen-filled lamps, such as better colour of the light, higher intrinsic brilliancy, &c.

Unless special expedients are employed, the cooling effect of the leads lowers the efficiency of the lamps. With voltages of 20 volts or more this effect is not serious, but for low voltages it may become very important.

For the particular type of nitrogen-filled lamp which has at present been furthest developed, it may be said that a life of over 1,500 hours is obtained at efficiencies better than 0·50 watt per candle, only in large units taking over 10 amperes. Lamps running at 0·6 to 0·7 watt per candle have been made in units taking at least 5 amperes.

No serious difficulty has been met in making high-voltage lamps. In nitrogen at atmospheric pressure there is no tendency toward arcing, even at 250 volts. Many lamps taking 6 or 7 amperes at 110 volts have been made up and run at 0·6 to 0·7 watt per candle, with a life of over 1,000 hours.

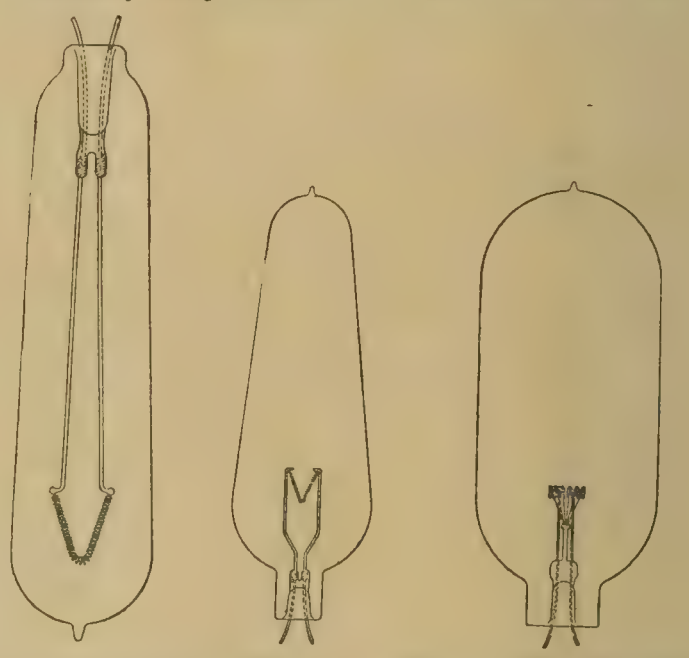
A number of special types of nitrogen-filled lamps have been made and tested. Large units of very high efficiency (0·4 to 0·5 watt per candle with a life of 1,500 hours or more) take currents of 20 to 30 amperes and (except in units over 4,000 C.P.) are best run from A.C. circuits by means of small transformers or auto-transformers giving a voltage depending on the size of unit desired. Thus, with 30 volts and 25 amperes, the power would be 750 watts, and this, in a lamp of, say, 0·45 watt per candle, would give 1,670 C.P. Higher or lower C.P. may be obtained by using other voltages. Typical lamps of this kind are shown in figs. 1 and 2.

Small units of low voltage take currents of 10 amperes or less and voltages as low as 4 or 5 volts. The efficiencies with 1,000-hour life range from 0·6 to 1·0, or even 1·25 watts per candle, according to the current used. These lamps are adapted for series street lighting on 6·6-ampere circuits (at 0·6 to 0·7 watt per candle), for stereopticon lamps, automobile headlights and in general wherever a source of high intrinsic brilliancy, steadiness and white colour is needed.

Large units (several thousand C.P.) to run on standard lighting circuits (110 volts) have efficiencies of 0·5 watt per candle or better. With smaller units the efficiency is ordinarily not so high.

A lamp of this type is illustrated in fig. 3.

The temperature of the filament being 400° to 600° higher than that of ordinary lamps, causes the light to be of a very much



FIGS. 1 & 2.—LOW-VOLTAGE LAMPS. FIG. 3.—HIGH-VOLTAGE LAMPS.
HIGH-EFFICIENCY NITROGEN-FILLED LAMPS.

whiter colour, so that it comes closer to daylight than any other form of artificial illuminant except the D.C. arc and the special Moore tube containing carbon dioxide.

Special colour screens are being developed which, when used with this light, will give a true daylight colour. The screens which will accomplish this purpose will absorb from 65 to 75 per cent. of the light, so that the net efficiency will be about 2·0 watts per candle for a pure daylight colour. At present, to accomplish this purpose with ordinary tungsten lamps, screens must be used which absorb so much light that the net efficiency is between 10 and 12 watts per candle.

At the operating temperature of the nitrogen-filled lamps the intrinsic brilliancy of the filament is about 1,200 C.P. per sq. cm. In ordinary tungsten lamps, on the other hand, running at about 1·25 watts per candle, the filaments have a brilliancy of only about 150 C.P. per sq. cm. The brilliancy of the filament of the nitrogen lamp is thus about eight times that of the ordinary lamp.

This feature, combined with the high degree of concentration preferably used, renders these lamps particularly useful for projection work, such as for headlights or for stereopticons. It is often possible so to design these lamps that their ampere-volt candle-power characteristics remain practically fixed during the greater part of their life. The lamp usually fails by the breakage of the filament with the candle-power well above 80 per cent. of its original value.

The efficiencies that have been given represent watts per mean horizontal candle. The ratio of mean spherical to maximum horizontal (practically mean horizontal also) candle-power has been found to average about 84 per cent. for the lamps made with single loops of helically-wound wire.

The method of photometry adopted for nitrogen-filled lamps is to regard temperature as the fundamental variable.

The temperature has been defined by the equation—

$$T = 11{,}230/(7{\cdot}029 - \log H),$$

where T is the absolute temperature and H is the intrinsic brilliancy of the filament in international candle-power per sp. cm. (projected area).

A most useful criterion for equality of temperature of tungsten filaments is that of colour match. A little practice with the Lummer-Brodhun photometer enables one to judge equality within about 5° if the illumination is good. The most convenient way of setting up temperature standards is to select a number of well-seasoned lamps of high-voltage type, in which the anchors are tightly pinched on to the filaments, so as to prevent variable cooling effects at the contact. It is best to standardise these, not on a basis of candle-power and filament dimensions, but by the aid of a special lamp with a diaphragm in front of it, which enables one to disregard the end portions of the filament and select a known length of the part which is at uniform temperature. It is thus possible to set up the special lamp at any temperature desired by getting the appropriate candle-power per sq. cm. from the filament. The standard lamps are brought to colour-match with this arrangement, and in this way a set of lamps with known relation between voltage and effective temperature is obtained. The life of the ordinary standard lamps would be very short indeed if they were run at the same temperature as nitrogen-filled lamps. For this work, therefore, the standards cannot be used directly as colour standards. For this reason a most important accessory is introduced in the form of a set of special blue glasses.

Four distinct screens of different intensity are used, and any or all of these may be combined with a tungsten filament run at any temperature, and the result will colour match correctly against another tungsten filament at a higher temperature. Thus one only needs to maintain one standard temperature by means of standard lamps, and that temperature can be so low that great permanence is ensured. The constants for the four glasses once determined, there are available a number of standard temperatures ranging from 2,250° to 3,600° K.

THEORY OF OPERATION OF CRYSTAL DETECTORS.

The well-known "crystal" detector now so extensively used in wireless telegraphy employs such materials as silicon or galena in more or less loose contact with brass or other metals and depends for its efficacy as a detector on what is apparently a rectification of the high-frequency aerial current. In his "Principles of Wireless Telegraphy," Prof. Pierce states that the action of the crystal detector cannot be taken to be thermo-electric since the rectification is generally greater than can be attributed to thermal action, and in many cases gives a current opposite in polarity to that which would be produced by thermo-electric action. Similar conclusions were reached by L. W. Austin, who, in 1908, published his tables showing the actual rectification obtained under various circumstances with various contact detectors. Austin pointed out, however, that the rectified currents received in his experiments were generally proportionally to the square of the alternating currents reaching the detectors—a fact which suggests thermal action.

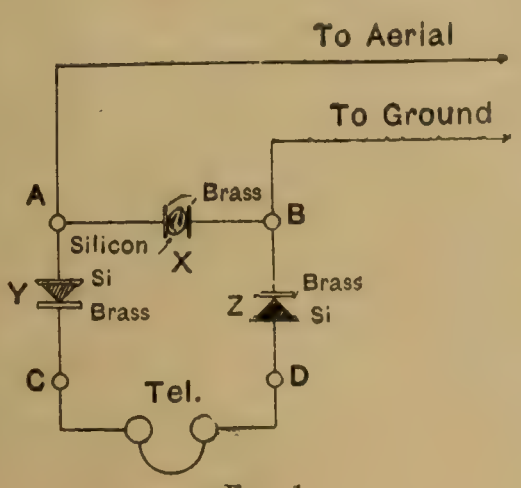


Fig. 1.

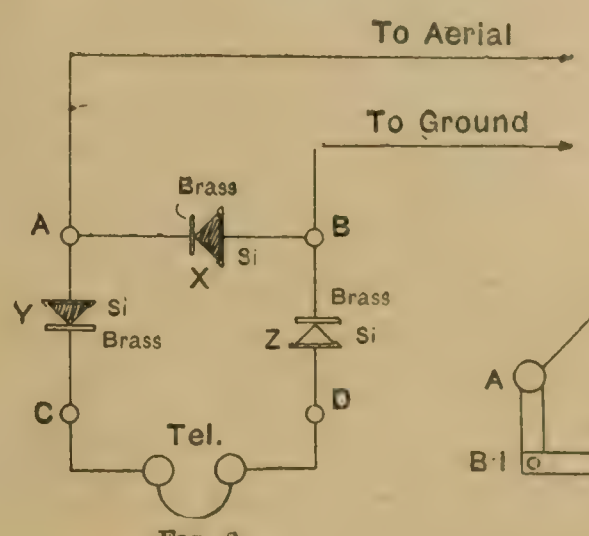


Fig. 2

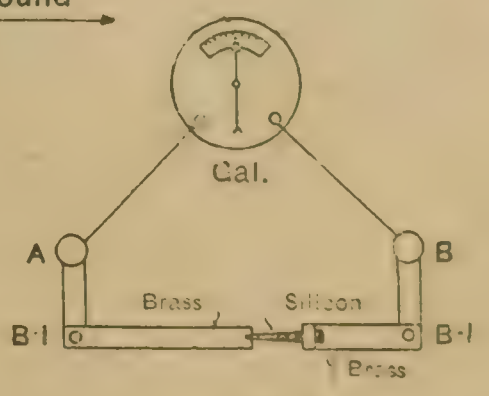


Fig. 3.

In a recent issue of "Modern Electrics," V. C. Wynne describes experiments which lead him to believe that the action of crystal detectors is really thermo-electric, and due to temperature differences across imperfect contacts. His experiments were conducted with silicon and brass, though many other combinations were tried to some extent. In working with experimental forms of detectors, with two or more pairs of contacts in series or parallel, it was found that the relative sensitivity of one set of contacts varied considerably with adjustment and, at times, the rectifying action reversed, so that one set of contacts opposed the other. After a number of tests yielding negative results, it was found that the polarity of rectification depended upon the nature of the contacts at each side or end of the silicon. Using a lump of silicon X, fig. 1, held between two brass springs, in series with two other detectors Y, Z (the adjustment of which was not changed during the experiments), it was easy to determine the relative polarity of rectification of the experimental detector. The total pressure on each side of X was necessarily equal, but by slightly rocking X it was found possible to get zero or right or left rectification at will. Definite direction of rectification could be obtained by making the area of contact of the silicon with the brass, greater on one side than on the other, and it was, therefore, possible to maintain constant polarity by clamping the silicon firmly to one strip (see fig. 2), and providing a small loose contact on the other side.

The arrangement shown diagrammatically in fig. 3 was designed to test different contacts for thermo-electric effects. The brass arms were made movable, so that any part of either arm could be heated by a bunsen burner without heating the other arm, and it was found that there was a pronounced pyro-electric effect across the loose contact when either the silicon or the brass was hotter than the other contact member. When heat is applied to a firm junction there is some thermo-electric effect, but this is much smaller than the current produced by temperature difference across loose contacts. Using silicon and brass, current always flows from the hotter to the cooler contact piece, but in the case of zincite and brass, or galena and brass or steel, current flows from the cooler to the hotter member. Between silicon and brass, the current thus generated is sufficiently great to be detected by a galvanometer of moderate sensitivity.

From these experiments, it appears that the action of crystal detectors depends on the heating of the loose contact by the high frequency aerial current (this heating being proportional to the square of the current received), setting up a temporary direct current which flows through the detector's local circuit (including the receivers). At each break in the received current there is a temporary redistribution of heat at the detector contacts, so that the D.C. impulses through the telephone are varied with the period of the sending apparatus, and yield a corresponding tone in the telephone.

With a single silicon-brass detector (as at X, fig. 2), the "generated" direct currents flow from the silicon to the brass, and if additional detectors be mounted as at Y and Z, these also appear to act as heat rectifiers of the received high-frequency impulses, and to deal with the half waves which do not pass through X. Hence, though Y and Z are not in series with X so far as concerns the high-frequency current, they generate direct currents which act in series with that produced at X.

From further experiments conducted by Wynne, it appears that the current flowing between the loose contact points (as distinct from the ordinary thermo-electric action of connected pairs) of various couples flows in the direction shown by the following table:—

Couple.	*Direction of Current Flow.*
Copper.—Copper.	Hotter to colder junction.
Copper.—Iron at moderate temp.	Cold copper to warm iron.
at high temp.	Hot copper to cooler iron.
Iron.—Iron.	Warm iron to cold, *or* warm iron to very hot iron.
Steel.—Silicon (moderate temp.)	Hotter to cooler junction.
Steel.—Antimony (moderate temp.)	,, ,, ,,
Silicon.—Antimony.	,, ,, ,,
Antimony.—Brass.	,, ,, ,,
Galena.—Antimony.	Cooler to hotter junction.

FORMULÆ FOR ESTIMATING SLEET LOADS.

The information published by meteorological bureaus makes possible a sufficiently accurate estimation of the stresses likely to be set up in aerial lines by wind pressure and temperature changes, but arbitrary rules have hitherto been depended upon in estimating the probable stresses due to the collection of ice on conductors. During a severe storm in January, 1912, some 300 or 500 poles were destroyed, and from 500 to 700 miles of line wire were brought down in the neighbourhood of the city of Portland (Oregon). A persistent light rainfall, unaccompanied by wind, and falling on to conductors at 28°-30° F., formed a destructive ice covering, and the continuation of low temperature made possible a systematic study of the form and dimensions of the coating on various wires. From an interesting report in the *Engineering Record*, dealing with this investigation, we reproduce the following conclusions:—

It was found that the ice coating formed in an eccentric position above the wires, as shown in the upper sketch, page 764. Due to the heating of the power and lighting wires subsequent to the storm, the ice sheaths were loosened and swung round, as shown in

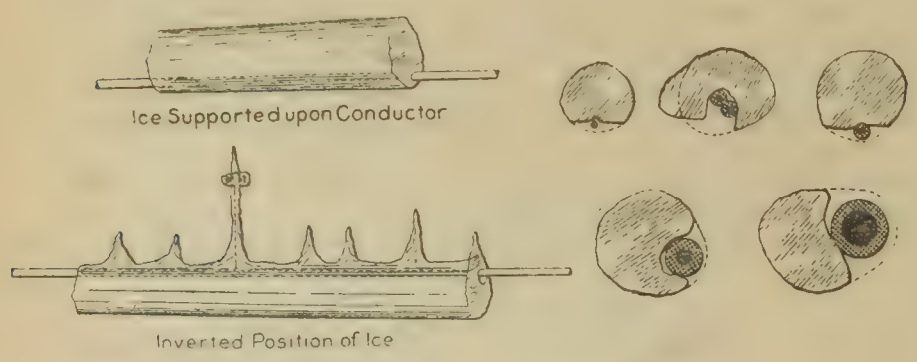
the lower sketch, icicles which had formed from the "drip" now pointing vertically upwards. The thin wall then holding the ice gradually melted, and strips of ice, typical sections of which are shown in the figure, fell to earth. Telegraph and telephone lines naturally did not free themselves in this manner, and lengths of ice had to be broken away from them for purposes of observation. Some of the original section of those fragments

TABLE I.—Size and Weight of Ice Coating for Different Kinds of Wire.

Wire.			Ice.		
Gauge. No.*	Kind.	Overall diameter.	"Corrected" area. Sq. in.	Wt. lb. per linear ft. of wire.	Mean dia. of sheath.
12	Bare	·080 in.	·745	·299	·980
14	W.P.T. phone	·210 in.	1·184	·473	1·250
8	Weatherproof	·262 in.	1·329	·531	1·300
4	,,	·500 in.	1·466	·585	1·430
4/0	,,	·709 in.	1·791	·715	1·600
14	2-wire twisted	each ·210 in	1·141	·456	1·320

* Corresponding S.W.G. Nos. are 14, 16, 10, 5 or 6, 6/0, 16.

which had melted away from the heavier current lines, had, of course, been lost, but there was no difficulty in forming a reasonable estimate of the original contour of the sheathing (see dotted lines in sections herewith).



Ice Coatings on Overhead Wires.

Table I summarises the data obtained by examination of ice collected from various lines. It will be found that the area of (wire + ice sheathing) (corrected as above) = $K \times \sqrt{d}$ where d = diameter of wire and K = from 2·36 to 2·64. The circumstances under which ice was recovered from the No. 4-wire made it probable that insufficient correction was made for loss of ice by melting; excluding the data relating to No. 4-wire, K = 2·646 as mean value with a maximum departure of 2·1 per cent. therefrom for other gauges. This relationship is confirmed by the fact that the mean diameter of ice developed, $D = k \times \sqrt[4]{d}$ where k = 1·812 (maximum departure 3·7 per cent.).

The American I.E.E. Committee on overhead line construction has recommended that for design purposes ½ in. ice coating be assumed all round conductors; the actual ice load carried by the Portland lines was practically identical with that corresponding to the above rule and, as the conditions were, if unusual, not unique, it appears that the American standard rule does not provide a sufficient factor of safety.

INSTITUTION OF ELECTRICAL ENGINEERS.

Manchester Local Section.

On Tuesday last Prof. E. W. Marchant, D.Sc., the new chairman, read his inaugural address, of which the following is an abstract:—

It seems to me that the time has come when it might be advantageous to look round at the vocation of an electrical engineer, to see what he has accomplished and to make an attempt to determine the place he should fill in the industrial world, and of the steps which may appear possible to improve his status, and the reward he should receive for the long and arduous training through which he has to pass before he can be regarded as a fully qualified member of his profession. My chief reason for discussing this subject is that the electrical engineer to-day is a very specialised person. Electrical engineering has developed so rapidly and in so many directions that it is now impossible for one man to keep in touch with what is happening in all the branches of activity in which electrical engineers are employed. Each man becomes obsessed, and very rightly so, with the work for which he is responsible; he busies himself in becoming acquainted with the technical development of his subject, and there is, I think, some danger that the "human" aspect of his profession may become forgotten and may be neglected. It is also opportune at this time to discuss the subject, because the Institution has recently organised a system of examinations to test the quality of the candidates who wish to join its membership. The examination scheme has been designed to test the knowledge of the candidate and to avoid, as far as may be possible, the respective member cramming for it; those who have had experience of this work know how difficult it is to achieve this end, especially after the examination has been in operation for some time, and it is the hope of a good many of those engaged in educational work that besides showing ability to pass an examination, the prospective candidate should also give evidence of having passed through a recognised course of instruction in some approved institution.

The examination is a step in the direction of attempting to provide that members of the Institution shall really understand the principles underlying the work in which they are engaged, that their work should not be done merely by rule of thumb, that there should be given evidence of capacity to think. To produce men of this kind is the object of all the universities and technical colleges of higher grade. It is to be hoped that the establishment of the new examination scheme may lead to a closer connection between the Institution and the chief training colleges, a result which should prove of much ultimate advantage to both. The electrical engineer, like every other member of the civilised community, has to take a place in the social structure; his position must depend (and here I do not mean his position in any narrow sense) on his recognition of the position his labours take in the work of the world. On the recognition of this fact by the world at large depends his future, not only from the point of view of influence, but also financially, and it is from this standpoint that I wish this evening to take a brief survey of his position.

The construction and supervision of stations for the supply of electric power must always provide occupation for a considerable proportion of electrical engineers. The running of a small station requires a comparatively small amount of general knowledge of electrical engineering principles. The ideal central station engineer is one who must possess a great variety of qualities; not only must he be a good engineer, but also a good man of business.

The central-station engineer is destined, in the future, to take a still more important place in the life of the community than he occupies at present. The remuneration offered, however, to those taking up this work is quite inadequate to its responsibility. Successful central-station engineers, in all but the largest cities, have, in many cases, forsaken their positions to take up consulting work, and are retained by their former employers as consulting engineers. It would surely be better worth the while of most central-station authorities to have at the head of affairs men of experience who would be able to do all the necessary work for the central station, without calling in outside advisers. If this is to happen, it must be made worth the while of the central-station engineer. It is significant that the salary offered to those who wish to enter some of the power companies has increased to a most marked extent during the last year or two, due to the fact that the supply of men has rapidly fallen off. I heard the other day of a case in the West of England, where an engineer who, years ago, had dozens of men on his books who were anxious to get into central-station work, now had none. The list of vacant positions in the electrical journal advertisements is more than twice as long as that of men wanting employment. This is a very healthy sign and a hopeful augury for those who have started in this profession. If the office of electrical engineer to a town or city is to become one of increasing honour and importance, it is essential that it should be filled with thoroughly trained men. I do not wish, here, to lay great stress on college education, though that, in the view of educationists, is an essential element in the training of such people; but that they should be persons of good general knowledge and high intelligence, that they should be competent, when the time comes, to assume the greater responsibilities which will rest upon them. To attract such men it is essential that these positions should be made financially remunerative. One cannot expect a man of promise to be content to spend 10 years of his life preparing for a profession which in the end will yield no adequate return for his expenditure of time and money.

A panel doctor with 1,200 patients receives a fixed income of at least £360 a year, and this may be regarded as a minimum salary for a qualified medical practitioner to-day. The training through which an electrical engineer engaged in central station work now has to pass, with three years at college and three or more years at works, is as exacting as that which a doctor receives. Surely such a man, whose work affects the life of the whole community, deserves as ample a recompense as the man who treats a limited fraction of its members.

The electrification of railways seems likely to be the direction in which the most important developments will take place during the next few years. The electrical engineer who intends to go in for railway work has, apparently, a great opportunity. It behoves the electrical engineer who looks on his work as his future vocation to equip himself with a thorough knowledge of railway conditions. Take two obvious examples: The arrangement of a schedule of trains for a suburban line is a problem of some mathematical complexity; the estimation of the power taken by an electric locomotive on a given line of road entails a large amount of detailed calculation and a thorough knowledge of mechanical principles. For this class of work the necessity for a good general engineering training is obvious, but, given this essential training, the field of the electrical engineer in railway work becomes a very wide one. As electric railways progress, it seems certain that the position of mechanical engineer to a railway will be filled by an electrical engineer, and if the success that has attended the promotion of engineer to the position of general manager of a railway has the effect one may reasonably anticipate, the electrical engineer may regard as a legitimate aspiration that he should be called on to fill this great administrative position.

The greater number of men with whom we, in the universities and technical colleges, have to deal, find their way to the manufacturing firms, and a considerable proportion of the membership of the Institution is engaged in the design and manufacture of electrical machinery and apparatus. The equipment of the engineer

intending to take a responsible position with a large firm has to be, from the technical standpoint, more complete and thorough than that required in any other branch of electrical engineering. It is easy enough for men who have had college training to enter works at the present time; most manufacturers seem only too anxious to obtain their services, and a living wage is paid from the start, but the number of openings that are better paid is much less numerous. There is a great gulf fixed between the men who are "just" on the staff and those in leading positions in a works, and in the long interval that might elapse before one of the former class becomes eligible for the higher positions, there is a period of great difficulty for most engineers in which the best men feel that they are wasting their time. In some cases, men have left the profession, who would otherwise have proved themselves a valuable addition to it. The main point that I would urge is that this condition is a discouragement to many able men, who might otherwise have entered electrical engineering, and have done much to advance it. I was discussing this matter the other day with a man in a good position with one of the best electrical engineering firms in the country, and he gave me his opinion that in his firm a man of initiative and energy might hope by the time he had reached, say 35, to receive a salary of £300 a year; I think all will agree that this prospect is not such as to attract into electrical engineering the bright minds and keen intelligence which it is so essential for the welfare of the industry should be attracted. Even in the early days of an engineer's career in a works, his remuneration is less than it should be. I know of one firm who offer a college-trained man, who has served his apprenticeship, 30s. a week to start with; a mechanic who has served his time can get 50s. What is the result? The only men who go to this firm are those who want to get practical experience, and are on the look-out for a better post from the start. The best men leave almost at once; the men who are not worth much remain. The manufacturers have been in a very strong position in the past, because the supply of trained men on which they could draw has been large; now conditions are changing, and I would urge, as strongly as I can, that in order to attract the best type of persons into the profession of electrical engineering, the standard of remuneration for technical men must be advanced. Surely it is to people of this type that a manufacturer must look far more than to any other for the progress and advance of his business, and it is of the greatest importance to him to ensure that such people shall be forthcoming in the future. The prospects of the manufacturer to-day, I believe, are better than they have been at any time during the last decade. It is, therefore, a suitable time at which to urge this matter, and to lay stress on the necessity of ensuring that the prospects of those entering an electrical engineering works shall be at least as good as those in any other branch of engineering practice.

The operating branches of telegraphy and telephony are under the control of the Government, and, as in other branches of the Government service, the position of its engineers is not as satisfactory as it might be. It is to be hoped that the higher administrative positions in this service will in the future be more open than they appear to be at present to those who have a thorough knowledge of the technique of telegraphy and telephony. The advance in status of the trained electrical engineer should lead, before long, to a recognition of his fitness for such administrative positions. It is only by a complete co-ordination of the technical and administrative sides of this undertaking that the greatest economy and efficiency can be reached; if that end is to be attained the electrical engineer must be ready and fully equipped for administrative work. To get the right kind of person, the engineering side of telegraph and telephone engineering must be made attractive enough to ensure that the most able people shall think it worth while to become telegraph engineers. The case for improved conditions in the telegraph service is overwhelming. The importance of the service of the telegraph and telephone to the community to-day demands that those engineers engaged in its direction shall receive recognition at least equal to that given to those responsible for any of the other great national services.

The application of electrical energy to chemical manufacture has made great strides during the last decade, and the price at which electrical energy can now be sold makes it evident that electrochemical processes will come even more extensively into use, not only for the manufacture of alkalis, carbides, and the like, but also for smelting iron and steel. The questions involved in the application of electrical energy to purposes of this kind are essentially engineering problems. Electrical engineers should find a considerable field for their activities in this direction, and one of the advantages this branch of engineering possesses is that it is likely to be rapidly progressive as the cost of electrical energy decreases. It is to be hoped that this work will not be left in the hands of those more directly concerned with chemical problems, as progress is much more likely to be rapid if the mechanical design of the plant is sound. A thorough engineering training, combined with a good knowledge of chemistry, is provided in most of the larger technical schools and colleges. It remains for the users of these processes to employ the raw material that is being produced.

The consulting engineer has been consigned by some people to a speedy end, as far as electrical work is concerned, his place being taken by engineers employed by large firms. It will, however, be a long time before the consulting engineer finds himself without occupation. Consulting engineering as a vocation can, however, hardly come within the scope of this brief survey, since a consulting engineer is necessarily a man who has had experience in one of the branches of engineering to which reference has been made already. I have made some attempt to classify the membership of the Institution with a view to finding the proportion engaged in each branch of work. The classification is very incomplete, and has been applied only to the class of members. The thing that has surprised me has been the apparently large proportion of men engaged in the business of the supply of electrical power who are members of this Institution. That, of course, is the greatest work at the present time, but it is one which will not, I believe, tend to increase very rapidly as an employment for engineers. The tendency to-day is towards large power stations and long transmission lines, and anyone who has seen the large power stations in Canada and the States, especially those operated by water, cannot but have been impressed by the very small number of engineers which a station of, say, 50,000 KW. requires.

The first conclusion one arrives at from this classification is that there must be a large number of electrical engineers engaged in manufacturing and constructional work who are not members of this body. These men are of great value to an institution such as ours, because it is they who are really in the fore-front of discovery, and I hope an effort will be made to bring men of this type into the ranks, as they cannot fail to strengthen the membership.

The electrical engineer of the future must be a person who can take a broad view of his profession; whether he be engaged in central station work, in manufacture, telegraphs, railways, or as a consultant, he must be able to see all sides of a question. He must be able to solve new problems along sound lines. If men of this kind are to be available as electrical engineers, it is essential that the best type of person must enter the profession. The position to-day is critical, and on the attitude of the industry to its engineers depends the future of the electrical engineer. The magnitude of the tasks that lie before him, the complexity of the problems he has to solve, the greatness of the results he can achieve are unequalled in any other calling. For the best results the best men should be got, and whether the best men enter electrical engineering depends entirely, or almost entirely, on whether it is made worth their while to do so.

As far as one outside the industrial world can judge, the prospects of the electrical engineering industry at the present time are exceedingly good; they are even better if one takes into account the openings that are available for those willing to go abroad; it behoves the electrical engineer, then, to make use of his opportunities, and to see to it, as far as lies in his power, that there may be great difficulty in obtaining really competent and well-trained electrical engineers at too low a rate of salary. It must be acknowledged that the income derived at the present day by most electrical engineers from their profession is generally not high enough, considering the importance of the work they have to perform.

The matter is one of supply and demand; the supply hitherto has been ample, the demand meagre; now, demand is overtaking supply, and the necessary consequence to an increased demand is either a worse quality of product, or a higher price.

It is to be hoped that the members of this Institution who have it in their power, will see to it that it is the latter alternative that is chosen by the electrical engineering industry.

POWER TRANSMISSION AT COLLIERIES.

A JOINT meeting of the Scottish Branches of the NATIONAL ASSOCIATION OF COLLIERY MANAGERS and the ASSOCIATION OF MINING ELECTRICAL ENGINEERS was held on October 25th, in the Royal Technical College, Glasgow, when a paper, by Mr. W. H. Telfer, of the Wilsons & Clyde Coal Co., on "Power Transmission at Collieries," gave rise to a lengthy discussion.

The author said that transmission of power by electricity easily took the premier place, and was cutting out to a large extent the older methods. Electricity was now being successfully used for operating all classes of mining machinery, with the exception of reciprocating drills and holing machines, and there were cases now of entirely electrically-equipped collieries.

Speaking generally, fairly large collieries, or groups of collieries, requiring generating plant of 400 KW. and upwards, should have their own plant. The ideal plan was to have steam winding engines, the fan driven by a compound engine, and possibly the washer driven by a compound engine, all exhausting into a mixed-pressure turbo-generator producing power for the operation of other machinery where that was being done electrically.

Where the maximum power required would be under 200 KW. and the load factor not likely to be good, and the colliery did not form one of a group, power could be got from a supply company on better terms than it could be produced at the colliery. He based these opinions on the prices charged by one of the large power companies in Scotland. This ran out about 0·7d. per unit, and where about 50 per cent. of the power was used in fairly continuous pumping or ventilation plant, the average would be 0·6d. per unit. For actually continuous pumping the figure would come as low as 0·4d. per unit. Buying from a power company had a great deal to recommend it, especially where the consumption of current was irregular and the power factor low.

Whether the system should be a three-phase or continuous current one depended on local conditions. Where the load was mostly pumping, auxiliary fans, and endless rope haulages, it was certainly a case for the three-phase. Where the load was mostly intermittent, such as coal-cutters, main and tail rope or single dook rope haulage, or winding from blind pits, continuous current was preferable. The pressure would depend principally on the length of transmission; where this did not exceed one mile and the amount of current was not great, a medium pressure was generally most suitable. Where large

currents would be required, even with short transmission, it might be advisable to have high pressure. With the adoption of the best type of plant and methods, and reasonable precautions, the dangers of electricity could be guarded against, and accidents reduced to a minimum.

As regarded the ignition of gas or dust by electricity, there were certainly some mines, but very few in Scotland, where the use of electricity at the face would not be judicious. In the great majority of their Scottish mines worked with safety lamps there was no objection to the use of electrical power right up to the working face. If proper precautions were not taken, fire was a more likely cause of danger in the Scottish mines, than ignition of gas or dust. Fire might be caused by defective or damaged cables, bad joints, defective switchgear, or excessive sparking. To minimise this danger, only the best class of cables and switchgear should be used.

Mr. Frank Onslow, Glasgow, wrote that compressed air should be regarded rather as the ally of electrical power than its enemy. There were many positions in which the use of compressed air was preferable to electricity, and to press the adoption of electrical power under such circumstances was only eventually to prejudice its further use.

THE RIGHTS OF SUB-CONTRACTORS.

[FROM A LEGAL CONTRIBUTOR.]

The case of Babcock & Wilcox *v.* the Metropolitan Water Board, which was decided by Mr. Justice Channell on October 27th, has a most serious bearing on the rights of those who undertake part of the work which is to be carried out under a large and varied contract. As the learned Judge himself said when he began his judgment, the case was more important that those which are usually found in the non-jury list. The material facts were these.

By a contract in writing made in 1907, the Thames Iron Works agreed to construct for the defendants certain water-works plant at Walton-on-Thames including (*inter alia*) 10 Babcock & Wilcox boilers, an electric coaling crane, an electric ash hoist, ash railway and two economisers. It was provided by the contract that payment for the boilers, &c., above referred to should be made as follows :—

"20 per cent. of the amount of the contract price of each boiler on completion of their principal vessels, tubes, forgings and castings ; 20 per cent. on the delivery of the above ready for erection ; 20 per cent. during the progress of further delivery and erection at the discretion of the engineer ; 20 per cent. on the delivery, completion and starting of the boilers, &c. The remaining 20 per cent. will be paid seven months after all the plant in this contract has been started." On December 5th, 1907, it was alleged that the Thames Iron Works assigned the contract for the supply, delivery and erection of the above goods to the plaintiffs. In a letter of that date they said :—"Subject to the approval of the Water Board we have pleasure in accepting your offer of July 20th last to supply the 10 boilers for the above pumping station . . . . for the sum of £12,250 . . . . delivered and erected in place. The whole to be to the approval of the engineer of the Metropolitan Water Board and ourselves, drawings to be submitted and approved before the work is put in hand, and it is understood you relieve us of the entire responsibility with regard to that part of the plant included in this order. Delivery, erected complete, on site, 10 months from date. Payments in accordance with the scheme of the Metropolitan Water Board less $2\frac{1}{2}$ of my account." Similar letters were written on the same date with regard to the economisers, the coaling crane, the ash hoist and the ash railway.

The plaintiffs alleged that the fact of this assignment was well known at the time to the defendants, and that in any event formal notice thereof was given on May 21st, 1912.

In that letter the plaintiffs said :—"As you are no doubt aware we took over from the Thames Iron Works that portion of the contract relating to the supply of boilers, &c., with all its responsibilities, and as the payment of the balance of our supplies is due . . . . we claim £3,134 7s. 6d., being the amount due to us under the arrangement with the Thames Iron Works, plus a bonus in accordance with the conditions of the contract, which we calculate on the basis of the tests made to be 4·4 per cent.

The goods were duly delivered and erected, payments being made from time to time to the plaintiffs by the defendants through the Thames Iron Works. The total amount so paid was £12,073, leaving a balance of £3,314 7s. 6d., which the plaintiffs now sought to recover.

The defendants, by their defence, did not admit the assignment, or that the letter of May 21st, 1912, constituted any notice of assignment. They pleaded that the contract in question was divided into two parts, and that what was alleged by the plaintiffs to have been assigned to them was only a portion of the work in Part II. They further said that payments on account of the boilers, &c., were included in payments on account of all goods supplied and all work done under the contract, and that all the amounts due and payable to the contractors under that part of the contract had already been paid. They admitted being aware that certain of the contract works were sublet by the contractors to the plaintiffs, but denied that the amount alleged, or any amount, was paid by them to plaintiffs. They further said that in making payments on account they had not differentiated between work done by the contractors by means of subletting to the plaintiffs and work done by the contractors otherwise. They further denied paying the plaintiffs through the contractors. After considerable discussion, Mr. Justice Channell came to the conclusion that the claim failed. It had not been established to his satisfaction that the plaintiffs had any claim in law against the Metropolitan Water Board, their right being to proceed to recover the amount due from the liquidator of the Thames Iron Works.

It is sometimes said that hard cases make bad law ; and this certainly appears to be one of them. That the Board have the benefit of the work was admitted, and it was clear from the documents that Messrs. Babcock & Wilcox were virtually in the shoes of the Thames Iron Works so far as the certain portions of the work were concerned. We hope to advert to this case again in a future issue when we have been able to ascertain the exact grounds upon which it was decided.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

Although overhead wires will not be banished from the streets of Canadian towns and cities for a good while yet, it is evident that underground work is receiving some attention, as three cities have recently ordered an aggregate of nearly 20 miles of underground cable. The Electrical Service Commission of Montreal has announced that all the overhead wires and cables on St. Catherine and Blenny Streets will be replaced by underground wires by next May, and has further suggested that buildings in future should be wired suitably for connection to underground services.

The Abitibi Pulp and Paper Mills Co. have recently erected new mills at Iroquois Falls, Ontario, in which motors totalling over 2,000 H.P. are being installed.

The Hydro-Electric Power Commission of Ontario is arranging to supply Eastern Ontario with electric power, which it intends to buy from the New York and Ontario Power Co., of Waddington, N.Y. It is intended to cross the St. Lawrence River at Morrisburg, which is about 50 miles south-east of Ottawa ; the towns of Morrisburg, Prescott, Winchester, Chesterville Russell, and others in the vicinity, will soon be receiving power. The City of Kingston, as reported in these notes some time ago, voted against obtaining power from the Commission, and decided to extend its existing steam plant, but now that other places in this district are about to be supplied, the matter is to be opened once more, and the Commission approached again.

In South-Western Ontario the matter of light railways to serve the towns and villages has been very much before the public for some little time, and recently a meeting of delegates from various municipalities met in Toronto to hear a report read by the Hon. Adam Beck, chairman of the H.E.P. Commission, on this subject, which had been prepared by the Commission's engineers. Five plans had been considered, the construction cost being estimated at about £7,000 per mile ; the revenue would be obtained from

passenger traffic, freight traffic, milk carriage, mail and express and advertising receipts. It is proposed that the line should be built by the municipalities interested, and operated by power bought from the Commission. Power users along the route would probably be able to obtain power at prices ranging from $5 to $17 per H.P.-year. The report referred to above is being printed in order that interested parties may be able to look thoroughly into the whole subject.

At a meeting of the Ontario Municipal Electric Union held recently in Guelph, the following resolution was passed unanimously :—"In view of the comprehensive scheme outlined by the Dominion Government for the erection and improving of waterways in connection with the St. Lawrence River, Welland Canal, French River, Sault Ste. Marie, Trent, Ottawa and others, involving the large expenditure of public money, and in view of the extensive developments which are possible in consequence thereof, also in view of the power requirements of the province, be it resolved that this Association request the Dominion Government to put such water-powers under the jurisdiction of the Hydro-Electric Power Commission of Ontario, to be developed by them for the use of the municipalities of the province for the benefit of the people."

The contract for the electrification of the Mount Royal tunnel at Montreal, which is to form the Canadian Northern Railway Co.'s entry to that city, has recently been let. The cost of this work will be about £100,000. No Canadian Northern steam locomotives will go into the city ; these will be exchanged at a point some distance away for electric locomotives, which will then run the trains through the tunnel and thence into the station. It is anticipated that the boring of the tunnel will be completed before the end of the year. According to the daily papers, Sir Thomas Shaughnessy, president of the Canadian Pacific Railway, has given it out that if the electrification of the Rocky Mountains division, which is now being carried out as an experiment, is a success, the entire railway will be electrified. It is stated that the Rocky Mountains section presents every problem of handling traffic known to railway men, and that if electric locomotives can deal with them all successfully, the changing over of the whole line from steam to electric operation is certain to follow.

THE CHIEF WHO HAD A BRAIN WAVE.

By IGNOTUS.

Now, it came to pass in the city of the Brobdingnagians, which is in the region of No Man's Land or thereabouts, that there was much tribulation among the population, for, verily, the streets were in a constant state of turmoil, insomuch that it was with much difficulty that even a coster's cart could proceed thereon, and the reason for this was that there were many councils and authorities in that city, and each of them had great and pressing matters in connection with the highways and byways of that city. There was one authority which was known as the Company of Water Bearers, and they had great powers in the laying of pipes, both of lead and iron, and they employed cunning workmen in divers metals to bear the water to the inhabitants of that city. Likewise, also, there was a company which carried strange sounds of music and of speech along wires, so that each inhabitant could converse one with the other over great distances while reclining at his ease. This authority was of great power and wisdom, and had taken down its overhead system, and the posts and poles thereof, and had placed the wires under the highways and byways, so that no man could see them. Also there was the great and mighty authority which purveyed heating, lighting and power to the inhabitants of that city by the agency of electricity at prices of ·5d. or thereabouts, and this again made many connections, so that traffic was much disturbed thereby. Furthermore, there was a very powerful and much-to-be-feared company, which purveyed gas unto the inhabitants, and these authorities and their servants did strive mightily one with the other, for as much as they all wished to take up all the roads at the same time, and the inhabitants of that city suffered.

Now, it came to pass that upon an occasion the chief of one of these authorities had a brain wave. This malady is most intense, and resembleth a species of calenture or sleeping sickness, and yet also possessing the properties of extreme fever, and its malignity while it doth last is most marked. Being therefore in this species of madness, the chief collected the other chiefs together and spake unto them, Behold now, the people of this city are risen up against us, for as much as their traffic is impeded and they may do us a great violence. Therefore now, go to, let us deal subtly with them and remove this grievance from among their midst, lest peradventure they turn upon us and rend us. Let us now consider whether it be not possible to co-ordinate our acts so that we be not continually destroying the pavements and the foundations of the city and of the houses thereof.

And this saying pleased the other chiefs greatly, and they spake unto him saying, Verily thou hast spoken wisdom. Let us now draw up a system whereby these evils may be abated. And they drew up a system whereby that whenever it entered into the mind of any chief to pull up the pavement, he should previously inform the other chiefs, saying at such a date and in such a place I shall uproot the street and destroy the pavement, and dig a trench and obstruct the traffic. If, therefore, thou wishest to perform the same act, let us join ourselves together and we will make one muddle of the whole thing. And thus it was agreed among them.

But there was in that city a still greater authority which was elected of the people, and the members of that authority were of great wisdom and power and might and understanding as befitted the representatives of that city, and owing to their rotundity they were named the Corporation. Now this matter came before the meeting of the Corporation, and the members thereof were greatly wroth, inasmuch as this action had been taken without their consent and sanction, and there was in that Corporation a Labour Member, and he arose, saying, What is this evil that is come amongst us, for, verily, if these authorities and these powers conjoin together to uproot and to destroy, there will be great economy of labour, for as much as one man can destroy as much as six could previously, and there will be many thrown upon the rates. Therefore let us now forbid these authorities to conjoin together and inform them that each must carry out their work separately, for Labour must be fed. And a great writing was inscribed upon the books of the Corporation, and it was so.

And to this day the powers and the authorities of the city of the Brobdingnagians do each and separately root up and destroy and dig trenches and lay cables to the great inconvenience of the inhabitants thereof, for as much as Labour must be fed ; and the inhabitants of that city do languish exceedingly.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"B. of T." writes : "I shall be greatly obliged if you will be so kind as to furnish me with the following information concerning the B. of T. regulations for overhead L.T. 250-volt bare wire transmission lines :—(1) When feeders and distribution mains are supported by iron brackets attached to the sides of houses, is it necessary for the wires to be kept above 7 ft. away from the building ? (2) Should the house service wires be insulated ? (3) what is the maximum distance apart that these brackets may be placed ? (4) When running wires across private fields on wooden poles, is there any limit enforced to the distance apart of the poles ? (5) I should also be glad to know in what section of the Electric Lighting Act the regulations for these lines are given in full.

***As to (1) Rule 7 of the Regulation made by the Board of Trade for securing the safety of the public pursuant to the Electric Lighting Acts, 1882 to 1909, provides that service lines from overhead lines shall be led as directly as possible to insulators firmly attached to some portion of the consumer's premises which is not accessible to any person without the use of a ladder or other special appliance. Every portion of any service line which is outside a building, and is within 7 ft. from the building, shall be efficiently protected by insulating material. Rule 18 of the Regulations made pursuant to the Electric Lighting Act, 1888, is in very much the same terms. It will be seen that any service line *within* 7 ft. must be insulated. As to (2) the regulations referred to do not say whether the service lines must be insulated.

(3) The regulations above referred to appear to be silent as to the distance between mural supports, but it is presumed that the limit of distance can be calculated from the regulation as to the factor of safety. "Rule 17: The factor of safety shall be overhead lines at least five, and for wooden poles at least ten, and for iron and steel structures at least six, taking the maximum possible wind pressure at 30 lb. per sq. ft. No addition need be made for a possible accumulation of snow."

As to (4) the regulations provide that "the interval between any two wooden poles used singly as supports for an overhead line shall not exceed 200 ft.; provided that where the line makes an angle at any such pole, the interval between that and the next pole shall not exceed 150 ft. In the case of supports other than single wooden poles, the intervals between the supports shall be such as may be prescribed by the Board of Trade.

As to (5), the "regulations" in question are not part of any Act of Parliament, but are made by the Board of Trade under powers conferred upon them by the Electric Lighting Acts. A copy can be obtained from the King's printers for a small sum.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,681. "Device for holding and adjusting the position of electric lamps for use on boats and for submarine purposes." A. Barnes. October 20th.

23,715. "Elements for electric heating devices or radiators." R. A. S. Paget. October 20th.

23,720. "Electrical resistances and resistance thermometers." W. J. Mellersh-Jackson. (H. N. Packard.) October 20th. (Complete.)

23,728. "Radiating system for signalling by electric waves from aeroplanes." Signal G.m.b.H. October 20th. (Addition to 736/13. Convention date, November 27th, 1912, Germany.) (Complete.)

23,739. "Contact-breaker for magneto-electric ignition apparatus." Unionwerk Mea G.m.b.H. October 20th. (Convention date, December 5th, 1912, Germany.) (Complete.)

23,741. "Substance for use in processes for electro-plating non-metallic objects." L. Waltispurger and C. A. Rivoal. October 20th.

23,754. "Brushes for electric contacts." J. E. Colas and Soc. d'Electricite Nilmelior. October 20th. (Convention date, November 26th, 1912, Belgium.) (Complete.)

23,774. "Electrical fuse or cut-out." E. W. Adams and W. Emmott. October 21st.

23,845. "Incandescent electric lamps." C. A. Harrison. October 21st.

23,867. "Rocker-arms and brush-holders for use on electrical motors and generators." J. Leech. October 21st.

23,892. "Construction of electrically-heated stove." H. S. Soutter. October 22nd.

23,897. "Hot-plates and the like electrical heating devices." G. Cooper. October 22nd.

23,903. "Starting-switches for electric motors." J. L. Warby and H. C. Parsons. October 22nd.

23,916. "Magneto-ignition apparatus for internal-combustion engines." N. F. Holder. October 22nd.

23,917. "Time-limit devices and their applications." J. Roothaan and Ferranti, Ltd. October 22nd.

23,950. "Insulators." M. Hentschel and Porzellanfabrik Hentschel and Muller. October 22nd. (Complete.)

23,959. "Electrodes for use in the production of nitric oxide." C. Rossi. (Convention date, October 22nd, 1912, Italy.) October 22nd. (Complete.)

23,976. "System of automatic electrical signalling for railway trains." W. Hiley. October 23rd.

24,006. "Treatment of sewage by electrolysis." J. W. Simson. October 23rd.

24,007. "Electric controlling switchgear." E. W. Adams. October 23rd.

24,025. "Apparatus for automatically regulating electric circuits." H. Leitner. October 23rd.

24,026. "System of regulation and control for electric circuits." H. Leitner. October 23rd.

24,028. "Manufacture of tungsten." C. Gladitz. October 23rd.

24,029. "Manufacture of incandescent electric lamps." C. Gladitz. October 23rd.

24,041. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., Ltd., United States.) October 23rd.

24,054. "Starting switches for electric motors." V. G. Middleton, F. Farndon and D. K. Morris. (Divided application on 26,912. November 22nd.) October 23rd.

24,074. "Automatic safety shunting devices for electric arc lamps." A. H. Railing and A. E. Angold. October 24th.

24,089. "Electrically-lighted advertising apparatus." G. Forster and S. E. Parker. October 24th.

24,117. "Oil insulated electrical apparatus such, for instance, as transformers." Siemens-Schuckertwerke G.m.b H. (Convention date, October 24th, 1912, Germany.) October 24th. (Complete.)

24,126. "Geared alternating-current electric motors." Siemens-Schuckertwerke G.m.b.H. (Convention date, October 24th, 1912, Germany.) October 24th. (Complete.)

24,130. "Electric candle lamp." H. Garde. October 24th. (Complete.)

24,148. "Masts." Marconi's Wireless Telegraph Co., Ltd., and A. Gray. October 24th. (Complete.)

24,162. "Oil transformers." H. Weiss. (Convention date, October 26th, 1912, Austria.) October 24th. (Complete.)

24,165. "Manufacture of sparking plugs." K. E. L. Guinness. October 24th.

24,191. "Dynamo-electric machines." F. M. Lewis. October 25th.

24,198. "Electric switches." V. Hope. October 25th. (Complete.)

24,204. "Electric tail-light showing red, for use on cycles and motor-cycles." L. H. Sacre. October 25th.

24,212. "Conversion of alternating electric current." A. Scherbius. (Convention date, October 25th, 1912, Germany.) October 25th. (Complete.)

24,219. "Control of electricity for lighting vehicles." G. Inrig and G. Inrig, Ltd. October 25th.

24,221. "Electrical contact devices." J. E. Taylor. October 25th.

24,226. "Safety device for use in connection with electric motors." W. Rogers and J. S. Davies. October 25th. (Complete.)

24,246. "Electric incandescence filament lamps." J. R. Quain. October 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Conversion of Electric Energy. W. A. Price. 22,524. October 3rd. (Cognate application 22,542, 1912.)

Manufacture of Metal Filaments. Pope's Electric Lamp Co. (Trenzen.) 22,548. October 3rd.

Circuit Connection for Electrical Installations with Mixed Loads. Landis & Gyr (Firm of). 22,591. October 4th. (October 12th, 1911.)

Means for Signalling and Controlling Apparatus by means of Electrical Oscillations in Electric Supply Mains. A. C. Brown. 22,649. October 4th.

Controlling Devices for Electric Motors. A. H. Curtis, A. H. Mackley and Adams Manufacturing Co. 22,747. October 5th.

Electric Signalling Systems for Railways and the like. C. W. Ward. 22,833. October 7th.

Production of Ozone. J. R. Quain. 22,854. October 7th.

Electric Arc Lamps. F. B. Cannock. 22,952. October 8th.

Electric Distribution Fuse Board. H. B. Prentice and H. Atlay. 23,014 October 9th.

Electric Heating and Cooking Apparatus. R. F. Venner. 23,082. October 9th.

Method of and Means for Electrolytically Depositing Metal upon the Interior of Tubes and other Hollow Articles or the like. G. P. M. Lee and W. A. Brame. 23,096. October 10th.

Telephonic Receivers. A. Marr. 23,240. October 11th.

Electric Ignition Apparatus for Internal Combustion Engines. H. Leitner. 23,430. October 14th.

Electrical Heating Apparatus, more especially Vulcanizers. H. R. Nash. 23,451. October 14th.

Process for the Manufacture of Chemically Pure Tungsten. C. H. Fischer. 23,475. October 14th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.) 23,594. October 15th.

Trolley Poles for Tram and like Cars. A. K. McQuade. 23,639. October 16th.

Clips for Anchoring Electric Trolley Wires for Tramways and the Like. A. Welsh. 24,522. October 26th. (Cognate Application 6,296, 1913.)

Apparatus for Periodically Testing Electric Currents. C. Smith. 24,960. October 31st.

Heating or Lighting Apparatus. H. J. C. Forrester. (Rector Gas Lamp Co.) 25,313. November 5th.

Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 28,122. October 5th.

Electric Motor-Meters. British Thomson-Houston Co. and F. Holden. 28,227. December 6th.

Contact or Commutating Devices for Electricity Meters. S. H. Holden and Chamberlain & Hookham, Ltd. 28,316. December 9th.

Electric Telephones. L. G. Hammer. 29,036. December 17th.

1913.

Means for Collectively Actuating and Controlling Alternating-Current Motors. J. L. Routin. 785. January 9th.

Methods and Apparatus for Producing Elongated Electric Arcs. F. H. A. Wielgolaski. 2,165. January 27th.

Method and Apparatus for the Production of Elongated Electric Arcs for the Treatment of Gases. F. H. A. Wielgolaski. 2,214. January 27th.

Electrical Advertising Signs, Devices or the like. L. Martin and G. Nixey. 3,562. February 11th.

Devices for Packing Eggs, Incandescent Lamp Bulbs and other Breakable Articles. J. B. Warren. 3,591. February 11th.

Electrically Heated Apparatus. E. C. R. Marks. (Landers, Frary & Clark.) March 3rd.

Protective Devices for Electric Circuits. E. E. F. Creighton. 5,662. March 6th. (May 2nd, 1912.)

Arc Light Electrodes. Geb. Siemens & Co. 7,108. March 25th. (March 28th, 1912.)

Number Impulse Instruments for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 7,530. March 31st. (March 29th, 1912.)

Electric Conduits. F. S. Rippingille and F. L. Broughton. 7,931. April 4th.

Electric Switches. Voigt & Haeffner Akt.-Ges. 8,409. April 9th. (July 8th, 1912.)

Electrolytic Electricity Meters. Schott & Gen. 10,512. May 5th. (June 10th, 1912; Addition to 14,288, 1909.)

Controllers for Electric Motors and like Apparatus. G. Ellison and M. H. R. Mueller. 12,882. June 4th. (Divided application on 22,959, October 8th, 1913.)

Apparatus for Covering the Silvering of Glass by the Galvanic Deposition of a Protecting Metal. J. J. Declere, A. L. E. Gresy and G. Pascalis. 13,109. (June 27th, 1912.)

Submarine Electric Leakage Telegraphy. Signal Ges. 13,919. June 16th. (June 5th, 1912.)

Electric Transformer Furnace. J. Bally. 16,011. June 11th. (July 12th, 1912.)

Switches of the Tumbler Kind. W. J. Charles. 16,151. July 14th. (Divided application on 22,477, 1912. April 3rd, 1913.)

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of the above Association was held on Friday, the 31st ult., at the Municipal and County Club, Whitehall Court, Whitehall, S.W., when the following were present:—Messrs. Ullmann (East Ham), Bruce (L.C.C.), Coveney (Erith), Schofield (Leyton), Harvey (Ilford), Moffet (West Ham), Hammond (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), hon. secretary. Letters of inability to attend were received from Messrs. Fell (L.C.C.), Stokes (Bexley) and Bruce (Dartford). Messrs. Ullmann and Coveney were re-elected chairman and vice-chairman respectively, and Mr. Goodyer was re-elected hon. secretary.

THE

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ELECTRICITY IN MINES.

WE give on another page a table showing the aggregate electrical horse-power in British and Irish mines, compiled from the reports of H.M. Inspectors of Mines for the eight divisions.

From this it will be seen that Scotland leads the way in the number of collieries which have installed electricity as well as in the amount of power plant installed underground, though this district is much below South Wales when the totals of underground and surface plant are taken together, that of the latter amounting to no less than 149,393 H.P., against a total of 98,357 H.P. for Scotland.

It is not a little remarkable how rapidly the development of electricity has taken place in South Wales, especially with regard to winding, ventilation, haulage and underground pumping. The district is undoubtedly the wealthiest of our coalfields, and could best of all afford to continue working with steam and compressed-air plant; but as enormous sums have been spent in putting down central stations for generating power, it follows that substantial economy in working must have been demonstrated.

The same thing has been experienced in Scotland, but mainly with regard to underground work, such as haulage, pumping, and coal cutting (portable machinery), the latter item being remarkable when compared to all the other districts.

Probably, however, the most difficult case to understand is that of the two North of England districts of Newcastle and Durham. In total H.P. these two districts are below either South Wales or Scotland, yet there is at hand a public supply, much of which is generated from waste heat, viz., that of the Newcastle-upon-Tyne Electric Supply Co. and the various companies associated with it, who are able to supply energy at rates, if not below, at least equal to what it could be generated for at the colliery itself. They are also the oldest mining districts not only in this country, but in the world, and if economy is needed anywhere it certainly is necessary here. It is true that the number of collieries in the two districts is less than in either Scotland or South Wales, the totals being for Scotland 520; Newcastle, 246; Durham, 248; and South Wales, 622. Of these, 39 mines in Cumberland must be deducted from Newcastle, which are included in that district, and seven mines from the Durham district which are outside the Supply Co.'s area, so that we have in Northumberland 129 collieries, and in Durham (including the Cleveland iron mines) 319, or together a total of 448 mines and collieries, 80 per cent. of which could probably be easily supplied by the electricity supply companies. There is ample room for the development of electric winding, and if it pays in South Wales, where the initial expenditure included the generating stations in most cases, surely it ought to pay in these two counties where there is only the cost of the motors to consider; it is not even necessary to install a complete new winder, as in most cases the present drums can be utilised, and if the silly prejudice against gearing were removed, the operation of conversion would be a simple one, and smaller motors with higher efficiency might be installed with very profitable results.

In Cumberland also there would appear to be ample opportunity for the development of electricity, especially seeing that there are a number of collieries with waste heat from coke ovens. There are 39 collieries, with a combined output of 2,133,563 tons of coal, yet only 12 collieries have installed electricity, and this only to the extent of 2,974 H.P.,

none of which is applied to either winding or ventilation, and only 473 H.P. to underground haulage.

One might also have expected greater development in the Yorkshire district, seeing that there were at work in 1912 no fewer than 630 pits, of which 317 only have electrical plant. Of the 317, 64 are in Derby, 43 in Nottingham, and 210 in Yorkshire, the total number of mines being in Derby 155, Nottingham 57, and Yorkshire 417, so that nearly 80 per cent. of the owners in Nottingham have recognised the advantages of electricity, the highest percentage, we believe, for any county in the British Isles. Many of the collieries in Derby are poor, as the whole output for the 155 mines was only 15,468,880 tons, valued at £5,899,685, as compared with an output in Nottingham of 11,122,832 tons, valued at £4,241,499, for only 57 collieries.

It is in the Doncaster district, however, in Yorkshire, that the greatest development may be expected, as very large collieries are being established, each capable of producing at least 1,000,000 tons a year. It certainly seems a pity that the coal owners in this area have not combined for their mutual benefit in the establishment of a central generating station, and the adoption of electricity for all the operations—including winding—incidental to the working of the colliery.

There are 555 mines in the Southern Division, 299 of which are in Staffordshire, which is the greateat coal-producing centre in the division, though, of course, great hopes are still held out for Kent, which, at present, is the least. In Kent there are 7 mines which produced 1,099 tons, valued at exactly £1,099, or £1 per ton, and we very much question whether any of the shareholders would get a scrap of profit at this price. It proves, however, that there is coal in Kent, but it takes a lot of getting! A lot of other people besides ourselves wonder why. Three of the mines have electricity established mainly for pumping water out of the pits, and we hope it will prove of such good service that later on it will be used for winding coals out of the pits, and at £1 a ton.

The Diesel Accidents.

In connection with this matter, there has followed considerable discussion on the Bray and other accidents since the issue of the Official Report. In the report, and by some who have entered into the discussion since it was published, our contention, expressed at the time of the Bray explosion, that there should be a check or reflux valve in the blast air pipe has been doubted. The Inspector seemed to think that a reflux valve might stick fast, and so be useless. But even if it does stick open and allow one explosion, this does not mean that the valve has *caused* the explosion, for the valve is just then in the position of a plain unchecked pipe. And for one stick-fast permitting, by not preventing, an explosion, there might be two, or twenty-two, occasions when the valve would not stick fast, and would prevent an accident. It can never be known how many accidents are prevented by a safeguard, but it is usually well known when a safety appliance fails to act. Safety valves often stick fast, but we never yet heard this awkward fact put forward as an excuse for not applying safety valves to boilers. On the contrary, it is the reason why *two* safety valves are always applied, for by the theory of chances the two are unlikely to stick at the same time, especially when there is reasonably careful attendance and the rule for daily testing, by making a valve blow, is carried out.

One writer says the check valve would be blown in pieces by the excessive pressure. Why should it be? Let it consist of a steel or bronze ball held freely in a suitable retainer inside a stout steel casing, and it is not likely to be burst. If also the junction pipe is of copper from the retainer to the engine and of solid-drawn steel from the retaining valve to the blast vessel, the chances are that the copper pipe will burst, and the blast vessel will blow its pressure away harmlessly through the reflux valve, which if a ball should seat itself by gravitation, by a vertical rather than a horizontal movement. A lesson to be learned is that the blast pipe should be long, and that the air blast pressure should not be used when low, even though it may act, for there is little doubt that occasionally the pressure in the engine cylinder has gone a long way beyond 500 lb., especially when oxygen has been employed—a thing that is hardly likely to occur in the future, now that a belated publicity has been given to the very serious accidents already caused by its use. As to the danger of blowing to pieces a small reflux valve, what of the still greater danger of exploding the larger casing of the labyrinth which it has been suggested should be employed instead to check the progress of a flame through the blast pipe. The labyrinth may be efficacious and based on sound principles, but it can hardly be rated as a positive piece of apparatus such as a reflux valve is, up to the limit of its strength against disruption. The larger article will be the more likely to be burst, but a stout reflux valve, with a ball, is easily made stronger than the copper pipe, which at Bray seemed to burst before the air vessel, for we read of a blue flame being seen to run along it.

Nothing so far has been advanced in the controversy to make it otherwise than essential to place one reflux valve, if not two, in the course of the blast pipe, for, as said above, it cannot cause accident, and though it might fail on occasion like any other mechanical appliance, it would generally act. Obviously, the ball should have a short lift, and should not be able to get far away from the direct vertical above its seating.

Rubber.

The rubber market has lately drifted on to quieter lines, there being considerably less doing in shares, where comparative somnolence has prevailed, and the rot in prices has been checked even though the outlook has not materially improved. The better class of shares seems now to be fairly steady, but at prices terribly below those of the boom period, and there is very little chance of any substantial part of the depreciation being recovered, at all events until fundamental conditions of the industry assume a very different appearance from those of to-day. Nevertheless, the position as a whole has steadied itself a little, and it is the fond hopes of the optimists that things are now heading towards a small revival in the confidence which for so long has been conspicuously missing from the market. At the plantation rubber auctions held at Mincing Lane every fortnight, the tendency lately has been steadier, and it really almost appears as if prices had touched bottom or near it. Truly there cannot be much further depreciation, for at current selling rates plantation companies cannot in many cases live, and failing a recovery to a better figure, it can be only a matter of time before estates are abandoned, while the reconstruction of companies will be rendered inevitable.

Already this reconstruction process has been unpleasantly in evidence, and it is not yet done with by any means. It is in order to help matters along that there has been so much discussion recently as to the formation of an organisation for the purpose of putting the selling arrangements of the various producing companies upon a different and sounder basis. It may be taken for granted that wild rubber at to-day's prices is doomed. So far as Brazil is concerned, rubber cannot be produced there at anything like to-day's selling prices of plantation, and though Para material is held for a premium, it is doubtful if this can persist, for there is a growing belief in plantation rubber being much cheaper intrinsically than wild Para, and if this extends far it will not be long before the outlet for the wild product is narrowed further. Already it has been cut down pretty considerably in one way and another, and any fresh interference with its uses might have a rather sharp effect. It is almost impossible for economies to be introduced into the collecting of wild rubber in the Amazon Valley, hence any material reduction in the costs of procuring this description of material is rather improbable, but it is quite possible for considerable cutting down to be made in respect to the cultivated product.

All efforts are now being bent to this end, and some tangible result will, no doubt, be effected. There is a wide difference between the costs of the producing companies in the Middle East, and there can be no doubt that the

balance sheets of the better managed and lower cost properties are receiving the very closest attention from the directors of the higher cost properties with a view to the reducing of costs. Anything that can be done to place costs upon a permanently lower basis deserves the whole-hearted support of the trade, for it is only by bringing these down to a minimum that the consuming trades can be permanently encouraged to increase and develop along the most favourable lines. One brighter spot is the somewhat improved condition of affairs in the United States. The general depression of the rubber market has been in no small part the direct result of troubles in the United States manufacturing centres, notably in Akron, in Ohio, the largest rubber-consuming area of North America. In this city things are now running quite smoothly again, and those on the spot look for a steady extension in manufacturing operations there, though no doubt allowance must be made for the apparently reactionary state of general trade across the Atlantic. This is, of course, bound to hit the rubber market, and bring about a temporary restriction in the uses of the commodity. A point which is bound sooner or later to have an effect upon the demand for rubber is the increasing demand met with for the employment of a greater percentage of rubber than hitherto in so-called rubber articles. The use of substitutes of all sorts in rubber manufacturing operations was fostered to an enormous extent by the excessively high prices ruling some time ago, and the trade is only just righting itself from this condition of affairs. At anything below 3s. a lb. it is certain that manufacturers will put increased quantities of rubber into their goods, and in this direction the probabilities are in favour of a very considerable increase in consumption apart altogether from the opening up of entirely new uses.

Canadian Electrical Trade.

British electrical manufacturing cannot fail to gain from the close investigation that the Canadian market has been receiving from the minds of experienced and up-to-date authorities. We have no need of reports to impress us with the vastness of the country and its resources, or to tell us what should follow the great inrush of population that we have witnessed in recent years. But we do need advice from men on this side, who, knowing thoroughly the conditions here from the manufacturing standpoint, and being possessed with a passion for trade expansion, are able to spare the time to consider the problems of the position in the very centres where those problems are created. When Mr. Hamilton Wickes, His Majesty's Trade Commissioner for Canada, was collecting his material on the position, he entered in great detail into the organisation and influence of the National Board of Fire Underwriters of the United States, and made recommendations which need not be repeated here—they are so well known to everybody who is interested in the Canadian and American position. Other writers approach the matter from a different and perhaps, to some extent, specialised electrical standpoint, and we welcome all opinions, for it is only by the most complete study of the position from every point of view that the most satisfactory results will be secured for the future—and it is the future, perhaps, more than the immediate present, that is of importance to us in Canada. This week we with pleasure throw open our columns to a valuable communication from Mr. Herbert Berry, in which he exposes, we think very effectively, some of the weak places of the Underwriters' armour. He does not so much concern himself in this letter with the questions of how to adapt ourselves to the conditions resulting from the Underwriters' control. He is more concerned to show that the Underwriters' Code is itself in need of amendment in the interests of efficiency and safety. In the United Kingdom we count human life as sacred, but in Canada and America the said Code, while it pays some heed to fire risks, appears not to recognise the life hazard. Without entering further into the question now, we would commend Mr. Berry's communication, written from a mind deeply impressed by things seen on his recent visit across the Atlantic, to the serious attention of all interested in the subject, and we invite contributions thereon, critical or otherwise, from others of our readers.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

The general consensus of opinion is that, were it not for the developments in an electrical direction, there would be little or no novelty at the 1913 Motor-Car Exhibition which opened at Olympia, London, W., on Friday last week. Not only is one glad to see the re-appearance of the electromobile—although, it is true, there is only a solitary example, an Arrol-Johnston coupé fitted with Edison battery—but on one car—an American, by the way—there is an electrically-controlled change speed gear, which, by many people, is regarded as the forerunner of another coming great change in petrol motor-car design. A year ago, when reviewing the 1912 Exhibition, I had occasion to point out that one of the principal features of the Show was the rapid development that had taken place with regard to the adoption of electricity as the medium for lighting the lamps in and about motor-cars. Being compelled for want of time, and also space, to withhold any lengthy remarks on this part of the display until next week, it must suffice, for the meantime, to mention that the tendency in favour of electric illumination on motor-vehicles has become even more accentuated.

Apart from lighting, the great outstanding feature of the current Exhibition is the large number of electrical devices that have been brought out to dispense with the old and crude methods of starting up the engines of petrol cars by means of a handle at the front of the vehicle. This is a departure, the lead in which has been taken by American motor and electrical engineers, who, encouraged by the motoring public on the other side of the Atlantic, have been producing electrical engine starting devices for two or three years past. As a matter of fact, there were a few examples of such arrangements to be seen at Olympia a year ago, but they then aroused but a relatively small interest. In the 12 months that have since elapsed, it is, however, apparent that both British motor engineers and British motorists have begun to take a keener interest in the question of electric starters, with the result that, as already mentioned, they this year form the great feature of the Exhibition, being shown as a standard part of the equipment of about 15 different makes of cars, and offered, as an extra, by most manufacturers, should purchasers of their vehicles desire the same.

Electricity is, of course, not the only means by which engines can be started; there have been various other systems introduced, some of a mechanical nature, using racks and wound-up springs, and yet others employing compressed air and acetylene. Judging from present indications, however, it would seem that electricity is becoming, if it has not already become, the most favoured method, and, of course, it is the only one with which I propose to deal in the columns of the Review. The moment one commences to inquire into the subject, however, so it is found that considerable difference of opinion exists, even among electrical engineers, as to the best means of solving the problem. Where an electric motor is used to start an engine, a source of energy is, of course, necessary, this premising the installation of a battery of accumulators; a second premise is that the frequent charging of the battery from a public or private electricity supply main being practically out of the question, a dynamo driven in some way by the engine must be installed on the car. Seeing that on most modern cars a dynamo and battery are already provided in connection with the lighting system, the problem of supplying current for engine-starting purposes has presented no great difficulty. It is here, however, that the first difference of opinion, and practice, has arisen.

Although there is no controversy regarding the desirability of electric lighting and engine-starting systems on petrol cars, opinion, even in electrical circles, is more or less divided as to whether the generator and motor should be combined in a single device, or whether it is better to separate them into distinct units, which are, in so far as is possible, independent of each other. There is much to be said for and against both methods. In addition to being reliable and of minimum weight, it goes without saying that

any such system, whether it be of the combined unit or separate unit type, must be as simple as possible, and, above all, accessible, for none can be expected to run indefinitely without attention and reasonable care. So far as the efficiency of the two systems is concerned, there is no reason why this should not be just as high in the one as in the other, while, again, as regards the question of weight, there is little or no difference between the two arrangements. The combined unit method has the advantage that the generator and motor form a single compact device, which may perhaps be more easily located under the engine bonnet, and with probably less wiring than its rival. On the other hand, the separate unit system has the advantage that each part is smaller and lighter than the combined apparatus.

To ensure efficient regulation, the dynamo must be, generally speaking, of the shunt-wound type, for supplying the lighting current and charging the battery, while the engine starting motor must be of the series-wound variety, in order to provide a heavy starting torque at low speeds, as well as a power output that increases more rapidly than the demand for current, this being essential to safeguard the battery. Where the system is in the form of a generator-motor, it is consequently necessary to employ two different types of winding on the same machine. Furthermore, in the combined unit system the generator-motor is always running when the engine of the car is in operation—although provision is made in some cases for throwing out the dynamo driving gear when the battery is fully charged. The separate unit advocates argue that these are drawbacks, and point out that in their method the motor is only in operation when it is desired to start up an engine. One could go on giving arguments pro and con for each of the respective systems. Thus the separate unit advocates claim that the dynamo and the motor can be disposed on the chassis to the best advantage. The rim of the fly-wheel is, in the majority of cases, regarded as the best position to apply the starting effort. On the other hand, this is not the best position for the driving of the generator, as it gives too high a speed. Whatever the outcome of the matter will be, as a result of practical experience, it may be stated that at the present time, while there are several very successful systems of combined dynamos and motors, the majority of the systems in use employ a separate machine for generating current and for starting the engine, and it is on this account that in briefly dealing with the features of the different systems, I have first taken what may be termed the separate unit section.

At this point it may be mentioned that the writer's object has been to give a general *résumé* of the various electrical methods employed for the starting of the engines of petrol cars, as revealed at Olympia. No attempt has been made to mention every system in detail, nor to point out at any great length the features of construction of each particular system. Nothing short of a volume would suffice to cover every one of the many devices which have been introduced, and, in the present state of development, such a volume would only be valuable as indicating the great variety of methods employed, and the wide variation of standards adopted for certain essentials. The experimental work and practical knowledge gained during the next 12 months will undoubtedly do more than all the theorising that could possibly be done regarding this interesting problem. Indeed, a new field of work for the engine-testing shops and motor-car factories is opened up by the advent of the electric starter, for at present there seems to be no definite information available as to the speed which must be imparted to an engine in order to start it up, or as to the amount of power necessary to impart that speed to it; these points have an important bearing on the power and size of the electric motor and the ratios of the gearing between it and the engine. Little, if any, experimental work has been carried out in this direction, the brute strength of man having hitherto been depended upon for the starting of motor-car engines. The speed at which an engine will start to take up its own cycle of operations is a function of the carburation and the ignition, and it is in this direction that experiments will have to be carried out. On other points, too, there is a wide variety of opinion as to the best methods to adopt, such as, for example, the necessary voltage—the systems in use varying from 6 to 24 volts—and also whether the wiring should be on the single-wire system with "earthed" return, or double-wire plan. Again, no uniformity exists as regards the transmission of the power of the starting motor, although the plan of causing a pinion on the armature spindle to slide laterally into mesh with a toothed ring formed on, or secured to, the periphery of the engine fly-wheel predominates. Thus it will be seen that there is a variety of problems which will only be solved by the results obtained in careful tests and actual use, for it must be remembered that not all drivers—paid or amateur—are electrical engineers, and it is on the behaviour of the different systems in their hands that the success or otherwise of the different installations largely depends.

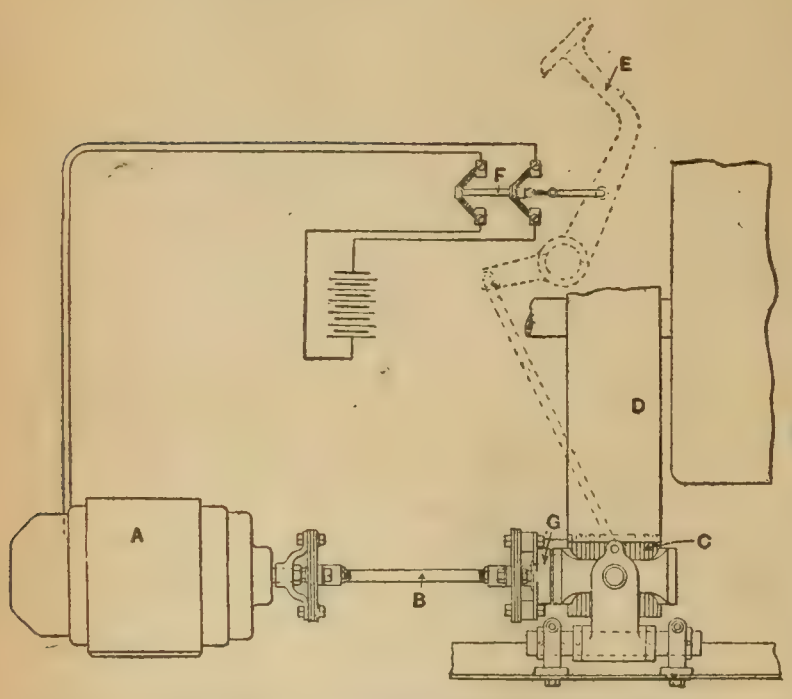


Fig. 1.—Showing Arrangement of Starter.

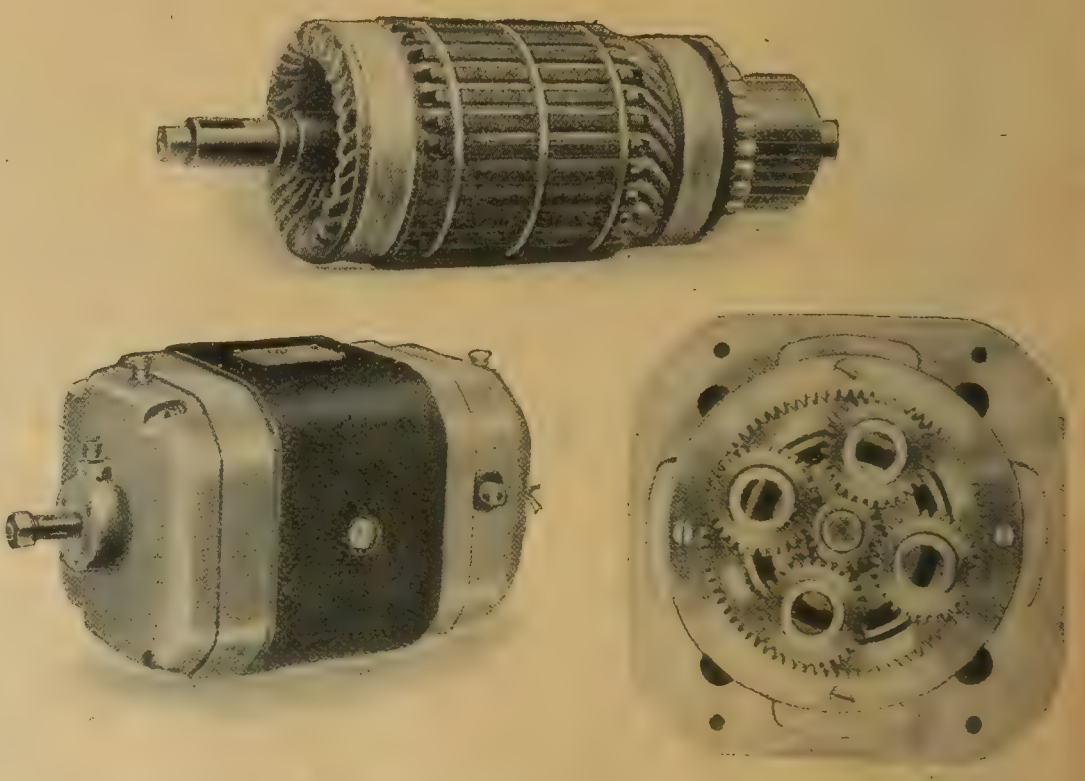


Fig. 2.—Armature, Geared Motor, and Reduction Gear.

The C.A.V. Electric Engine Starter.

Separate Unit Starters.

The C.A.V.—Among the new starters, probably the one that is engaging most attention, is that which has been brought out by Messrs. C. A. Vandervell & Co., of Acton Vale, W., whose lighting dynamos have met with considerable success in the motor world. The starter is separate from the dynamo; the motor is series-wound, and is provided with an enclosed reduction gear, enabling the employment of a high-speed machine, capable of developing a powerful starting torque, the momentary discharge of current being at the same time kept well within the safe limits of the battery. A diagram of the connections is given in fig. 1. As will be seen, the motor A drives, by means of a shaft B fitted with two leather flexible joints, a friction roller C, which is pulled into

engagement with the fly-wheel D of the engine, when the pedal E is depressed. As illustrated, the further depression of this pedal closes a double-pole switch F, connecting up the battery to the motor, but, in practice, Messrs. Vandervell are now separating these two operations, a separate pedal being provided to switch on the current as soon as the friction roller is in contact with the fly-wheel. A free-wheel clutch at G allows the engine to overrun the motor directly it starts up, so that no harm is done to the motor before the current is switched off and the roller thrown out of contact. The starters are made in two sizes, one for engines up to 20 H.P., and another for those of



Fig. 3.—Friction Pulley, C.A.V. Starter.

high compression or developing up to 50 H.P. Furthermore, to suit other plans of installation, motors without the enclosed speed reduction gear are also being made. All are claimed to be able to rotate an engine at from 90 to 140 R.P.M., and to be sufficiently powerful to prevent an engine back-firing against them. The C.A.V. system has already been adopted as a standard fitting on one of the new types of Daimler cars, as well as on several other British and foreign vehicles.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Travelling Representative.

Your correspondent "Anti-Traveller" in his letter under the above heading, has, I think, put the case from a very narrow point of view. He proclaims himself just the sort of man that a representative engineer would be glad to miss when on his travels. Probably he would deign to glance at the representative's card, and then send out a message to the effect that he is too busy to see anyone—the usual well-worn excuse with men of this limited type.

Reading the letter in question, one would suppose that manufacturers in the bulk are fools to waste their money in paying wages, and sometimes commission, to an army of representatives. Now does "Anti-Traveller" really think that if representatives did not bring business to the manufacturer, he would continue to employ them? If they (the manufacturers) could do as well by advertising and Press notices, then why on earth don't they? "Anti-Traveller" must show them the way to do it; his services would be invaluable, and no doubt he could reckon on a substantial salary, by acting as consulting advertiser to manufacturers. May I suggest to him that it would be profitable to set up business on this basis, and as I feel sure he has a generous spirit, give employment to the army of representatives whose present jobs he would do away with.

The idea of the principal or managing director of a large manufacturing firm making a round of old customers is distinctly good. The "ordinary" representative, doubtless, would not be granted an interview by "Anti-Traveller," but a principal or director—Ah! well—that is a different matter, eh! No trace of snobbishness here. Does "Anti-Traveller" know that the representative might conceivably know more about the goods he is selling than either the principal or director, although he might not be able to offer such fat cigars, and stand such comfortable lunches!

Another point "Anti-Traveller" misses is personality. I suppose he will agree that there is very little personality about an advertisement or Press description. Now a large proportion of representatives have personality, while some have confounded cheek, and both qualities are useful, in the great art of getting orders.

Regarding the question of cost, it seems fairly obvious that if you do away with the representative, you will have to increase the amount spent on advertising, and although advertisement is good, advertisement plus representation is better.

I cannot agree with "Anti-Traveller" when he states that the "ordinary" traveller "seldom possesses more than a smattering of technical knowledge." Usually the men sent out by a manufacturing firm know what they are talking about, and are fully conversant with the goods they are selling, even if they cannot answer every question which an anti-traveller might put to them.

I have the good fortune to be one of the selling engineers of a well-known British firm, and from my experience can say that a very large number of engineers make it a practice to grant, as far as possible, an interview to any representative calling. They may not always be satisfied with the call, but at least they do stand a chance of having something brought to their notice which had perhaps escaped them when reading the various journals, and consequently have added a little knowledge to their store. Of course the engineer to whom you can tell nothing, and the snob, will always be with us, but thank heaven they are few in number, as they are of very little use to their own employers, and none at all to yours truly—

Representative Engineer.

Noticing the article on this subject in a recent issue, I wish to join issue with several of the author's comments. The custom of sending out travellers is both ancient and modern, but it does not influence the cost of electrical accessories in the direction of higher prices any more at the present than it has in the past; in fact, against the increased cost of labour and material, prices have a tendency to be lower, to the benefit of the consumer and to the popularising of the uses of electrical energy. It is recognised that the technical Press is willing to give descriptions of any useful apparatus (when called upon to favour), but in these stirring times, business astuteness aims to maintain its establishment by offering special lines to prospective purchasers, and giving practical demonstrations without circularising; hence where consulting engineers and contractors do not interest themselves to the extent derived from an energetic representative's call, one feels that consultants and contractors become attached to one firm's goods at a disadvantage to themselves and their consumers. The advantage of the "Travelling Representative" is again apparent.

Time and money spent upon looking up contractors and engineers for the purpose of keeping them reminded of a firm's existence are not wasted, but are serviceable in avoiding, as far as possible, giving bogus prospectors latitude without inquiries being made on the spot. This object cannot be effected by the issue of periodical circulars and the avoidance of "The Travelling Representative."

Probably "Anti-Traveller" is in possession of a sinecure, or may be tied to accept or specify one firm's specialities, and does not desire to be influenced for the better, though the accusation of smattering knowledge generally arises from "Anti-Traveller's" attempt to obtain information without any intention of purchasing an outside firm's goods, to the disadvantage of the introducing representative.

First Office Boy Up.

Pressure Regulation.

I have been following with considerable interest the articles appearing in your columns *re* Pressure Regulation. Some time ago Mr. Turnbull stated in an article that, should the supply of steam be shut off from a self-excited compound-

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wound D.C. turbo-generator, the shunt field would disappear, owing to the current coming back on the generator from parallel machines, causing it to run up as a series motor and attain a dangerous speed.

Part of this statement was queried by Mr. Allingham by saying, how can the shunt field disappear so long as it is connected across the brushes? but he agreed with Mr. Turnbull as regards the machine running as a series motor. I should like to point out that before this is possible, the machine must first reverse in rotation, for should the speed of the generator drop, owing to bad steam, &c., sufficiently to allow it to be motored by the other sets in parallel, the shunt field will be found to be overpowered by the main field long before the speed becomes excessive. As soon as this has been accomplished, the machine will pull up to a standstill, cause a dead short, reverse and then run up as a series motor. Up to the time of reversing it is acting as a compound motor, differentially wound, and not as a series motor until it has reversed in rotation.

Though reverse-current relays are unreliable in operation, they are generally inserted, in order to help to avoid the possibility of this danger; but where an equaliser is employed the machine runs very little risk, as any reverse current will flow through the armature only and not through the main winding.

W. D. Lovell.

Middlesbrough,
November 4th, 1913.

The Value of a Sense of Proportion.

The interesting leading article in the current issue of the ELECTRICAL REVIEW on the sense of proportion, might well be taken up by the I.E.E., and copies sent to the principals of various colleges, with a request that they be placed before the senate, who could read, mark, learn and inwardly digest them, especially the last two paragraphs.

However great one's admiration may be for thoroughness, there is no doubt that it can, and has been, overdone in some electricity works, either in the stations, on mains, or in the organisation. Some stations may be said to be in some respects models from an engineering standpoint, but certainly not from a financial point of view.

One has only to compare treatises by British authors with those by American authors, and I think it will be found that the former do not come up to quite the same standard as the latter in their chapters dealing with commercial problems, although I may not have had the pleasure of reading the best of the former up to the present.

Lectures on commercial economics would not only be of great value in themselves, but would stimulate the interest and broaden the outlook of students.

Managers, with all due respect to them, may be classified good, bad and indifferent, with still further subdivisions; and it is quite possible that many a good engineer has not the full confidence of his Committee, because of this lack of business training.

In some few instances it is very probable that quite different financial results would have been obtained if the Committees concerned had had the wisdom and foresight to engage good consultants in the first instance and had retained their services afterwards, in order to preserve uniformity in policy and design; this is sometimes difficult to achieve when there are many changes in the managerial positions. But the question of consulting engineer *versus* manager is rather delicate ground to tread on, and many would, in all probability, prefer to sit on the wall and decide each case on its merits.

W. E. P.

A Call to the Soil.

In the past two or three issues of the ELECTRICAL REVIEW there appears an advertisement for 12 youths to learn farming in Australia, which is, to me, very amusing. Is the REVIEW in the future to be converted into a Farming Gazette, or a combination of both electrical engineering and farming?

I hope you won't be offended at this suggestion, Mr. Editor. Although I do not doubt for one moment that it is a genuine advertisement, I am struck with your deep sense of humour in the acceptance and the placing of the same.

Twelve youths will be paid good wages to learn farming, and have board and lodgings found; and directly underneath is another advertisement for a premium pupil for central station work, whose people, methinks, will have to provide his board and lodgings for many a year to come.

The young men who are the successful applicants will in time no doubt consider themselves fortunate that they were not drawn into the tangles of the electrical central-station profession, or escaped from them in time, in which, to use your phraseology, there is absolutely no idea of "The value of the sense of proportion."

Further, we learn that electricity is being applied to agriculture with good results. Now very probably these gentlemen are at present employed in our central or sub-stations at the usual office-boy's wage, therefore I tender them my heartiest congratulations for their far-seeing and prophetic powers, for who dare deny that one day we may hear of such a man as the farm electrician, whose duties may be either to act as shift engineer at the farm power-house or to wire circuits around a gooseberry bush or apple tree?

In conclusion, to the older men in the electrical profession I say "cheer up!" for everything comes to him that knows how to wait. If we, not being youths, are barred from applying for the positions above referred to, we may yet have an opportunity of applying our electrical engineering experience to advantage.

Like Micawber, many of us have for years been waiting for circumstances to change—for something to turn up. Be ye, therefore, ready to harken unto the call of the soil.

A. V. Beuck.

Aberdare, *November 9th*, 1913.

Electric Clocks.

In your issue of to-day, I observe a description of an installation of electric clocks, in which occur the words:—

"Mr. F. Hope-Jones, the inventor of the system."

The original patents of the system in question are Nos. 1,587 of 1895, and 7,868 of 1897, and upon both may be read the names of the joint patentees, Messrs. G. B. Bowell and F. Hope-Jones.

Now that the electric clock industry has become a real feature in the electrical and commercial world, it is of some interest to give "honour where honour is due," to the genuine pioneers and experimentalists to whom the successes of the present day are due.

The commercial sagacity of Mr. Hope-Jones is, I think, universally admitted by those who know him. But, as regards the "invention," it cannot be too widely known that Mr. G. B. Bowell had spent some years previous to 1895 in experimental work—the outcome of which was the first patent No. 1,587 of 1895—and I trust that my natural desire to see that every credit is given him for the years of unsparing labour he has spent upon electric clocks may be accepted as an excuse for this letter.

H. T. W. Bowell.

London, E.C., *November 8th*, 1913.

Canadian Electrical Trade.

I have read a communicated article on the subject of Canadian electrical trade, published in your issue of October 31st, and it interests me to read an expression of opinion on this subject, viewed from a different point.

I have just returned from a journey across the Canadian Continent, and my time has been devoted to a careful study of the existing electrical conditions.

I was fully alive, before I left England, to the powerful control of the electrical trade exercised by the National Board of Fire Underwriters of Chicago and New York, and I was also aware that considerably more than half of the Canadian fire insurance is underwritten in England.

The average British investor is notoriously apathetic, and he is doubtless satisfied that the Canadian fire risk has been reasonably safe-guarded by the Electrical Rules and Regulations issued by the National Board of Underwriters.

It is a significant fact, however, that the insurance premiums in Canada are about 100 per cent. higher than in Great Britain. A comparison of Canadian and European electrical practice throws immediate light on this subject. It does not require a trained electrical expert to find a reason for the high insurance premiums obtaining.

From the fire hazard point of view, the National Electric Code, as at present constituted, provides a safeguard against fire which leaves much to be desired. If we ask ourselves how this is brought about, the answer is not far to seek. The Underwriters' Laboratories are, as far as possible, self-supporting. They are not out for profit-making, but, at the same time, they must live, and they have heavy expenses to meet. How are these expenses met?

By levying a charge upon the manufacturer who pays toll for the inspection and approval of his goods, and a tax for the labels which he attaches to his manufactured articles.

So far, so good, but then let us look a little further into this matter.

There is an adage that the "man who pays the piper calls the tune." Let us take a glance at the names of the various bodies who constitute the Committee of the National Board of Fire Underwriters. They are all American and are as follows:—

American Electric Railway Association.
American Institute of Electrical Engineers.
Associated Factory Mutual Fire Insurance Companies.
National Board of Fire Underwriters.
National Electric Light Association.
National Electrical Contractors' Association.
National Association of Electrical Inspectors.

Is it then surprising that one finds the code bristling with data and dimensions *built up around* the specialities of the American manufacturer? Is it surprising that apparatus which is the outcome of the best British electrical practice is excluded? Personally, I think not. I think it would be strange were it otherwise. Self-preservation is the first law of nature.

The situation is full of anomalies, and we have to ask ourselves "What is the remedy?" The executive of the American National Board of Fire Underwriters have recently extended the hand of good fellowship to the British electrical manufacturers and have invited them, if they are desirous of doing business in the British Dominion of Canada, to realise that their best interests will be served by contributions to their support; in other words, to pay a similar toll for the approval of their goods either in Chicago or through the medium of a London agent. It may be that this proposition has in it the basis of a future agreement, but it is obvious that before such a scheme can be seriously considered by British electrical manufacturers, the National Board of Fire Underwriters must volunteer to "put their house in order."

If the British manufacturer accepts the invitation to co-operate and pay his share to the piper, he must have a proportionate voice in calling the tune.

Any commercial proposition which would not offer proportional representation on the Committee would be an affront to the dignity of the British electrical industry.

In short, Sir, the Electrical Committee of the National Fire Protection Association would require to be widened to include the representatives of interested British electrical associations, and the National Electric Code would require to be redrafted upon impartial lines to suit the best electrical practice for the work under consideration, irrespective of the country of origin.

I enclose herewith copy of a letter which I have addressed to the Canadian *Electrical News*, and which I should like you to insert. It contains the explanation of my previous remark with regard to the serious fire risks obtaining in Canada under the National Electric Code. My letter also deals with a larger and more important subject which is outside the scope of the Board of Underwriters.

I refer to the problem of the life hazard in Canada.

The Canadian Government hoid out tempting invitations for the British manufacturer to establish works in Canada, and I am sure there are others, like myself, who are only waiting a favourable opportunity to start works inside the Dominion.

If the Canadian Government will make rules and regulations for the safe-guarding of human life and limb in their Dominion, they will achieve a double purpose: they will materially reduce the loss of life and accident, and, further, they will open up a wide field which will encourage the British electrical manufacturer to build works and open depôts through Canada.

A fair field and no favour is all that the British electrical manufacturer requires.

Herbert H. Berry,
For Berry, Skinner & Co.

London, E.C., *November 11th*, 1913.

(*Copy of Letter to the "Canadian Electrical News."*)

THE ELECTRICAL LIFE HAZARD.

It gives me pleasure to accept an invitation to record a few of the impressions created in my mind during a first and very memorable journey across your vast and progressive Continent.

In doing so, I desire to emphasise the fact that this letter is written by request, not in a critical spirit, but with the sole object of mutually ventilating a subject which is already foremost in the minds of many of your leading engineers.

In order, Sir, not to occupy too much of your valuable space, my remarks must necessarily be of a brief description, and I, therefore, purpose to restrict my comments as far as possible to a superficial comparison of the methods adopted by our respective countries in one particular direction.

I refer to a comparison of the electrical rules and regulations as they exist and the methods of enforcing them, having regard to the safe-guarding of human life.

It will undoubtedly be conceded by every humanitarian that the progress of civilisation must of necessity be retarded if the problem of the life hazard is in any particular direction seriously neglected.

It will also be conceded by every practical engineer that this same problem which makes for civilisation must indissolubly identify itself with the rate of progress of electricity in respect of its widespread and multitudinous industrial application.

With this assumption conceded, it appears that it should be the premier object of the governing body of every community to provide rules and regulations in connection with the uses of electricity to safeguard the public, as far as is reasonably possible, against preventable accidents and loss of life.

The governing body having made such regulations they *must* have the power to enforce them, and to inflict penalities for non-compliance. It is here, Sir, that I find the "Great Divide"—it is here that the ways of the Dominion and the Old Country separate.

I am advised that there are no rules and regulations universally adopted throughout your country, which have primarily been prepared with the sole object to take care of the life hazard. I am advised that with certain local exceptions the National Electric Code of the National Board of Fire Underwriters is generally adopted.

Now, I submit that while admitting the excellent pioneer service of this most respected and valuable Institution, and passing over, at the moment, the admitted technical anomalies the code contains, such an Institution, by reason of its very constitution, *cannot* be a suitable governing body to regulate in its entirety the problem of the life hazard.

The primary object of the underwriters must necessarily be, and should be, to protect the pockets of their shareholders against losses by fire.

Comparisons are oftentimes objectionable, but your country teaches us so many useful lessons that you can afford to believe that, in this case, the comparison is not an invidious one.

In the Old Country the method of procedure is different. Rules and regulations are issued by a governing body, which has the power to enforce them. These rules are widely drawn to embrace the entire life hazard, and are devised to protect "the man in the street" as well as the "employé" in the workshop.

They are entirely independent of any rules and regulations which the Fire Underwriters are free to devise for their own protection against fire.

Great care is exercised that no particular section of the industry is unduly hampered or fostered. The engineer is not the sole arbiter.

Deliberate care is taken to avoid the recommendation of any special type or shape or measurement of apparatus, thus no embargo is placed upon invention.

The degree of safety to be obtained rather than the method of obtaining it, is, and should be, the object of the Regulations.

Every student of thought in your country will agree that it is political suicide to adopt permanently a code which selects for universal use, certain dimensions, "*types*," or "*makes*" of apparatus. It is obvious that such a course is strangling the inventive faculty of the country at its birth, and incidentally playing into the hands of the monopolist. It cannot be argued that the requirements of the National Electric Code are sufficient to prevent loss of life and accident, nor can a code be called consistent which presents in elaborate detail a specification stating that a three-ampere 250-volt switch must have quick make and quick break and a suitable cover, and at the same time allows in the same factory a switch one hundred times larger, *without either* quick make or quick break, and *without* any grounded or protective cover whatever.

Moreover, one is appalled by the number and frequency of accidents, fatal and otherwise, which occur in the workshop and elsewhere. I refer only to those accidents brought to my personal notice during a brief stay in your country. All of these accidents were preventable, and could not have occurred under the normal regulations obtaining in the Old Country. Moreover, I submit, Sir, that it cannot reasonably be argued that the conditions of a new country demand a sacrifice of human life and limb on the grounds of mere "cheapness." This is false sophistry, and not an acceptable theory to the rigid economist. I venture, Sir, in conclusion to put just one case to illustrate the absolute danger of an attempt to standardise too rigidly any particular "speciality."

I submit for discussion that there are at least three important grounds for objection :—

1. A bad electrical practice on technical grounds.
2. A bad business on commercial grounds.
3. A bad fire hazard on both grounds.

(1) *Bad Electrical Practice on Technical Grounds.*—I refer you to page 136 of the 1913 edition of the National Electric Code and to the following statement :—"With link fuse cut-outs there is always the possibility of a larger fuse being put into the cut-out than it was designed for, *which is not true of enclosed fuse cut-outs.*"

This statement being quite incorrect, it is equally misleading. Wherever one goes, the private residence, the workshop, the theatre, the central station, nay, even the Underwriters' Laboratories, one is overwhelmed with samples showing ingenious abuses of this enclosed fuse which (the Code says) cannot be true.

French nails, solid rods, brass tubes, zinc tubes, wires soldered across the old fuse case, wires twisted across the terminal contacts, and for the screw plug, the American penny, the wired cork and the more frequent "nick" with the pocket knife—and yet the Code still says—"It is *not true* that the enclosed fuse cut-out admits *the possibility* of a larger fuse being put into it."

I submit, Sir, that it is never wise to commit to print a statement which cannot be established, and which the Underwriters' engineers themselves do not attempt to defend. It can only serve to discredit in the minds of the uninitiated the other parts of the Code Regulations, many of which are good.

It should be assumed as a basis of reasonable argument that at some time or other in the life of every pair of fuse terminals there will come a moment when, through some reason or other, there is no spare cartridge at hand. Numerous causes may account for this :—(*a*) Demand exceeding supply ; (*b*) shipments lost or late in transit ; (*c*) consumer omits to order spares, &c. ; (*d*) consumer realises that the condition of his electricity supply never warranted the introduction of the extravagant cartridge.

Obviously, the consumer cannot allow his factory to stand still—he must try some temporary expedient, and invariably he *does*.

It is here the code fails conspicuously—it is here the risk of fire is increased, for not only is the *length of air break too short* to give reasonable protection, but the very nature of the terminals are the worst that could possibly be selected for the purpose.

The alternative method, of course, is to provide ample length of break and ample spacing for an open link fuse to break in air, and to provide a proper system of clamping for the fuse link, and finally to make it compulsory that *every fuse*, irrespective of its design, must be enclosed in a suitable cabinet, so that under conditions of normal use or *abuse* there is no danger of the melted fuse coming in contact with any substance which might be ignited thereby. (See Code, page 136.)

The judicious use of cartridge fuses, under these same terminals, must be a question depending upon the conditions and pressure of the electricity supply. It must obviously be a question of education as between the supplier and the consumer. It is very significant when the electrical department of the city of New York consider it necessary to state in the latest edition of their Electrical Code (see page 157) "owing to the difficulty of making proper inspection of the fusing where fuses of the cartridge type are used, it is strongly recommended that this type be not employed where plug or link fuses may be installed."

(2) *A Bad Business on Commercial Grounds.*—I am given to understand that the largest number of enclosed fuses are used on an alternating-current voltage, not exceeding 110 volts. Everyone knows that an alternating current at this voltage presents little fusing difficulty, and to use a cartridge every time a fuse melts is very wasteful. Multiply this proposition by a million consumers, and you have a national economical calamity. It is an undeniable fact that hundreds of thousands of dollars are wasted annually upon the American Continent by the wasteful use of cartridge fuses upon conditions of low voltage where their use is not warranted, and where an open link fuse in a suitable cabinet would provide a lessened fire risk and a great saving in cost of renewals.

I do not wish to be misunderstood on this question. As a manufacturer, I am an interested party, and therefore biased in favour of the cartridge fuse, and I am fully alive to the necessity of its judicious use, particularly upon continuous-current circuits. A properly-designed cartridge fuse is the only fuse I know that can be relied upon to successfully negotiate a "dead short" under the most adverse conditions, but, I say it with deliberation, the case for the cartridge fuse is, in my opinion, being prejudiced and its *abuses* encouraged by "indiscriminate recommendation." It is common knowledge that "over organisation" can become an incubus ; in like manner the ingenious plea of "interchangeability" can be so exaggerated that it becomes a fetish.

(3) *A Bad Fire Hazard on both Grounds.*—It is obvious from the wording that when the Code was first arranged it was either wrongfully or carelessly assumed that a form of cartridge and plug fuse had been invented which "could not be tampered with," and in consequence permission was given for such apparatus to be used without other external protection. Now that it is discovered that such fuses are recklessly abused, not only by the uninitiated, but also by engineers themselves, the whole case for the use of the cartridge fuse without *other protection* fails.

If an N.E.C standard fuse is tampered with and there is no external cover, the risk of fire through melted fuse metal coming in contact with any substance which might be ignited thereby (see Code, page 136) is very great.

I submit, Sir, that here at least is a matter for the urgent and immediate attention of the National Board of Fire Underwriters. They have the advantage to possess a distinguished staff, conspicuous for ability and for courtesy, and fully conscious of anomalies which exist in their code, and anxious to redress any just grievances.

It remains for the electrical trade and the public alike, irrespective of nationality, to assist them to make bold use of the pruning knife, to make the Code consistent and efficient, to model it so that according to the requirements it deals equally and fairly with the *best* accepted electrical practice, not of any one particular country, but of every country irrespective of origin, and to fight courageously at all times the engineered opposition of the monopolist.

HERBERT H. BERRY.

October, 1913.

We were much interested in the article published in your issue of October 31st under the above heading, and we are able to confirm the remarks of your correspondent, who is undoubtedly well informed.

We believe that the British electrical manufacturer is still ignorant of the possibilities of the large business to be obtained in the Canadian market, and if he will study the requirements of the market and make arrangements for the manufacture of various specialities insisted upon by the Canadian buyer, there is a large field open to him.

At the present time the British manufacturer has an advantage, generally speaking, of 10 per cent., and in some cases of 12½ per cent., preference in duty over the American and Continental manufacturer, and the freight rates on electrical goods are the same whether shipment is effected from London, New York or Hamburg.

It may be a surprise to many manufacturers of electrical apparatus in this country to learn that the leading lines of Canadian switches, clusters and other accessories in large demand in Canada, are actually being made in the Birmingham district with the assistance of Continental capital, and that one enterprising electrical firm in this country have thought the prospects of business good enough to induce them to commit themselves to the entire output of Canadian specialities of the factory referred to for some time to come, and their foresight is showing excellent results for themselves.

We have a number of orders on hand at the moment for specialities which we cannot place in this market for the reason that manufacturers whom we have so far approached on the subject quote prices which apparently include the entire cost of the tools necessary to start the business, with the result that we have been compelled to place orders abroad.

With regard to the manufacture of conduit to the "National Code" standard, we think there is a great opportunity awaiting the firm which is the first to lay down plant for the manufacture of the same at competitive prices, and we ourselves are able to order, and have ordered, conduit for the Canadian market in carload lots.

In our opinion, the alleged want of enterprise on the part of many British manufacturers is mainly due to the fact that they are not aware of the opportunities obtaining in Western Canada as compared with Eastern Canada, and representatives sent out from time to time are rarely instructed to go further west than Montreal or Toronto ; and that they believe the difficulties of obtaining a proper show in the East also obtain in the West, where business is more in the hands of buyers who received their early training in the Old Country.

We are looking forward to the time when our clients will be able to obtain the greater part of their electrical machinery and supplies in this country, and when we shall not be compelled to place orders in foreign markets in order to obtain competitive prices.

Chiswell & Co.

London, W.C., *November 7th*, 1913.

No Reflection Intended.

Representations having been made to us by our friends, Messrs. Nalder Bros. & Thompson and Mr. R. W. Paul, that the wording of a recent advertisement of ours in your paper is open to the construction that the goods of other manufacturers are of poor quality; we beg to state that the words used were not intended to convey this meaning, and we should like to express our regret that our advertisement should have been put in a form open to misconception.

Eversheds & Vignoles, Ltd.
E. B. Vignoles, *Managing Director.*

Chiswick, W., *November 7th*, 1913.

A prominent advertisement in your issue of October 31st stated :—"No other testing set competes effectively—not only because the work is hopelessly inferior."

There can be no question that this statement is untrue, and is in bad taste. I am further advised that, in view of the recent report in your paper of an abortive action brought against myself by the advertisers, the statement is actionable. The intention of the statement appears to be summed up in the words, "No case, abuse the other side."

The Omega insulation meter is sold on its own merits and by fair methods, in open competition with the testing set referred to in the objectionable advertisement, and even to the "exclusive users" named therein.

I cannot conceive that an advertisement so detrimental to the dignity of your paper, and to that of the electrical trade, appeared with your full knowledge.

R. W. Paul.

New Southgate, N., *November 11th*, 1913.

[As the above letters show, complaints have been made to us by Messrs. Nalder Bros. & Thompson, Ltd., of Queen Street, E.C., and Mr. R. W. Paul, of New Southgate, London, that an advertisement which appeared in one of our recent issues might be construed to cast a slur on the combined ohmmeters and generators manufactured by them respectively under the names of "Ohmer" and "Omega," by a suggestion that they are of inferior workmanship. The advertiser has assured us, as will be seen above, that the advertisement was not intended to convey this impression, and has apologised for the same; and we, on our part, equally regret the form of the advertisement.

It is not within our province to publish editorial comparisons of similar and competing apparatus, and we have consistently refrained from doing so. Therefore we do not regard it as incumbent upon us to enter into any discussion regarding the respective merits of the different apparatus involved in the above correspondence. Nevertheless, the proprietors are fully prepared to express regret that an advertisement which the advertiser responsible admits is open to misconception, should, in the hurry of getting to press with "copy" received at an exceptionally late hour, have escaped the advertisement censor's scrutiny. The practice sometimes adopted by advertisers in our own and other publications of reflecting upon goods supplied by their rivals is, to our minds, both undesirable and unnecessary, and those responsible for the preparation of advertisement "copy" will save trouble and annoyance by avoiding the making of such reflections.—Eds. Elec. Rev.]

Remarkable Motor Records.

Referring to the letter appearing in your issue of the 7th, I see that the first point raised has been answered by the Editors.

As the statement in my letter of October 31st, that the motors were designed to do 120 B.H.P. at 650 R.P.M., appears to have given rise to some misunderstanding, I will endeavour to explain the matter more clearly.

The order for these machines was given and accepted (but not by me) subject to the condition that they were to be capable of running at speeds varying from 228 to 650 R.P.M. The F. L. rating was to be 80 B.H.P. at 650 R.P.M., but they were also to be capable of running at top speed with an overload of 50 per cent. for one hour.

Now with 120 B.H.P., or say, 226 amps., at 650 R.P.M., the strength of field would only be one-third that of the full field at 228 R.P.M., while the armature strength would be enormous in comparison, and I knew very well that if the machines would run under these conditions for one hour, they would run for an indefinite time, as the time would not be limited by heating or sparking; therefore, for the machines to be able to run at all under these conditions, the matter demanding my chief attention was that of armature reaction.

That is why I said I designed them to do 120 B.H.P. at 650 R.P.M.; obviously if they would do that they would be all right for the 80 B.H.P. Of course, they were not correctly rated as 80-B.H.P. motors.

Whatever load the machine will carry at top speed with weakened field, it will carry throughout the entire range, with this difference, that as the bottom speed is approached, and the field becomes stronger, the overload margin becomes greater and greater.

In practice, however, these machines have no heavy work to do at the lower speeds, for although the motor has some 90 tons of rollers to put in motion, owing to the fact that the drive is through the exceedingly clever gearing invented by Mr. G. W. Mascord, only about 50 amperes is required to start up.

Certainly, the final temperature occurs when the rate of heat generation equals the rate of radiation, but the time taken to reach that final temperature will depend upon the nature of the design, and for a machine to reach final temperature in minimum time, it is not necessarily "essentially a copper machine"; on the contrary, such a machine would be badly designed and expensive to build.

In regard to "efficiency," if it is merely a question of some trifling increase in output due to cutting-down of material, then your correspondent's contention as to percentage of losses is correct; but if, on the other hand, owing to certain constructional differences, it should really be a matter of increase in output to the extent of three times that obtainable from an ordinary type machine of the same weight and speed, then I think even he will be able to see and ready to admit that, assuming no unreasonable departure in the way of current and flux densities, the ratio of waste to useful output may be materially affected by the fact that we have only to deal with about one-third the quantity of active material.

The same argument also bears in a measure upon the question of cost per H.P. or KW. of output.

I think your correspondent has made his position perfectly clear, and although at the present moment it may not suit me to give him all the information he may desire to have, I can assure him that no statements have been made in the article of October 10th, or in the letter of October 31st and this present communication, that cannot be fully substantiated; and if he is at any time coming to London, I shall be very pleased to meet him, and will undertake to dispel all his doubts, and think I can promise to give him an opportunity of seeing these machines in operation.

H. Chitty.

London, N., *November 11th*, 1913.

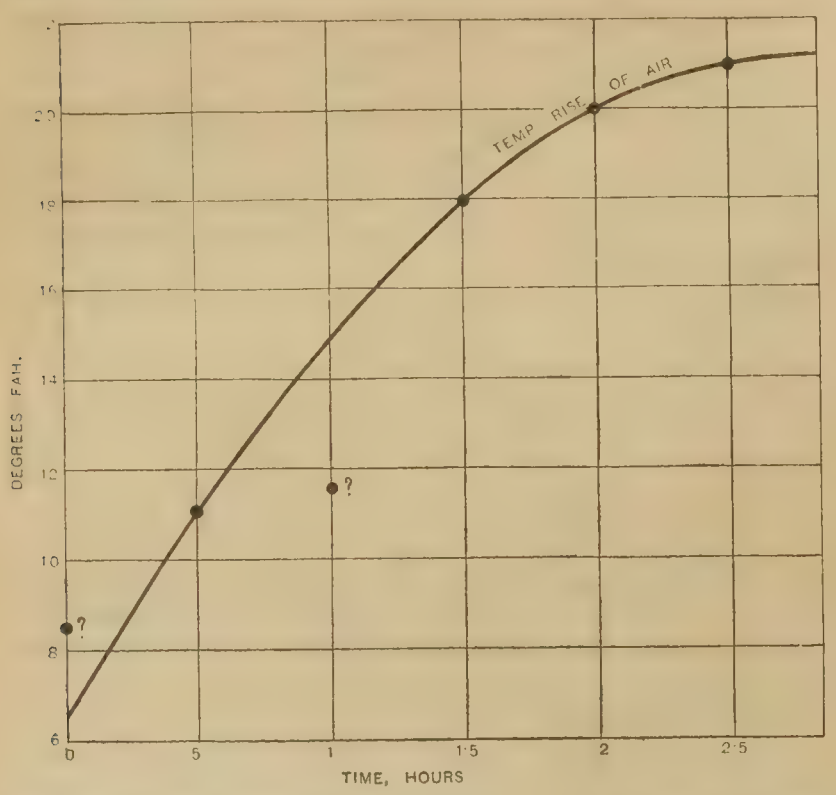
Some Industrial Uses for Electric Fans.—When first introduced, small electric fans were mainly used for creating a cool current of air in confined rooms and areas. In recent years, however, a new field of usefulness seems to have been discovered for the hand appliance. They are now being employed by chocolate sweetmeat makers in dealing with urgent orders. As soon as the chocolates and bon bons are dipped they are placed on long trays in front of a row of fans, which render the confections ready for packing in a fraction of the ordinary time required. Electric fans are also being largely used for the rapid drying of photographic prints. Nowadays press photography has to be carried on with such celerity that the time available for drying purposes has to be cut down to a minimum, a result which is served by the use of the fans. In the bottling department at the works of the Lash Bitters Co., in New York, a room is equipped with long stout tables on which are ranged in open rows a multitude of bottles, each displaying a fresh and, as yet, moist label. Maintaining a vigorous circulation of air, a number of fans hum merrily away on neighbouring brackets and dry the labels in a very short space of time, the installation having proved extremely satisfactory.

REMARKABLE MOTOR RECORDS.

We have received the following particulars on this subject from the designer of the motors (see Electrical Review, October 10th, page 564) :—

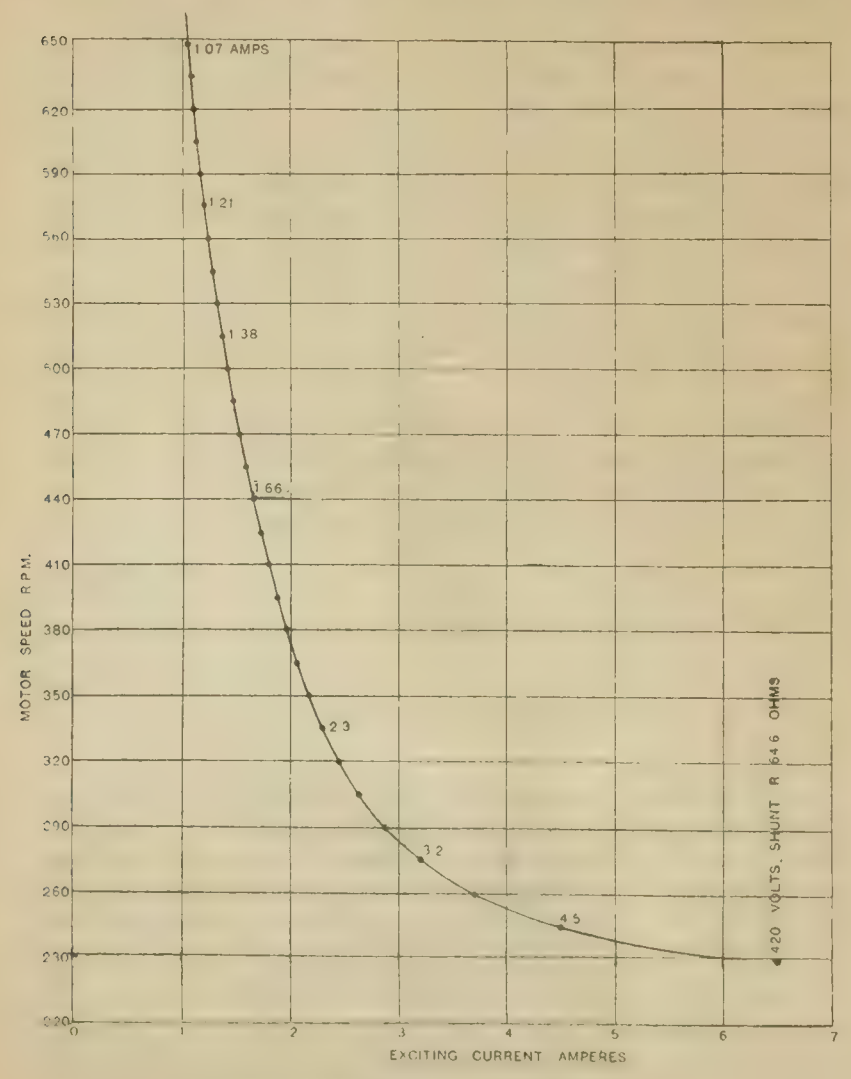
As desired, I now give records of shop tests with one of the motors referred to in the notice of October 10th.

The first part of the run was made approximately under the F.L. rating conditions, *i.e.*, 80 B.H.P. at 650 R.P.M. Throughout this part of the test, half-hourly readings were taken showing temperature of air escaping from the machine, also shop temperatures, columns A and B.



Temperature Tests on Motor for "United Newspapers," Ltd.

There was evidently some inaccuracy in the readings taken for the shop temperatures; the first reading should probably be 76°, instead of 74°, and the third reading 72·5°, instead of 76°. This will be at once apparent from the curve showing the rise of temperature (from column C) of the air escaping from the machine.



Speed and Excitation Curve.

When the temperature of the escaping air becomes constant, the machine will have reached its maximum temperature; in this instance, this was clearly the case in from 2½ to 3 hours; accordingly at 4 o'clock the machine was brought to rest and the temperatures were taken. The machine was started up again at 4.30 for a further run under a 50 per cent. overload, and the temperatures were taken after stopping at 7 o'clock.

Thomas Parker, Ltd.

Requirements, six-pole shunt motor				
420 volts.	150 amps.	307 revs.	Thermometer in vent gap of yoke	Date, 5/6/08.
,,	,,	650 ,,	Col. A, Temperature air at M/c	

	Armature.			Shunt.		A.	C.	B.	
Time.	Volts.	Amps.	Rev.	Volts.	Amps.		Diffce.	Temp. air in shops.	Aux. amperes diverted.
1.30	420	145	652	92	1·33	82·5° F.	8·5 (?)	74° F.	36
2.0	420	146	650	91	1·32	85	11°	74	37
2.30	420	150	651	92	1·26	87·5	11·5 (?)	76 (?)	40
3.0	420	150	650	92	1·25	88	18°	70	40
3.30	420	150	652	91·5	1·24	89	20°	69	41
4.0	420	150	650	88	1·2	89	21°	68	40
						Temperatures.			Rise.
						Armature F.		106° F.	38° F.
						Armature B.		99° F.	31° F.
						Com.		124° F.	56° F.
						Aux.		98° F.	30° F.
						Air in shops		68° F.	α Div.
4.55	423	218	655	87	1·2				58·5
5.10	419	228	660	85	1·19				60
			All	these	readings taken		with $\frac{3}{16}$	in. Fwd.	lead.

	Armature.			Shunt.					Aux. amps. divert'd
Time.	Volts.	Amps.	Rev.	Volts.	Amps.	Res. in.			
5.25	420	226	654	86	1·19	72·3		$\frac{3}{16}$ in. F. lead.	60
5.40	420	226	655	86	1·19	72·3			60
6.0	420	226	655	86	1·19	72·3			60
6.30	420	226	656	86	Temperatures after 2½ hours' full load and 2 hours 50 per cent. overload.				60
7.0	420	226	655	86	Armature, 143° F. rise 75°				
					,, 138° B ,, 76°				
					Comm. 145° ,, 77°				
					Aux. 126° ,, 58°				
					Air in shops 68°				

	Armature.			Shunt.				Date 12/6/08.	Aux. amps. divert'd
Time.	Volts.	Amps.	Rev.	Volts.	Amps.	Res. in			
	420	?	310	266	3·42				
	420	240	307	This load thrown on suddenly.					
1.45	418	240	650	92	1·23				58
2.15	420	240	650	92	1·23				59
2.45	420	239	650	91	1·22				60
3.15	412	240	652	86	1·18				62
3.45	408	240	651	86	1·18				63

Temperatures after 2 hours.
Armature front 131° F., rise 61° F.
,, Back 136° F. ,, 66° F.
Auxiliary 150° F., ,, 80° F.
Comm. 144° F., ,, 74° F.
Air in shops 70° F.

I think there would have been very little increase beyond the temperatures recorded, even if the run had been continued, but nothing further was required by the engineer for whose satisfaction the tests were made.

A further two hours' test was made on this machine with a still heavier load. The load of 240 amperes was thrown on suddenly, without any effect whatever. It should be remembered that this run was made with the field reduced to less than one-third its strength at 230 R.P.M., because the difference in the C.E.M.F. must be taken into account as well as the difference in speed.

Probably the speed curve got out for the design of the controller for the shunt winding may be found interesting.

H. Chitty.

Agricultural Research. — Important extensions are being made in the Agriculture Department of Leeds University, and Prof. Priestley, financially assisted by the Board of Agriculture, is engaged upon experiments in the application of electricity to crop production, with a view to ascertaining whether the discharge of electricity under carefully controlled conditions can really produce sufficient increase in the yield of a crop to make it suitable for extended application.

STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.

By J. W. JACKSON, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Newcastle, November 10th*, 1913.)

An important consideration in the case of boilers for central power stations is the liveliness of the boiler for dealing with variations in the load. The result of this is that the water-tube boiler has been adopted almost universally ; at least eight of the leading makes of water-tube boilers will permit of steam being raised from cold water to the full working pressure in about 30 minutes, whereas with the big cylindrical type of boiler several hours are required for this purpose.

In a previous paper* the author advocated the vertical or only slightly inclined straight tube. Nothing has happened since that time to alter this view. In designing boilers to fulfil this condition of straight vertical tubes, some difficulty is experienced in designing the drums so as to accommodate the requisite number of tubes without at the same time having to press the drum ends or sides into bad shapes. Where the metal is at all strained in obtaining these deep seatings or facings, an irregular stress is permanently put upon the metal, with the result that irregularity of expansion causes local working, and ultimately fracturing of the metal at these positions.

In connection with the design of superheaters, modern competition appears to have called for a superheater of smaller area but placed in a much hotter portion of the boiler, with the natural

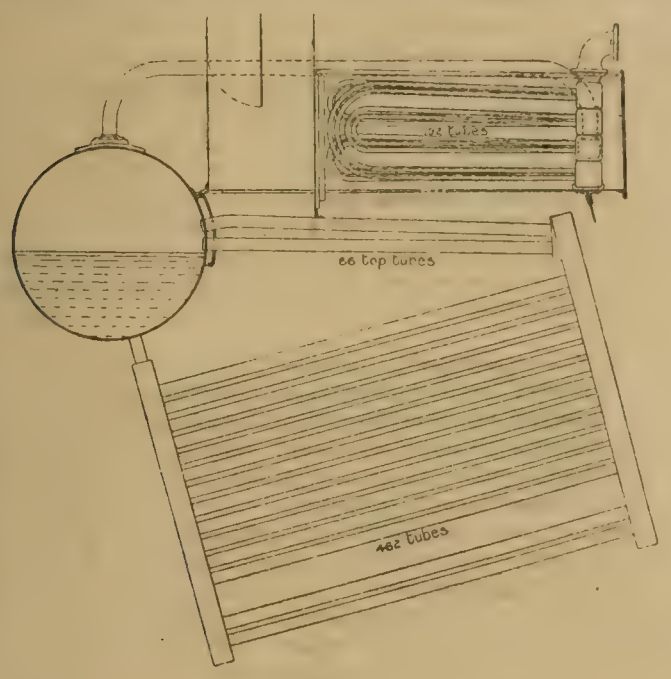


Fig. 1.

result that the superheater tubes are overheated, and will therefore have only a short life. In addition to this, difficulty is experienced in keeping the tubes in position. This is undoubtedly a mistake. Superheaters which were designed 10 years ago with ample surface were fixed much further from the furnace (fig. 1), with the result

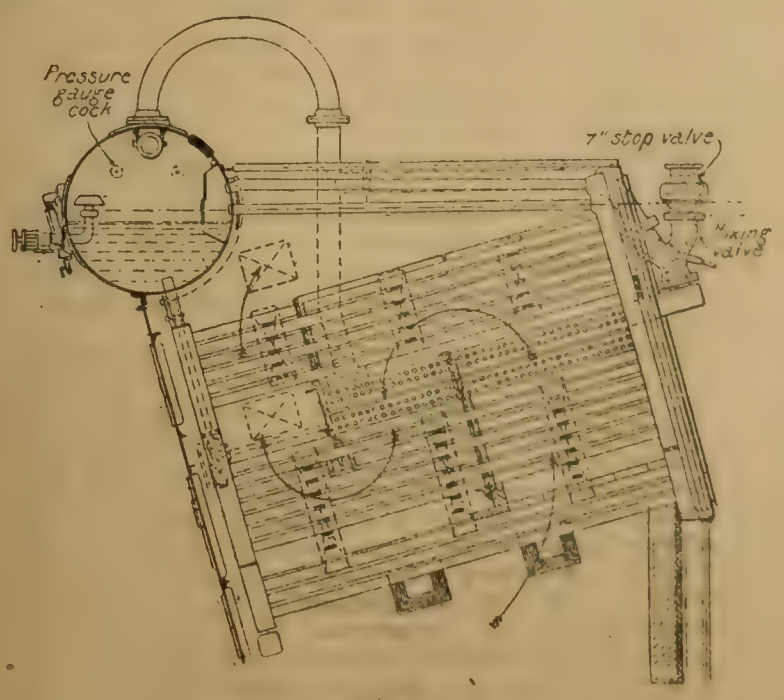


Fig. 2.

that they are much steadier to work and of almost everlasting wear. They also have the advantage that the amount of superheat can be reduced without overheating the tubes.

The more modern superheater (fig. 2) does not usually vary the path of the gases, but shunts more of the saturated steam past the superheater. A smaller quantity of steam passing through the superheater, less heat is transmitted to the steam, thereby allowing the superheater-tube temperature to rise so high that corrosion or oxidisation occurs inside and outside the tube.

The new superheater can be made considerably cheaper but the difficulties in operation are increased as regards maintenance, reliability and control. The scheme usually means that the modern superheater is fixed between the main water tubes of the boiler, with the result that "sooting" of the tubes becomes a difficult matter ; when portions of the path of the gases become clogged with soot, the gases are then concentrated on the narrow passages, with the result that a greater amount of heat is brought to bear on those portions, which causes more rapid oxidisation of the metal, and so shortens its life. This clogging of the gas-passages continues until the amount of superheat falls to a comparatively low figure. This trouble is one that requires most careful consideration when the lower grades of fuel are handled, such as duff coal, &c.

The more generous superheater fixed beyond the first bank of tubes being of ample size for its work, because of the lower temperature of the gases is much less sensitive to the fouling of the passages by soot. We are undoubtedly at the beginning of the period when really high superheated steam is coming into use, and steam temperatures of from 700° F. to possibly 900° F. at the turbine stop valves are likely to be required before very long. Under these conditions it will be seen that if the superheater of the future is fitted in such a hot position of the boiler as in the case of some existing superheaters, troubles will increase. If a superheater tube is bent so that it cannot drain itself at the bottom, serious corrosion or possibly complete clogging of the tube is liable to occur ; but even this trouble can be lessened if the superheater is kept well up in the boiler so that it does not normally become flooded when the boiler is at rest. Here again, fig. 1 offers a good solution, as owing to the gas by-passing the superheater there is no danger of the latter being flooded or of its being overheated when starting the boiler. Fig. 3 is a good design when kept well up

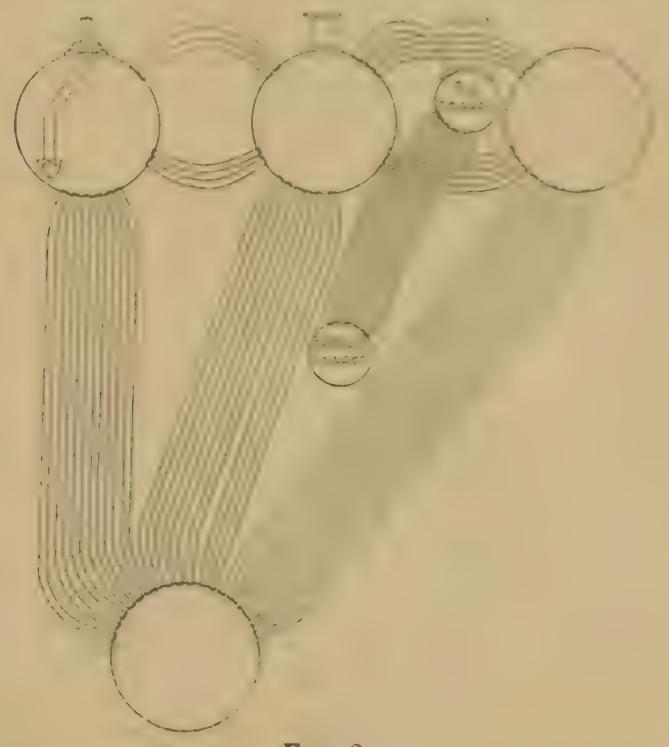


Fig. 3.

above the water level. There is always a considerable amount of risk with a superheater that has to be blown out before the boiler can be put on load, and from this point of view alone it is advisable to stipulate that the superheaters be kept well up above the boiler water-line and also that the superheater be considered, so far as operation is concerned, a portion of the main steam pipe—that is to say, that the boiler should not be fitted for the main steam with a main saturated steam pipe arrangement.

Another trouble with the modern superheater is that owing to its comparatively small surface a considerable drop in pressure takes place when the boiler is being worked at its normal full load, this drop amounting to as much as 10 to 15 lb. per sq. in. at the normal full-load rate of working, whereas with the older superheater a drop of about 5 to 7 lb. takes place. The difficulty of overhauling and cleaning the exterior of the modern superheater is also considerable, this being due to the narrow space provided, it being almost impossible for a man to get into the space and carry out the necessary work. The older superheater being fixed at the top of the boiler allows of the superheater casing being dismantled entirely, so giving very thorough and complete access.

If the drums are placed parallel to the path of the gases, then the front of the drum should be set at a higher level than the back of the drum, while if the drums are at right angles to the flow of the gases the front drum should be elevated and the back drum lowered in comparison with the level of the centre drum. In actual practice, in the case of a boiler with three drums set at right angles to the flow of the gases, the length of the boiler from the front to the back being about 16 ft., there is a difference in the water levels between the back drum and the front drum of as much as 12 in. when the boiler is being steamed at normal full load. The reason for this is not difficult to see. It will be remembered that nearly 75 per cent. of the total evaporation of the boiler takes place in the front two or three rows of tubes. The bubbles of steam rising up

* Elec. Rev., April 26th, 1912.

the tubes at a fairly high rate displace the water in the tube, and so set up a rapid circulation; moreover, the water in the front drum is quite full of large and small bubbles of steam, which have the effect of lowering the density of the water; and, further, friction is set up in the water-circulating tubes by the water flowing from the front drum to the middle and back drums to repeat again the cycle of circulation. There does not appear to be any disadvantage whatever in elevating the front drum by as great an amount as that indicated. A fairly long water-gauge glass is required to cover fully the variation in water levels; this, however, is an advantage rather than otherwise, and in following this scheme out a lower water level can be maintained with much greater safety than is at present experienced; that is to say, by elevating the front drum the water level throughout all the drums will be the same mean level under working conditions, and by carrying as small a quantity of water in the drums as is reasonably safe, greater freedom from priming, when dirty water is carried, is obtained. This question of priming is of great importance, whether the steam is required for reciprocating engines or turbines, and any scheme that can be put forward for reducing this difficulty must receive attention.

Another difficulty in connection with priming is the corrosion of the steam space of the drums and of the steam and superheater tubes. The steam rising from the water surface heavily charged with moisture comes in contact with the heated surfaces of the upper portion of the drum and steam-connecting and superheater tubes, and is liable to set up very serious corrosion, which in a comparatively short time will completely destroy the tubes. It is quite easy to overcome this trouble, so far as the drums are concerned, by painting the internal surfaces of the drums with any of the first-class bitumastic paints that are now on the market. This process of painting with bitumastic paint has now been carried out on boilers for at least five to six years with completely satisfactory results, and if the paint could be easily applied to the surfaces of the cross-over steam and superheater tubes, there is little doubt that the trouble would be got over by the same means. Priming is undoubtedly the real cause of the trouble.

One of the most notable advances made in the present-day steam boiler is that of smokeless working with ordinary bituminous coals, which can be obtained of equal value to the best Welsh steam coal at something like half the cost. In the water-tube boilers built about 15 years ago, the space between the fire grate and the tube surface was extremely small, with the result that the gases were chilled before combustion was completed.

With the modern water-tube boiler a very large combustion space is provided, and a great deal of this combustion space is lined with high-grade firebricks. The firebrick becomes heated up to a fairly high temperature, but being sufficiently far removed from the heart of the flame, it does not suffer at a prohibitive rate, and so allows combustion to be almost completed before the heated gases are allowed to come in contact with the comparatively cold metal surfaces.

Another important reason for the smokelessness of the modern boiler is the mechanical stoker, with which the fuel is gradually heated up at a comparatively slow rate, so that there is no great rush of gas into the furnace at any moment.

Air leakages into the furnace are of very considerable importance, and require the largest amount of attention from the point of view of efficiency. With the induced-draught system, air leakages can occur over very wide areas. In boilers using gas firing, where practically the whole of the furnace brickwork is heated up to almost the same temperature, those places at which air leakage occurs show up as black spaces over the brickwork inside the furnace.

The CO_2 indicator is of great assistance in locating air leakages, but it only indicates that a leakage is taking place. It is of great value, not only to the officials, but also to the firemen. Wages for the firemen are sometimes controlled by the amount of CO_2 indicated by the recorders. This scheme has a great deal in its favour, but it is quite possible to get a very high percentage of CO_2 in a furnace, and so earn a big bonus, without going to great trouble, by allowing a rather large quantity of fuel to go over the back-end unconsumed.

A new page in boiler history was recently opened by Prof. Bone and Dr. Nicholson. The particular line of research adopted by Prof. Bone has been that of surface combustion. The field for this scheme is somewhat limited, the fuel employed being cleaned gas. The great point in its favour is the high thermal efficiency.

Dr. Nicholson's scheme can apparently be applied to any of the usual commercial boilers by rearranging the gas paths. The furnace remains much the same as before, the chief idea being to pass the gases after combustion over the heating surfaces at a very high rate of speed, allowing of a more ready transference of heat. It is also possible to reduce the temperatures of the outlet gases below 200° F., so that the latent heat of the steam contained in the gases is recovered. Of the two schemes, Dr. Nicholson's is the more promising.

The selection of firebricks requires very careful attention. The sulphur and fireclay in coals affect some firebricks very badly.

When difficulty is experienced, experiments must be made with various firebricks until a suitable make is discovered. In some cases natural stone, very high in silica content, taken direct from the stone quarries has been used with very good results.

It will generally be gathered from the above remarks that a good furnace is one that allows plenty of room for combustion and is well lined with a refractory material, as undoubtedly the theory is being more and more appreciated that the boiler has the function of absorbing the heat delivered to it from the furnace, while the function of the furnace is to produce the heat, and the requirements of both must be kept in view if good results are to be obtained.

An important consideration in favour of machine firing is the regularity with which the fuel can be fed into the furnace, and this generally means that a high percentage of CO_2 can be obtained under equal conditions as compared with the hand-firing scheme, the liability to form smoke being at the same time reduced.

It is possible now to handle coal in the finest possible state of division without causing smoke or encountering any other than the usual difficulties; that is to say, that "duff" coal can be as easily handled as "nuts."

Some stokers are much more suitable for certain types of fuel than others. One particular advantage of the chain-grate and step-grate stokers is that they allow of the ash being handled more or less automatically, that is to say, the ash is delivered by the stoker on to or over the dumping bars at the back end of the furnace. Links have recently been developed which allow of a dumping bar being fitted as short as is desirable; the determining factor in this latter case being that a slight check to the ashes, &c., is necessary to allow of complete combustion occurring at the back end, otherwise good fuel may be carried over in fairly considerable quantities.

It is of considerable importance that the ashes should be handled mechanically, as otherwise very high costs of labour and other labour difficulties will occur. This automatic principle is equally necessary for putting the coal into the bunkers. A better scheme than the ash conveyor has been developed, and is now being solely relied upon for some large boiler plants, and it is giving a very considerable amount of satisfaction. The principle, roughly, is that a large cyclone chamber is fitted above an ash bunker; the cyclone chamber is connected up to an exhauster of fairly large capacity which will create a vacuum of as much as 4 in. of mercury. Another pipe is taken from the cyclone chamber and has a number of openings in it, the openings corresponding with the number of ash hoppers under the boilers. An ash crusher is fixed on wheels, and is capable of being moved from one ash hopper to another; it is driven by an electric motor and crushes the ash as the latter is allowed to issue from the boiler ash chute, in which condition it is allowed to fall into the suction pipe. The draught created by the air exhauster at this pipe is so great as to cause the ash and clinker to be drawn up the pipe to a considerable height, where it is ejected through the cyclone chamber into the ash bunker. A very important advantage that this scheme has over any other ash-handling plant is its freedom from dust. The only place where dust can be met with is at the point where the ash is loaded up into the railway trucks from the ash bunker, and even this can be dealt with by fitting spraying pipes inside the ash bunker. In a somewhat similar method, water pressure is used for ejecting the ashes.

Wherever the opportunity presents itself of roughly analysing the solid matter in the boiler water and the amount of hardness of the make-up water, the simple system of treatment, generally with soda ash and lime, should be adopted. Very few boiler compositions can deal with the softening of feed water at anything approaching the cost of the lime and soda system.

Boiler corrosion has always been a most difficult subject, and it is possibly not much nearer being solved now than ever it was. Various electrical schemes are being tried for overcoming the local action on the boiler tubes and plates, by concentrating it on renewable plates located inside the boiler. This promises well, but it must be applied with the utmost care or the troubles may be much increased.

LEGAL.

In re Brecknell, Munro & Rogers, Ltd.

Mr. Justice Sargant on Tuesday, November 11th, in the Chancery Division, heard a petition for the sanction of the Courts to special resolutions passed by this company for the reduction of its capital.

Mr. Arthur Sims, in support of the petition, stated that the company was incorporated in 1904 for the purpose of carrying on business at Bristol as electrical and mechanical engineers. Its nominal capital was £30,000, divided into 2,000 preference shares of £5 each, and 20,000 ordinary shares of £1. It was proposed to reduce that capital by reducing the ordinary shares to 10s. The company had no creditors.

His Lordship asked whether the preference shares were preferential as to capital as well as to dividend.

Counsel said that the preference shares were to be in no way affected by the reduction, though, as a matter of fact, they were preferential as to both. As all the ordinary shares had not been issued, the reduction was really not so large as would appear on the face of it. It was actually a reduction of £7,414 10s., which would be found to be writing off one half of the issued ordinary shares. All the resolutions had been duly passed, and the loss was satisfactorily explained by the affidavit of Mr. Rogers, who had, since the incorporation of the company, been a director, and was also the managing director and chairman. He said that the company had carried on business without writing down its assets or allowing anything for depreciation, and as certain of the company's leases were on the eve of expiring, the board thought the time had now come for putting things in order. Owing to the expiration of the leases, they put the depreciation of the value of the buildings at £1,732 odd, the depreciation on machinery at £4,000, and on loose tools at about £1 400. Nothing had been allowed for depreciation since the incorporation of the company.

There was no opposition, and his Lordship sanctioned the reduction as proposed.

Sunderland District Electric Tramways, Ltd., v. Newcastle-upon-Tyne Electric Supply Co. and the County of Durham Electric Power Supply Co.

Mr. Justice Sargant, in the Chancery Division, had again before him on Friday, November 7th, the motion by which the plaintiffs in this action sought an interim injunction to restrain the defendants from cutting off the supply of electric power to their tramways.

Mr. Mark Romer, K.C., who, with Mr. Percy Wheeler, appeared for the plaintiffs, said that the matter had stood over from the previous week, an interim injunction already granted being continued over that day to see if some arrangement could not be come to between the parties for a speedy trial. On the previous occasion it had been suggested by Mr. Martelli, K.C., who appeared for the defendants, that the plaintiffs had paid nothing in respect of what was admittedly due. He understood that the defendants had now filed evidence, but he had not yet seen it.

Mr. Martelli said that they now had evidence that the plaintiffs had paid nothing for their supply of electricity since January last, and they now wanted rather a long time for their pleadings. The defendants were quite willing to continue the supply for a short time if the action could come on for trial at an early date. The result of their filing evidence that nothing had been paid by the plaintiffs since last January was that on the previous night the defendants received by post a cheque for £737. This cheque purported to be in settlement of the defendants' account, and that, of course, could not be right.

Mr. Justice Sargant: Of course you will accept it without prejudice.

Mr. Martelli said of course that would be so, but he wanted to make it quite clear.

Mr. Romer said that would certainly be right. He had not seen the affidavits that had been filed, but probably there had been some misunderstanding about the matter.

Mr. Martelli said the supply would be continued, but the defendants were most anxious that this dispute should be settled at an early date, as their case was that there was no agreement whatever between these parties.

His Lordship: You would like to get it disposed of this term?

Mr. Martelli said yes, but the difficulty was about the statement of claim. Mr. Wheeler wanted three weeks to put it in, but he (Mr. Martelli) suggested that it might be done in a shorter time, and

His Lordship pointed out that he had already had a week, and if he had 10 days more it should be sufficient.

Mr. Wheeler agreed to deliver the statement of claim within 10 days.

His Lordship: Then 10 days for the defence?

Mr. Martelli thought they could do it in a week from receiving the statement of claim.

His Lordship: Very well. Then seven days for the defence; do you want discovery?

Mr. Martelli thought if the parties exchanged documents it would be sufficient; there were only Acts of Parliament and agreements.

Mr. Romer agreed.

His Lordship: Then there will be an exchange of documents within three days after the delivery of the defence, and I will fix an early day for the trial.

Counsel suggested December 9th, and his Lordship said he would take it on that day, subject to anything part heard.

Hobart Manufacturing Co. v. Newcombe.

At Devon Assizes at Exeter on November 4th, before Sir Fredk. Low, K.C., M.P., this action was heard.

The Plaintiff asked for the return of a mincing machine or its value, £58, and £11 4s. damage for alleged wrongful detention. An electrically-driven mincing machine was fixed in the Plymouth Market to a stall belonging to defendant, a butcher, for exhibition purposes. The company forwarded the defendant a cheque for £2 for the use of the stall, with a request to return the cheque and machine if the arrangement were not satisfactory. Neither the cheque nor machine was returned, the contention of the defence being that the defendant did not require the machine, and could not remove it because he was unable to disconnect the electrical apparatus.

The Commissioner said that the action should have been heard in a County Court. However, he was of opinion that an agreement had been broken by the defendant. He, therefore, ordered the machine to be returned, or its value paid, within seven days, with costs against the defendant on the County Court scale.

German Telephone Prices.—Various firms engaged in the light electrical engineering branches (telephony, telegraphy, &c.) in Germany, recently approached the Imperial Post Office authorities with a view to securing the grant of higher prices in these branches, and it is now stated that the application has been successful in regard to certain post office supplies. The attitude of the postal authorities in the matter is of substantial advantage to the branches concerned, as the former are the most important customers of the latter. As to the price convention which was concluded a short time ago, the interested firms are endeavouring to extend the scope so as to include manufacturers other than those already affected by the convention. The hope is also entertained that it may be possible to apply the system to the export trade.

BUSINESS NOTES.

Notice to our Advertisers.—The Electrical Review Advertising Department is seriously inconvenienced at times by the very late arrival of copy for advertisements. In order to avoid disappointment, those who are responsible for preparation of advertising matter are asked to let their desires be known at the earliest possible moment, and to take special note of the fact that *new copy and alterations to existing advertisements should reach the offices, 4, Ludgate Hill, E.C., not later than Monday morning.* Requests to this effect have sometimes been overlooked, but it is imperative that the rule be adhered to in future in order that there may be neither disappointment to the advertiser nor delay in printing the Electrical Review.

Private Arrangements.—Ridings Arc Lamp Co., Ltd. Parr Street, Liverpool.—A meeting of the creditors interested in the above matter was held on November 6th, when it was reported that the business was originally started in Manchester, but in 1911 it was taken over by Mr. Atherton, and a company was floated in February, 1911. The capital at that time was £3,000, of which 1,500 shares have been issued, 1,000 £1 shares, and 500 £1 vendors' shares. Debentures have been issued from time to time to the extent of £4,200, on which there is now £179 due in respect of interest. No salary has been drawn by the directors, their services being given absolutely free to the company. Negotiations have been entered into with a view to selling the patent rights and business generally and the majority of the debenture-holders are agreeable to their debentures being transferred. The statement of affairs showed liabilities to sundry creditors of £658, and liability on shares £1,502, while there are debentures for £4,380. The assets are estimated to produce £3,988, there being thus disclosed a deficiency of £2,550 on paper. It was ultimately decided to confirm the liquidation. The following are creditors:—

Bramall, W. H., Manchester	£33
Burman, R. H., Birmingham	36
Cod Arc Lamp Co., Nottingham	92
Eckstein Heap, Manchester	22
Kelly, Rob & Sons, Liverpool	32
Middleton & Son, Liverpool	41
Royston, E. R., & Co., Liverpool	19
Veritys, Ltd., Manchester	16
Wittauson & Co., London	45

Joseph Green & Nephew, Ltd., Globe Iron Works, Crown Point Road, and Norman Hurst's Garage, Wade Lane, Leeds, automobile, electrical, and general engineers.—A meeting of the creditors interested in the above matter was held at the offices of Messrs. Booth, Wade, Farr & Lomas Walker, solicitors, Central Bank Chambers, Leeds, on Friday, November 7th. The statement of affairs prepared by Messrs. Frederick & C. S. Holliday, incorporated accountants, Greek Street, Leeds, showed unsecured trade liabilities amounting to £961, bank claim £1,159, cash creditors £458, and other liabilities £30, making a total of £2,608. The assets were £2,892. There were preferential claims, including interest on debentures and costs, amounting to £1,381, which reduced the assets to £1,511, and disclosed a deficiency of £1,097. It was explained that the deficiency was accounted for by loss on trading and depreciation as shown in the statement of affairs. The company was formed in April, 1909, with a capital of £4,000 in £1 shares, of which £3,726 were issued. On July 4th last the debenture-holders took possession, and appointed Mr. Fredk. Holliday, Receiver. This was followed by a meeting of the shareholders on October 20th, when Mr. Holliday was selected as liquidator. This appointment was unanimously ratified at the meeting of creditors on the 7th inst., and the estate was left in the hands of the liquidator without a Committee of Inspection.

Trade Announcements.—The Westinghouse Brake Co., Ltd., of King's Cross, London, N., have secured the services of Mr. D. McGregor Stewart, of 166, Buchanan Street, Glasgow, to act as their agent, owing to increased business in Scotland.

Messrs. Watlington & Co., Ltd, announce that increased business has made a second telephone line necessary, and their number has now been altered to City 1257 (two lines).

The Edison & Swan United Electric Light Co., Ltd., Ponder's End, announce that their telephone service has now been supplemented by five lines, and their number is 520 Enfield (six lines).

The Altrincham Electric Supply, Ltd., announce that they have transferred the whole of their installation business for wiring and electrical supplies to Mr. E. Wood, hitherto superintendent of the department, who will carry on the business as Messrs. E. Wood and Co., at 29, Stamford New Road, Altrincham.

Mr. J. E. Barnes, an engineer of Messrs. L. J. Healing & Co., Ltd., contracting engineers, at Yokohama, Tokyo, &c., is now in this country, and will be pleased to hear (care of the Editors, Electrical Review) from manufacturers having anything likely to be of interest to the Japanese market.

Electro-Tanning at Burton-on-Trent.—With reference to a proposal for the establishment of a tannery worked on Dr. Groth's system of electric tanning, the Burton-on-Trent Health Committee resolved under date October 28th, "That this Committee will be prepared to recommend the Council to give its consent to the establishment within the borough of the trade in question, subject to a suitable building scheme being submitted, and an approved site chosen."

Catalogues and Lists.—Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, Westminster, London, S.W.—Illustrated lists announcing reduced prices for Osram, Mazda and tantalum lamps.

The Benjamin Electric, Ltd., 117, Victoria Street, Westminster, S.W.—Leaflet No. 52 giving descriptive notes and prices relating to their "Bengrip" adaptors, Benjamin wireless adaptors, and "Benco" lampholders.

Messrs. S. Wolf & Co., Ltd., 115, Southwark Street, London, S.E.—Five pamphlets have been received giving particulars with illustrations and prices of their portable electric tools, as follows:—Air-cooled electric portable drills and reamers with mechanical overload release; electromagnetic chucks and surface plates; electric grinding motors; and electric drilling machines. Dimensions, codewords, and other useful information is included.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—A new catalogue of 12 pages containing a full description, with illustrations, of the "Meldrum" improved forced draught furnace; a circular describing the "Koker" and "Sprinkler" mechanical stokers; also leaflets further relating to these specialities.

Messrs. P. L. Dwyer & Co., 66, Victoria Street, S.W.—Pamphlet dealing the Lighthouse radiator, "Simpla" electric kettle, and steam cooker, for which Messrs. Dwyer are wholesale agents. The price of this apparatus is astonishingly cheap; full particulars as to price, heat loading, spares, &c., are given.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—Eight-page price list, giving information descriptive of their solid rubber-sheathed cables for withstanding hard ware and rough usage in mines, docks, &c. Sizes and prices are clearly tabulated for these and also for solid rubber type trailing cables.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 736, gives illustrations and detailed prices of a variety of designs of "Aston" radiant lanterns for shop, office, station and street lighting.

Book Notices.—*English and German Technical Terms.*—By J. G. Horner; translated by O. Holtzmann. London: Crosby Lockwood. Price 3s. net.—This is a handy little pocket dictionary of technical terms, compiled by the author for the use of engineers, who nowadays must follow the developments in foreign countries if they wish to keep up to date in their profession. It is neatly got up and printed in clear type. Not being specially designed for the use of electrical engineers, it does not give all the terms which they require; for instance, Bügel is translated as stirrup—in electrical work it has a number of special meanings; Anker is not translated armature; Drehstrom, Kollektor, Bürste, Zähler, Zelle are not mentioned. Nevertheless, it will be found a very useful companion by a large class of engineers.

"Handbook of Technical Instruction for Wireless Telegraphists." By J. C. Hawkhead. 1913. London: Marconi Press Agency, Ltd. Price 3s. 6d. net.

"Lewis's Quarterly List of New Books and New Editions" added to Lewis's Technical and Scientific Circulating Library, 136, Gower Street, W.C.

"Las Funziones Iperbólikas." By A. E. Salazar. Santiago, Chile: University Press. Price 1 zentor.

"*The Laboratory as a Servant of the Engineer.*"—This booklet, issued by the West Ham Testing Laboratory (principal, Mr. G. Lloyd Jones), gives particulars of the procedure followed by the laboratory in testing fuels, and the tests made on engines and boilers, oil, water, cement, &c., with scale of fees charged. Many electricity works are clients of the laboratory.

Dissolutions and Liquidations.—The Sun Power Co. (Eastern Hemisphere), Ltd.—At meetings on September 24th and October 22nd, it was resolved that the company be wound up voluntarily for the purposes of reconstruction, and that Mr. P. S. Fitzer, of Friars House, New Broad Street, E.C., be appointed liquidator.

J. W. Garsden (J. W. Garsden & Co.) electrical engineer, Blackburn.—November 22nd is the last day for receipt of proofs for dividend. Trustee, Mr. J. Smith, 27, Ainsworth Street, Blackburn.

Freeman & Curtis, electric lighting experts, 52, Church Street, Stourbridge.—Messrs. E. Freeman and A. W. Curtis have dissolved partnership. Mr. Freeman will continue the business at the same address as the Stourbridge Electrical Co.

The Nevile Engineering Co., Ltd.—The statutory meeting of the creditors of this company was held on 1st inst. The financial position was fully explained and showed that the tangible assets as stated in the balance-sheet dated June 30th last were as follows:—Freehold land and buildings, £6,664; cash in hand, £6; fixed plant, machinery, tools, patterns, drawings, &c., £3,453; book debts and work in progress, £1,569; stock-in-trade, £2,381 = £14,073. Mr. G. W. Bull, the liquidator, says that the land and buildings have undoubtedly depreciated, and it is feared the assets will not realise anything like the figure stated. The claims of the debenture-holders amount to £9,900, and it is unlikely there will be a surplus available to meet the claims of unsecured creditors. These claims are small, the liability to trade creditors being under £600.

Preston Electric Co., Ltd.—This company is winding up voluntarily, with Mr. T. L. Rawlins, 12, Bennets Hill, Birmingham, as liquidator.

Hydro-Electrical Gear Co., Ltd.—This company is winding up voluntarily with a view to reconstruction. Mr. J. A. Henderson, of 11, Pancras Lane, London, E.C., is liquidator. A meeting of creditors is called for November 20th.

Metalite, Ltd.—A meeting of creditors is called for November 24th, at 9 and 10, Pancras Lane, E.C., by Mr. G. S. Clarke, the liquidator.

Bankruptcy Proceedings.—At the London Bankruptcy Court on Monday, the first meeting of creditors was held under a receiving order made recently against Frederick William Chamier, described as of 59, Fleet Street, E.C. Mr. Daniel Williams, Official Receiver, reported that it appeared from the debtor's statements that he was an Australian, and qualified as a mining and electrical engineer at Frieberg, Saxony. Until 15 months ago he was in the employment of various commercial companies and enterprises in Europe and Asia. He then came to England and became a partner in a business carried on at 59, Fleet Street, E.C., as the British Empire Hygienic Association, the intention being to exploit pharmaceutical products. Having withdrawn from the partnership last June, the debtor had subsequently had the use of an office at the same address. He had asserted that he made at least £100,000 by his earnings and investments, and had lost large sums by speculations and loans. He became interested in the Deutsche Beck Bogenlampen Gesellschaft, of Frankfort-on-Main, an electrical company, of which he ultimately obtained the controlling interest. The company owed him £76,700 in respect of loans, overdrafts, guarantees, &c.; it was now in liquidation, and the debtor was of opinion that when the assets were distributed he would get at least between £10,000 and £12,000. The debtor was the owner of various patents taken out in his own name in Germany in connection with mechanical and electrical appliances, but he placed no present value upon them. A statement of affairs had been submitted, showing the liabilities £511 and assets expected to produce £18,517. The latter consisted of book debts to the face value of over £80,000, and included the before-mentioned debt of £76,700 due from the Frankfort company. The debtor, consequently, did not admit insolvency, but hoped to pay his debts in full, and apply for a rescission of the receiving order, the present position being due to the fact that the assets were not immediately realisable.

Mr. J. F. Spencer Cridland attended for the debtor, and, by general consent, the meeting was adjourned for three weeks, with a view to payment of the debts in full.

William Henry Davis (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, Birmingham.—Receiving order made November 4th on debtor's petition. First meeting November 19th; public examination December 4th, at Court House, Birmingham.

Bernard Musgrave, director of a limited company, Howick, Preston.—A supplementary dividend of $\frac{11}{12}$d. in the £, payable November 18th at 19, Exchange Street, Bolton.

We have received the following communication in *re* S. A. M. Rose, in bankruptcy:—"With reference to the notice appearing in the columns of your paper of the 31st ult. regarding the above, my directors wish me to write and say that for some time since Mr. Rose has ceased to be in the employ of the company as technical adviser, or, indeed, to hold any connection with it, other than that of a shareholder. We shall be obliged if you will kindly insert this correction at the earliest opportunity.—The Rose Automatic Target Co., Ltd., H. R. Bower, Manager."

Lead.—In their weekly lead report, dated November 8th, Messrs. James Forster & Co. state:—"Production statistics. The increase of 3-5 per cent. mentioned in our last week's circular is the average annual increase for the last 10 years. Closing prices last week were £20 12s. 6d. October, £20 7s. 6d. November, £19 17s. 6d. December, and £19 10s. January. A large business has been done this week for all positions, the buying for November shipment being particularly heavy. Prices have eased off, the demoralisation in other markets having had a sentimental effect on lead, while the arrival of a large quantity at the end of this week and early next will afford a welcome relief to the exceedingly strained position many consumers are now in. We are afraid the relief will be only of a temporary character, as a great deal of the lead coming in will be immediately transshipped to Russian, South American and provincial ports. The demand for export continues, and has resulted in considerable business for shipment up to February. We can only recommend consumers to provide for their requirements in advance for some time to come. October shipment has been done during the week at £20 12s. 6d. to £20 7s. 6d. and £20 10s.; November, £20 5s. to £19 17s. 6d.; December, £19 17s. 6d. to £19 10s.; January, £19 5s. to £18 12s. 6d.; and February, £18 15s. to £18 17s. 6d. Closing prices are:—October, £20 12s. 6d.; November, £19 17s. 6d.; December, £19 10s.; and January, £19 5s. English lead nominal at £21."

Norway.—A company has just been formed at Drammen, for the purpose of building a factory for the manufacturing of rubber cables and electrical insulating materials of all kinds. This is the first manufactory in Norway in this line. The capital of the new company is £2,777. The first works for the manufacture of copper wire was also started at Drammen only a short time ago, and both these works will no doubt be able to cover a good portion of the inland consumption of such materials, which have hitherto been imported, chiefly from Germany.

Canada.—A Canadian paper states that the Canadian General Electric Co., Ltd., have just acquired by purchase all the plant and assets of the Stratford Mill Building Co., at which plant in future will be manufactured not only lines of flour mill machinery heretofore manufactured by the Stratford Mill Building Co., but also the wider range of machinery and equipment as produced by the Allis-Chalmers Co.

For Sale.—By tender (December 9th), electrical power plant and machinery, now at Head Post Office, Cardiff; Controller of Stores, G.P.O., Studd Street Department, London, N. Offers are also invited for purchase of second-hand steam and electrical plant; Leeds Corporation Electric Lighting Department. Particulars are given in our advertisement pages.

Sweden.—A new company, under the name of the Swedish Trading Co., has recently been formed at Stockholm, for the purpose of exporting all kinds of industrial products and manufactures, and for opening up connections between Swedish producers and manufacturers on the one hand and foreign consumers on the other. The new company has a capital of £111,100. and will commence active operations in the course of next year. Simultaneously, another company under the same name at Hong Kong, China, is going to work in connection with the former company for the distribution of Swedish goods in China.

A joint stock concern is about to be started at Arboga, says *Affärsvarlden*, with a capital of 200,000 krona to manufacture corundum, carbide of calcium, and iron alloys by the electric method. The promoters are A. Grönvall, Fars Blume, Lars Svenson, A. Ljungman, P. M. Carlberg and Arvid Johansson, M.E.

LIGHTING and POWER NOTES.

Aboyne.—E.L. Scheme.—At a public meeting held last week it was decided to apply for a prov. order to light the village by electricity, a scheme for which has been submitted by Messrs. T. C. Smith & Co., of Aberdeen.

Aldenham.—Terms having been arranged, the Watford R.D.C. has agreed to support the application of the Watford U.D.C. for powers to supply current within the parish of Aldenham.

Ardsley.—The U.D.C. has decided to invite the Electrical Distribution of Yorkshire, Ltd., to submit a scheme for lighting the town by electricity.

Ballater.—Water Power Scheme.—The T.C. has accepted the offer of Mr. Duncan, of Tillycorthy, through Messrs. T. C. Smith & Co., of Aberdeen, to install electricty in the burgh. The proposed charges are 6d. per unit for private lighting, 4d. for power, and for street lighting; the scheme proposes to utilise water power in the neighbourhood.

Batley.—The Batley Tradesmen's Association has decided to make arrangements for an electric lighting display in the town for a few days preceding Christmas.

Bognor.—Electricity Supply Inaugurated.—This scheme, promoted by the Bognor Gas, Light and Coke Co., and for which Messrs. Handcock & Dykes were the consulting engineers, was formally opened on the 3rd inst., current being switched on to the town by the chairman of the Council. The station plant consists of one 120-B.H.P. Diesel engine, direct coupled to an E.C.C. 30-KW. D.C. generator for 450 to 483 volts, and one 50-B.H.P. Diesel engine direct coupled to a Dick, Kerr 33-KW. D.C. generator, ample space being left for additional sets to be added as required later. The circulating water for the engines is provided by a cooling tower which, with the engine house, is situated in the gas works yard. A balancer booster by the E.C.C., consisting of two balancer motors and two booster dynamos, coupled together and reversible, gives 100 amperes at any voltage from 10 to 80, and the balancers will deal with an out-of-balance current of 48 amperes. The switchboard is by Messrs. Middleton, and consists of nine marble panels; the necessary regulating resistances are fixed below the switchboard. A battery room contains 240 D.P. storage cells, having a capacity of 54 amperes for 10 hours, and capable of supplying the whole of the town when the engines are not running. The underground mains were supplied by Messrs. Siemens Bros. & Co., Ltd., and consist of three-core paper, lead-covered, armoured and jute-covered cables laid direct in the ground; between 7 and 8 miles have been laid. Very neat switch-control pillars have been fixed at various parts of the town, so as to bring the whole of the connections, switches and fusegear above ground, and do away with underground boxes, which are always liable to give trouble in the event of flooding. The system of supply is three-wire at 220 and 440 volts The number of consumers connected to the mains on the opening day was 70, representing about 4,138 20-watt lamps, and it is anticipated that this number will be considerably increased now that the new station is at work. The price charged for private lighting is 6d. per unit, the maximum allowable under the Order being 8d. We are indebted to Mr. Hammond, the general manager of the company, for these particulars.

Bradford.—The Electricity Committee recently paid a visit of inspection to the electrically-driven weaving shed of Messrs. Emsley, containing 345 looms, and at a luncheon held subsequently, Mr. Thomas Roles, the city electrical engineer, mentioned that the Corporation has received instructions from another firm to electrically equip a similar shed of about the same size. Mr. Emsley, in the course of some remarks, pointed out that though the electricity department paid over £8,000 a year in rates, which was included in the charge for current, yet the Assessment Committee was also rating his motors, as though he had installed a steam plant. Thus he paid rates twice over, and he suggested that this was a matter to be looked into.

Burnham (Somerset).—The U.D.C. has received from the B. of T. consent to the transfer of the E.L. order to a local company in consideration of the costs incurred being repaid to the Council. The company will supply current for lighting at not more than 6d. per unit for lighting and 3d. for power.

Canada.—The Quebec Development Co., Ltd., incorporated under a Federal charter with a capital of [illegible] has for its objects the acquisition of water rights, the manufacture of electric machinery, the erection of plants and generating stations and the building of underground subways. The head office is in Montreal, and it is understood that American capital is behind the project.—*Canadian Electrical News.*

Clevedon.—The T.C., on November 5th, adopted a recommendation from the Lighting Committee to the effect that as the Clevedon and District Electric Supply Co., Ltd., had not carried out its agreement with the Council with regard to electric supply in the town, the B. of T. be asked to revoke the prov. order.

Consett (Durham Co.).—Street Lighting.—The Lighting Committee of the U.D.C. has recommended that notice be given to the Shotley Bridge and Consett District Gas Co. to terminate lighting the town on the 18th inst., the Cleveland and Durham Electric Power Co. having undertaken to be in readiness to light the town by that date. The power company is supplying the town with current at 2½d. per unit.

Continental Notes.—Norway.—A company was some time ago formed by three municipalities in the neighbourhood of Notodden, where the large nitrate manufactories are situated, for the purpose of harnessing the Aarlis Waterfalls, which will develop about 12,000 H.P., to be transformed into electrical energy. The work in connection with the erection of the power station has been going on for some time, and will be completed in the course of next year. As the whole amount of power was not required for municipal purposes, it has been decided to hire out the superfluous power, and negotiations have been carried on with a Swiss company, which has made an offer to hire 6,000 H.P. for a manufactory to be erected in the neighbourhood of the town of Porsgrund at the Skiensfjord. These negotiations have now been concluded with the signing of an agreement between the two parties, according to which the Swiss company will take over 6,000 H.P. from the above-mentioned waterfalls, provided that the Government's concession for erecting the works is obtained. The Swiss firm is carrying on a metallurgical business, and the new works in Norway may be regarded as an extension of its present plant.

The Folla River, a tributary of the Surna River in Nordmör, has, it is reported, been purchased with a view to its utilisation as a source of electric power. As there is no convenient lake to collect the water, an artificial basin will be constructed. It is stated that a tunnel nearly two miles long from the artificial basin through the Sandefjeld mountain, would afford some 40,000 to 45,000 H.P., and the reported purchase of marble deposits near the Folla River suggests that the undertaking will be connected with the manufacture of fertilisers from the air.—*Board of Trade Journal.*

Italy.—The Officiri Elettricita Genovesi, a concern in which the A.E.G., of Berlin, and the Bank für Electrische Unternehmungen, of Zurich, are interested, has secured a concession from the municipal authorities of Genoa for the supply of electrical energy for power purposes in the city until the end of the year 1926. In return for the monopoly certain reductions in the rates charged for public lighting have been agreed to.

Of the 28 big Italian companies engaged in electrical undertakings, only two in 1912 (as compared with three in 1911) paid no dividend, whilst 14 paid the same, nine paid more and three less than last year. The average increase of dividend was from 6·56 to 6·69 per cent. During 1912, 12 companies increased their capital by 30,000,000 lire, whilst the amount of capital invested in new enterprises was 10,000,000 lire. Several important hydro-electrical schemes were sanctioned by the Government during the summer of this year. The sale of electro-mechanical manufactures fell slightly in 1912, and the imports of dynamo-electrical machines and machine parts also suffered, as did the home production of these goods.—*Board of Trade Journal.*

Cornforth.—Street Lighting.—The P.C. has received from the County of Durham Electric P. D. Co., Ltd., an offer to supply electricity for public lighting, with 40 lamps, on a five years' agreement at 30s. per 50-C.P. lamp, from dusk to dawn, and 27s. each from dusk to midnight. The Council has deferred the matter for further consideration.

Dawlish.—Owing to increasing demand for current, the plant at the local E.L. works is to be triplicated.

Elland.—L.G.B. Inquiry.—At an inquiry into the application of the D.C. to borrow £1,550 for the purposes of the electricity undertaking, Mr. H. R. Hooper was informed that there was a deficit of £629 at the beginning of the year. The Council had a powerful gas company to fight, who had a showroom, which the Council had not power to provide for its undertaking.

Finchley.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the Council of £7,500 for mains, and £6,000 for services.

Flockton.—E.L. Scheme.—The U.D.C. has decided to accept a scheme submitted by the Yorkshire Electric Power Co. for lighting the town by electricity, and to apply to the L.G.B. for sanction to borrow the necessary money. The Ossett Corporation had submitted a scheme previously, but the estimate of the company was much less costly.

Gillingham.—New Loans, &c.—The E.L. Committee has recommended the Council to apply to the L.G.B. for power to borrow £5,000 for mains and services.

The engineer reported that he had inspected the new Diesel engine at the makers' works in Germany, and was informed that the device for enabling the engine to run on gas tar oil could be fitted for less than £100. He estimated that the saving would be about £125 per annum, and recommended that the apparatus be fitted. A motion that the chairman and engineer inspect the Diesel plant at Kingston, which is run on tar oil, and report thereon, was carried.

Glasgow.—Exhibition Results.—The Electrical Exhibition, held under the auspices of the T.C., has had a most successful run. The daily attendance is reported to have averaged about 4,000, and much interest has been evinced in the many-sided exhibits on view. Stand-holders are expressing themselves highly gratified with the results, and local retailers are receiving orders for such articles as radiators, geysers, and the smaller laundry appliances.

Following the example of America, the Electricity Committee has inaugurated on a small scale an experiment in electrically-lighted advertisement hoardings. There is a feeling in the T.C. against the adoption by shop keepers or general advertisers of flashing signs, on the ground that these are apt to frighten restive horses, and add to the dangers of the chief thoroughfares. The suggestion is that if the experiment proves successful, it will be further extended, and bill-posting firms invited to adopt the system, the proposal being to switch on the light after 6 o'clock during winter, when the peak load is off.

Hants.—The C.C., which is establishing a farm school at Old Basing, has decided to utilise electric power for driving the machinery there.

Ilkley.—E.L. Loan.—The D.C. proposes to apply for sanction to borrow £18,000 for its electric lighting scheme.

Kendal.—The T.C. has agreed to supply current to the works of Messrs. Gilkes & Co., engineers, and Messrs. Morphy, Aynam Mills. The latter firm will take 8,000 units per annum for four years, at 1½d. per unit.

Kirkby Lonsdale.—The U.D.C., after discussing an electric light scheme submitted on behalf of a proposed local company, has passed a resolution expressing a friendly attitude to the proposal, but not pledging itself in any way with regard to the method of installation.

Knottingley.—Prov. Order.—The U.D.C. decided at a special meeting on the 6th inst., to apply to the B. of T. for a prov. order for the supply of electricity within the district.

Leeds.—Roundhay E.L. Purchase.—At a meeting of the City Council on Monday, Ald. Wilson again submitted the proposal of the Finance Committee that the Corporation should purchase the undertaking of the Roundhay and District Electric Lighting Co., the Corporation to receive the assets and take over the liabilities as from July 1st, 1914, including £12,390 share capital, together with interest from the date on which the same was raised, and £500 for all the costs of the company incidental to winding up and transfer. After discussion, the resolution was carried by 43 votes to 14.

London.—Islington.—Reserve Fund Investment.—The Finance Committee has had under consideration the report of the district auditor upon the accounts of the borough for the year ended March 31st last. In this report the auditor draws the attention of the Council to the fact that part of the reserve fund of the electricity undertaking is being applied to purposes of a purely capital nature, chiefly an extension of the generating plant, and states that he does not find any statutory authority for the appropriation of this fund for purposes of such a nature. The borough treasurer has informed the Committee that he has consulted the Council's solicitor, who is in agreement with the auditor's views, being of opinion that Sec. 55 of the Electric Lighting Order deals specifically with the application of money carried to a reserve fund, and that the spending of this fund in the purchase of plant is contrary to the terms of the order. Under these circumstances the Committee has decided in future to refrain from applying the reserve fund to purposes which should be met out of capital.

Poplar.—Application is to be made to the L.C.C. for sanction to the borrowing of £2,350, in respect of cable extensions.

Marylebone.—In February, 1912, the Council authorised the supply of current to exhibitions where electrical appliances were shown, at the rate of 1d. per unit, less a rebate of 50 per cent. The Electric Supply Committee now informs the Council that there are certain contractors in the borough who are prepared to make a special display of heating, cooking, &c., apparatus in their showrooms if this rate is granted them, and this has been agreed on. The Committee has also decided to adopt the "telephone" system of tariff for the supply of electricity to the departments of the Council. Based upon last year's accounts, it is expected that the alteration will show a saving of about £150.

Lewisham.—The B. of G. has decided to adopt electricity for wood sawing at the workhouse, in place of hand labour. A 5-H.P. motor is to be hired from the E.L. Co. for the purpose.

Leyton.—The surplus of £3,050 made on the electric lighting undertaking for the last year is to be equally divided between the reserve fund and the ratepayers.

Malvern.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £2,000 for expenditure on electric mains.

Masham.—The electric lighting question was discussed at a public meeting convened by the U.D.C. last week. The scheme proposed was described by Mr. Best, of Bradford, who said that it was proposed to supply current at 6d. per unit. A resolution was passed requesting the U.D.C. to adopt a friendly attitude towards the scheme, and to offer every facility for carrying it out.

Morden.—Street Lighting.—The Council is considering terms offered by the South Metropolitan Electric Light Co. for lighting a portion of the district by electricity.

Newcastle-under-Lyme.—The T.C. has adopted a recommendation by the Electricity Committee that the scale of charges for current for lighting should be reduced as under:—Shop lighting and other premises (closing at 8 p.m. Saturdays excepted), for any number of lamps burning on one circuit, and using up to 6 amperes, £15 per annum; 8 amperes, £20 per annum; 10 amperes, £25 per annum; theatres and premises keeping open until 11 p.m., for any number of lamps burning on one circuit and using up to 6 amperes, £21 per annum; 8 amperes, £28; 10 amperes, £35. Owing to the hostility of the Gas Committee, the Council rejected a recommendation to canvass a part of the district for electric light consumers.

Newton-in-Makerfield (Lancs.).—Prov. Order.—The U.D.C. has approved of a recommendation of the E.L. Sub-Committee, that application be made to the B. of T. for an E.L. order. The Committee considered an estimate of the cost of a scheme, submitted by Mr. E. M. Lacey, for private lighting consumers and small power users only. As it was thought that the gasworks site might be used for the generating station, Mr. Surtees was instructed to get out alternative costs for gas and steam generating plants at the gasworks capable of developing 220 KW.

Pickering.—Proposed E.L. Scheme.—The U.D.C. after considering an E.L. scheme submitted by Messrs. H. Best and Pullan, has expressed its favourable attitude towards the scheme, but does not pledge itself to adopt it. It is proposed to form a local syndicate to carry out the project and to utilise overhead wires for the supply.

Port Erin (Isle of Man).—The Board of Commissioners has been approached by Messrs. Campbell & Jordan with reference to an E.L. scheme for the town, and offering to provide the generating plant if the authority would undertake the laying of mains, &c. The Board has replied that "the gas company has a monopoly of supply."

Radcliffe (Lancs.).—Proposed Loan.—The D.C. has decided to ask the L.G.B. for permission to borrow £3,950 for extensions.

Rathmines.—New Loans.—The Council has decided to apply for sanction to borrow £11,000 for additional electrical plant, and £1,500 for wiring.

Royton (Lancs.).—The Council has approved the agreement with the Oldham Corporation in regard to the supply of electricity to Royton, and the Royton Council will take steps to get an order.

Sale.—New Plant.—The U.D.C. decided at its last meeting to apply to the L.G.B. for sanction to borrow £1,000 for the provision of a new storage battery and booster at the electricity works.

Shipley.—Plant Extensions.—The U.D.C. has decided to purchase a water-tube boiler, two steam turbines, two 1,000-KW. alternators, two surface condensing plants, and the necessary switchboard and switch gear for the Dockfield Electricity Works. The cost of the new plant is over £10,000. The Council has also resolved to make application to the L.G.B. for powers to borrow £27,000 for extensions at the electricity works in connection with the scheme for providing an alternating-current supply.

Slough.—Football by E.L.—A correspondent informs us that a football match was played at Slough on the evening of November 5th, in aid of charity. The ground was specially lighted by the Slough and Datchet Electric Supply Co., with four 8-ampere Excello arcs, one at each corner, and 10 100-watt Osram, lamps, three on either side, and two at each end of the ground. We understand that the field was splendidly lighted, play being easily followed in any part of the ground, and that over 5,000 spectators were present.

South Africa.—A Large Electrical Winder.—The East Rand Proprietary Mines, Ltd., have placed with Messrs. Fullerton, Hodgart & Barclay, Paisley, an order for a very large electric winder. The plant is to be capable of winding eight tons of ore from a depth of 4,500 ft. at a speed of 3,000 ft. per minute. The winder is arranged for double motor drive on the "Ward-Leonard" system, and will be the largest plant of this type which has been installed in any mine. The conical drums alone will weigh over 200 tons, and the drum shaft, which is in one piece, will weigh over 40 tons.

Sutton (Hull).—Notice has been given to the Hull T.C. of a motion to rescind the recent resolution to apply for a prov. order for electric lighting at Sutton.

Todmorden. — L.G.B. Inquiry.—No opposition was raised at the inquiry, on the 7th inst., relative to the Corporation's application for sanction to borrow, amongst other sums, £5,800, for an extension of the plant at the electricity works. It was explained that the latter had been rendered necessary by the large orders from the cotton manufacturers for increased lighting and power.

Trowbridge.—In view of the local opposition, the U.D.C. has refused the application of the Electric Supply Co. to erect overhead wires in the Bradley Road district.

Tunbridge Wells.—The borough engineer has been instructed to prepare specifications and obtain tenders for wiring the sanatorium buildings. The E.L. Committee has decided to scrap the present day-load set and to install a new 300-kw. steam set, at an estimated cost of £3,500, of which the details are as follows :—Engine, alternator and condensing plant, £2,970 ; pipework, valves and instruments, £230 ; foundation, £100 ; contingencies, £200. After providing for repayment of capital and interest, it is estimated that the proposed new set will reduce the annual working cost of the undertaking by not less than £770.

Venezuela.—One of the features of the electricity supply business in Venezuela appears to be that as soon as one company has established a successful undertaking, another one is organised to compete, though not because of increased demand for current for lighting and power purposes. The result is that a price-cutting war is indulged in, it being a question not of the usual kind, of the survival of the fittest, but which can last the longest financially. This is the state of affairs which, we are informed, has existed for some time in Caracas. We are glad to learn, however, that the opposing parties have been got together, and that there appears a prospect of an early cessation of the price-cutting war. In the same connection, news has just come to hand that in the town of Valencia, where there already exists a company with a plant sufficient to supply the whole demand for electricity supply for many years to come, a syndicate is seeking powers to establish a second plant.

Walsall.—The L.G.B. has given its consent to a loan of £4,840 required by the T.C.

Warminster.—Proposed E.L. Scheme.—The U.D.C. has decided to place no obstacle in the way of the proposal of the Bristol Electric Light Co. to supply the town with electricity.

Watford.—The electrical engineer has been authorised to commence the work of laying mains in connection with Abbotts Langley extension. The 22 houses recently erected by the Council are to be wired for electric light.

Whitworth.—L.G.B. Inquiry.—On Wednesday, last week, an inquiry was held with respect to an application for borrowing powers in connection with the proposed electric lighting of the Whitworth Valley. Mr. H. R. Hooper conducted the inquiry, and Mr. J. C. Owen presented the case for the Council, the only opposition came from the Whitworth Vale Gas Co.

Wisbech.—B. of T. Inquiry.—Mr. A. P. Trotter held an inquiry last week in respect of the site selected by the Wisbech Electric Power and Light Co. for a generating station. Several owners of adjoining property objected on the ground that the noise and vibration would be a nuisance.

Wolverhampton.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £22,000 for electricity purposes.

In the report of the Electricity Committee it is stated that the assessment of the undertaking has been increased from £2,000 to £5,000. The borough accountant and engineer conferred with the valuer to the union, and finally the assessment was agreed at £4,500, which figure the Committee approved.

Wrexham.—Subject to the consent of the B. of T., the T.C. has decided to supply current in bulk to the Wrexham Tenants, Ltd., for homes to be erected at Acton Garden Village, at 3d. per unit net, on a 10 years' agreement, with a minimum annual payment of £100, on condition that all houses erected are wired and fitted up for the electric light.

The B. of T. has granted the Council an order enabling it to supply current to the new miners' rescue station on the border of the town.

York.—In reply to requests for current from residents at Haxby, the T.C. has replied that it is the Council's intention to supply electricity to the district as soon as the necessary powers are obtained.

TRAMWAY and RAILWAY NOTES.

Asiatic Turkey.—A tendency is being shown to improve the methods of communication between the larger cities in Turkey by means of electric tramways, and Aleppo and Jerusalem, in association with the ports of Adana and Jaffa, are at the present moment the subjects of consideration. In this connection the *Bulletin Commercial*, of Brussels, enforces the need to very minutely study local conditions before engaging in tramway construction in any part of Turkey. It should, it says, be noted that the law giving the vilayet authorities power to grant concessions is only of recent date, and it makes no dispositions with regard to older concessions which were hanging fire at Constantinople at the time the law was passed.

Blofield.—The R.D.C. has decided to offer no objection to the proposal of the Norwich Electric Tramways Co., Ltd., to extend the tramway to a point in the village of Thorpe.

Bournemouth.—Tramways Extensions.—The recommendation of the Tramways Committee that powers be sought to extend the tramways in Charminster Road has been confirmed by the T.C., and the latter has decided that the whole question of tramway extension in the borough be taken into consideration.

Canada.—The question of the electrification of the London and Port Stanley Steam Railway was decided on October 22nd in favour of electrification, by the passing of a by-law authorising the expenditure of $700,000 for this purpose.—*Canadian Electrical News.*

Continental Notes.—Switzerland.—The electrification scheme of the Swiss State Railway authorities contemplates the conversion of the St. Gothard railway in the first place, as the production of smoke in the tunnels has long been felt to be a very serious defect. The standing committee of the administrative council of the Federal railways recently had under consideration the question of proceeding with the section of the St. Gothard railway, which connects Erstfeld and Bellinzona, and at the next meeting of the Council a proposal will be made to vote a credit of £1,520,000 for this purpose. It is intended to throw open most of the works to the public competition of private firms, whilst the remainder will be carried out by the State railway department. The reconstruction works, according to a Zurich correspondent of a Cologne newspaper, are of special importance to German industry, inasmuch as the new St. Gothard railway treaty affords to German firms the possibility of competing on the same conditions as Swiss firms for the contracts ; on the other hand, the power for the operation of the railway is to be produced in State hydro-electric works, and the Government has already assured itself of various waterfalls for the purpose of the conversion of the railways in general. This decision is said to be based upon the circumstance that in the event of energy being procured from companies, the latter might combine in the form of a trust, and dictate terms to the State, whilst the danger would also exist that the shares of the trust might be acquired by foreign companies, and thus place the railways under the control of external sources.

Germany.—Bavarian State Railways.—According to the *Munch. Neuest. Nachr.*, the Budget allowances for 1914 and 1915 in respect of the electrification of the Bavarian State Railways, will be as follows :—The credit authorised for the lines Salzburg-Berchtesgaden, Garmisch-Mittenwald Scharnitz, and Garmisch-Griesen, amounts to M. 7,600,000 ; M. 7,000,000 was apportioned by the 1908-9 Budget ; and by the 1912-13 Budget it is intended to defray M. 600,000 of the 1910-11, M. 6,000,000 levy. In the 1912-13 supplementary Budget, M. 527,000 was provided for locomotives on the Garmisch-Griesen line, and M. 1,770,000 for the line equipment and locomotives on the Salzburg-Berchtesgaden route. The total amount provided for rolling stock on these two lines was M. 1,307,000 ; on the Garmisch-Scharnitz line the driving service and electric loco. equipment is entirely in Austrian hands. Five electric locomotives costing M. 592,000 are required by the traffic on the Garmisch-Griesen line. For the Salzburg-Berchtesgaden route eight hauling locomotives (four each at M. 150,500 and M. 154,700), and four pushing locomotives (two each at M. 112,000 and M. 116,850) are required ; the total cost of these is M. 1,768,500. The hauling locomotives for this line are larger, more powerful and built for higher speeds on the level, than are those on the Garmisch-Griesen line, hence the higher cost of the former type. The price differences between the various locomotives for the Salzburg line are due to differences in mechanical design and to differences, made for experimental reasons, in their electrical equipment. The total outlay on the locomotives of both lines, including M. 29,000 for contingencies, is M. 2,300,000, *i.e.*, M. 993,000 in excess of the M. 1,307,000 provided for this purpose. This surplus cannot be made up out of the M. 7,600 000 credit, and must, therefore, be defrayed from the second (M. 6,000,000) levy. The deficiency in the amount provided for the electric locomotives is chiefly attributable to the abnormal increase in total manufacturing costs, which increase was not foreseen even by manufacturers when the 1912-13 Budget was introduced. It was originally expected that the locomotives required could be obtained at a comparatively low price, but subsequently it was found that expenditure in some directions would be 80 per cent. higher than initially estimated.—*E.T.Z.*

According to the *Financial News* the Berlin Metropolitan Railway has placed an initial order for 60 electric locomotives with the Siemens Schuckert Co., the A.E.G. and the Schwartz Kopf Works.

Glasgow.—Tramways Extensions.—The Tramways Committee is still negotiating with the local authorities and others interested on the routes of the proposed big extensions. So far as can be learned, there are threats of opposition from the railway companies, particularly the Caledonian, while no really definite line of policy appears to have been promulgated by the County Councils involved—those of Lanark, Dumbarton and Renfrewshire. In the case of Dumbarton, there does not, however, appear to be much likelihood of opposition to the extension from Clydebank to Duntocher. The extension from Bank Street, Hillhead, Glasgow, to Byers Road, to which objection was taken by the authorities of the University, and which the route would pass, has also been under consideration, and steps are to be taken to obviate, as far as possible, the risk of danger, through vibration and current, to the more delicate apparatus in the college. The whole scheme of extensions will come before the T.C. shortly for final approval, before the provisional order is actually applied for.

Gosforth-on-Tyne.—The inquest on Robert Walton, the second victim of the tramway accident on the Tyneside Co.'s system on October 18th, was concluded on the 5th inst. The jury returned a verdict that Walton died from the injuries accidentally received in the collision in a dense fog, and it was of the opinion that both cars were being driven at an excessive speed, having regard to the climatic conditions prevailing at the time; the jury also censured Linkhorn, the driver of the break-down wagon.

Greenock.—Tramway Purchase Negatived.—At a meeting of the T.C. on Tuesday, Mr. T. Mitchell handed in a petition, signed by 1,391 ratepayers, approving of the municipalisation of the tramways, and proposed that the Greenock and Port Glasgow Co. be given notice that the T.C. intended exercising its option under Clause 17 of the lease between the town and the company, and terminating the lease at the first break—namely, May 15th, 1914. He contended that £158,000 would be a fair price for the 4½ miles of tramways within the burgh. Mr. Dunn, who seconded, spoke to an interview he had had with Mr. Dalrymple, manager of the Glasgow tramways, who said he was surprised that anyone in Greenock should be against municipalising a concern which had progressed so well during 13½ years. Bailie Brown moved a direct amendment, arguing that if the Corporation waited another 14 years, it would get the tramways at a mere valuation, and not require to pay for them as a going concern. Mr. A. Robertson, who seconded, thought it would be foolish to take over the Greenock portion and leave the company with the Port Glasgow and Gourock sections. Provost McMillan pointed out that the money to buy the tramways would require to be got on loan, and repaid within 30 years, whether earned by the tramways or not. The amendment was adopted.

Leeds.—Proposed Extensions.—The Tramways Committee has decided to apply for powers to extend the tramways to Halton and to the junction of Otley and Shipley Roads, Guiseley, and to construct a system of railless traction from that point to Otley and Burley-in-Wharfedale

Liverpool.—Goods Transport Schemes.—Mr. C. W. Mallins, manager of the Corporation Tramways, has reported on the question of goods transport by means of the city tramways, more particularly with a view to relieving congestion of the dock traffic. As regards the docks-to-station traffic, Mr. Mallins suggests that mechanically-propelled vehicles would largely solve the congestion experienced with horse-drawn vehicles. As regards the transport of goods between the docks and manufacturing centres, in view of the increasingly heavy passenger traffic on the city tramways during the day, the most that could be done would be to run three or four trains per day; and if this were successful a larger scheme could be arranged with the help of the Dock Board and Bootle Corporation, and dependent on the guarantee of at least 1,314,000 tons traffic per year at 2¾d. per ton-mile. The greater scheme suggested includes electrification of the dock railway, or construction of a tramway alongside, with tramway connections to Knotty Ash, joining with the county tramway system, at a cost of £246,750. As an alternative, Mr. Mallins suggests a railless traction scheme at a cost of £40,800.

Oakworth.—At its next meeting, the Keighley T.C. is to be asked to authorise the Tramways Committee to obtain tenders for the overhead electrical equipment and trolley vehicles necessary for installing the Cedes-Stoll system of railless traction on the Oakworth and Eastburn routes.

Oldham.—Car Emergency Appliances.—Arising out of a local tramway fatality and a jury's recommendation that appliances should be carried on cars to enable the rapid release of persons who might be caught underneath, the Tramways Committee on November 6th considered a report of Mr. Dugdale, the general manager, on the subject. This report pointed out that no appliances were carried locally, but a special emergency wagon was kept at Wallshaw depôt. Of 20 authorities communicated with, those at Birkenhead, Blackburn, Blackpool, Halifax, Huddersfield, Hull, Leeds, Nottingham, Preston, Salford, Sunderland and Sheffield adopted a similar system to that at Oldham, the cars not carrying jacks, but emergency wagons being kept. At Birmingham, Bolton, Burnley, Bury, Glasgow, Manchester and Rochdale, jacks were carried on cars, and motormen and conductors were instructed in the use of them. Having heard the report, a resolution was adopted that appliances be procured for all cars in Oldham, and that the men be instructed as to their use.

Oxford.—The Tramway Agreement.—A special meeting of the City Council was held last week to consider the question of the tramways. The General Purposes Committee reported recommending that, instead of adopting the draft agreement submitted by the Tramways Committee, the Council should rely on the existing rights of the Corporation, and that the National Electric Construction Co. be informed of this decision. In the course of a very long discussion, Ald. Brooks moved an amendment to accept the agreement with the company, and asking the latter to notify its acceptance within seven days; this was lost by 27 votes to 25 votes. Mr. Callcutt, seeing that the Council had refused to put the agreement before the company, proposed a further amendment instructing the city solicitor to issue a writ forthwith for the recovery of the liquidated damages. He felt that if they passed the report, they were in exactly the same position as a year ago, and the delay would still go on. Upon a division this amendment was lost by 28 votes to 9, and the report was then carried.

Numerous protests and memorials against the proposal to substitute modern passenger transport for the present out-of-date system have been received from the colleges, &c.

Sheffield.—The Tramways Committee has decided to convey mail bags by tramcar without being accompanied by a Post Office official, at a charge of 2d. per bag per journey for bags not exceeding 28 lb. in weight and 3d. per bag per journey for bags exceeding 28 lb., but not exceeding 56 lb., it being understood that the Corporation does not take or accept any liability in connection with the work.

South Shields.—In our issue of October 31st, we gave some figures relating to the extension of the tramway service from Market Place to Horton Nook. Mr. Robson, the tramways general manager, points out that these referred to the mile of route extension, the 2·38 miles mentioned being the total length of the route which the cars would take.

Tunis.—A tramway system is shortly to be installed in the town of Sfax. The project has just received official approval, and the municipal electricity works will now be handed over to a private company, which, besides improving the lighting of the town, will proceed with the construction and working of the electric tramway system.—*Board of Trade Journal.*

Tyne Tunnel Proposal.—According to the *Newcastle Daily Journal*, a new company has been formed to revive the scheme for connecting North and South Shields by a tunnel and electric railway, and a quarter of a million pounds has been assured.

U.S.A.—Electric Vehicles.—The Electric Light Co., of Hartford, Conn., has not only recently taken up the sale of electric motor vehicles, but has adopted a somewhat novel plan in connection with the same. The vehicles are sold without the usual battery, the Electric Light Co. undertaking for a definite charge to regularly provide the machines with fully-charged batteries.

Wolverhampton.—Six Months' Tramway Results.—The Tramways Committee reports that the receipts for the year ended September 30th were £28,893, as compared with £27,206 in 1912, an increase of £1,687. The assessment of the undertaking has been increased from £2,500 to £5,294.

The Tramways Committee proposes to introduce a motor-'bus service on several routes at an early date.

TELEGRAPH and TELEPHONE NOTES.

Hand-Writing by Wire.—It has just been reported from Stockholm that the Swedish engineer, Widgreen, has invented a new method for the transmission of ordinary hand-writing and of pictures by wire. Patents have been applied for in 15 countries, and the rights have been transferred to a company which was formed recently at Stockholm. It is thought, says our correspondent in Norway, that the invention will become of great commercial value, and that it may effect a considerable reduction in the telegram rates. By means of the new apparatus ordinary hand-writing, as well as ordinary type, may be transmitted directly and reproduced at the receiving station with photographic accuracy. The apparatus can also be employed in connection with telephone wires. It is connected with an ordinary telephone apparatus, which can be used for telegraphic purposes or for telephoning alternatively.

Imperial Wireless Chain.—The Postmaster-General is prepared to consider applications to tender for the construction of the second three high-power wireless stations of the Imperial chain from any wireless company, syndicate, or contractors who are able by means of a practical demonstration to satisfy him of the capacity of the system for continuous efficient communication by day and night over a distance of not less than 2,000 geographical miles. Any person or company wishing to give a demonstration is invited to communicate with the Secretary to the Post Office before November 21st, stating the earliest date on which the demonstration can be given.

Japan.—Some new arrangements have lately been concluded between the Japanese Government and the Great Northern Telegraph Co., whereby the former is laying a new cable between Nagasaki, Japan, and Shanghai, China. The line will, however, be limited to the transmission of Japanese telegrams and Japanese and Chinese official dispatches. The cable between Formosa and Chuanchishan, which has hitherto been exclusively used for the service of the island, will in future be utilised for general international purposes, while the Ogasawara cable, which has hitherto been used for messages to America only, will now be employed also for messages to Hong Kong.

Johnson-Varley System.—Mr. A. T. M. Johnson (director of the Universal Cheap Cables, Ltd., and the Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd.) (in liquidation), has issued a circular to the shareholders, in which he states that "before the end of the present year the directors will be in a position to prove that the Johnson-Varley system is the only perfectly selective and secret system of wireless telegraphy in the world."

New Cable.—A new telephone cable is being laid between Holyhead and Dublin by the Post Office cable ship *Monarch*. The distance is a little over 50 miles, and the cable will be laid in two sections. Messages will go *via* Manchester.

Postal Servants.—A letter dealing with the agitation in the postal service over the findings of the Holt Committee has been addressed by the Postmaster-General to the National Joint Committee representing the Postal Unions. Mr. Samuel states that: "There is no prospect of the Government granting more money in increased wages than the sum recommended by the Committee. Withdrawal of labour by any member of the staff must be regarded as his resignation from the service," and it will be treated accordingly.

At a meeting of all grades of postal, telegraph, and telephone workers, at Bow, on Sunday, a resolution was passed condemning the Holt report. Mr. W. J. Ash, of the Postal Telegraph Clerks' Association, who presided, said that if the Postmaster-General's verdict was against them, there was nothing to stop their saying they were going to withdraw their labour. If postal and railway workers combined, something would happen.

The interview which the postal employés were to have had with the Postmaster-General on Tuesday in order to discuss the Holt report has been postponed until the 19th inst.

State-owned Cables.—At a sitting of the Dominions Royal Commission on Wednesday, Mr. Crabb, Second Secretary to the Post Office, said that the existing service provided by the Atlantic Cable Companies, was a good one, and the Post Office was convinced that the laying of a State-owned cable was not commercially justifiable. The cost of telegraphing had diminished at least 50 per cent. during the past 10 years. The possibilities of wireless telegraphy could hardly be overstated.

The Railophone System.—A number of erroneous reports having appeared in the daily Press, with regard to the experimental adoption of the Railophone system by the Midland Railway Co., the inventor, Mr. H. von Kramer, has issued a statement describing the system, which is being installed on a section of the Midland Railway near Derby.

Wireless Amateurs.—There has recently been a large increase in the number of licences granted by the Postmaster-General to amateur workers: at the close of the last financial year, March 31st, 1913, the number was 992, as compared with 258 at the end of the previous year, and there has been a considerable addition to the list during the first six months of the current financial year. In the majority of cases amateur stations are limited to a transmission range of about 20 miles, but a few of the more powerful installations have, when efficiently operated, a radius of about 100 miles. In addition to the Wireless Society of London, which hopes to include in its membership the large number of amateurs who have installations in the metropolitan district, wireless clubs have been formed at Derby, Liverpool, Northampton, Birmingham and Leicester, and efforts are being made to form similar societies or clubs elsewhere.

Wireless Telegraph Research.—The Postmaster-General has appointed a Committee "to consider how far, and by what methods, the State should make provision for research work in the science of wireless telegraphy, and whether any organisation which may be established should include problems connected with ordinary telegraphy and telephony." The members of the Committee are as follows:—

The Right Hon. C. E. H. Hobhouse, M.P. (chairman); the Right Hon. Lord Parker of Waddington; Sir Joseph Larmor, M.P., F.R.S.; Sir Henry Norman, M.P.; Dr. R. T. Glazebrook, F.R.S.; Mr. W. Duddell, F.R.S; Mr. R. Wilkins, C.B.; Rear-Admiral E. F. B. Charlton, R.N.; Commander J. K. Im Thurn, R.N.; Sir Alexander King, K.C.B.: Mr. W. Slingo; Commander F. Loring, R.N.; Major the Hon. H. C. Guest, M.P. The office of the Committee is at 6, Catherine Street, Strand.

The Postmaster-General is going to erect a small wireless station on the Marlborough Downs at a point about 5 miles from Devizes.

Wireless Telegraphy on Salvage Vessels.—The Dover Harbour Board, after obtaining tenders from manufacturers of wireless telegraph apparatus, have decided to equip their two salvage vessels—ss. *Lady Brassey* and ss. *Lady Crundall*—with wireless apparatus upon the quenched-spark system. The installations will be manufactured at Messrs. Siemens Bros. Woolwich works, and will be of their "E" type, the guaranteed ranges being 100 miles by day and 150 miles by night. This installation transmits about 0·2 kw. of electrical power. The major portion of the apparatus is enclosed in a cabinet, the dimensions of which are not greater than 4 ft. 8 in. × 2 ft. 2 in. × 2 ft. 2 in.

Wireless Telephony.—According to the *Telephone Engineer*, wireless telephone messages were lately sent over a distance of more than 600 miles from Rome to Tripoli, by Prof. Vanni, of the Military Wireless Institution, Rome. In these experiments he makes use of a liquid microphone based upon the ideas of Chichester Bell, brother of the celebrated Graham Bell. Using a microphone of this kind together with apparatus of the Moretti type, the voice could be very well heard at Tripoli, and persons there were able to recognise the professor's voice. After improving his apparatus, Prof. Vanni hopes to telephone between Rome and Paris.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 14th.—Two sections switchboard, common-battery multiple. See "Official Notices" October 17th.

Brisbane.—December 17th. For the P.M.G.: Insulators. See "Official Notices" October 31st.

December 31st. For the P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. Specifications (£5 5s.) from Agent-General for Victoria, on or after November 10th. Consulting engineers, Messrs. Merz & McLellan, 32, Victoria Street, S.W. See "Official Notices" last week.

Canberra.—November 26th. In connection with the preliminary work of the foundation of the Australian capital city, Canberra, there is at present a good deal of activity being displayed, and the Department of Home Affairs of the Commonwealth in Melbourne has issued specifications and conditions of contract for the water supply pumping plant at Canberra, tenders for which close on the 26th inst. Copies of the plans and specifications may be seen at the office of the High Commissioner for the Commonwealth of Australia, 72, Victoria Street, London, S.W.

Victorian Railways.—December 10th. One 15-ton electric crane for Ballarat. Tenders to "Tender Box," Railway Offices, Melbourne.

Belgium.—January 26th. The municipal authorities of Antwerp are inviting tenders for the supply of six electrically operated cranes.

November 16th.—The Fonderie Royale de Canons, in Liége, (80, Quai St. Leonard) is inviting tenders for the supply of the cables and accessories required in connection with the electricity mains that are to be installed at 11 forts in the Liége district, and at nine in the Namur district.

Bootle.—November 19th. 2,000 tons of steam coal and 2,000 tons of slack for the electric light station. Form of tender, &c., obtainable from the Borough Electrical Engineer, Pine Grove.

Bradford.—November 15th. Electrical installation, Technical College, for the Education Committee. City Architect, Town Hall.

Bulgaria.—November 17th. The Bulgarian Bureau of Finance in Sofia is inviting tenders for the supply and erection at the new electricity generating station at the State Collieries at Pernik of the following plant: Three tubular boilers, two 250-H.P. horizontal double-expansion steam engines, two three-phase generators, the necessary switchboards and transformers, and an electrically-operated pump of a capacity of 110 gals. per min.

Canada.—Calgary.—November 18th. City Commissioners, 1,000-kw. synchronous motor-generator and exciter set. Specifications from City Clerk. Deposit $2,000.

Dublin.—November 17th. Twelve months' supply of stores, for Dublin Tramway Co., Ltd. See "Official Notices" October 31st.

Gateshead.—November 25th. Electric lamps, electric wires and cables, electrical sundry fittings, arc lamp carbons, glasses for electric arc lamps, &c., for the North-Eastern Railway Co. Mr. E. H. Clark, Stores Superintendent, Gateshead.

Huddersfield.—November 17th. Slack required for the Electricity Department for 12 months. Particulars obtainable from Borough Electrical Engineer, St. Andrew's Road.

(*Continued on page 793.*)

THE LATE SIR WILLIAM PREECE, K.C.B., F.R.S.

Exactly 12 months ago, in an article in which he wished us "Many Happy Returns" on the fortieth birthday of the Electrical Review, Sir William Preece concluded by indulging the hope that he might "live long enough to compliment the Editors and proprietors at some future day on the jubilee of their achievement."

The fulfilment of that hope has, however, been denied him, for on the morning of Thursday last week, November 6th, he breathed his last at Penrhos, his Carnarvonshire home, where he had been laid aside for some time.

Within a few months he would have completed his eightieth year, and when it is remembered that it was in the days when Faraday was in his prime, occupying the minds of students of the day with his new electrical theories, propounded before the Royal Institution, that Preece came under his spell, and became his assistant, it will be observed that for more than 60 years he had been intimately interested in electricity and electrical applications. That is a record of which but few can boast. A man of even average activity and average ability can achieve much in 60 years; but Sir William was more assiduous than most, and possessed many excellent qualities and gifts, which he untiringly turned to good account in a variety of directions, and which brought him into more or less prominence.

Born at Carnarvon in 1834, and educated at King's College, London, after a brief experience in the engineering offices of the late Edwin Clark, he was, in his twentieth year, given an appointment with the Electric and International Telegraph Co., becoming Superintendent of the Southern Division in 1856. Subsequently he was employed as engineer in connection with the Channel Islands Telegraph Co. and as Telegraph Superintendent of the L. and S.W.R., and when the telegraphs were transferred to the State in 1870, he became a Divisional Engineer in the Post Office. Seven years later he was appointed Electrician, which rank he held for 15 years, until he became Engineer-in-Chief and Electrician in 1892. After another seven years he retired from active State service, but acted as consulting engineer to the British Post Office and the Colonies. On his retirement in 1899, he was honoured with Knighthood. Sir William, of course, did not cease from engineering interests when he left the Post Office, but joined his sons and Major Cardew in the consulting practice in which they were engaged at Westminster, and which is to-day so well known under the firm name of Preece, Cardew & Snell.

It was during his period as Engineer-in-Chief to the Post Office that Mr. Marconi came upon the scene in 1896, and Sir William, who had for many years been engaged upon important experiments in wireless transmission by electromagnetic waves, gave him every opportunity to demonstrate the practicability of his Hertzian wave system which has had so fine a record since. Indeed, one of the first to express sympathy with Sir William's relatives on Thursday last week was Mr. Marconi, who in his message said that the deceased gentleman was the first person in England to take an interest in his experiments and to lecture upon them. "It was due to his influence that I received considerable encouragement from the British Post Office."

In his official position, Sir William was perhaps mainly concerned with telegraphic and telephonic matters, but even as long ago as the date of his retirement, now some 14 years ago, electricity was rendering service in many other ways in connection with the vast undertakings of the Post Office.

The scientific institutions with which he was connected were numerous. As long ago as 1880 he was a president of the Society of Telegraph Engineers, and in 1893 he again presided over the deliberations of that organisation under its now better-known name, the Institution of Electrical Engineers. In 1881 he was elected a Fellow of the Royal Society. In 1888 he was Chairman of the Engineering (or Mechanical Science) Section of the British Association for the Advancement of Science, before which, 11 years earlier, he had exhibited the "first pair of telephones" shown in England—he referred with obvious pride to this interesting episode in his connection with matters telephonic in many of his public speeches in later years. Sir William was in 1898 President of the Institution of Civil Engineers, and he was also a Member of the Institution of Mechanical Engineers, the Physical Society, and the Meteorological Society. He was the author or joint author of many addresses and papers which are to be found in the *Proceedings* of these bodies, and a large number of them were reprinted in the pages of the Electrical Review. He was also the author of a number of standard works, notably the "Text-book of Telegraphy," which he prepared in collaboration with Sir James Sivewright; "The Telephone," in collaboration with Dr. Julius Maier; and later the "Manual of Telephony," in collaboration with Mr. A. J. Stubbs.

In recent years Sir William Preece had interested himself in movements for the better organisation of the electrical industry, and he showed a marked solicitude on behalf of the electrical worker who had fallen or was falling in the struggle, his sympathy and anxiety taking a very practical shape in his support of the Electrical Trades Benevolent Institution of which he was chairman of the committee almost from its inception and was president right up to the last.

> "A man so various that he seem'd to be
> Not one, but all mankind's epitome."

To Sir William's family—several of his sons are well known throughout the electrical profession—we tender our deepest sympathy in their bereavement.

The remains were laid to rest in the family grave at the Llanbeblig Parish Churchyard, Carnarvon, at noon on Tuesday, and a Memorial Service was held at St. Margaret's, Westminster, at the same time.

A large company assembled at the graveside at Carnarvon. The chief mourners included three of Sir William's sons—Mr. A. H. Preece, Mr. P. J. Preece, Mr. F. H. Preece; Mrs. Llewellyn Preece; Mr. and Mrs. David Moseley, son-in-law and daughter; the Misses M. F. and Amy Preece, daughters; and Mr. J. R. Preece, brother. The firm at Westminster was represented by Mr. J. H. Woodward. The Mayor and Corporation of Carnarvon were in attendance, and representatives were also present from the local Harbour Trust and the British and Foreign Bible Society, with both of which the late Sir William was identified. The vicar conducted the service. Among the wreaths were tributes from the President and Council of the Institution of Electrical Engineers, the Electric Lodge of Freemasons, and the American Institute of Electrical Engineers. Many messages of condolence were received, among them being one from the Postmaster-General and another from Lady Kelvin.

At the memorial service held at Westminster, a distinguished company was present, including Sir John Gavey, the Hon. R. Clere Parsons, Sir A. F. King, Sir J. A. Ewing, Prof. S. P. Thompson and Prof. Unwin representing the Royal Society, Prof. E. Wilson (King's College), Mr. W. Slingo (Engineer-in-Chief to the Post Office), Mr. A. P. Trotter, Dr. Glazebrook (National Physical Laboratory), Prof. Fleming, Mr. J. F. C. Snell and Mr. Alexander Siemens.

On behalf of the President, Mr. C. O. Mailloux, the directors, and members of the American Institute of Electrical Engineers, a handsome wreath was sent down to Carnarvon, and the Institute was officially represented at the memorial service at St. Margaret's, by Mr. C. Le Maistre, secretary of the I.E.E., in the absence of Dr. H. F. Parshall, who is abroad.

By the instruction of the Committee of the Electrical Trades Benevolent Institution, Mr. F. B. O. Hawes, the secretary, sent a letter of condolence to the members of the family, and in the absence of Mr. Justus Eck, the chairman of the Committee, Mr. Hawes represented the Institution at St. Margaret's.

SIR WILLIAM PREECE.

By Sir John Gavey.

One of the best-known personalities in scientific, electrical and engineering circles has passed away, after an active career extending over nearly 60 years. Always in the limelight, he was an indefatigable worker, who commenced his day's operations at 6 a.m., appeared at his offices from 10 to 7, and thence till midnight was to be encountered at any one of the many scientific and social functions in London, where his cheery presence was always welcome. He was a miracle of industry, and only the strongest constitution would have permitted such a constant strain as his was exposed to without serious results. He was equally at home and equally well known in the United States of America, which he visited several times, and on the Continent of Europe where he represented the service of the State on sundry occasions, as he was in London.

He was one, of whom few are now left, who witnessed the entire growth of modern electrical engineering, and who himself took a most active share in its development all through his life. To look back to the period when he commenced his career, when electrical engineering was confined to telegraphy, when only minute electrical currents of a few milliamperes could be generated and maintained for any lengthy period, when there were no units of measurement other than the resistance of a mile of No. 16 B.W.G. copper wire of indefinite composition, and the potential of a Daniell's cell was the standard of voltage, when submarine telegraphy was in its infancy and land telegraphy only partially developed, and when there was scarcely a text-book on electricity and magnetism worthy of the name, and to compare that period with the present when electrical engineering embraces every sphere of life and has invaded every branch of industry and electrical literature suffices to fill a large library, enables one to realise the intense happiness which a man of his personality must have enjoyed in a life spent in the midst of the growth and development of the art to which he was wedded and which in so few years have led to such results.

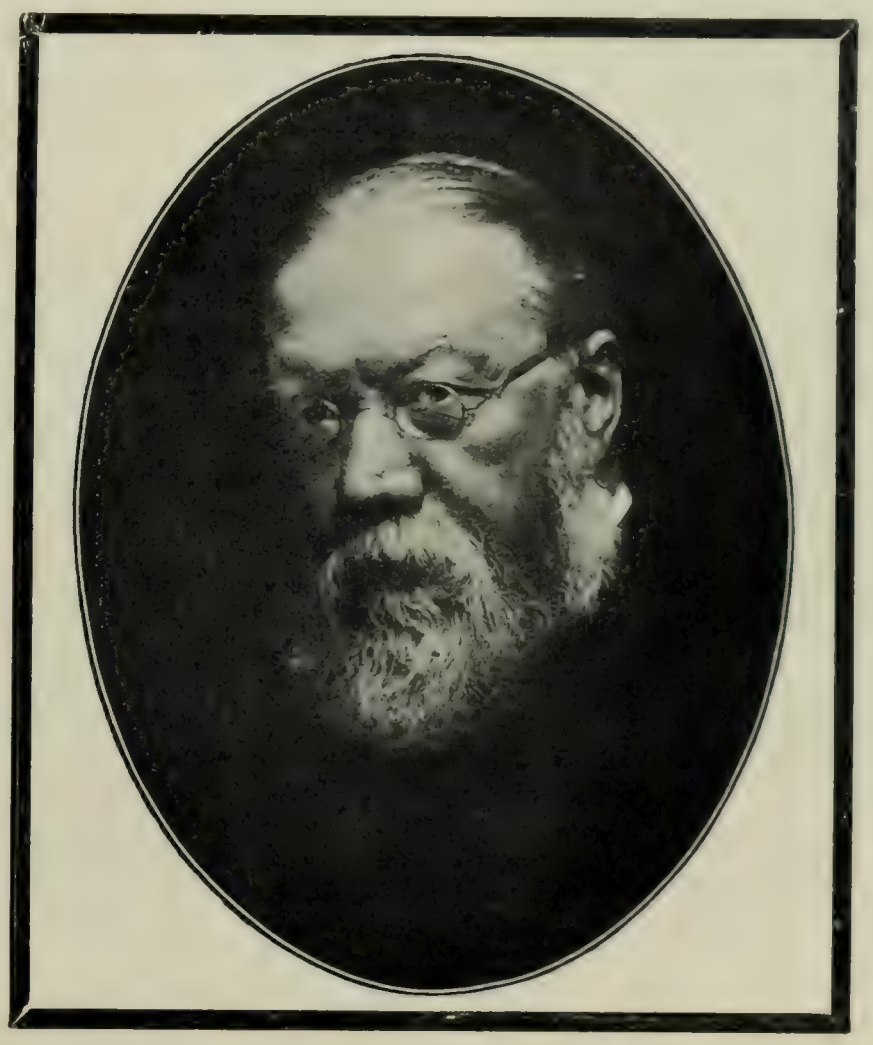


Photo. by [*Histed.*

His general career has been described elsewhere, but perhaps a brief reference to one or two incidents may not be amiss.

When associated with the London and South-Western Railway in the sixties, his practical mind turned to the subject of block signalling on railways, which was then only very sparingly used by a few companies. He devised a system the prominent feature of which was the reproduction of the outdoor signals by miniature signals placed in the signal boxes and worked electrically. He was thus an early pioneer in one branch of electrical work, which, as now in use, doubles the carrying capacity of our railways.

Later he was in America when Graham Bell produced the form of telephone that is now in practical use throughout the world as a receiver, and those who knew him well can realise the sanguine joy with which he exhibited the two telephones he brought back with him. In the course of the year 1877 he delivered a lecture on the subject before the British Association at Plymouth, and to illustrate it he arranged that an assistant should speak from Exeter to Plymouth late in the evening when the wires were idle. At the close of his lecture he invited one of the most eminent persons in the audience to open the conversation. The gentleman took up the instrument, and shouted, "Hi diddle, diddle!—follow that up." A slight pause, when he repeated triumphantly, "The cat and the fiddle." The next day we heard from our friend who had returned to Plymouth, that he had not distinguished a word owing to the induction on the wires, and that his reply was, "I cannot hear you. Repeat." An illustration of the sanguine use of the scientific imagination.

His endeavours to solve the problems of wireless telegraphy are well known, but the narrow limits beyond which it was impossible to communicate by electromagnetic induction between parallel wires led to the abandonment of the method when the Hertzian wave system was introduced.

As a sequel to the numerous experiments in various parts of the country with electromagnetic induction, a trial was made between a point on the coast near Cardiff and the Island of Flat Holm, in the Bristol Channel, the localities in which, by the way, at a later date the crucial experiments with Marconi's methods were conducted.

Two parallel wires being provided, and everything ready for the trial, Preece came down to witness the experiments. The weather proved too stormy to land on the island, and, after a couple of days' waiting, he returned to London. The next day, the weather having calmed, the writer reached the island, and in the course of the day received the first message transmitted by this method across an arm of the sea, which message dramatically announced the death of the then Engineer-in-Chief of the Post Office—Mr. Edward Graves.

No appreciation of his character would be complete without a reference to his pre-eminence as a lecturer or public speaker. When lecturing, the lucidity of his address, his logical methods of leading up to his main points, and his clear illustrations, carried conviction to all. As a public speaker he exercised a magnetic influence over his hearers, and on one occasion when he had been particularly happy, he was styled by a large section of his audience the Demosthenes of Electricity.

To speak at any length of Preece's general work, or of his association with the many institutions to which he was affiliated, would far outstep the limits of this notice.

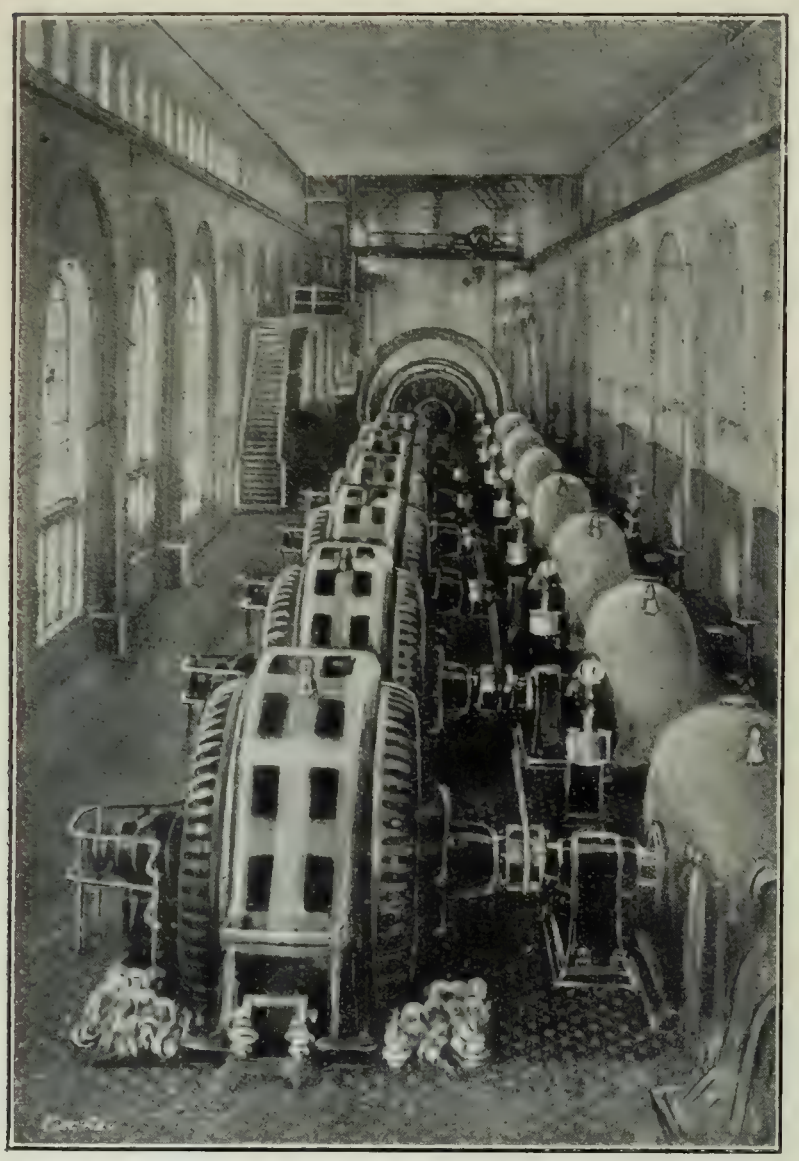
As an administrator, the one quality which, perhaps, the writer admired most, was his encouragement of originality and of the assumption of responsibility by his assistants and subordinates. These qualities, which are not too generally exhibited by the majority of employés, are not always fostered as they should be by heads of departments. The advantages that young men in their early training derive from being taught at the outset of their careers the very elements of their future success in life are incalculable.

Finally, as an individual he was a warm friend, a genial cheery spirit, with a large fund of humour, enjoying a joke or a good story, but above all his deep and unwearied interest in the development of his profession was his most marked characteristic. His name was almost a household word, and he has left behind him an immense circle of friends to mourn his loss.

A NORWEGIAN HYDRO-ELECTRIC PLANT.

[BY OUR NORWEGIAN CORRESPONDENT.]

The Tyssefaldene Co. was recently formed for the purpose of developing hydro-electric power from the Tysse River, which flows in the south-west of Norway into the Sör-fjord —one of the many small fjords of the Hardangerfjord.



Interior of the Tysse Power Station.

The river runs through a barren and mountainous district, at an average altitude of 1,000 m. above the sea-level, forming in its course six different lakes, of which the Ringedals Lake and the Vetlevandene are the lower ones. The total area of the watershed is about 378 km. sq., including the above lakes. The power scheme was divided into two sections, the first of which has already been two-thirds completed, while the second stage will be completed later on.

The first section is intended to develop 62,250 KW. at a power station at Tysse, by the installation of the necessary generating plant after the preparatory works in connection with the water supply have been completed.

The second stage includes the erection of a new power station at Skjäggedal, which will be capable of producing 18,000 KW., and be situated on the biggest tributary to the Tysse River, viz., the Mogeli River, which flows into the Vetlevandene after having passed two small lakes. The Skjäggedal station is situated higher up than the Tysse station, and the same water will thus be employed twice. The area of the water shed of the Mogeli River is about 31 km. sq., and the power station will be situated 200 m. higher up than the storage basin for the Tysse station, viz., the Ringedals Lake.

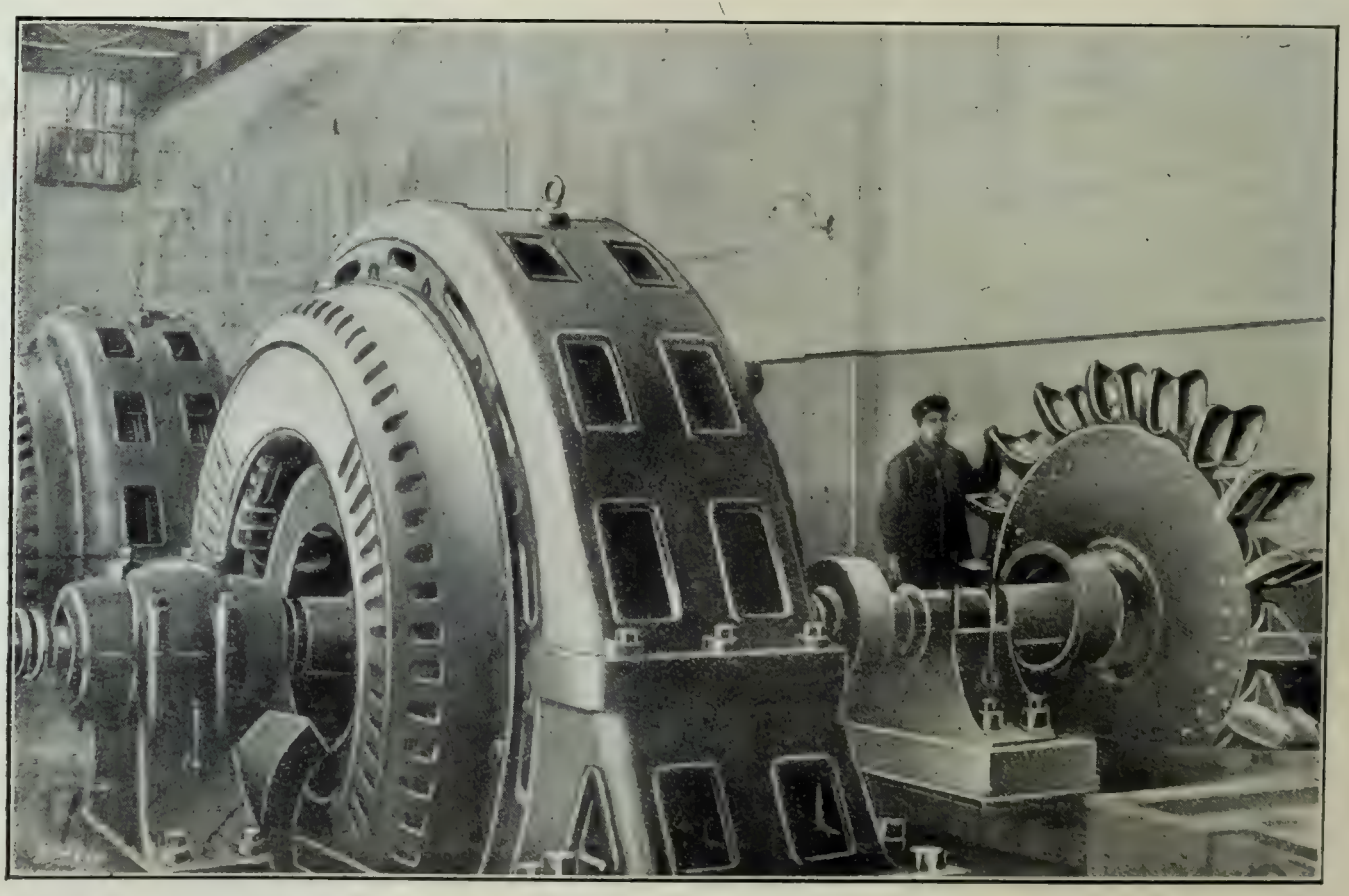
After the completion of the whole scheme the company will thus have for disposal a total of 112,000 KW., viz., about 94,000 KW. from the Tysse Station, of which 62,250 KW. are already provided for and partly in use, and 18,000 KW. from the Skjäggedal Station.

The Tysse Power Plant.—A dam has been built across the lower end of the Ringedals Lake, at an elevation of 448 m., from which the water passes through two tunnels, each 150 m. long, into the Vetlevandene. The tunnels are fitted with a gate and throttle valves for controlling the discharge of water. From the Vetlevandene the water is carried along the side of the mountain through a tunnel constructed in the rock, 3,420 m. long, terminating in the penstock chamber at Tyssenut. From the chamber the water falls through four pipe-lines down to the turbines in the power station, which is on the shore of the Sör-fjord.

Seven main and two exciter units, constructed by the Allmänna Svenska Elektriska Aktiebolaget are in operation, and two other large units with exciters have been delivered by the A.G. Siemens-Schuckert, of Berlin.

The first seven units are horizontal three-phase generators, each having a normal capacity of 3,300 KW., and operating on a power factor of ·8, corresponding to 4,100 K.V.A. These generate 12,000-volt 25-cycle current, and run at 375 R.P.M.; the machines are coupled direct to Pelton turbines. The rotating generator field is manufactured from steel castings with the poles cast on, and has a diameter of 1·95 m.; it is guaranteed to withstand a momentary speed of 700 R.P.M. in case sudden unloading should occur.

The first two exciter machines are shunt-wound generators of 165 KW. each, at 110 volts and 750 R.P.M., and are also coupled direct to horizontal Pelton turbines. In case of accidental unloading they are guaranteed to be able to run at a speed of 85 per cent. in excess of the normal. The two main units of German construction are horizontal three-phase generators, each of 9,600-KW. capacity at 250 R.P.M., the pressure being similar to that of the other units.



3,300-KW. Generating Unit, showing Pelton Wheel.

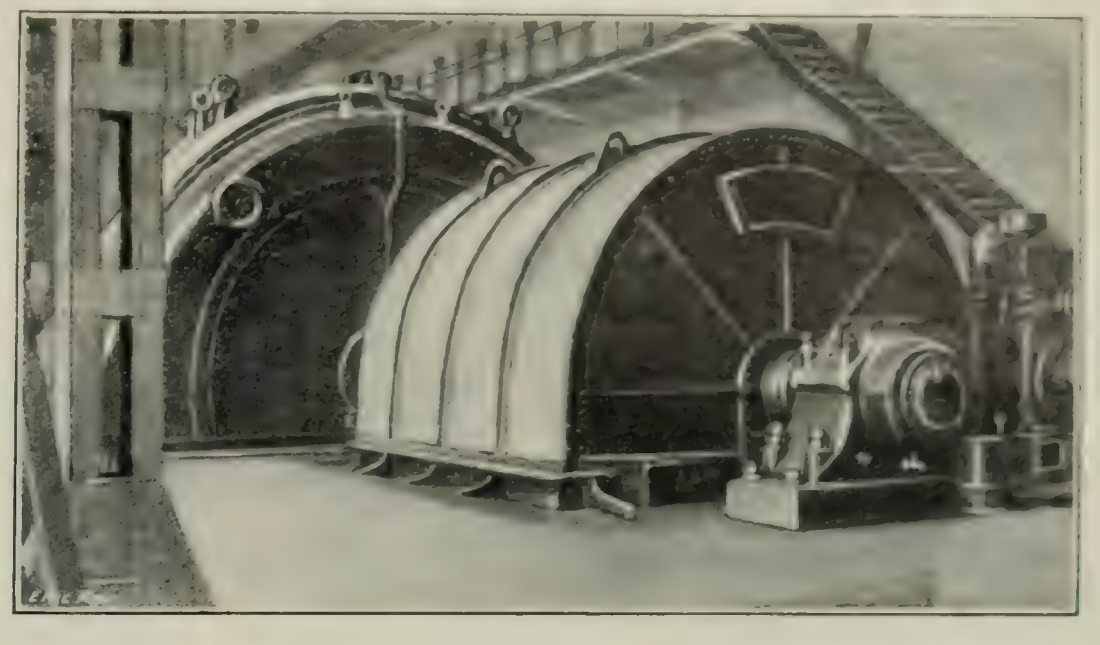
These also are coupled direct to Pelton wheels. The stator, divided into four parts, has an external diameter of 6·8 metres. The rotor is built up solid with 12 poles, and is 4,462 metres in diameter, and complete with the axle, weighs 56 tons. It will withstand momentary increases of speed up to 450 revolutions per minute. The two exciter units are shunt-wound 110-volt generators of 182 KW., and run at 750 R.P.M.; they are direct-coupled to Pelton wheels, and can safely exceed the normal speed by 80 per cent.

Our various illustrations show the interior of the Tysse power station from either end.

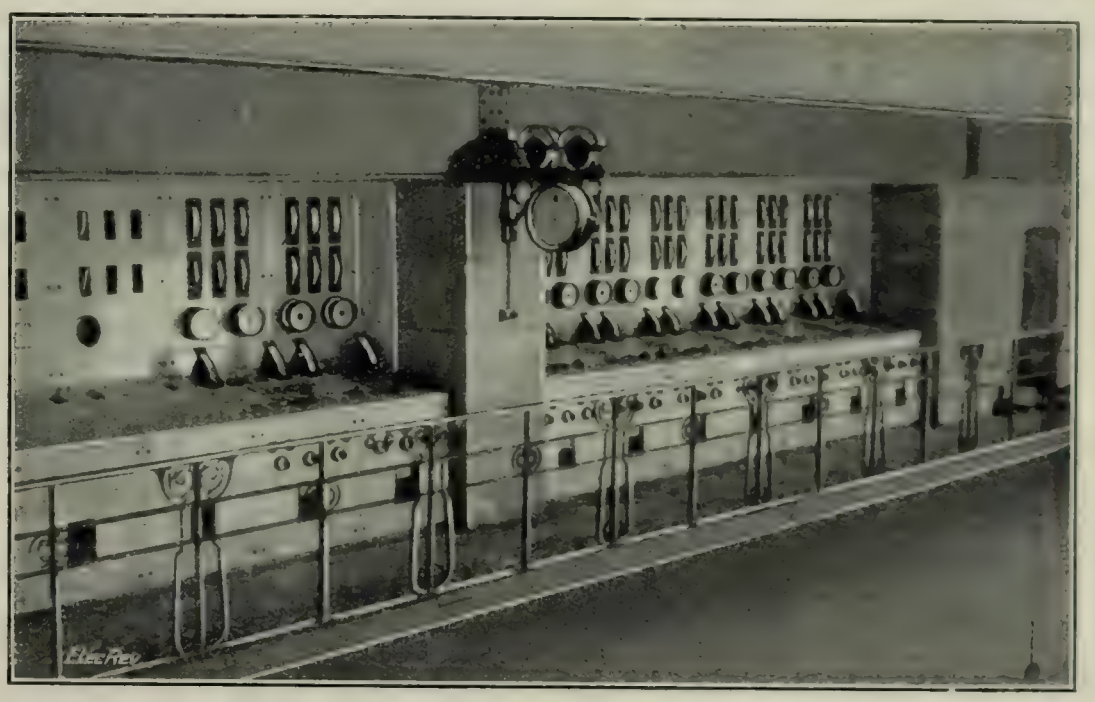
Two units which have been delivered by the Westinghouse Co. are being erected; these are of the same capacity as the Siemens-Schuckert generators. Three further generators will be installed as soon as the extension of the power station is carried out. One of these will have a rated capacity of 13,500 B.H.P., while the two others will be of 15,000 B.H.P. each.

Transmissions.—Only a portion of the energy produced at the Tysse power station is used on the spot; the greatest part is transmitted 6½ km. to Odda, which, from a desolate country place, has grown during recent years into an industrial centre. The chief customer of the A.G. Tyssefaldene at Odda is the Alby United Carbide Factories, which are consuming 47,500 KW., while the North-Western Cyanamide Co. takes 4,500 KW. The Hardanger Electrical Ironworks also has a contract with the company for up to 6,000 KW., but these works have been closed down for the present, and the contract has been taken over by another firm, which is now building factories.

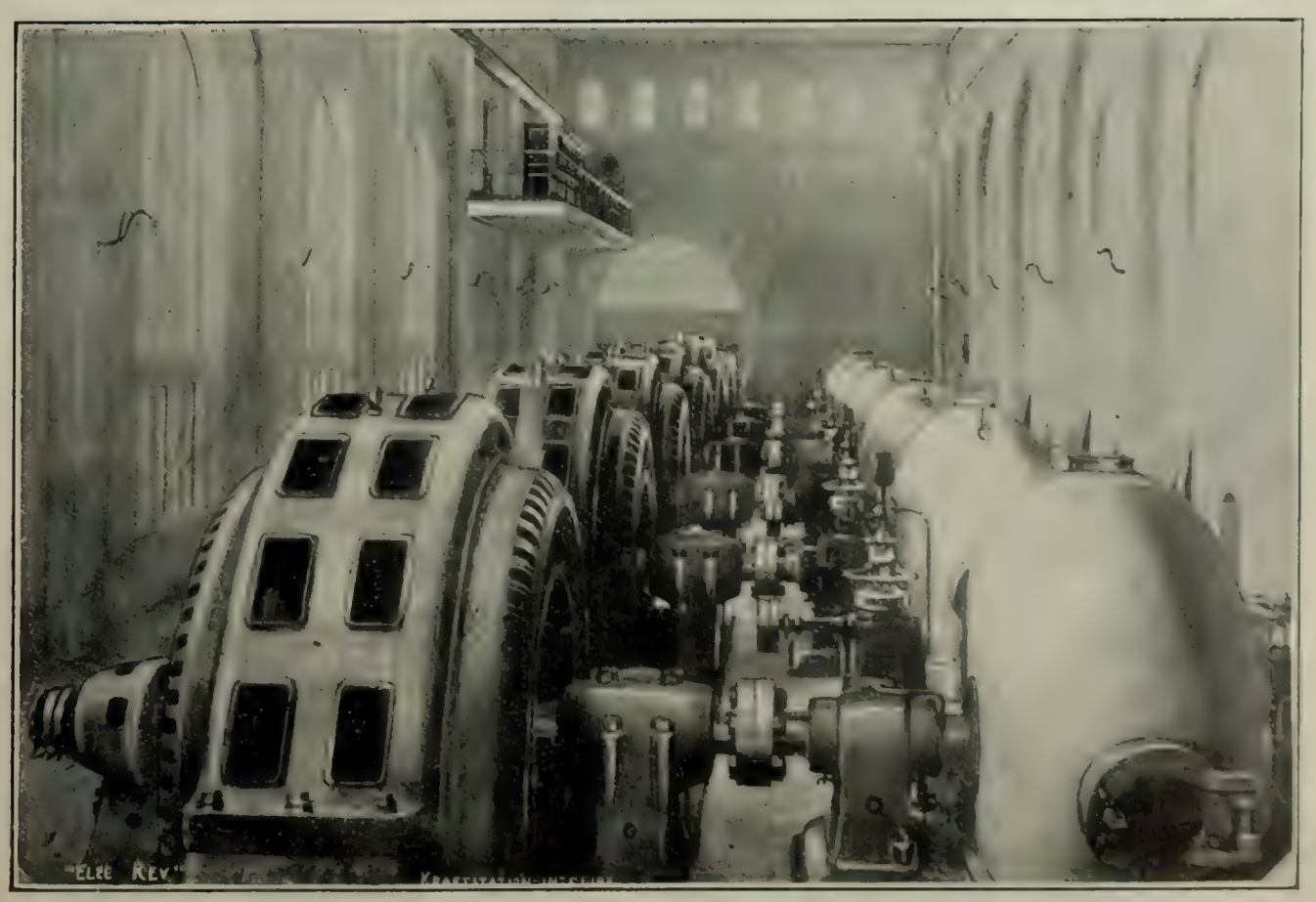
The electrical energy from Tysse to the Alby United Carbide Factories is carried by duplicate transmissions, each consisting of two lines, with three aluminium cables.



9,600-KW. GENERATING UNIT, TYSSE POWER PLANT.



THE MAIN SWITCHBOARD.



ANOTHER INTERIOR VIEW OF THE TYSSE POWER STATION.

Of the four lines, three are regularly used, the fourth being kept in reserve. The transmission lines are provided with four switch-towers for facilitating their operation.

In one place it has been found necessary to lead the cables through a tunnel 700 m. long, in order to avoid disturbances in the working due to avalanches, &c.

The supply to the North-Western Cyanamide Co. is conducted to the factories by means of two underground lines, each consisting of three copper cables of 120 mm. diameter.

The switchgear and instruments at the power station were supplied by the British Westinghouse Co., and are of the most modern type.

The Tyssefaldene Co.'s plant is typical of the numerous hydro-electric developments which are being carried out in Norway and Sweden at the present time, and which are contributing largely towards the industrial progress of these countries, especially in the production of electro-chemicals, wood pulp, &c., and in the operation of numerous railways.

A BRIGHTON HOTEL KITCHEN.

The directorate of the Old Ship Hotel, with which famous old hostelry a good many of our municipal electrical friends made a passing acquaintance a few years back, have recently carried out some important alterations, including, in addition to certain reconstruction work and refurnishing, the adoption of electrical cooking.

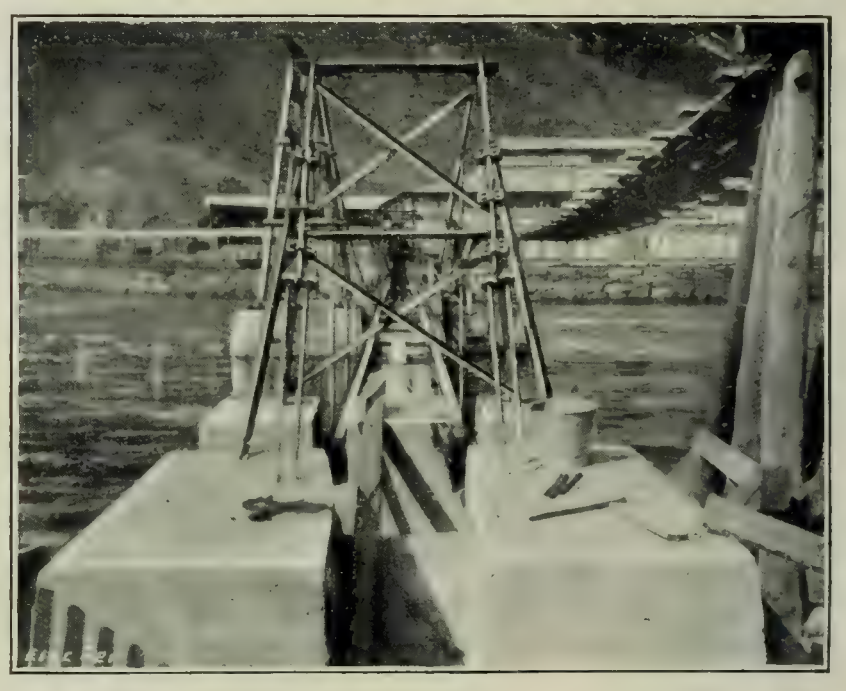


Pipe and Transmission Lines, Tysse Power Plant
(Page 791).

Through the courtesy of Mr. John Christie, borough electrical engineer, Brighton, we are enabled to illustrate and give some details of the cooking equipment, which has been installed in a specially-built kitchen, under the direction of his department, by Messrs. Page & Miles, of Brighton, and is entirely dependent on the Corporation electricity supply for current.

The equipment, which was manufactured by the Jackson Electric Stove Co., consists of a range of four ovens, each measuring inside 24 in. × 20½ in. × 20½ in., with hot cupboards separately heated about the ovens; each oven has a 5-kw. loading, and the hot cupboards approximately 2 kw. each, making a total of 24 kw. There are also a grill, 36 in. × 12 in., with a hot cupboard above (7 kw. loading in grill and 1 kw. in hot cupboard) having a total loading of 8 kw.; a fish fryer consisting of two oval pans, each measuring 18 in. × 12 in., fitted with draining rack, and having a total loading of 5 kw.; a hot-plate for boiling purposes, 4 ft. × 2 ft., containing four 12-in. boiling rings, each with a loading of 2·5 kw., making a total of 10 kw.; and two large vegetable steamers with a loading of 10 kw.

The equipment is now doing the whole of the work of the hotel, including banquets, and has given very satisfactory results, as regards the quality of the cooked food, simplicity of operation, and low cost of working with electricity at 1d. per unit, amply vindicating the claims which were put forward by the electricity department when the question was under discussion. The directors, who are to be congratulated on their enterprise in this matter, are now considering the question of electrical heating as well as lighting and cooking; the large garage attached to the hotel has already been fully equipped for charging the batteries of electric automobiles belonging to visitors who may be staying at the hotel.



Transmission over River, Tysse Power Plant
(Page 791).

In conclusion, we may congratulate Mr. Christie on having been instrumental in obtaining such an important addition to the list of such installations.



The Specially Built and Equipped Electric Kitchen at the Old Ship Hotel, Brighton.

CONTRACTS OPEN.

(*Continued from page 787.*)

Italy.—Naples.—November 29th. Tenders are invited for the supply of all the material and the electrical and mechanical appliances required for three distribution cabins located in Montaquila, Calvi Risonta and Melito, on the transmission line from Cape Volturno to Naples. Preliminary deposit 3,000 lire. Particulars of the Società Volturno, in Naples.

Keighley.—The Tramways Committee has recommended that tenders be obtained for the overhead equipment and trolley vehicles necessary for installing the Cedes-Stoll system of trolley vehicles on the Oakworth and Eastburn routes.

London.—Hammersmith.—November 14th. Corporation: Arc lamps for fixing on consumers' premises, to work two in series on single-phase A.C., 50 periods 110 volts. See "Official Notices" November 7th.

L.C.C.—November 26th. Installation, 140 lighting points, at Hammersmith Trade School for Girls, Lime Grove. See "Official Notices" November 7th.

November 26th.—Installation, 240 lighting points, at Lancaster Road Elementary School, Notting Hill, W. See "Official Notices" to-day.

Fulham.—November 26th. Corporation. 2,500-kw. turbo-alternator and condensing plant. See "Official Notices" to-day.

Manchester.—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" November 7th.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Plymouth.—December 1st. Corporation. Contract No. 31. Ironclad high-tension switch panels. See "Official Notices" to-day.

Rainhill (near Liverpool).—November 24th. Wiring and fittings for new ward, Lancashire County Asylum. See "Official Notices" November 7th.

Rhyl.—November 19th. One 160-kw. Diesel engine set, for U.D.C. See "Official Notices" October 17th.

Spain.—Tenders have just been invited by the municipal authorities of Pals (Gerona province) for the concession for the electric lighting of the town during a period of 10 years.

November 30th. The Spanish Ministerio de Fomento in Madrid is inviting tenders for the concession for the construction and working of a new electric tramway in the Spanish capital, between the Paseo de la Delunas and the Puente de la Princèsa.

Valencia.—November 18th. Electric crane for the handling of coal at the port of Valencia. Particulars from the Secretary, Junta de Obras del puerto de Valencia.

The Azores.—The Junta Geral of the district of Ponta Delgada, St. Michael's, Azores, is opening a competition, for 90 days, for the construction and exploitation of an electric railway to be laid between Ponta Delgada and the Valley of the Furnas, and Ponta Delgada and the town of Ribeira Grande. Particulars at the Portuguese Consulate in London and at Messrs. Wm. Hooton and Yates, 12, Fenchurch Street, E.C.—*Financial Times.*

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

Warrington.—November 14th. Telegraph materials and carbons for a year, for the Cheshire Lines Committee. Stores Superintendent, Cheshire Lines, Warrington.

CLOSED.

Australia.—According to the *Australian Mining Standard*, the Sydney Municipal Council has accepted the tender of Messrs. Siemens Bros. for a 1,500 kw. rotary converter, for the Town Hall sub-station, at £4,380; also the tender of the British Insulated and Helsby Cables, Ltd., for 17 feeder pillars, for £975; and that of Messrs. Ferranti, Ltd., for extensions to sub-station L.T. switchboard, at £144.

Victorian Public Works Department:—

Electric lighting plant at Hospital for Insane, Mont Park, £210.—Sutherland & Ashman.
Cables, &c., at the Sanatorium, Cheltenham, £256.—Noyes Bros. Pty., Ltd.

Board of Water Supply and Sewerage, Sydney:—

Insulated cable for Balmain low-level pumping station telephone service,—W. T. Henley's Telegraph Works Co., Ltd.—*Tenders.*

Bridlington.—The T.C. has accepted the tender of Messrs. Willans & Robinson, Ltd. for pipes, valves, plating and pipe covering in connection with the installation of a turbine and generators at £420 and also for the necessary switchboard panel at £220, and for spare parts for the turbine at £—.

Bristol.—The Docks Committee of the T.C. has accepted the tender of the Electric Construction Co. for spare starters for motors at the Royal Edward Dock Granary.

Cambridge.—The C.C. has accepted the tender of Messrs. Baily, Grundy & Barrett, Ltd. for electric light fittings and bells for the new county offices at Cambridge at £—.

Cape Town.—The tender of Messrs. Siemens, Ltd., has been accepted for petrol engine, dynamo, accumulators and switchboard for the Royal Hotel, Hout Bay, near Cape Town. The contract for the wiring of the hotel, winter garden, tea terrace, &c., has been placed with Messrs. E. A. Shaw & Co., who are also the successful tenderers for the erection of the generating plant.

Germany.—As will be remembered, the Prussian State Railway Administration obtained the sanction of the Diet some time ago to a scheme for the conversion of the Berlin City Railway to electric traction, it being intended to substitute electric locomotives for the existing steam engines, while continuing to use the present carriages. It is now announced that orders have just been placed for the first batch of 60 locomotives, which are to be supplied by the Siemens-Schuckert Works, the A.E.G. and the Maffey-Schwarzkopff Works at a cost of £4,750 per locomotive. Apparently a change in the original programme has been made, for it is stated that the railway authorities intend to erect State power stations of their own at Rummelsburg, near Berlin, and at Charlottenburg respectively, whereas the former scheme was to procure a supply of power from outside sources.

Glasgow.—The Cleansing Committee of the T.C. recommends the acceptance of the offer of the Macfarlane Engineering Co., Ltd., for the supply of three electric motors for power purposes at the granary in Graeme Street.

London.—The Metropolitan Railway Co. has placed a contract for incandescent lamps for next year with the Edison and Swan United Electric Light Co.

Battersea.—The tenders of the Foster Engineering Co., and Electrical Street Lighting Apparatus Co., have been accepted by Battersea B.C. for a supply of metallic-filament lamps for public street lighting and street lighting fittings, respectively.

Marylebone.—Messrs. William Cory & Sons have received the contract from the Marylebone Council for a supply of 20,000 to 25,000 tons of steam coal to the Electricity Department, at 14s. per ton; and Messrs. A. Blackmore & Co., that for the supply of 10,000 tons at the same price.

Newport (Mon.).—The contract for the electric light installation at the new offices for the Monmouthshire County Council has been awarded to Messrs. A. G. Arnold & Son, Newport.

Padiham.—Messrs. Frank Thornton & Co. have secured the contract for the complete electric lighting installation of the new Cinema Theatre, Padiham, near Burnley.

Paisley.—It is stated that Messrs. Fullerton, Hodgart and Barclay have secured an order from the East Rand Proprietary Mines, Ltd., for a large electric winder. The plant is to be capable of winding eight tons of ore from a depth of 4,500 ft. at a speed of 3,000 ft. per minute. The winder is arranged for double motor drive on the "Ward-Leonard" system, and is said to be the largest plant of this type which has ever been installed in any mine. The firm supplied recently to the same mines an installation of four steam-driven air compressors, with a capacity of 55,400 cb. ft. of air per minute.

Sheffield.—The following tenders have been accepted for supplies to the electricity department:—

British Electric Transformer Co., Ltd.—Two 100 k.v.a. testing transformers, £108.
Firth, Blakeley, Sons & Co., for Neepsend power house, wrought steel shoot, £116.
Army and Navy Manufacturing Works, Ltd.—1,200-1,300 uniform caps, 2s. 9d. each, and 1,200-1,300 black waterproof covers, 1s. each.
West End Clothiers Co., Ltd.—1,200-1,400 pairs of trousers, 12s. per pair; and 350-400 motor-men's melton reefers, 22s. 6d. each.
R. S. Whitworth, Ltd.—600-700 conductors' serge reefers, 20s. 3d. each.
Brightside Foundry and Engineering Co., Ltd.—Engineering work at Holme Lane Car Depot, £11,118.

Tunbridge Wells.—The Corporation cable contract for the ensuing year has been placed with the Western Electric Co., Ltd.

Walsall.—The T.C. has accepted the tender of Callender's Cable Co., Ltd., at £124, for laying a length of cable from the Bridgeman Street sub-station to the corner of Queen Street. The tender of the British Westinghouse Co., Ltd., has also been accepted, at £27, for the supply of a motor and starter.

Worthing.—The T.C. has accepted the tender of Messrs. Mirrlees, Bickerton & Day, Ltd., for a Diesel oil engine and generator at the electricity works, at £1,168.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, November 14th. Paper on "Electric Tram-Car Equipment," by Mr. S. James, and visit to depôt.

Junior Institution of Engineers.—Friday, November 14th. At 8 p.m. At Victoria Station Restaurant. Smoking Concert. Saturday, November 15th. At 3 p.m. Visit, Saltley Gas Works, Birmingham.
Monday, November 17th. At 7 p.m. At Institution of Electrical Engineers, Victoria Embankment. Annual general meeting. Benevolent Fund annual general meeting, and paper on "The Institution," by Mr. E. King.

Northampton Engineering College Engineering Society.—Friday, November 14th. Discussion on "The Future Sources of Energy."

Physical Society of London.—Friday, November 14th. At 8 p.m. At Imperial College of Science, S.W. Papers on "Thermal Conductivity of Mercury by the Impressed Velocity Method," by Mr. H. R. Nettleton, B.Sc. "Polarisation and Energy Losses in Dielectrics," by Mr. A. W. Ashton, D.Sc. A Lecture Experiment to illustrate Ionisation by Collision and to show Thermoluminescence, by Mr. F. J. Harlow, B.Sc.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, November 15th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Wireless Experiments," by Mr. J. R. Laird.

North-East Coast Institute of Engineers and Shipbuilders (Graduates' Section).—Saturday, November 15th. At 7.15 p.m. Paper on "Centrifugal Pumps," by Mr. A. Temple Thorne, B.Sc.

Electro-Harmonic Society.—Monday, November 17th. At Holborn Restaurant. At 8 p.m. Ladies' Night.

Institution of Electrical Engineers (Newcastle Local Section).—Students' Section. Monday, November 17th. At 8 p.m. At Armstrong College. Inaugural meeting.

North of England Institute of Mining and Mechanical Engineers (Newcastle Section).—Monday, November 17th. At 8 p.m. At Chemical Theatre, Armstrong College. Third lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, November 18th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Papers.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 18th. At 7.30 p.m. At the University (Physical Laboratory). Paper on "A Two-rate Tariff System Without Time-operated Control," by H. H. Perry.

Illuminating Engineering Society.—Tuesday, November 18th. At 8 p.m. At Royal Society of Arts, 18, John Street, Adelphi. First meeting.

Batti-Wallahs' Society.—Wednesday, November 19th. Informal Evening.

Royal Society of Arts.—Wednesday, November 19th. At 8 p.m. At John Street, Adelphi. Opening meeting.

Chemical Society.—Thursday, November 20th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Institution of Mechanical Engineers.—Thursday, November 20th. At 7.30 p.m. At Memorial Hall, Manchester. Paper on "Cutting Power of Lathe-Turning Tools," by Prof. W. Ripper. Members of Manchester Association of Engineers are invited. Friday, November 21st. At 8 p.m. At Meeting Hall, London. Same paper.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, November 17th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, November 18th.—"B" Company. Ditto.

Wednesday, November 19th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, November 20th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, November 21st.—"D" Company. Technical instruction, 7.30 to 10 p.m.

Saturday, November 22nd.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Captain R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Copper.—Messrs. Merton's statistical circular for October shows a decrease in English stocks of 1,856 tons, while French stocks have increased 258 tons during the month. The quantity generally known as "European supplies" stands at 21,350 tons, showing a decrease of 1,173 tons on the month. The supplies, including Rotterdam, Hamburg and Bremen, and estimates for other ports, are 27,377 tons.

Arrivals from North America have been low, from Spain and Portugal (always a fluctuating quantity) high, from Chile average, and from Australia slightly under the average. "Other countries" not specified by name have this month contributed 6,517 tons to England and France. This month American supplies are 60 per cent. of the whole delivery. Deliveries at 40,991 tons are fair, but below the average. The world's supply at the end of September was 41,119 tons. American stocks were given as 13,300 tons. In the face of such a position the moderation of the price is worthy of notice.

Royal Commission on Railways.—The first meeting of the Commission for the purpose of hearing evidence will be held to-day, Friday, November 14th, at Winchester House, St. James's Square, at 10.30 a.m.

Foreign Trade in October.—The following are the electrical and machinery figures given in the official returns for October trade :—

Imports.	*Month of Oct.* £	*Inc. or dec.* £	*Ten months, 1913.* £	*Inc. or dec.* £
Electrical goods, excluding machinery and uninsulated wire	146,858	+ 7,035	1,277,781	+ 101,582
Machinery	656,539	+ 6,545	6,101,150	+ 455,327
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	356,763	—189,816	4,121,152	+ 375,803
Machinery ...	3,271,296	—174,574	30,760,860	+ 3,258,605

Northampton Polytechnic Institute.—The annual prize distribution, by Mr. Cyril S. Cobb, chairman of the L.C.C., takes place on Friday, December 5th.

Nobel Prizes.—The Swedish Academy of Sciences has decided to award this year's Nobel's Prize for Physics to Prof. Kamerlingh Onnes, of Leyden, Holland, and the Prize for Chemistry to Prof. Alfred Werner, of Zurich. Each prize is worth about £7,880.

Institution and Lecture Notes.—Royal Society of Arts.—The arrangements for the present session include the following :—

Wednesday, November 19th.—Opening meeting. Address, by Col. Sir T. H. Holdich, R.E., &c.
Wednesday, December 10th, at 8 p.m.—Mr. T. Thorne Baker, on "Applications of Electricity to Agriculture and Life."

Papers to be Read After Christmas.

A. J. Wallis-Tayler, Assoc.M.Inst.C.E., "The Preservation of Timber."
W. R. Ormandy, D.Sc., F.C.S., M.I.Automobile Eng., "Alcohol as a Motor Fuel."
F. W. Goodenough, "Coal Gas as a Fuel for Industrial Purposes."
W. S. Rogers, "Posters."
W. B. Bottomley, M.A., Ph.D., F.L.S., "Bacterial Treatment of Peat, and its Application as a Fertiliser."
Sir R. W. Perks, Bart., Assoc.Inst.C.E., "The Montreal, Ottawa and Georgian Bay Canal."

Cantor Lectures.

Monday evenings, December 1st, 8th and 15th at 8 o'clock.—E. G. Coker, M.A., D.Sc., Professor of Mechanical Engineering and Applied Mathematics, City and Guilds of London Technical College, "The Measurement of Stresses in Materials and Structures." Three lectures.
Monday evenings, March 16th, 23rd, 30th.—W. A. Bone, D.Sc., Ph.D., F.R.S., Professor of Chemical Technology, Imperial College of Science and Technology, "Surface Combustion." Three lectures.

Juvenile Lectures.

Wednesday evenings, January 7th and 14th, at 5 o'clock.—R. P. Howgrave-Graham, M.I.E.E., Demonstrator in Applied Physics, City and Guilds of London Technical College, "Electric Vibrations and Wireless Telegraphy." Two lectures. The lectures will be fully illustrated with simple experiments.

Bradford Engineering Society.—At a meeting of the Society at the City Technical College on Monday, Mr. M. C. Wheat lectured to a large audience on "Incandescent Electric Lamps and Modern Industrial Lighting," with particular reference to lighting in works and factories. The lecture was illustrated with lantern views and cabinet demonstrations. The lecturer spoke of the proved increase of output in works as result of effective electric lighting, and the importance of it in regard to cleanliness and the comfort and health of the workers. So great an advantage in increased output and avoidance of spoilage was obtained, that in many instances the cost of an installation had been repaid in a very short time. Mr. Wheat strongly emphasised the importance of keeping the lamps free from dirt. He described in detail the methods of direct lighting, and demonstrated the points to be observed in order to secure good illumination, in contradistinction to mere glare. To illustrate this he showed a 40-watt light under a reflector, producing as good illumination as 500 watts of glare light from bare lamps. Mr. Wheat also dealt with the drawbacks of direct lighting, and the advantages of indirect lighting.

Institution of Municipal Engineers.—At a special general meeting on Friday last, changes of the by-laws were approved. The Report of Council for the year ending June 30th, showed that the membership had increased from 882 to 915 during the year, and that income exceeded expenditure by £122, bringing the accumulated balance to £356.

The address of the president, Mr. Horace Boot, dealt mainly with matters relating to the affairs of the Institution and its members. He referred to the unfair competition of motor-'buses with municipal tramways, and the wide scope for extension of the railless trolley system. A paper by Mr. R. J. Spencer-Phillips on "Electricity as a By-Product," showed how mill-owners and municipalities could co-operate to secure a cheap supply of electrical energy.

In the evening a conversazione was held, at which there was a large attendance.

Royal Society.—Sir William Crookes, O.M., D.Sc., is recommended by the president and Council of the Royal Society for election as president at the anniversary meeting on December 1st.

Institution of Electrical Engineers.—The programme of the Birmingham Local Section includes the following :—

November 26th.—S. Evershed, "Characteristics of Insulation Resistance, with an Appendix on Insulation Values."
December 10th.—A. R. Everest, "Notes for a Discussion on the Rating of Electric Machinery."
December 19th.—Annual Dinner.
January 7th.—H. R. Speyer, "The Development of Electric Power for Industrial Purposes in India."

I.E.E.—At the meeting of the Scottish Local Section on November 11th, in Glasgow, Mr. J. A. Robertson, chairman, opened the session with an address on "Recent Progress and Limitations in Electrical Development."

I.E.E.—At the meeting of the Birmingham Local Section on Wednesday last, a paper was read by Mr. A. H. Holden on "The British Standard Specification for Consumers' Electric Supply Meters." The reading of the paper was followed by a discussion, in which representatives of manufacturers and municipal authorities took part. An abstract of the paper appears elsewhere in this issue.

Institution of Post Office Electrical Engineers.—A paper on "Telephone Engineering Economics," with special reference to underground pipes and cables, was read by Mr. Harvey Smith on Monday last.

Educational Notes.—Imperial College of Science and Technology.—City and Guilds (Engineering) College, South Kensington :—An advanced course of lectures is to be given on the Principles, Designs and Manufacture of Electromagnetic Machinery and Transformers; Series II. Conducted by Dr. S. P. Smith. See our advertisement pages to-day.

A new department for the study of chemical technology is being erected in connection with the Imperial College of Science and Technology in South Kensington. Prof. W. A. Bone, F.R.S., has been placed in charge of it.

The University of Bristol has made a regulation whereby the Bath Municipal Technical School will be connected with the Faculty of Engineering of the University, which is provided and maintained in the Merchant Venturers' Technical College.

The new buildings of the applied science department of Sheffield University, opened by Lord Haldane on October 25th, are mainly devoted to mining and metallurgy, and include important electrical sections. The electroplating department is planned for work of all classes on a practical scale, and the recalescence laboratory has been provided with electric vacuum furnaces and electrical apparatus forming the most complete equipment in existence. Electrical furnaces are installed in the melting shop, capable of making 90-lb. ingots.

Electricity Supply Rifle League.—The following matches were decided during September :—Brompton (Nash 96), 549; Central (Wells 100), 570. Brompton (Willis 98), 563; Hackney (Barham 94), 536. Central (Wells 95), 558; Hackney (Hilling, Mathews 96), 546. Ilford (R. Tufnell 97), 567; Poplar (Mogg 93), 526. Ilford (L. Tufnell 99), 553; Stepney (Barber 96), 519. Poplar (Mogg 94), 523; Stepney (Barber 99), 549. St. James' (Cockburn 98), 537; Shoreditch (Ebner 98), 577. St. James' (Cockburn 97), 550; Westminster (Neville 97), 570. Shoreditch (Ridd 93), 547; Westminster (Horley 96), 568.

The following are the positions to date :—

	Matches.				Scores.	
	Shot.	Won.	Lost.	Points.	For.	Against.
Westminster ...	10	9	1	18	5,700	5,472
Shoreditch ...	10	8	2	16	5,691	5,441
Ilford	10	8	2	16	5,633	5,375
Central	10	7	3	14	5,630	5,463
Brompton ...	10	6	4	12	5,577	5,451
St. James' ...	10	3	7	6	5,373	5,554
Hackney ...	10	2	8	4	5,406	5,477
Stepney	10	2	8	4	5,395	5,387
Poplar	10	0	10	0	4,810	5,595

The fixtures for 1914 will soon be under consideration, and with this in view all the electricity works within the 20-mile radius from Charing Cross have been circularised, but up to now not many have replied. Most works ought to be able to muster eight men who can use a rifle; the cost of running a club is not great, and in the majority of cases range accommodation is easy to get somewhere about the works.

The hon. secretary, Mr. E. Mathews, 306, Mare Street, Hackney, N.E., will be pleased to answer inquiries.

Manchester Engineers' Club.—In connection with the opening of the above club, a lunch was given by the directors on Thursday last week to the Life Members, Committee and the Press. Close upon fifty persons were present, including Sir Charles Behrens (Deputy Lord Mayor), Dr. Ed. Hopkinson, Dr. G. J. Fowler, Mr. E. H. Langdon (president of the Chamber of Commerce), Councillor Simpson (solicitor to the club) and Mr. J. B. Broadbent, A.R.I.B.A. (architect). Sir Charles Behrens proposed the toast of "The Engineers' Club," and hoped that it would be successful. The chairman (Mr. Daniel Adamson), in responding, said that the club was the only one of its kind in the country, and to find a club of a similar kind they had to travel to New York, where there was an Engineers' Club with a membership of about 2,000. They did not intend the club to interfere in any way with any of the existing technical societies, but it would be a common meeting-place for members to entertain their friends, and would form a most suitable place for receiving eminent engineering visitors to the city. He thanked the life members, shareholders and the Press for the work they had done in helping to form the club. Mr. W. Cramp proposed "The Guests," and Mr. E. H. Langdon, in responding, said that at the last Census of Production the value of the engineering output of the country in wages, dividends and taxation was £712,000,000, and was only exceeded by the cotton and coal trades. Mr. G. D. Seaton, in his own inimitable style, proposed the toast of "The Press." He expressed the thanks of the Committee for the help and encouragement given, particularly in the early days, towards the formation of the Club. Mr. H. W. Braly of the Manchester Guardian, responded.

The club premises are situated in Bridgewater Buildings, Albert Square, and occupy four floors comprising dressing rooms, cloak rooms and lavatories, smoke room and library, dining room, and a billiard room on the top floor, together with manager's office, kitchen, &c. The building which was formerly occupied by the Arts Club, has been entirely refurnished and decorated under the direction of the Committee, assisted by Mr. J. B. Broadbent, architect. The furniture and carpets have been supplied by Mr. J. E. Heighway, and the decorations have been carried out by Messrs. Goodalls. A passenger lift has also been fixed for the use of members.

Fatalities.—An inquest was held on the 5th inst., at Dunston-on-Tyne, into the death of Thomas Bradley, 25, a locomotive engine driver, engaged at Messrs. Mawson, Clark & Co.'s oil works at Dunston. The evidence was to the effect that Bradley had to stop late on Monday, the 3rd inst., to repair a valve that had been leaking, and was handling an electric hand lamp, of about 250 volts, when he received a shock that proved fatal. The whole of the electric plant had been overhauled about seven weeks ago; the lamp had since been frequently used, and there had been no complaint. Henry James Greener, a clerk, said that Bradley complained that someone had stolen his lamp, but a little while after witness saw Bradley at the fitter's bench holding with both hands the metal framework of the lamp. Witness thought that the man was dancing in fun, but soon saw it was serious, and ran to Bradley's assistance. He took hold of the man's hand and got a shock, having difficulty in freeing himself. He then put his arms round Bradley, and got him away, but he thought he was then dead. Mr. Lauder, H.M. Inspector, examined the lamp, and pointed out the defect. It was admitted that there was no earth connection. Dr. Andrew Dougall said death was due to electric shock. He did not think that any of the ordinary methods of resuscitation had been used. In all such works there should be one or two trained first-aid men; had artificial respiration been properly applied, Bradley's life might have been saved. A verdict of death from electric shock was returned.

Mr. J. A. K. Ferns, deputy-coroner, held an inquest at Hyde on October 31st, regarding the death of George Barton (59), labourer, of Hyde. Deceased was working at the Cheshire Cheese Hotel, Gee Cross, when he received an electric shock through grasping a cellar door handle, the rear part of the latch of which had pierced the wood casing, and come in contact with a live wire in the wall. Death was instantaneous. A voltmeter showed that the pressure was 220 volts.

Mr. David K. Cant, an electrician, who put in the installation, said the wood casing was chosen for safety. The door latch was an old one, and might easily pass unnoticed by the man who carried out the work.

The engineer-in-chief to the Stalybridge, Hyde, Dukinfield and Moseley Joint Board (Mr. R. Blackmore) said the system was carried out strictly in accordance with the requirements of the Board of Trade, and in this case the usual regulations were complied with. Some men were more susceptible to shock than others. All his men were touching 230 volts all the week through.

A verdict of "Accidental death" was returned.

An inquest was held on November 11th, on the body of Amos Boniface, an electrical labourer on the Brighton Co.'s Railway, who died as a result of coming into contact with a live wire at London Bridge Station.

Evidence was given before Sheriff Mitchell and a jury, in the Stirling Sheriff Court, into the circumstances attending the death of James Waugh, fireman, Dennyloanhead, who was killed in No. 3 Broomrigg Colliery, belonging to the Banknock Coal Co.

Mr. Robert Nelson, H.M. Electrical Inspector of Mines, held that the deceased received a shock from the haulage rope, as the result of a fault which had been found in the plug connection at the machine. If water got into the plug box, it would cause the electricity to leap to the frame of the coal-cutter.

Mr. A. B. Muirhead, electrical engineer, Glasgow, who was called on behalf of the Banknock Coal Co., said the coal-cutter was installed in a very wet place. One of the three phases on the coal-cutter itself was earthed, apparently through moisture causing sparking from the terminal to the frame of the coal-cutter. There was another leak on the trailing cable almost opposite where the body was lying. From these facts he formed the impression that this cable was made alive and deceased was handling the cable. A formal verdict was returned.

The Electro-Harmonic Society.—The next concert (Ladies' Night) will be held at the Holborn Restaurant (King's Hall), on Monday evening, November 17th, 1913, at 8 o'clock. Mr. S. Z. de Ferranti will preside. The artistes will be as under :—Vocalists: Miss Mabel Manson (soprano); Miss Violet Oppenshaw (contralto); Mr. Charles Saunders (tenor); Mr. Peter Dawson (baritone). Raconteuse, Miss Helen Mar; ventriloquist, Mr. Tom Edwards; entertainer, Mr. Lindon Wyatt; pianoforte solo, Miss Adela Hamaton. Accompanist, Mr. Bernard Flanders, A.R.A.M.

An Electrical Vehicle Test.—Following the recent example of the Arrol-Johnston Motor-Car Co., in submitting one of their electric cars to a run from Dumfries to London, a distance of nearly 400 miles, a Bailey electric car has lately made the journey from Boston, Mass., to Burlington, Vt., U.S.A., the distance in this case being 258 miles. The actual running time was 13 hours 35 min., equal to an average speed of 19 M.P.H. The 60-cell Edison battery, which was fully charged at the start, was given five "boosts" *en route*, at rates varying from 30 to 150 amperes.

Electrical Vehicles at the Paris Motor Exhibition.—Although there were no examples of the pleasure type of electric motor vehicles at the Motor Car Exhibition just held in Paris, one or two examples of electrically-operated industrial automobiles were to be seen. Among them was an auto-Fram front-wheel-driven chassis made by the Société F.R.A.M. Française, of 47, Boulevard Haussmann, Paris. The electrical equipment, which is carried on a swivelling fore-carriage, consists of a battery of 42 Tudor cells, coupled in series and supplying current to two motors which drive the front wheels through pinions meshing with internally-cut gear wheels. An important advantage of the design is that practically any type of chassis frame and body can be employed. Two 5-ton vehicles were exhibited, one having an ordinary lorry body, while the other was fitted with a roomy steel dust cart body built for the Paris Municipality. The controller on these vehicles is adapted to give five forward positions and one reverse. Messrs. Balachowsky & Caire, of Surasnes, Paris, displayed a railless trolley single-deck omnibus, the electric motors being built up so as to form the hubs of the rear road wheels. This firm also had on view one of its petrol-electric 3½-ton motor lorries. The power is supplied by a 24-H.P. motor direct-coupled to a generator, both being supported on a sub-frame, suspended from the main frame by rubber shock absorbers. The current from the generator is taken to a junction box on the back axle, and thence by two short cables to electric motors contained in the hubs of the rear wheels.

London Electricians' Wages Movement.—Carrying out the intention mentioned in our issue of October 31st, the Electrical Trades Union has sent a circular to all electrical contractors demanding an increase of wages to 11d. an hour, and other improvements in the conditions of service. The Electrical Contractors' Association, being an incorporated body, cannot deal directly with the situation, but is issuing a circular to all contractors convening a meeting for a date early in December, at which the question will be discussed.

The Melun Railway Collision.—Much discussion has been aroused in France with regard to the desirability of improving the systems of signalling, so as to provide effectually against the failure of the human factor which has been manifest in so many railway accidents of late. The *Temps* urges that all passenger trains should be lighted with electricity, so that fire caused by gas may in future be prevented.

Appointments Vacant.—Deputy head of the electrical engineering department of the Victoria Jubilee Technical Institute, Bombay, for five years (Rs. 350 to Rs. 450). Particulars from the office of this journal; see also advertisement pages.

Inquiries.—Makers of the "Universal" storage battery; makers of glass cases for electricity meters; and makers of "Ensign" electric fires, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Before MR. J. BEMROSE left Tunbridge Wells to take up his appointment as chief engineer at Leek, Mr. R. N. Torpy, the borough electrical engineer, on behalf of the staff and employés, took the opportunity of presenting him with a silver chronometer stop watch, suitably engraved, expressing their good wishes. Mr. J. Bemrose suitably responded.

MR. VALENTINE F. BUSH, second assistant engineer, Tunbridge Wells electric supply department, has been appointed assistant engineer to the Scarborough Electric Supply Co.

The Stoke-on-Trent T.C. has appointed MR. S. H. FOWLES, of Dewsbury, as mains superintendent for the southern district of the borough.

The Kendal T.C. has increased the salary of the manager of the electricity works by £15 a year to £175.

The Bridlington T.C. has passed a vote of sympathy with the borough electrical engineer, MR. A. J. BECKETT, in his illness, and expressing a hope that he will soon be restored to good health.

Out of 180 applicants for the post, MR. LIONEL B. HOGARTH, borough electrical engineer at Morecambe, has been recommended for appointment to a similar position at Whitehaven, at a yearly salary of £250.

Tramway Officials.—MR. H. HUGHES having been appointed chief clerk of the Ashton-under-Lyne Corporation Tramways has resigned his appointment on the Walsall tramway manager's staff. The appointment of a successor has been deferred in view of the approaching centralisation of all the clerical work at the Bridge Offices, and in this connection the manager has been empowered to make such arrangements for the reorganisation of his staff as he considers expedient.

General.—The address of MR. C. S. NORTHCOTE is Navaltum, Ltd., Jubilee Place, Chelsea, S.W. (Telephone, "No. 1279 Kensington.") The firm is supplying a patent metal.

MR. J. WILTSHIER, electrical engineer, St. John's Lane, Canterbury, was on Monday re-elected an Alderman on the City Council.

MR. PATON has resigned his position as manager in Scotland for the Electrical Co., Ltd., London, and has taken up an important position with Messrs. Andrews & Co., mechanical and electrical engineers, 198A, St. Vincent Street, Glasgow.

MR. P. J. BOUCHER, who has for some three years acted as traction lamp expert to Messrs. Siemens Bros. Dynamo Works, Ltd., has been appointed to a similar position with the Edison and Swan United Electric Light Co., Ltd., in London.

MR. W. H. MULHALL, who for the past three years has acted as traction lamp expert to Messrs. Siemens Bros. Dynamos Works, Ltd., has been appointed to a similar position with the Edison and Swan United Electric Light Co. He will take over his appointment on December 1st.

MR. W. A. COATES, of Hamilton, Ontario, has just joined the Ferranti Electrical Co., of Canada, as assistant general manager, his duties being those of the chief engineer in Canada. Mr. Coates was in charge of the Switchgear Sales Section for the British Westinghouse Co. until the end of the last year, when he resigned to join the Switchgear Engineering Department of the Canadian Westinghouse Co.

MR. E. BROWN, late contract manager of Blackburn Telephone Exchange, took up his new duties at Nottingham last week. Prior to leaving he was the recipient of a dining room clock and cake stand, the gift of the Blackburn District staff.

MR. D. P. IONIDES, M.I.E.E., is to-day moving into larger offices at 124, St. Vincent Street, Glasgow. His telephone number and telegraphic address are unaltered.

The staff and employés of Siemens Bros. Dynamo Works, Stafford, have presented a silver tea and coffee service to MR. J. F. BROADHEAD, shop engineer, on his marriage, and from the shop engineers he received a case of fish knives and forks.

MR. FREDERICK TURNER GARRETT, J.P., who is the new Mayor of Dunstable, is the principal of the firm of F. T. and A. Garrett, electrical engineers. He entered the Town Council in 1887 as a member of the Beds. County Council, was a borough magistrate, and previously acted as Mayor in 1897, 1898 and 1905.

Obituary.—MR. THOMAS CUSHING.—We regret to record the death, which occurred toward the end of October, at Woodside Green, S.E., of Mr. Thomas Cushing, M.I.E.E., F.R.A.S., at the age of 73 years. In 1863 he was appointed to a junior post in the firm of Messrs. T. Cooke & Sons, of York. This firm made chiefly astronomical instruments at the time, but some instruments of other kinds were manufactured under the head of "scientific instruments." Among these were some of the original telephones. In 1867 an assistant inspector of scientific instruments was required at the India Store Depôt (India Office) and Mr. Cushing was appointed. Upon the retirement of Col. Strange, F.R.S., Mr. Cushing was promoted to the post of Chief Inspector. During the last 40 years the demands of India have increased enormously, and in a like proportion has the work of the inspector of scientific instruments increased. At the time of the retirement of Col. Strange the scientific instruments comprised astronomical, mathematical and physical and sundry other instruments, and little or nothing was known of electrical apparatus. Mr. Cushing was one of those who was able to follow up electrical apparatus from its birth. Beginning with telegraph instruments and sundry small apparatus ordered by India, Mr. Cushing successfully tested and sent out all sorts and descriptions of apparatus, ranging from the above to the 1,400-KW. installation at Ishapur (Marshall-Crompton), 1904/1905. Whether 1,400-KW. machinery can be rightly termed "scientific instruments" or not, the Government title still subsists. Mr. Cushing's figure was a familiar one on the test-beds and in the works of the various large electrical firms throughout the country, when he was not in his office at the India Store depôt. About 1902, Mr. Cushing received an assistant inspector. About this time trouble was caused through the insufficient insulation of a certain long telegraph line in India. Mr. Cushing suggested the use of a new form of insulator, and accordingly an oil insulator was tried. He finally invented an altogether new form of oil insulator, which he patented. This was tried and found successful. Mr. Thos. Cushing became a member of the Institution of Electrical Engineers in 1881. He was introduced by Prof. Carey Foster and seconded by Mr. Alexander Siemens, with whom he was always a great friend. After his retirement Mr. Cushing spent several years on the Continent, and when he returned to England he settled down at Rosslynlee, Woodside. His death occurred at his residence on October 22nd due to liver complaint.

MR. J. SANKEY.—The death recently occurred quite unexpectedly of Mr. J. Sankey, chairman of Joseph Sankey and Sons, Ltd., ironmasters, of Bilston. Deceased gentleman was the eldest of three sons of the founder of the business. He had very large interests in the Midlands. He was only 57 years of age.

MR. ROBERT WYLLIE.—The death occurred suddenly on October 25th at the age of 75 years, of Mr. Robert Wyllie, formerly manager for 22 years of the works of Messrs. N. Greening & Sons, Ltd., wire manufacturers, Warrington.

SIR ROBERT HUNTER.—We regret to record the death which occurred on November 6th, at the age of 69 years, of Sir Robert Hunter, who was for 30 years solicitor to the General Post Office. Sir Robert had for many years been very closely concerned with a host of legal matters, negotiations, agreements, &c., relating to telephone, telegraph, and wireless interests; his duties must have been particularly arduous in recent years, which have witnessed the transfer of the telephones to the State, and Marconi discussions and agreements.

NEW COMPANIES REGISTERED.

Standard Meter Co., Ltd. (131,952).—This company was registered on November 3rd, with a capital of £20,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, gas, electric and water meters and all apparatus and things required for or capable of being used in connection with such meters, electricians, electrical, mechanical and civil engineers, &c. The subscribers (with 100 shares each) are F. Thorp, Grasmere, Whitefield, near Manchester, engineer; H. T. Thorp, Moss Bank, Whitefield, near Manchester, engineer; T. Thorp, Moss Bank, Whitefield, near Manchester, engineer. Private company. The number of directors is not to be less than two or more than five; the first are F. Thorp and H. T. Thorp (both permanent); qualification, £100 shares or stock: remuneration as fixed by the company: solicitor, C. H. Pickstone, Radcliffe Bridge, Radcliffe, Lancs. Registered office, Victoria Works, Narrow Lane, Whitefield, near Manchester.

William Maxwell & Co., Ltd. (132,030).—This company was was registered on November 6th, with a capital of £2,000 in £1 shares (1,000 preference), to take over the business of an electrical and mechanical engineer carried on by W. Maxwell at 204, Goldhawk Road, W. The subscribers (with one share each) are:—A. Docker, 9, Gray's Inn Square, W.C., solicitor; R. P. Glanville, 9, Gray's Inn Square, W.C., managing clerk. Private company. The number of directors is not to be less than two or more than five; the first are W. Maxwell and J. F. Tester (both permanent). Registered office, 204, Goldhawk Road, Shepherd's Bush, W.

Enfield Electric Cable Manufacturing Co., Ltd. (131,995).—Registered November 5th, by Cecil J. Rawlinson & Son, 47, New Broad Street, E.C. Capital, £50,000 in £1 shares. Objects: To carry on the business of manufacturers, merchants, engineers, patentees, agents, manufacturers of, and dealers in, wires, cables and other articles and accessories in the electrical and allied trades, &c. The subscribers (with one share each) are:—F. Plutte, Fontainebleau, Daores Road, Forest Hill, S.E., merchant; C. C. Rawlinson, 47, New Broad Street, E.C., solicitor. Private company. The first directors (to number not less than three or more than five) are W. Bakewell, F. Plutte, C. H. W. A. Weuste, G. Ziegler and G. J. Andrews; qualification, 500 shares; remuneration, £100 each per annum. Registered office, 47, New Broad Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Trust deed dated October 16th, 1913 to secure £400,000 debenture stock at 5 per cent. per annum, with power for the company on complying with the conditions of the trust deed to issue not more than £100,000 further stock ranking *pari passu* with above amount, charged on electric lighting and power undertakings of the company; certain freehold and leasehold land at Carville, Northumberland, Dunston, Durham; and company's undertaking and other assets, present and future, except uncalled capital (subject to first mortgage debenture stock secured by trust deed dated June 30th, 1909). Trustees: Law Debenture Corporation, Ltd., Threadneedle Street, E.C.

Eastern Telegraph Co., Ltd.—Particulars of debenture stock for an amount not exceeding one-third of the share capital for the amount being issued and paid up, created October 29th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £92,296. Property charged: The company's undertaking and revenue. No trustees.

New Liverpool Rubber Co., Ltd. (109,933).—Return dated October 1st, 1913. Capital, £150,000 in £1 shares (52,000 pref.). 58,502 ord. and 51,410 pref. shares taken up. £58 502 paid on the ord. £51,410 considered as paid on the pref. Mortgages and charges: £25,705. Registered office, 292, Vauxhill Road, Liverpool.

National Conduit and Cable Co., Ltd. (59 251).—Return dated September 17th, 1913. Capital, £1,000 in £1 shares. All shares taken up. £1 per share called up on 7. £7 paid. £993 considered as paid on 993 shares. Mortgages and charges: Nil.

Llangefni Electric Light and Power Co., Ltd. (111,909).—Return dated April 18th, 1913. Capital, £3,000 in 2,750 pref. and 250 ord. shares of £1 each. 2,566 pref. and 250 ord. shares taken up. £2,566 paid on the pref. £250 considered as paid on the ord. Mortgages and charges: £700.

Yale Electric Power Co., Ltd. (60,493).—Return dated October 9th, 1913. Capital, £20,000 in 668 ord. shares of £25 each, and 3,300 pref. shares of £1 each. 668 ord. and 300 pref. shares taken up. £25 per share called up on 600 ord., and £1 per share on 300. £15,300 paid. £1,700 (£25 per share) considered as paid on 68 ord. Mortgages and charges: Nil.

South American Light and Power Co., Ltd. (74,446).—Return dated August 5th, 1913. Capital, £200,000 in £1 shares. 172,400 shares taken up. £122,407 paid. £49,993 considered as paid. Mortgages and charges: £150,000.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

The directors' report for the half-year ended June 30th, 1913, after regretting the death of Mr. Henry Holmes, who had been a director of the company since 1874, says that the accounts show that the amount to credit of revenue is £45,524, against £46,718 for the corresponding half-year of 1912, and the expenses have been £26,260, against £27,109. The result is a balance of £19,263, plus £1,879 interest on investments and £2,435 brought forward, making £23,578. The directors have placed £2,000 of this to reserve, leaving an available balance of £21,578. They recommend:—First preference shares dividend, six months to June 30th, 6s. per share, £10,368; second preference shares dividend, six months to June 30th, 6s. per share, £1,400; ordinary shares, 1s. 6d. per share (free of income-tax), £6,624; balance to current half-year's account, £3,184. The traffic receipts show a decrease of £1,084, as compared with the corresponding period. The expenses of repairing cables were £7,759 as compared with £8,611. In July a contract was entered into with Messrs. Siemens Bros. & Co. for the manufacture of 15 knots of cable for stock, which have since been delivered in the West Indies. The Imperial and Canadian Governments, having brought pressure to bear on the company for a general reduction of West India rates, the directors have found it necessary to reduce the rates in return for subsidies on certain conditions. A formal deed to give effect to the agreement is in course of negotiation and will have to be submitted to Parliament.

Continental.—SWITZERLAND.—The balance-sheet of the Compagnie de l'Industrie Electrique et Mecanique of Genève for the last financial year, shows a loss of £4,370, reduced to £3,481 by the amount brought forward from the previous year, when a dividend of 4 per cent. was declared. A net profit of £43,246 is reported by the Société des Usines Electriques de la Lonza, of Basle, out of which a dividend of 7 per cent. is being paid.

FRANCE.—A new company has lately been formed in Paris with a capital of £40,000, and the title La Compagnie Haut Marnaise d'Electricité, to acquire a small central station at Rouelles-Sur-Rognon, and to undertake the electric lighting of a number of small towns in the district.

The Berliner Elektromobilfabrik Gesellschaft, of Berlin, is apparently meeting with an increased demand for its vehicles, as it just been decided to increase the capital of the concern from £7,500 to £12,500.

PARIS TRAMWAY FINANCE.—The Paris General Omnibus Co. which secured, through its new agreement with the Municipal Council, the control or ownership of almost the whole of the motor-omnibus and tramway traffic of the city, has decided to increase the share capital from £3,200,000 to £4,000,000 by the issue of 40,000 new shares of £20 nominal. These are to be offered at the price of £24, and existing proprietors have a preferential right of subscription in the ratio of one new share to four old shares. It has also been resolved to strengthen the working capital by the emission of debentures up to the amount of £800,000. The proceeds of the issues are to be devoted to the acquisition of further motor-omnibuses and the reconstruction of sections of tramways by the substitution of the underground for the overhead system, or by the introduction of the central conduit in place of the side conduit.

Prospectuses.—*Rangoon Electric Tramway and Supply Co., Ltd.*—The list opened on Monday and was to close on Wednesday, in an offer of £100,000 5 per cent. mortgage debenture stock at 98. The issue has been made to provide additional capital required to meet the demands of the business and to carry out extension works.

United Electric Tramways of Monte Video, Ltd.—A circular has been issued to the existing preference and ordinary shareholders, offering 10,000 6 per cent. cumulative preference shares of £5 each at par, and 19,800 ordinary shares of £5 each at par, the capital being required in order to cope with the natural growth of the company's business, as explained at the last meeting. (See ELEC. REV., June 20th, 1913.)

Amazon Telegraph Co., Ltd.—The report of the directors for the year ended June 30th, 1913, states that the gross revenue amounts to £105,666, and the working expenses to £59,091. After providing £22,917 for debenture interest and sinking fund and carrying £10,000 to the general reserve and £2,500 to the reserve for the renewal and maintenance of cable steamers, the directors recommend the payment of a dividend of 4½ per cent., free of income-tax, on the share capital, leaving £5,571 to be carried forward.

Stock Exchange Notices.—The Committee has ordered the undermentioned security to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—£200,000 6 per cent. cumulative preference stock.

Application has been made to the Committee to appoint a special settling day in—

City of Las Palmas Water and Power Co., Ltd.—Provisional scrip certificates fully and partly (40 per cent. paid) paid, for £267,000 5 per cent. first mortgage debenture stock.

Japan.—The Keihan (Kyoto-Osaka) Electric Tramway Co. is declaring a dividend of 6½ per cent. for the last financial half-year.

The Toyooka Electrical Light Co., of Hyogo, is increasing its capital from £15,000 to £25,000.

The Minoms Electric Tramway Co. has declared a dividend of 7 per cent. for the last financial year.

The New British Ever-Ready Co., Ltd.—The directors have declared the first interim dividend at the rate of 7 per cent. on the 7 per cent. cumulative preference shares (participating in further profits up to 10 per cent.) for the period ending September 30th, the dividend to be payable on December 1st.

Joseph Sankey & Sons, Ltd.—The recent issue of 100,000 7 per cent. preference shares was subscribed more than twice over, and the books were closed on the 7th inst.

Richard Johnson, Clapham & Morris, Ltd.—Interim dividend of 9d. on the ordinary shares for the half-year ended September (7½ per cent. per annum).

Cape Electric Tramways, Ltd.

The seventeenth ordinary general meeting was held on November 5th, at the offices, London Wall Buildings, E.C., Mr. L. Breitmeyer presiding.

The Chairman, in proposing the adoption of the report (see *Electrical Review*, page 671), said that no startling incidents had occurred to interrupt the even tenor of their way during the past year. Since the end of their fiscal year, however, a serious labour disturbance broke out at Johannesburg, which left its mark on the whole of South Africa. A general strike throughout the country was, however, averted, but even if one had taken place he thought they could have counted upon the loyalty of their men. The twelve months under review had shown a steady development both in Cape Town and Port Elizabeth, which was the best possible condition for securing to the shareholders a continued dividend. Last year he had the pleasure of informing them that they had increased their traffic by nearly a million passengers and their receipts by about £8,000 beyond those of the previous year. This year he was gratified to state that those figures had again been topped, inasmuch as they had carried 1½ million more passengers with an increase in receipts of about £12,000. The number of passengers carried last year was 18,935,000, and when the company started in 1898 they only carried nine million, which showed that they had doubled their traffic. Unfortunately the operating expenditure kept pace with the increased revenue, to which fact he drew their attention at the last annual meeting. They paid a higher rate of wages, the price of coal had gone up, and the age of the plant was also responsible for the heavier costs of the upkeep. Those were conditions to which their managers in Cape Town and Port Elizabeth must submit, although they exercised the strictest economy in all departments. Last December, at the request of the board, Mr. Bommel, the managing director of the company, paid a visit to South Africa, and spent some time in going through the details of the working of the systems of Cape Town and Port Elizabeth. As a result of his investigations they were making considerable additions to the rolling stock of both systems, and were increasing the power at Port Elizabeth by another unit of 500 kw. That policy really meant reapplying their reserve funds in a far more profitable manner for the benefit of shareholders by increasing the carrying capacity of their systems, and they were bound to keep their plants in the highest state of efficiency if they wished to continue their pleasant position with the inhabitants of Cape Town and Port Elizabeth and retain their goodwill and patronage. Up to now, the first quarter of the current year—from the 1st July to 30th September—showed an increase in receipts of £2,890, as against the similar period in 1912, and he had every reason to anticipate that such proportionate increase would be maintained. They would remember his remarks last year upon the motor omnibus service with which they were making trials. He could not yet give their full information and their final experience on the subject. That enterprise was still in the experimental stage, but they had gained sufficient knowledge to convince them that for the regular town service in Cape Town those 'buses, under present conditions, were not required. A service to the docks, where they possessed no tram line, had shown poor results, and they intended to discontinue it if it was not better patronised by the public. As far as they could see those motor 'buses answered well on suburban districts as feeders for their tramway system and also for pleasure traffic on the Victoria road and other routes round the peninsula. They were quite alive to the necessity of increasing their business in all directions, and were constantly on the look out for the promotion of ventures which came under the legitimate scope of their transportation business. Those of them who were connected with South Africa might have heard that they had bought the Royal Hotel, Hout Bay. It was being reorganised and placed under the management of the Peninsula Excursions Company, and they expected from this enterprise the best results both for them and also for the Cape Town public.

Admiral Sir A. H. Markham, K.C.B., seconded the motion, and the report was adopted.

Edison & Swan United Electric Light Co., Ltd.

The thirtieth ordinary general meeting of the shareholders of the above company was held on Tuesday at Winchester House, Old Broad street, under the presidency of Mr. C. J. Ford.

The Chairman, in moving the adoption of the report (see page 757), said that the position of affairs as disclosed by the balance sheet was, at the first blush, very disappointing, but when they came to fully consider the circumstances which had led up to the result, it was not as bad as it appeared to be. The company expended about seven or eight years ago a sum of approximately £30,000 in laying down plant for the original type of metal filament lamp, known in the trade as the pressed lamp. About two years ago this type was to a great extent superseded by the drawn wire lamp, and it became necessary for the company to expend a large sum upon additional plant for the purpose of manufacturing that lamp. Shortly after the commencement of manufacture it was intimated by the owners of certain patents that the process of manufacture employed by the company was an infringement of their rights. As a consequence the manufacture of those lamps was suspended, and when he (the chairman) joined the board negotiations were entered into with the parties in question with a view to coming to some amicable arrangement under which the company should have the right of manufacturing those lamps under a licence. They would readily realise that a matter of this importance must necessarily take some time to carry out, and it was not until some time in July that the matter was finally settled. That being so, the sales of lamps for the whole of last winter were very greatly interfered with, and that fact alone had had the effect of largely reducing the sales for the period under review. The revenue account for the year had also suffered by the absence of the dividend which had hitherto been received upon the shares which they held in the Altrincham Electric Supply Ltd. That company at the close of its financial year at the 31st December last, showed a profit which would have enabled a dividend of seven per cent. to have been declared as heretofore, but at that time it was exceedingly short of funds in consequence of the heavy outlays which had been made upon new plant to cope with its rapidly extending business. As chairman of the Altrincham Company he felt that it would be financially unsound to distribute that profit under the circumstances, as the requisite money would have had to be borrowed for the purpose, and in his view it would have been a mistake to have depleted the Altrincham Company of money which it badly wanted for other purposes in order to pay a dividend upon its shares—the whole of which would practically have come into the pockets of the Edison and Swan Company. If the dividend had been paid it would have amounted to the substantial sum of £2,300. He was glad to tell them that further capital had since been provided for the Altrincham Company by the issue of additional debentures, and, as far as he was able to judge, there was no reason whatever why dividend payments should not be resumed for the current year. They would see from the report that a revaluation had been made of certain of the assets, particularly with regard to the lamp stocks, and those were now brought down to a figure as near as they could get to present manufacturing cost, which had recently been materially reduced. The reserve fund, amounting to £45,000, had been applied to meet that and other depreciated values. A further £3,013 taken out of the balance brought forward from last year had been applied as special depreciation, making a total of £48,013. The Benwell works were finally closed in March last. They were used for the manufacture of lamps of the carbon type, and the whole of the work carried on there had been transferred to their Ponders End works. Loans figured in the balance sheet at the sum of £20,000, secured by the deposit of some of their own debenture stock and £25,000 debentures in the Altrincham Electric Supply, Ltd. When he joined the board, of those loans £14,000 was due to the company's bankers, who held as security the Altrincham debentures and £50,000 second debenture stock of the company. He was glad to say that since the date of the balance sheet this loan had been repaid and the Altrincham deebntures and their own second debentures freed—the loans now standing at only £8,000. To enable them to do that they had disposed of the Altrincham debentures as it was necessary after paying off the loan in question to provide further funds for carrying on the business of the company. In this year's balance sheet they had split up the figures previously shown under the heading of stock and plant into three headings as follows:—Fixtures, fittings and office furniture, £4,456 11s. 3d.; plant and machinery, £78,986 16s. 8d.; and stocks on hand, £152,404 2s. 1d.; making a total of £235,847 10s. as against £267,341 3s. 4d. last year. He was glad to say that very large economies had been made in expenditure without loss of efficiency, and he was sure they would agree with him that this was a move in the right direction and must materially improve the position of the company during the current year. Amongst other reductions they would be glad to hear that there was a considerable saving in the fees paid to the directors, and they had also made a considerable saving by removing the whole of their stores and clerical staff from the city to the works, and in connection with this they were giving up their showroom and stores at College Hill. He noticed in a Press comment dealing with the report and accounts it was pointed out that at a meeting of the debenture-holders held in June he stated that economies had been instituted which at that time amounted to £6,000 per annum, and he was asked how it was in spite of these economies the showing was so disappointing. His answer was that he only joined the board in March and it naturally took him some little time to become acquainted with the intricacies of the company's business. The making of economies required very serious consideration in order that no loss of efficiency was brought about, and it was therefore towards the close of their financial year that these economies were brought into being, and naturally the present accounts received practically no benefit whatever from them. He made the statement in question at the debenture-holders' meeting on June 18th, and the accounts before them only carried them to June 30th. Since that date, however, additional economies had been made, bringing the total up to the large figure of £10,000 per annum. The lease of 123-125, Queen Victoria street had been acquired, and he thought the advertisement they would receive when they occupied these premises would be a very valuable one. After taking into account the revenue

which they expected to receive from letting the Queen street premises, of which they had a long lease, and the saving from closing down College Hill and the printing office, they would not stand at a higher rent than hitherto. They were looking for a considerable access of sales as they had thoroughly reorganised the sales department, which was badly in need of it, and had appointed a gentleman as sales manager who had had a very large experience in this direction gained with some of their competitors. In order to provide themselves with very necessary funds they had disposed of the Altrincham debentures, and it might be that if the business expanded as they had every reason to expect it would, they might have to dispose of part or all of their Altrincham shares to provide further capital. The Altrincham Co. were doing exceedingly well and the board were not anxious to make a sale until it was absolutely necessary, as they felt that the longer these shares were held the more valuable they were likely to become. Messrs. C. E. Hunter and E. Gimingham had been elected directors, and this step had proved of the greatest benefit to the company. Mr. Hunter for many years had been in charge of the fittings and general manufacturing side of the works, and Mr. Gimingham had occupied a similar position in connection with the manufacture of lamps, and, under the powers of the articles, the board elected them as technical directors. For a considerable time the company had not entered upon any large scheme of advertising, and undoubtedly their sales had very much fallen off by reason of this. They had now taken steps to bring their goods prominently before the public by posters. He felt he must refer briefly to the scheme which was submitted to the debenture-holders last June with the object of providing a considerable amount of working capital. It was not carried through as the debenture-holders did not think it was favourable to them. They might take it that if the debenture-holders objected to it on that ground the scheme was undoubtedly one favourable to the shareholders. For his own part he was fully convinced it was favourable to both classes. It was difficult to carry on a business of such magnitude as theirs unless they had ample funds, and in framing that scheme apparently there was no other alternative for providing a really substantial and adequate amount. Some of the shareholders adversely criticised it on the ground that a call of £1 per share was proposed to be made upon them. That undoubtedly was from their point of view very material, but it had the effect of putting the company in a strong and profit-earning position and he thought it was fully justified. He noticed that in some quarters attention had been drawn to the fact that the item in the balance sheet of £390,000 for cost of establishing the business, goodwill, etc., remained the same as last year, and it had been suggested that some steps should be taken to reduce this. He entirely agreed with this view, but the difficulty was, how it was to be reduced. That could only be done by a reduction of capital which in their case presented more than ordinary obstacles. If the whole of their shares were fully paid, it would not present insuperable difficulties, but if they were to bring forward any scheme for materially reducing that item, and he thought they would agree with him that if it was to be done there was no good tinkering with it, it would mean that an amount would have to be written off the partly paid "A" shares which would practically leave them with very little else but the present liability of £2 upon them, and no doubt the majority of the shareholders would strenuously oppose any such step. In conclusion he might say the board were very hopeful as to the future prospects, and they were looking for a very distinct improvement during the current year. They must not look, however, for an early resumption of dividends, as before that could happen, he thought they would agree it was absolutely essential that they should build up a substantial reserve fund. If they had at their disposal the sum likely to have been produced by the call on the shares to which he had before referred to, any profit earned would have been available for dividend, but as it now was they must provide the very necessary further working capital out of future profits, as the sum which would be produced if they sold the Altrincham shares might not by itself be sufficient. Had they the money now, they should be in a position to increase their advertising and put down additional plant, both of which operations would increase their business.

Mr. Ellice-Clark seconded the motion.

Mr. E. B. Parsons said he would like to know whether the company now possessed a proper technical staff. Looking back it seemed to him that a great deal of the trouble from which they had suffered was because they had not had a proper technical staff at the works, and consequently they had not been able to keep ahead of their competitors.

Mr. F. J. Rogers asked the chairman whether he could make any definite statement as to the intention of the board in regard to making a call upon the ordinary shares on which there was a liability of £2.

Mr. Lock said he thought they had reason to congratulate themselves that in Mr. Ford they had a chairman of the calibre he had shown himself to possess. He (the speaker) was satisfied that the business was now in strong, capable and energetic hands. With regard to the necessity for a technical staff he rather differed from Mr. Parsons because he was given to understand by gentlemen connected with the trade that in the two new directors—Mr. Hunter and Mr. Gimingham—they had technical men of a high order who would be able to render the company very valuable service in the future. What they had suffered from had been the antiquated method of manufacture of lamps and lack of working capital and the troubles they had had with the patentees. That trouble had now been overcome, and he hoped and trusted that the manufacture of the new [illegible] lamps would be carried on without any obstruction on the part of competitors and also in the most economical manner possible. He would like the chairman to tell them whether that thing had been adequately dealt with by the special depreciation, and whether there was any more depreciation of that character which would have to be dealt with in the future. It was very satisfactory to find that the economies which had been introduced represented the substantial sum of £10,000, which saving he took it would go on year after year. With regard to the Altrincham shares he hoped that the board would not have to dispose of them, as with the growth of the town and the earning capacity of the business, it seemed to him that the value of the shares was likely to go on increasing. Should the board be obliged to sell them rather than they should be sacrificed to any outside purchaser, he hoped the shareholders of Edison and Swan would be given their refusal.

The Chairman, in reply, said that as Mr. Lock had remarked it was perfectly true that in Mr. Gimingham and Mr. Hunter they had two of the most capable men in the electrical trade, and since they had been on the board they had been of the utmost assistance to him and his colleagues. With regard to inventing new lamps, of course they were taking steps to discover something better than the existing lamp. All the electrical manufacturers were doing the same thing—they were all experimenting daily, but none of them had yet hit upon anything extraordinarily new. They had produced what was known as a half watt lamp. Up to the present it was not on the market, but it was very satisfactory as far as it had gone. It was a lamp which if it was brought into commercial use would enormously reduce the expenditure on current. With regard to any call on the shares, that could not be done without the consent of the debenture-holders, as the whole of the uncalled capital was part of their security. The holders of the debentures refused the scheme which the board brought forward some months ago, and he could only now say that they were not proposing to bring forward any scheme which would make a call likely. Mr. Lock had suggested that the £10,000 economies which had been effected would go on from year to year. He (the chairman) would like to point out that what he intended to convey on that point was that they had saved £10,000 upon expenditure which they could do without, but if they were going to push the business they must spend money on doing it. They were making economy on one side on expenditure which he considered was to a great extent quite useless, and they were replacing that partly by expenditure which he hoped would be of a most fruitful nature to the company. They were spending money on advertising, they had got a new sales manager, and they were putting on new travellers. As to the Altrincham shares, he quite agreed with Mr. Lock that they were very valuable. The company was operating in a district which was growing very quickly, and it was likely that the shares would increase very materially in value. They would not part with those shares unless they were absolutely forced to, but if they were going to push the business properly they must have money, and that was one of the sources from which they could obtain it. Personally, should they have to sell these shares, he would be quite willing to offer them to their present shareholders, but his experience had taught him that if they were to do so the probability was that only about £5,000 would be taken up, and if such a thing should happen it would seriously prejudice them when they came to offer them *en bloc* subsequently. With regard to the special depreciation, the amount they had written off absolutely cleared the board and the stock had been written down to absolutely bed-rock.

The report was adopted.

Buenos Ayres Lacroze Tramways Co., Ltd.—The report for the year ended June 30th last states, says the *Financial Times*, that the gross receipts amounted to $6,162,305 legal currency, against $5,650,827 obtained for the preceding year, an increase of $511,477. The working expenses amounted to $3,839,729, an increase of $361,748, leaving $2,322,575 as net receipts of operation, plus $115,380 as interests and discounts, making a total of $2,437,956 legal currency. After deducting the difference in exchange, interest on debentures, fund providing for accidents, amortisation of municipal concession and other outlays, such as preliminary expenses, expenses of issue and payment of roadway, there remains a balance available of $1,708,019, which, together with $24,917 brought forward, makes a total of $1,732,937 legal currency, which the directors propose to distribute as follows:—5 per cent. to the reserve fund, $85,400; 5 per cent. to the directors, $85,400; ½ per cent. to the auditor, $8,540; extraordinary expenses, $23,134. To the special fund for renovations—Permanent way, overhead line and cables, $150,000; buildings, machinery, rolling stock, &c., $100,000; to the shareholders (5 per cent.), $1,250,000; carrying forward $30,460. Thus the shareholders will receive the sum of $1,250,000, against $1,125,000 distributed last year.

STOCKS AND SHARES.

Tuesday Evening.

This week has brought a new account to the Stock Exchange, but no further influx of business. Mr. Asquith's speech at the Guildhall on Monday night was reassuring, so far as it went, with regard to Mexico; but, on the week, there are falls in most of the Mexican securities. Of course, these falls are, in the majority of cases, merely nominal markings, especially as regards the selling prices. Because a stock happens to be quoted 57½ to 62½, it does not follow by any means that a man who wished to realise would get 57½ for it. On the other hand, were a buyer of any substantial amount to come into the market, he would probably be able to secure only a small quantity at 62½. This gives some idea of the extremely nominal character of quotations, which, by the way, is not confined in every case to Mexican issues.

From the Stock Exchange point of view, an important event of the week has been the publication of the Committee's findings in connection with the introduction of American Marconi shares to the market in April, 1912. The subject has been so well ventilated in the daily papers, that no more need be said as to the details of the business, beyond noting that the Committee have passed a resolution strongly condemning the manner and method of the introduction of these shares in the Stock Exchange, adding that all introductions of this character will render members concerned in them liable to be dealt with under Disciplinary Rules.

One effect of the American Marconi affair has been to depress the price of Marconi shares, which show a fall of $\frac{5}{16}$ on the week, the company's Preference shares also participating. Americans and Canadians remain a dull market. It is to be devoutly hoped that the last has been heard of this unhappy affair, the extraordinary part about which seems to be that nearly everybody who was at all intimately connected with the Marconi agreement got into some trouble or other. The only people who appear to have made any substantial capital out of it are the politicians. And the capital in their case is not of the bank-balance variety.

The Electric Lighting market is steady, without calling for special notice. Money remains dear. Every week the Bank of England escapes by a miracle the raising of the Rate; and if Lombard Street gets through the year with a 5 per cent. minimum, it will be a wonderful performance. This uncertainty with regard to money reacts upon all investment securities. Charing Cross City Preference went back to 3¾. Metropolitan Ordinary lost another ⅛, and London Electric Debenture stock drooped.

The Home Railway market has again suffered sharply from a small amount of liquidation and a complete want of confidence on the part of the public. Steam stocks went down with a run, recovering, however, from the lowest. In sympathy with this weakness, Metropolitan Consolidated fell back to 38¾, subsequently improving to 39. Districts at 28 are also ¼ down, following upon their fall of 3½ last week. Underground Electric "A" shares braced up to 10s. 7½d., a rise of the pence. City and South London Preference stocks are flat, the two senior issues both losing two points, while the 1901 and 1903 stocks fell 1. A similar loss took the company's 4 per cent. Debenture stock to 91, which is some 7 points lower than Central London 4 per cent. Debenture. British Electric Tractions have weakened, the 6 per cent. Preferred at 12 showing a fall of 1¼, while the 5 per cent. Debenture stock has lost another point at 90½. London United Tramways 4 per cent. Debenture is down 1.

In the Mexican division, the chief flatness is a drop of 16½ points in Monterey 5 per cent. first Mortgage Debenture, which has lowered the price to 54½. The decline, therefore, has been 21 points in less than a fortnight. Mexican Light and Power Company stocks have again given way sharply. The Common and 7 per cent. Preferred shares are both 5 lower at 47 and 77½ respectively; while the first Mortgage 5 per cent. Bonds weakened to 73½. Vera Cruz Debenture stock fell 1, but Mexico Trams are better, the price, after dropping to 72, bracing up to 76. This group, as a whole, shows weakness. Montreals fell 2½, Shawinigan Capital stock 2, British Columbia Deferred and Preferred 3½ each, and Rio Tramway bonds of both classes have lost ½.

The news from Mexico is obviously still grave, each cable adding one or more picturesque details to the tales of chaos, financial and military, prevailing in the country. Where it is all going to end nobody can tell; but a few brave—or rash—spirits maintain that there are fortunes waiting for the capitalist who will buy some of the better-class utility stocks and hold them until the tide turns, taking the risk of whatever damage that same tide may do before it begins to ebb.

There was a rumour current the other day to the effect that the Brazilian Traction Company was about to issue fresh capital, and on this the shares fell to 84. Upon its contradiction there was a recovery to 86, which leaves the price 1½ up on the week. The Anglo-Argentine group is steady. Para Electric Ordinary have started to regain part of their loss; and the feature in this market has been a rise of ⅛ in Rangoon Preference and of 3 in the company's 4½ per cent. first Debenture stock. Cape Electric Trams are a little easier.

The only movement worth remark in the Telegraph and Telephone section are those in Marconi shares, to which reference has been already made. American Telephone and Telegraph issues are lower, in consequence of dear money and the continued fear that President Wilson may be inaugurating before long a campaign against the Trusts. West India and Panama Telegraphs lost $\frac{1}{16}$. Reuters are nominally easier at 9½, and there the list of changes comes to an end.

Manufacturing shares are almost as quiet. General Electric Preference rose ⅛ to 10⅛, and Crompton Debenture put on a point. Willans & Robinson 4 per cent. "B" Preference stock is quoted at 8-13, which is a gain of several points. British Aluminium Ordinary again fell $\frac{1}{32}$, this taking them down to $1\frac{3}{16}$. Edison and Swan fully paid £5 shares dropped 10s., to the level sovereign. The rubber market shows considerable strength, in consequence of a rise in the price of the stuff to 2s. 4½d. per lb. Most of the leading shares are better on the week, and a fair amount of money has been put into the market during the past 10 days by investors who are paying for their shares at the current Stock Exchange settlement.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 12th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	8d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£24	..
a Lead, Nitrate	,,	£30	..
a ,, White Sugar	,,	£28	10s. inc.
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) ..	,,	7½d.	..
(for mining purposes only)			
a Shellac	per cwt.	92/-	8s. dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10 5	..
a ,, Chlorate	per lb.	8⅝d.	..
a ,, Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£121 6 8	..
b ,, Sheet, in ton lots ..	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅛d.	⅛d. dec.
c ,, Tube (brazed)	,,	9⅛d.	1d. dec.
c ,, ,, (solid drawn) ..	,,	8⅝d.	1⅛d. dec.
c ,, Wire, basis	,,	7⅛d.	⅛d. dec.
c Copper Tubes (brazed)	,,	10⅛d.	⅛d. dec.
c ,, ,, (solid drawn) ..	,,	10⅛d.	⅛d. dec.
g ,, Bars (best selected) ..	per ton	£86	£5 dec.
g ,, Sheet	,,	£86	£5 dec.
g ,, Rod	,,	£86	£5 dec.
d ,, (Electrolytic) Bars ..	,,	£74	£4 10 dec.
d ,, ,, Sheets ..	,,	£92	£4 10 dec.
d ,, ,, Rods ..	,,	£79 10	£4 10 dec.
d ,, ,, H.C. Wire	per lb.	9⅜d.	⅛d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/6	inc.
h India-rubber, Para fine	,,	3/4	2d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	49/7	2/4½ dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£20 5	10s. dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£183 to £184	£5 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals ..	per ton	£44 to £206	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 11th.	Rise + or Fall −	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	93 — 96	−1	4 8 4
Charing Cross, West End & City	5	5	5†	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref	5	4½	4½	8⅞ — 4⅜	..	5 2 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	+ ⅛	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	15⅜ — 16¾	..	5 7 6
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 8 11
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	86 — 90 xd	..	4 11 0
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref. ..	5	6	6	4 — 4⅜	..	3 8 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	7⅞ — 8⅛ xd	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8	7½ — 8	..	5 0 0
Do. 4 % Deb.	[illegible]	4	4	6[illegible] — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	[illegible]	[illegible]	4½	7[illegible] — 7[illegible]	..	5 16 5
London Electric, Ord.	3	1½	..	1½ — 1⅝	..	4 13 7
Do 6 % Pref.	5	6	6	4½ — 5[illegible]	..	5 17 1
Do. 4 % First Mort. Deb. ..	[illegible]	4	4	[illegible] — 90	−1	4 7 0
Metropolitan	5	4	4	[illegible] — [illegible]	— 8	[illegible]
Do. 4½ % Cum. Pref. ..	5	4½	4½	4½ — 5[illegible]	..	4 17 6
Do. 4½ % First Mort. Deb. ..	[illegible]	[illegible]	4½	[illegible] — [illegible]	..	4 19 1
Do. 3½ % Mort. Deb.	[illegible]	3½	3½	7[illegible] — [illegible]	..	4 5 4
North Metropolitan Power Sup ply, 4 % Mortgage Deb.	100	5	5	[illegible] — [illegible]	..	4 [illegible] 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	11 — 12	..	5 11 7
Oxford	5	7	6[illegible]	6 — 6[illegible]	..	5 7 [illegible]
St. James' and Pall Mall, Ord. ..	5	10	10[illegible]	[illegible] — [illegible]	..	5 — 1
Do. 7 % Pref	5	7	7	[illegible] — 7	..	5 [illegible] [illegible]
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 1 10
South London, Ord.	4	3½	..	2[illegible] — 2[illegible]	..	7 [illegible] [illegible]
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 [illegible] [illegible]
South Metropolitan, 7 % Pref. ..	1	7	7	1[illegible] — 1[illegible]	..	[illegible] 1 3
Do 4½ % First Deb. Stock ..	100	4[illegible]	4½	[illegible] — [illegible]	..	4 13 9
Urban, Ord.	£1	Nil	..	[illegible] — [illegible]	..	..
Do. 5 % Cum Pref.	5	3	..	2[illegible] — 2[illegible]	..	..
Do 4½ % First Mort. Deb. ..	100	4½	4½	[illegible] — 8[illegible]	..	5 4 3
Westminster, Ord.	5	10	10[illegible]	[illegible] — [illegible]	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4½ — 5	..	4 10 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	6 17 1
Calcutta, Ord.	5	5½	..	7½ — 7⅝	..	5 9 8
Do 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 98	..	5 7 6
Canadian General, Ord. Com. ..	$100	7	7†	104 — 104	−1	6 8 5
Do. 7 % Pref	$100	7	7	117 — 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — ¹³⁄₁₆	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91½ — 92½	−1	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$100	5	5	93 — 95	+1	5 5 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	[illegible] — [illegible]	..	Nil
Do. 6 % Pref.	1	6	6†	[illegible] — [illegible]	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	10[illegible] — 104½	..	4 15 8
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb ..	100	5	5	103 — 106	..	4 14 4
Mexican El Lt., 5 % 1st M. Bds.		5	5	65 — 70		7 2 10
Mexican Lt. & Power, Common	$100	4	4	45 — 50	− 5	8 0 0
Do. 7 % Cum Pref.	$100	7	7	75 — 80	−5	8 15 0
Do. 5 % 1st Mort. Gold Bds.		5	5	71 — 76	−1	6 11 7
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 70	..	7 2 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	82 — 89	− 15½	5 9 6
Montreal, Lt., H. and Power .	$100	9	10†	210 — 215	−2½	4 13 0
Northern, Ltg., Power and Coal, 5 % 1st Mort. Bonds	$500	5	6a	15 — 25 xd	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 — 104 xd	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	6½	6½	181 — 186	− 2	4 8 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	165 — 167	..	4 13 6
Toronto Power, 4½ % Deb. ..	Stock	4½	4½	100½ — 102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	80½ — 81½	−1	6 9 8
Victoria Falls Power, Pref. ..	1	6	6	⅞ — 1⅛	..	6 8 0
West Kootenay Power and L't., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅛	.	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 8 1
American Telep. & Teleg., Cap.	$ 0[illegible]	8	8	123 — 125	−1	6 8 0
Do. Collat. Trust	$1 00	4	4	80 — 82	−1½	4 7 0
Anglo-American Telegraph ..	Stock	8	8	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½ — 105½	..	5 13 9
Do Def.	Do.	30 -	..	28¼ — 28½	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 — 104	..	4 16 2
Chili Telephone	8	8	..	7⅝ — 7⅞	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	8	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 16½	..	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6⅞ — 7⅛	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅝ — 7⅛ xd	..	5 12 3
Direct W. India Cable, 4½ % Reg Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 — 129	..	5 8 6
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12½ — 12¾	..	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	..	6 2 8
Indo European Telegraph ..	25	10	5†	56½ — 58½ xd	..	5 11 1
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref	$1 0	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	3⅜ — 3⅝	−⅛	6 0 0
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅜ — 2⅝	— ⅛	6 9 6
Monte Video Telephone, Ord. ..	1	6	6	⅞ — 1 xd	..	6 0 0
Do. 5 % Pref.	1	5	5	1[illegible] — 1[illegible] xd	..	6 8 1
New York Telep., 4½ % Gen. Bnds.	100	4½	44	96½ — 97 xd	..	4 12 1
Oriental Telep. and Elec. ..	1	1[illegible]	10[illegible]	1⅞ — 2 xd	.	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅝ xd	..	5 1 1
Do 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	9 — 10	..	10 0 0
Submarine Cables Trust	Cert.	6	6	121 — 124	..	4 16 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6[illegible]	6⅞ — 6⅞ xd	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	6 — 6[illegible]	..	4 11 0
West Coast of America ..	2½	2½		1[illegible] — 1[illegible]	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97		4 2 6
West India and Panama Teleg.	10	1½	..	2[illegible] — 2[illegible]	— [illegible]	4 17 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10[illegible]	+ ⅛	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9[illegible] — 9[illegible]	..	[illegible] 9 1
Do. 5 % Debs	100	5	5	98 — 100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12[illegible] — 13	..	6 4 8
Do. 4 % Debs.	Stock	4	4	91 — 96	..	4 8 4
Western Union 4½ % Fdg. Bonds	$10 0	4½	4½	92 — 95	..	4 14 3

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 11th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 33/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	— ¾	..
Do. Do. Deferred	100	..	..	4 — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	5	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb.	100	5	5	89 — 92	—1	5 8 8
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 78 xd	..	5 15 5
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	—2	5 2 0
Do. Do. 1896	100	5	5	96 — 98	—2	5 2 0
Do. Do. 1901	100	5	5	95 — 97	—1	5 3 1
Do. Do. 1903	100	5	5	95 — 97	—1	5 3 1
Do. 4 % Deb.	100	4	4	90 — 93	—1	4 7 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 3/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	¼ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	13/32 — 21/32	— 1/32	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	77 — 82	..	5 9 9
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	57 — 61	—1	6 11 2
Metropolitan Railway Consol.	100	1⅜	1½†	38¾ — 39¼	— ¼	4 3 10
Do. Surplus Lands	100	2¼	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan District Ord.	100	Nil	..	27¾ — 28¼	— ¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	—1	5 8 5
Do. 3½ % Gtd	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	5/8 — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	1/32 — 19/32	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	110 —113	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	88 — 89	..	6 14 10
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	8½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	+1	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 8 11
Do. 4 % Deb.	100	4	4	89½ — 91½	—1½	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	+ ½	4 10 6
Do 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction, Light and Power	$100	6	6†	84 — 86	+ ½	6 19 6
Brisbane Trams Invt., Ord.	5	8	8	7¼ — 7¾ xd	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8 xd	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	—1	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	115 —120	— 3½	6 13 4
Do. Pref. Ord.	100	6	6	102 —107	—3½	5 12 2
Do. 5 % Pref.	100	5	5	99 —102	..	4 18 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4¼	4¼	90 — 93	..	4 11 5
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	23/32 — 25/32	..	6 8 0
City Buenos Aires Trams (1904)	5	5†	5	5⅜ — 5⅝	..	4 13 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92 xd	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	2	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 1
Do. 6 % Pref.	1	6	6	1 5/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	74 — 78	+1	8 19 6
Do. Gen. Con. 5 % Bonds	..	5	5	73 — 78	+1	6 8 2
Do. 6 % Bonds	100	6	6	78 — 82	..	7 6 4
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅜ — 5⅝	+ ⅛	8 10 2
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅜	+ ⅛	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	+8	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98 —100	— ½	5 0 0
Do. 5 % Mort. Bonds	100	5	5	88 — 90	— ½	5 11 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5¼	..	6 13 4
Do. 6 % Pref.	5	5	6	5 — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	93½ — 96½ xd	..	5 8 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	2⅝ — 3	..	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord.	1	..	..	1⅛ — 1¼	— 1/32	..
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½ — 87½	..	5 14 3
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1/16 — 1⅛	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11½ xd	..	6 10 5
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	..	3 1/16 — 3 5/16	..	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	62 — 67	+1	7 9 3
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	1 23/32 — 2 1/32 xd	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	¾ — 1¼	— ½	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 3/16 — 1 5/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	+ ⅛	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7 2
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4
Do. B 4 % Cum. Pref.	100	..	..	8 — 13	+4	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

ELECTRICAL ACCIDENTS IN MINES.

(*Continued from page* 733.)

In addition to the foregoing, an engineman on the surface had his arm burned through a short-circuit from an ammeter in the engine room, and two persons were prosecuted by the owners and fined £1 each for attempting to relight a safety lamp with the electrical relighting apparatus when not authorised to do so.

In the Newcastle district there were two fatal accidents underground and one on the surface, while three persons were injured.

One of the fatal accidents occurred at Hartford Colliery, where some alterations were being made by the British Westinghouse Co. to the main switch handles at the pit bottom. It was a Saturday afternoon; one of the Westinghouse Co.'s fitters was at work on the job along with the colliery electrician. The current was three-phase (2,750 volts), and was not cut off at the time at bank; the electrician had, however, attempted to get communication by telephone to bank to get the current cut off, but without success; they could not get the cage at the time, so they decided to proceed. The deceased, who was a skilled electrician, went down the pit later in the afternoon to examine the alterations made; there were no lights; no one appears to have told him that the current was on, and in all probability he assumed that the current was off and the apparatus dead. This was a reasonable assumption for him to make.

He received a shock whilst trying the working of the switch, and died without recovering consciousness, although he was pulled off at once and artificial respiration was resorted to. It was most regrettable that the deceased was not warned that the switch was "live."

The report is very incomplete, and the strange thing about it is, how did the other two men who had been working at the switches avoid receiving an electric shock?

The other accident occurred at Chopwell Colliery, and involved the death of a coal hewer. "A motor-driven coal face conveyor was at work in what is known as 8th West Mothergate district of the New Stone Coal Seam. A defect had arisen in the switch controlling the motor, which switch was fastened, like the motor, to the framework of the conveyor. Hudson went to the switch when he heard of the defect, saying 'I think I can put that right.' He lifted the cover from the switch, and then called for the current to be switched on by means of a neighbouring switch a few yards out-bye of the defective switch. When the current was switched on, it was seen that Hudson was suffering from shock from the defective switch he was handling. Current was quickly switched off, but the shock proved to be fatal. The switch from which the fatal shock was received was not earthed, though the pressure was 600 volts alternating current."

Under instructions from the Home Office, legal proceedings were taken against the manager for an infringement of Rule 8 (*a*) of the recently established electricity rules, which requires that "All metallic sheaths, switch and fuse covers, &c., shall be earthed by connection to an earthing system at the surface of the mine."

The case was heard before the Gateshead magistrates. The facts were admitted by the defence; they, however, claimed that as the coal conveyor was in use before June 1st, 1911, the exemption Rule 20 (*b*) applied, and that that exemption during its continuance held free from the necessity of any earth connection all apparatus which was not required to be earthed by the (recently superseded) 1905 code of rules, that is to say, all portable apparatus. The magistrates accepted this view and dismissed the case. They were asked to state a case, and on appeal it was again dismissed, and the magistrates' decision upheld. The conveyor switch has, however, since been connected to earth.

The fatal accident on the surface occurred at Mickley Colliery to a young man, 20 years of age, in charge of an electric haulage engine. The motor was 10 H.P., D.C., 450 volts. There was an open-type metallic starter, with no-volt release, mounted on a pillar about 3 ft. behind the motor, and an enclosed double-pole switch with fuses. He was putting the clutch into gear ready for starting the full set. He was seen with his left hand on the clutch lever and his right extended towards the starter, which was behind him, and was looking out of the window of the engine room, when he fell backwards. His right hand probably came in contact with a live part of the starter.

This is clearly an accident which would have been avoided had the starter been enclosed. No particulars are given of the non-fatal accidents.

In No. 3 district (Durham) there was one fatal accident underground and one on the surface. The latter was of a very simple character, and would not have happened if ordinary precautions had been observed by the deceased. It occurred at Bowden Close Colliery, belonging to Messrs. Pease & Partners, Ltd. An electrician was sent to fit an adapter and portable lamp to a lampholder. He knew the current was on, and he had frequently done similar work. After attaching a length of flexible cable to an adapter, he placed the latter in the lampholder, and was afterwards found with the bared end of the flexible cable in his hand. All efforts to restore him were unsuccessful. The pressure was 250 volts alternating between one phase and neutral.

It is admittedly difficult to prevent accidents such as this, and it only shows how very important it is that the circuit should be broken before the very simplest operation is done. Evidently the man quite unconsciously held the other end of the bared cable in his hand while in the act of fitting the adapter, and had he only taken the precaution of cutting off the current, his life would have been saved.

The underground accident caused the death of a "siding" attendant. The deceased was on his way in-bye when he stopped to speak to another "siding" attendant, and as the electric lights at once went out, the latter thought the deceased had switched them off in fun, as had previously happened. The deceased was shortly afterwards found lying insensible on his back with one of the lighting cables broken in his hand. His oil lamp was standing burning close at hand. It is not known what the deceased was doing, as the lighting wires were over 6 ft. from the floor. The pressure was 250 volts alternating. One wire was broken, and on the other there was no insulation for a length of $1\frac{1}{2}$ in. The deceased was got clear and efficient artificial respiration resorted to, but without success, in spite of continuous efforts for two hours.

It would appear that the deceased had been in some way interfering with the wires, probably with the object of finding out what was wrong, and paid with his life for his curiosity. Practical joking, such as switching off lights in fun, cannot be too strongly discountenanced by the management.

In No. 4 district (Yorkshire) there were two fatal accidents, one on the surface and one underground, and 10 non-fatal accidents causing injury to 11 persons.

The surface fatal accident occurred in the coke-oven stamper house connected with a battery of Simon Carve by-product ovens; the deceased's occupation was that of coke-oven labourer, and, amongst other duties, he had to "set the ram" right for entering the coking chamber. He had nothing to do with the mechanical parts, which were manipulated by an attendant named McLean, who had control of two electric motors, one working the stamper, the other working the ram. The stamper, worked by a $7\frac{1}{2}$-H.P. motor, taking 550 volts alternating current, travelled 30 ft. backwards and forwards, and took its power from three bare wires. When the traverser and coal box were in one position there was 3 ft. 6 in. gap between the movable building and the coke-oven wall, and on the top of the coke ovens there was a substantial two-railed iron fence. It seems that after asking an attendant if the coke was nearly ready, a fact which he could have seen for himself, the deceased, in order to get from the top of the coke ovens into the stamping house, climbed over the iron fence referred to, stepped over the 3 ft. 6 in. gap, and while getting on to the floor of the stamping house came in contact with two live wires and was killed. Deceased seems to have been making a "short cut" by a forbidden path from one point to another, which short cut took him close to some wires which he must have known were live, and which were necessarily, for the working of the machinery, bare; he failed to appreciate the true meaning of the fence which

had been placed there to protect the wires and avoid danger to the persons employed.

At the inquest the verdict of the jury was that the man "died from electric shock which was accidentally sustained," but this is clearly a case where the man himself was to blame.

The underground fatality occurred to a youth named Henry Gillies on June 20th, near an electrically-driven coal-cutter in a machine face in the Lidgett seam of coal.

The system of supply was 500 to 550 volts D.C. The current for this machine was taken from a distribution board underground, a voltmeter on which registered only 400 volts, due probably to the running of a haulage motor on the same circuit. The gate-end switch was enclosed, and beyond was a metal box having a movable cover, containing two open switches, one on each pole. From there the conductors entered a plug connector to receive one end of the trailing cable, which was a two-core, leather covered cable 80 yd. in length. The attachment to the coal-cutter was by means of a plug connector similar in design to the one at the other end of the trailing cable.

The coal-cutter, the frame of which was not earthed, was of the bar type, driven by a 25-H.P. D.C. compound wound motor, taking about 48 amperes at 400 volts.

It seemed that the deceased's duty was to clean out the "holings" behind the machine. When kneeling on the damp floor he made contact with the machine haulage rope, which proved to be "live," and was killed. Artificial respiration was tried without avail.

Mr. Robert Nelson, H.M. Electrical Inspector of Mines, attended the inquest, and expressed the opinion that the accident was primarily caused by bad contact between the live parts of the connector and the contacts for the latter at the coal-cutter. In cases of bad contact an electric arc is formed, and Mr. Nelson thought that such an arc, spreading to the side of the machine, had made the whole machine frame "live," and that the youth Gillies received the fatal shock from the haulage rope, which was, of course, in electrical contact with the machine. The question arose as to why the coal-cutter machine was not earthed properly. Early in March, fully three months before the accident, a new code of electricity rules was established for coal mines. One of these rules, 8 (*a*), requires the coal-cutter frames to be earthed for the safety of persons operating them. Such an earth connection was not, prior to the above date, compulsory; there appears to have been ample time to allow of the new regulation being complied with, for there was already an earth-wire laid at the gate-end, and this could easily have been extended to the machine frame. Had the matter promptly received the attention of the management, and had the safeguard of an earth connection been provided, the accident would, no doubt, have been avoided. The verdict was "Accidental death," but the jury added that it would have been better had the earthing been carried out more expeditiously.

Of the non-fatal accidents by electricity, five occasioning injury to six persons occurred on the surface, and five causing injury to five persons, underground. Of the five surface accidents, four happened to electricians or persons in charge of apparatus. Two of the underground ones were caused by persons making contact with defective cables, another being due to a worker accidentally falling with his hand on terminals while a controller case was open for the purpose of examination.

In addition to these, "electricity" was said to be the cause of an underground fire, but this *was rather due to the presence of inflammable material in a motor house than to the actual use of electricity.* A breakdown had occurred at the commutator of the motor, and if there had been no inflammable material in the neighbourhood of the motor, or if the live parts of the latter *had been completely enclosed*, in all probability there would have been no dangerous occurrence to report.

(*To be continued.*)

The Electric Treatment of Bauxite.—Of the products of the treatment of the mineral bauxite by means of the electric furnace, apart from aluminium, corundum ranks as the most important. It is used for polishing purposes under a variety of names and in various forms—emery wheels, polishing stones, &c. The industry was started in Bohemia, but is now chiefly prosecuted in France, where the La Bathie works have a capacity of 3,000 H P, and in the United States, where a factory of a capacity of 3,600 H.P., derived from the Niagara Falls, turns out 16,000 tons a year. In the electric furnace bauxite undergoes many transformations. By fusion, together with purification by reduction more or less complete, the whole series of aluminous abrading materials are obtained; the last stage is pure alumina, used for the manufacture of aluminium. The reducing treatment may even result in yielding complex alloys, and, lastly, aluminium and carbide of aluminium. This carbide, which is found in many combinations, is essentially harmful to all these products, in which it leads to a rapid disintegration on contact with damp air. The reduction, made in an atmosphere of nitrogen by means of long rotary furnaces, furnishes nitride of aluminium, a very interesting new industrial product; treated with an alkaline solution it is decomposed into salts of ammonia and pure alumina. The profit obtained from the salts of ammonia lessens proportionately the cost of the production of the alumina, and consequently allows of the production of aluminium at a much lower price.—*Bulletin de la Société Internationale des Electriciens.*

TABLE SHOWING AGGREGATE ELECTRICAL HORSE-POWER IN MINES IN THE UNITED KINGDOM.

——	No of mines.	Surface.						Underground.				
		Winding.	Ventilation.	Haulage.	Coal washing & screening.	Miscellaneous.	Total.	Haulage.	Pumping.	Portable machinery.	Miscellaneous.	Total.
No. 1 District: Scotland ...	290	1,666	2,363½	2,527	5,513	6,944½	19,014	22,813½	36,143¾	17,367	3,018¾	79,343
No. 2 District: Newcastle-on-Tyne	111	3,159	4,402½	2,333	3,318	5,511	18,723½	11,361½	13,128½	1,627½	2,309½	28,427
No. 3 District: Durham ...	145	2,149	6,224	3,748	6,080	9,409	27,610	15,918	17,988	1,550	700	36,156
No. 4 District: Yorkshire and North Midland	317	657	3,947½	2,088	16,836	18,729	42,257½	24,132	11,880	7,250	2,353	45,615
No. 5 District: Manchester and Ireland ...	73	110	830	246	1,167	2,052¼	4,405¼	2,666	3,097¾	234	437	6,434¾
No. 6 District: Liverpool and North Wales ...	82	25	1,111⅓	255	1,304	1,309	4,004½	5,686	4,132½	409	820½	11,048
No. 7 District: South Wales ...	286	16,129½	11,299⅓	11,696	7,075½	24,711¼	70,911¾	32,733½	43,638½	926	1,183¼	78,481¼
No. 8 District: Midland and Southern Counties	121	—	715	861½	2,276	3,309½	7,162	14,714½	14,309½	1,674	461½	31,162½
Total ...	1,425	23,895½	30,893½	23,754½	43,569½	71,975½	194,088½	130,025	144,318½	31,037½	11,286½	316,667½

THE ART OF TRAVELLING.

By S. WALLACE WILKINS.

Recent correspondence in the Electrical Review has suggested that the functions of that much-abused man, the commercial traveller, are misunderstood, both by employers and buyers. The scope of travellers varies remarkably in different trades. The methods adopted by a man selling drapers' goods would be useless if employed in selling agricultural machinery. The difference between trades lies in the number of articles sold. Where the quantity is great, the goods are kept in stock; the trade is wholesale, and the traveller deals in bulk with a recognised *clientèle*. Where the quantity is small, the goods go direct from manufacturer to user through an intermediary, who does not handle them.

In selling bulk goods to stock-holders, business capacity and personality are the qualities most valuable in a traveller. The capacity for making friends and pleasing them is foremost. He need know little of his goods, they need be little more than paper expressions to him.

In selling specialised articles technical knowledge is before all things necessary.

The electrical trade generally covers many trades with totally different characteristics. Electric lamps and wiring sundries have been sold very successfully, in the writer's experience, by drapers' travellers. They come under the head of bulk supplies, and although working knowledge of their manufacture is distinctly an advantage, it can be dispensed with.

However, the sale of these articles is confined to a few firms. The traveller with whom we are most concerned is the seller of specialised articles. It is in this department that talent is called for, and, unfortunately, is not forthcoming.

The theory of buying and selling entertained by most people not in business is that the buyer becomes acquainted with goods by perusing advertisements, then obtaining competitive prices through the post, and placing his order with the lowest tenderer. The traveller, in this scheme of things, is a nuisance; he is an importunate interloper, endeavouring to upset the even tenor of business competition by his persuasive arts.

Practice, on the contrary, makes the traveller, if he be worthy of the name, the most important agent in the transaction. He is invaluable to the buyer for the information he is able to give, and as the responsible party to see the contract carried out to the customer's liking. He is invaluable to his principals for information of another character which he brings both before and after the business.

Let us define "traveller." The man who pays a call—if indeed an interview be granted—to keep the name of his firm before the possible purchaser is not a traveller; he is a waster. Abolish him, by all means; a page in the Electrical Review costs less and does more. A traveller that is worthy of the name does not call for orders. He is a diplomatist. He is out for information, to find where business is going, the special wants of the purchaser requiring attention, and what steps have to be taken to get his firm favourable consideration. He introduces the personal touches with negotiations that just remove the transaction out of the groove of relentless bargaining. He arranges the call of his managing director on the right person at the right time. He sees that the way of the purchaser is made smooth.. Sometimes he finds out what the other fellow's price is—but tells this not in Gath. When it comes to placing the actual order he is not wanted any more, he is above such clerical details—his work is done—and he is nursing his next job.

Such men are ambassadors of commerce. They act as their firm's antennæ, to keep the works up-to-date and the latest requirements of the market before the managers, and to ascertain where their firm's goods fall short of new standards. Such men get valuable information out of a casual conversation with a station engineer without the latter being aware that he has said anything. He will get equally valuable information sometimes out of the office boy. If he can clinch a transaction, and come away with the order, so much the better, but if he regards that as his primary duty, he is not a first-class representative, and he is likely to waste a great deal of valuable time. If he is judged by the business he brings in his pocket, he will then concentrate on his certainties, and neglect his uncertainties.

This class of man must know his subject, and he must be a man of education. He is best supplied from the class of premium apprentices, after a few years' mature experience, but men with a personality must be selected. It is a great mistake to send men round who are of a lower social grade than those on whom they call. A man can easily stoop, but he cannot increase his stature.

It must not be forgotten that the principal aim of the representative, from the manufacturer's point of view, is to lift each transaction as far as possible out of the "lowest tender" stage. Roughly speaking, business that goes to the lowest price out of a dozen is no good to anyone. It is like throwing a bone to the dogs. All the dogs get mauled, and the one that gets the bone has a sorry meal. The purchaser is usually also to be pitied. Instead of a conscientious job, he gets as little as his suppliers can give him to keep out of the law courts.

There are always points in which each customer's requirements call for something special. It is the traveller's duty to cater for these minor embellishments, which may decide a contract. There are always points in which the traveller's make of goods is superior to others for the particular job in hand. It is the traveller's duty to emphasise these points.

The traveller's calling in the electrical engineering and allied trades is an exacting one, in which a gentleman, with more than average brains, is required. To the detriment of the trade as a whole, too few of such are employed.

In a number of firms the job of traveller is a sort of "Chiltern Hundreds" for anyone who has turned out a failure in another capacity. An unsuccessful manager, a discontented clerk, a redundant shown om hand, the managing director's importunate wife's cousin—all are dumped down to try their hand at travelling. This is the type of man who "leaves his card," and helps to swell the transit companies' dividends.

The firms who regard travelling as a most serious and trustworthy job, who map out their business campaign under a responsible director with a qualified staff, and who consider the travelling staff as forming the necessary link between the publicity campaign and the shops, will economise on their selling expenses, and secure greater efficiency. The publicity manager has now come—the director of travellers and outside organiser is in most cases yet to be created.

AMERICAN METHODS ARE NOT SUITABLE FOR BRITISH CONDITIONS.

By A. HUGH SEABROOK.

This has been a generally accepted statement made on the authority of those who have never tried such methods, and has been almost universally blessed by the technical electrical Press.

As sound advice, I have never agreed with it, but finding myself in a minority of about one it seemed futile to labour in opposition to general opinion.

Now, I wonder how many electrical men have carefully and thoroughly read the accounts of the proceedings and conferences of the recent annual meeting and Exhibition of the British Commercial Gas Association.

I have read practically every word, I have visited the Exhibition several times and have had discussions with the organisers, and what do I find? This: that I cannot detect any difference between the principles, practices, arguments and advice of those gas men and those of the foremost American commercial electrical development men with whom I have also had discussions, and the proceedings of whose conferences I have read.

Principles which are scouted in the British electrical industry are being taken hold of with both hands by the British gas industry.

One hears and reads of the most eminent gas men of to-day telling their audiences that gas supply is a matter of salesmanship, and salesmanship *alone*.

They urge the discarding of the "canvasser" and advocate the employment of highly paid, well educated and intelligent gas salesmen.

They urge that the man who can sell is worth more than the man who merely makes: that the salesman should be paid at as high and higher rates than the engineer; that every gas undertaking should run a gas sales department, and that the satisfaction and convenience of the consumer are of all importance. Every speech (and these were made by gas engineers, managers, chairmen and directors, as well as those representing the purely selling staff) was on sales departments, publicity development, education of the public and demonstrations of gas appliances.

The note of keen enthusiasm was strikingly significant, such enthusiasm as we in the British electrical industry know nothing of, and pour contempt upon.

From the point of enthusiasm I could hardly believe I was not at a convention of the National Electric Light Association of America.

Now, the electrical man who believes the statement forming the subject of this article will say: "Oh yes, of course they know it (gas) is a dying industry, and only by such artificial boosting can they keep it alive." Well, then, I will ask him why does the American electric supply industry adopt precisely the same methods in a new country where there are many towns where gas does not exist at all, and where it has not nearly the hold on the public that it has here?

There (U.S.) it is most certainly not a case of boosting up a dying industry suffering from the competition of a superior agency. No, it is because the so-called American methods mean increased prosperity owing to the rapidly increased business they result in.

To run a "Sales Department" in the British electrical supply business is even to-day *infra dig.*; it indicates that the management responsible for inaugurating it is displaying an indecent enthusiasm which should never be allowed to be noticeable. Even the big electric supply companies only inaugurate sales departments furtively, and jump if anyone suggests that they are really trying to increase sales in their areas.

Don't let electrical men in this county adopt the ostrich-like method of depreciating this increasing enthusiasm in the gas industry! Don't think that these gas men do not actually believe that they have a commodity to sell that is better in every way than any competitor!

They do believe in it, and therein lies the seriousness of their competition. One cannot talk to any prominent gas man for five minutes and not realise this. The trouble is that we do not believe in electricity as our American electrical cousins do, and as our competitors believe in gas.

Look at our Association and Institution discussions for examples of this blatant and unashamed scepticism in regard to electricity and its possibilities. Do you ever read anything like it in the gas journals at home, or the electrical journals abroad? Those industries would not tolerate it for a moment. With all the multitudinous weaknesess in the armour of our gas competitors, they take very good care not to expose them; how it is done is remarkable.

We have the purest, therefore the best and most hygienic agency, and we seem to endeavour to hide its advantages from the public and spend our spare time in publicly discussing imaginary defects which do not exist.

There is another parallel between the American electrical and British gas industries. It is in a direction unstudied, misunderstood and sneered at when mentioned in electrical circles here. I refer to the close attention given to the human element in the *personnel* of the employés.

Both industries pay an increasing regard to welfare work, contentment of, and improved conditions for, workpeople, their proper feeding, housing, and so on. A great deal of time is given up to the consideration of these subjects, and they are well worth it. They result in the best work being obtained from employés.

An increase in the efficiency of staff and workpeople has an enormous beneficial effect upon an industry.

Do you ever hear the subject mentioned in electrical circles here? The only efficiency talk we hear of is a fraction of 1 per cent. improvement in the steam consumption of a turbine at an altogether disproportionate risk and expenditure of money.

I wonder when we shall realise that such things are as nought compared to the effect of a bigger business, and a very slight increase (obtainable at almost negligible cost) in the personal efficiency of staff and workpeople.

It is fairly well known that British gas companies lead the world in the successful application of co-partnership principles, and American electric supply men are following closely upon their heels.

It may surprise electrical men here to know that these industries have standing committees who deal solely with these questions.

I have kept silent for some years on the question of American methods in regard to electricity supply, because I was always met with the scornful objection that such may be all very well there, but would never go down with the British public.

I have found that they "went down" very well with the diverse specimens of British public with whom I have had to deal, and now that I see another great industry applying them with unqualified success, I think it time to suggest that it may be worth the while of our very superior industry to look into them.

I was delighted to read Mr. Vernier's spirited address to the Newcastle Section of the I.E.E. I believe we require a few such thorough-going pessimists (pessimists, not in regard to the possibilities and prospects of the industry, but men wholly discontented with present progress) to scourge, irritate and abuse all (and there appear to be many) who are disposed to be satisfied with the present state of things.

The following hinges on an interesting portion of Mr. Vernier's address. The enlightened and successful business methods in vogue in the American electrical and British gas industries invite still further thought, and one then realises that in America municipal electrical undertakings are hardly known, and of the British gas authorities, by far the largest (they are actually the largest in the world) are the London gas companies.

In both countries there are a few men at the head of each industry personally controlling millions of capital, unfettered by either State or municipal red tape and restrictions, free to spend money in development, able to engage the best brains the countries can produce, and "big" enough to dictate to their respective industries what is best for them to do.

By force of example and financial weight, and not by any means omitting high personal ability, what men like Insull and Gilchrist say to the American electrical industry that industry does, and does to its continual advantage.

Similarly, that which Sir Corbet Woodall tells the British gas industry to do, it likewise does, also immensely to its advantage.

Take the case of the inability of municipal trading undertakings to subscribe to a co-operative publicity campaign; municipal electrical men have grumbled and complained, for more years than one cares to remember, that they are unable to form a central publicity organisation to educate the public to the advantages of the uses of electricity.

Now, what happens when the gas industry gets up against the same problem?

Mr. Goodenough (you can see the shadow of Sir Corbet Woodall behind him) immediately goes straight to the President of the Local Government Board and gets an arrangement made whereby municipal gas undertakings can subscribe in effect to the British Commercial Gas Association funds.

Why have municipal electrical undertakings been unable to get the same privilege? Simply because we *are* nearly all municipal, which is the same thing as saying that we are each self-contained, limited by parochial boundaries, and parochial ideas, and have no sense of combination, consequently we have no "big" man, and finally, and most important, the municipalities who do possess electrical supply undertakings are not sufficiently enamoured of them to wish to further increase their spheres of influence.

Do you suppose that if this were not so, the Association of Municipal Corporations could not get any such powers at any moment?

The attitude of this Association is, to all intents and purposes, not only apathetic, but even opposed to any further facilities being granted to municipal electrical undertakings to increase their business.

We have no such men here as Insull and Woodall, because we are municipalised ; the convener of the Electricity Committee of such an important city as Glasgow has not as much power as a chairman of a small electric supply company. He has actually no power at all as regards the industry

He cannot talk with the power of millions sterling to back up what he says. He can only try and persuade. Only money talks. Goodness knows what can be done except persistent agitation, but there is one feeble stray ray of hope.

It is within the bounds of possibility that the London County Council may be induced to bring about a consolidation of London electric supplies in the near future, and may further be induced, while retaining a certain amount of control, to arrange with a powerful commercial organisation to operate the immense undertaking—not only the generation of electricity, which is of comparatively small importance, but the distribution and selling of electricity as well.

In view of the present foolhardy craze for nationalisation and municipalisation, it is, as I have said, only a faint hope. But it is the sole hope in this country of raising an electrical equivalent of Insull or Woodall, who can talk with the necessary financial weight behind him and lead the whole British electrical supply industry.

He need not be a technical man any more than are the two men I have mentioned, in fact, a non-technical man might be a distinct advantage. One can see a few men —and only a very few—leading other great industries to success whom one would like to see leading the British electrical supply industry.

If, however, the more than probable happens, and we get a London County Council management, it seems to me that the last ray of hope will be gone of ever building up a great supply industry in this country. Such a management could never negotiate railway supplies, for instance, because such negotiations are generally arranged financially in such a way that no municipal management could conduct them ; apart from that, railway companies are not likely to go to a municipal electrical supply for their power, knowing as they do that such a management has to respond to political changes and influences.

Without railway supplies, Consolidated London electrical supply cannot obtain the diversity of load required to attain the lowest general prices of energy. As it is, many of the railway supplies are already lost to the general London business for 50 years, because so many of the companies have installed, and are installing, their own power plants. This is unfortunate for two reasons, one being that these plants will perpetuate for many years the destruction of the by-products of coal by burning it on boiler grates, whereas it is of vital importance to the country that these by-products should be preserved, and only gas-fired boilers or gas-driven turbines (which will assuredly be developed in the near future) used for the generation of electricity.

The second reason is that such power plants will also perpetuate for many years the generation of electricity in London, whereas that operation should in the future be carried out only in the coalfields of Warwickshire and Kent by the above-mentioned means and energy transmitted to London by high-pressure overhead transmission lines, fenced in like railway tracks and skirting the intermediate towns.

The cost of freight is continually increasing, due to increased wages and so on, whereas the art of constructing and maintaining very high-pre-sure aerial lines is so much better understood, resulting in decreased cost per 1,000 KW. per mile, that I am not certain that even at the present moment the balance may not be in favour of electrical transmission as against coal carriage.

How could the London County Council take upon itself a task of such magnitude and responsibility, necessitating the purchase and operation of several coal mines and many auxiliary operations, each in itself a large technical business ?

If the County Council retains the business, we shall not get our " big " electrical supply man, so badly needed to lead the industry, and we shall potter along with the old ideas which go no further than a generating station at Barking for bulk supplies, leaving the present muddle and mixture of distribution to go on indefinitely.

I am afraid at first sight it may appear that I have wandered far from the subject of my article, but yet I do not think I have in reality, because I think that American electrical men, if unhampered by State or municipality, would tackle the London problem much on the lines I have indicated.

AN ELECTROSTATIC OSCILLOGRAPH.

At a meeting of the Physical Society of London on October 24th, a paper on "An Electrostatic Oscillograph," by Messrs. H. Ho and S. Koto was read by the latter.

The paper describes an electrostatic oscillograph suitable for recording very high voltages. Two vertical bronze strips are hung symmetrically between two parallel metallic plates called "field plates." They are connected at their lower ends by a silk fibre, which passes under an ivory pulley. An extremely small mirror is fixed to the strips. This arrangement constitutes the vibrator, which, mounted on an ebonite frame, is immersed in an oil bath. To the upper extremities of the strips are connected the terminals of a direct-current voltage of about 300. The alternating voltage to be recorded is connected to the "field plates," in parallel with which there are two oil condensers in series. The electrical mid-point of the direct-current battery is connected to a point between the condensers.

The turning moment on the strips is proportional to the product of the momentary values of the alternating-current voltage and the direct-current voltage so that if the latter is constant the deflection of the mirror accurately follows the variation of the former.

Oil plays an important part, not only acting as a damping agent and insulator, but increasing the sensitiveness on account of its high dielectric constant.

In cases where the voltage is low, but the source of energy is so limited that a sufficient current cannot be taken to actuate the ordinary oscillograph, the electrostatic vibrator may be used by applying the voltage in question to the strips, while the terminals of a high-tension battery, or influence machine, are connected to the "field plates." The instrument may also be used for recording very small currents by replacing the oil condensers by two exactly equal resistances, which are traversed by the current.

In the discussion, Mr. A. Campbell said it was a considerable advantage to be able to do without high resistances, and Mr. R. S. Whipple emphasised the commercial advantage of the instrument, as high resistances were very expensive.

Mr. J. T. Irwin said the principal difficulty with an electrostatic oscillograph was that a very high polarising voltage was required if the zero was to be stable. The authors had reversed the process—using a small polarising voltage compared with the alternating-current voltage. Hence it was only when the alternating-current voltage was applied that a change of zero was produced. In most cases this could not be compensated beforehand. Castor oil was not suitable for use in oscillographs, as it became acid and conducting under high voltages ; well-filtered paraffin had not this defect.

Mr. G. L. Addenbrooke said that if castor oil free from dust and moisture were used he did not think oscillograms with the instrument would be affected perceptibly by action in the oil at 10 periods or higher.

Prof. Koto, in reply, said that the deviation of the strips from the centre was a cause of the change of zero, if a large polarising voltage were applied. To suppress this effect, the authors made the distance between the two field plates, and consequently the distance between the strips and the plates, sufficiently great to make the inevitable slight deviation from the centre a very small percentage of the distance between the strips and the plates, and consequently this deviation from symmetry would cause no appreciable "out of balance" of the forces due to the polarising voltage acting upon the strips and effecting this change of zero.

Electrolysis and Armoured Concrete.—The New York correspondent of *Der deutsche Steinbau* states that symptoms are multiplying which tend to show that the American enthusiasm for "skyscrapers" is greatly weakening. It is becoming clearer every day that the massive armoured concrete buildings contain within themselves serious hidden dangers, and it is significant that a jury of specialists is now in session in New York to examine these questions and to elaborate proposals for the limitation of such structures. The most serious risk feared in connection with the skyscraper building is the electrolysis of the steel framework and the destruction of the steel supports by the electric current. With the unlimited use of electric installations in these buildings, it is said, the avoidance of stray currents is impossible. Specialists in Chicago reckon, after close investigation, that the destruction of steel in a skyscraper building proceeds at the rate of 1 lb. per hour. This statement is rather vague, and we believe that under normal conditions there is little risk of damage to reinforced concrete by electrolysis, which cannot take place except in damp situations and where stray currents have direct access to the reinforcing rods.

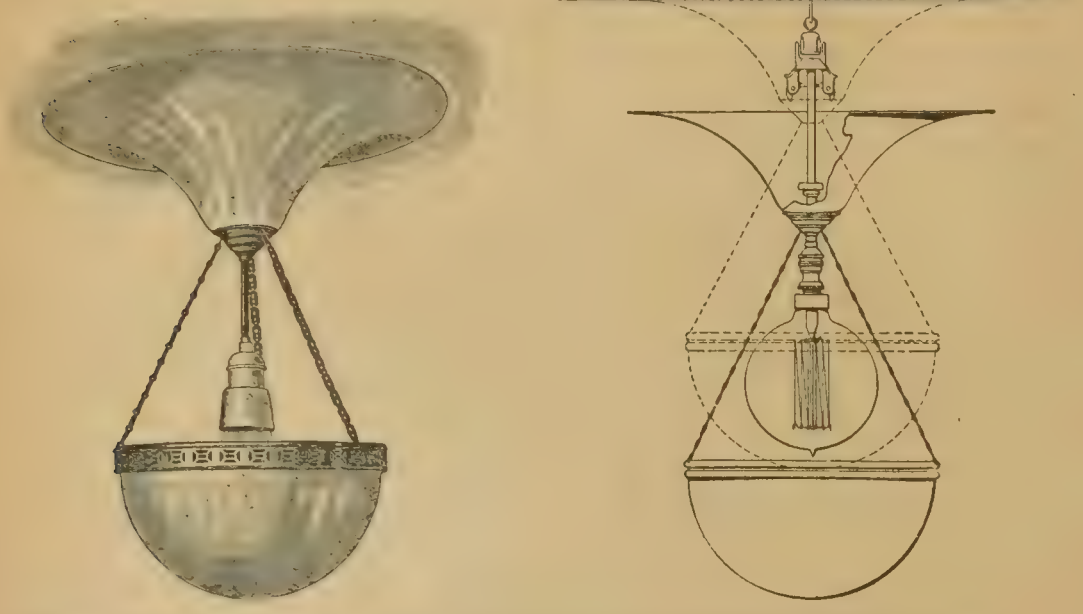
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Benjamin Steel Reflectors.

The Benjamin Electric, Ltd., 117, Victoria Street, S.W., announce that they have developed a special interior surface, which will in future be applied to all Benjamin steel reflectors, and which is obtained by a transparent coating which forms a simple protective surface over the aluminium reflecting medium. This allows reflectors so treated to be cleaned very easily, and this surface will be referred to as the "Ezekleen" reflecting surface; the ordinary aluminium surface shows depreciation in efficiency after a short service, which is due to the dirt particles, which it is impossible to remove as they get into the pores of the aluminium.

The Saturn Lamp.

To meet the demand for fittings for semi-indirect lighting, the Electrical Engineering and Equipment Co., Ltd., of 109, New Oxford St., W.C., have just placed on the market the "Saturn" lamp. This has a number of advantages over similar devices on the market, the principal one being that the bowl and reflector are fitted with a special automatic raising and lowering device similar to that employed in the firm's arc-lamp contact gears. This allows of the bowl being lowered clear of the lamp for cleaning purposes, the difficulty of cleaning the bowl and the risk of breakage of the lamps being one of the drawbacks of existing fittings. The possibility of lowering the reflector on the centre stem also makes the erection of the fitting very simple; a further advantage is that the centre stem does not go through the bottom of the bowl—which method of support produces a black spot immediately under the fitting—but is supported on chains. The new lamp is illustrated in figs. 1 and 2.



Figs. 1 and 2.—Exterior and Lowering Arrangement, Saturn Lamp.

A Knife-Polishing Machine.

The Atlas Manufacturing and Trading Co., of Revenue House, 7 and 8, Poultry, E.C., who are the sole licensees for its sale in this country, on the Continent, and in the Colonies, have recently put on the market the Dilg Defiance cutlery polisher—an electrically-driven machine with a capacity of 800-1,000 knives an hour, and an attachment for polishing forks, &c. The machine is fitted with a 110 or 220-volt motor geared to the knife polisher, which simultaneously cleans the sides, back and shoulders of the blade. An additional spindle containing a grinding wheel, buffing brush for silverware, and a brush for polishing hollow-ware can be attached, the complete machine then occupying 28 in. × 13 in. table space. The starting switch is incorporated with the motor, and the machines weigh roughly from 50 to 55 lb. each. They are in extensive use in hotels, restaurants, &c., and on passenger steamships including those of the Hamburg-America Co.

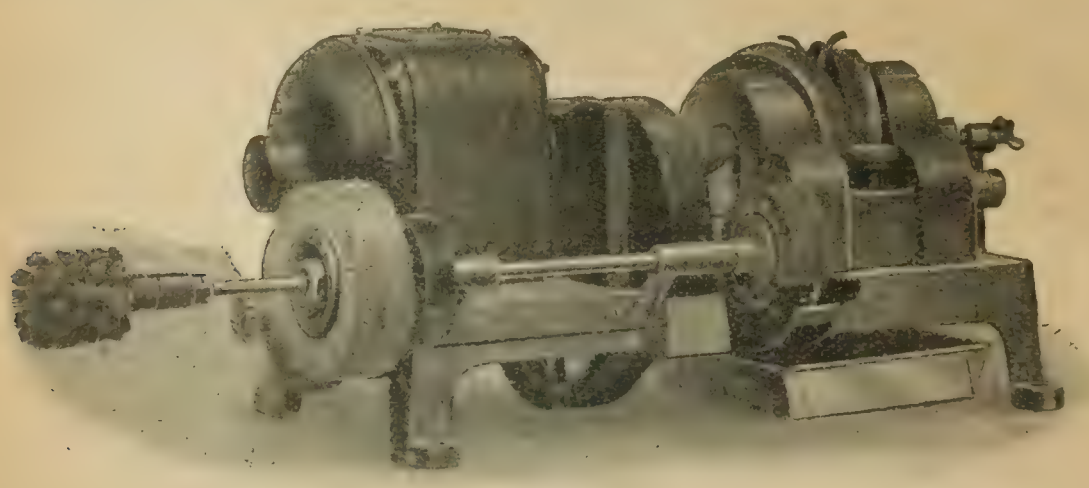


Fig. 3.—Dilg Electrical Cutlery Polisher.

The Lighthouse Radiator.

We illustrate in fig. 4 the Lighthouse radiator, a low-priced heater, with an easily-renewable element, which is guaranteed for 12 months.

It is finished with a dead black body and polished copper base and top; the heating element runs at red heat, giving a cheerful glow through the openings and warming the air by convection.



Fig. 4.—Lighthouse Radiator.

The heaters, which are manufactured by The Lighthouse Radiator Co., Ltd., of Woking, and for which Messrs. P. L. Dwyer & Co., of 66, Victoria Street, S.W., are wholesale agents, are suitable for domestic and office use, and have been supplied to several leading supply authorities.

Insulated Lampholder.

We have received from the British Central Electrical Co., Ltd, of Rosebery Avenue, E.C., a sample of their latest pressel insulated lampholder, which meets every requirement of the Home Office Regulations. In it is embodied a simple push-pattern switch movement which can be actuated with one hand, thus reducing to a minimum the strain on the flexible at the cord grip. The switch consists of an insulating block carrying a contact strip, which is moved across a pair of vertical plunger terminals by the push movement; on the other side of the porcelain interior carrying these terminals, are the ordinary lamp socket terminals.



Fig. 5.—Insulated Lampholder with Push Switch.

The arrangement is simple and compact, and provides a smoothly working switch, while the outer cover is fireproof and of robust proportions.

"Velveduct"—a New Conduit.

After continued experiment, The General Electric Co., Ltd., have been able to put on the market a drawn tube, similar in quality and appearance to solid-drawn or seamless conduit, but at

a price very little higher than that of welded or brazed tube. The chief points of superiority, which have maintained the employment of the higher-priced seamless conduit, have been the facility with which it could be bent or set cold, and the freedom from internal fins and burrs, such as are sometimes found in the cheaper tubes. The processes employed in the production of "Velveduct" entirely prevent the possibility of the tube having any internal irregularities, and it can be set cold as easily as the seamless tube. "Velveduct" is stocked with both the standard electric thread and gas thread, and can be used with all the varieties of screwed accessories illustrated in the conduit catalogue, issued by the General Electric Co., Ltd.

Edison Screw Cap Lamp.

The Edison & Swan Co., of Ponder's End, have recently introduced a miniature form of tungsten lamp with a cone-shaped bulb, in voltages from 100 to 125, and from 10 to 40 watts. It is a lamp largely in demand abroad, having a bulb of small dimensions, viz., $1\frac{15}{16}$ in. diameter, and 4 in. overall length approx., so that a much larger number per standard case can be shipped, and it has been



Fig. 6.—Miniature Tungsten Lamp, with Screw Cap.

sought after by exporters because it effects a saving in freight. An Edison screw cap is provided.

The company has also introduced the "Royal Ediswan" traction lamp, which is made in the popular small pear-shaped bulb, and possesses great strength with long life. The drawn-wire filaments are short and rigid, and withstand vibration well; the lamps are all carefully selected for series burning before leaving the works.

An Electrical Vibrating Grindstone.

Messrs. E. Siegmund, of Zurich, have recently placed a novel grinding tool on the market. This is shown in fig. 7, and differs from the ordinary revolving wheel, in that the grindstones are given a very rapid short-stroke to-and-fro motion (vibration) in a horizontal plane.

The driving motor runs at 1,400 R.P.M., and the rapid vibration

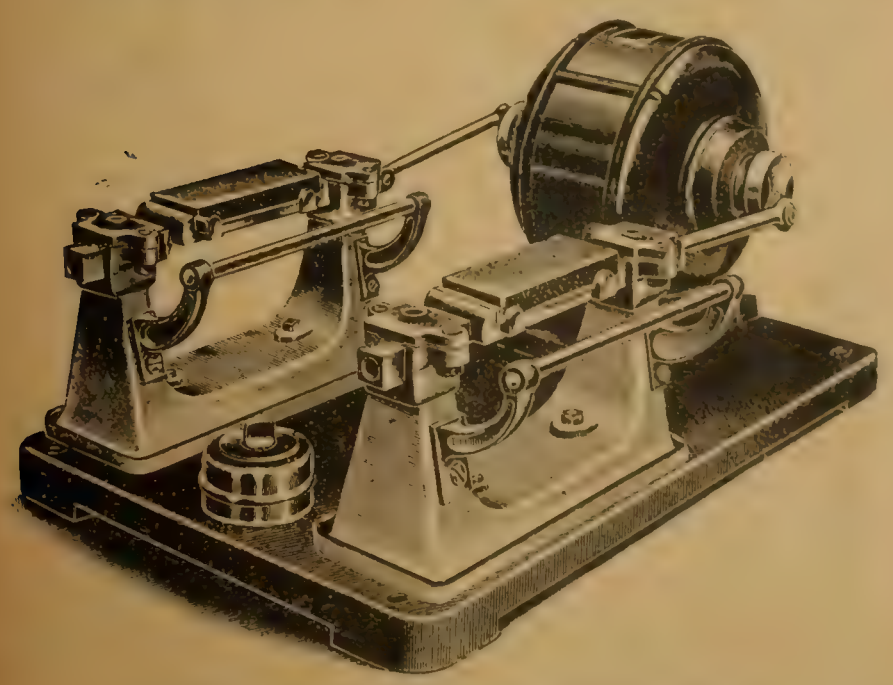


Fig. 7.—Electrical Vibrating Grinder.

of the stone enables a very short range of motion to produce the necessary attrition in an astonishingly short time.

Provision for two true grinding surfaces is made—one for roughing and the other for finishing. The stones are held in position by small wedges and are easily replaced by [illegible] or by any other form of polishing surface. Great care is taken in balancing the machine so that it runs quite noiselessly, and an [illegible] cushioning arrangement is employed to avoid all shocks at the ends of the stroke. The power taken is about one-tenth [illegible]. A.T.J., October 30th, 1913.

INSTITUTION OF ELECTRICAL ENGINEERS.

The opening meeting of the session of the Yorkshire Local Section was held on Thursday last week at the Hotel Metropole, Leeds, and took the form of an inaugural address by the chairman (Mr. W. B. Woodhouse), followed by a smoking concert. There was a very large attendance of the members. The following is an abstract of the address:—

The valuable properties and constituents of coal are many. In addition to the heat derived from its combustion there may be obtained ammonia, tar, pitch, creosote, benzol, cyanides, sulphur compounds and other products. The value of these chemical products is enormous and the process of burning coal in its raw state wastes them entirely. The most inefficient use made of coal is to burn it in the domestic fireplace. When consumed under steam boilers and utilised to produce steam power, the case is little better; the best modern practice accounts for only 15 per cent. of the heat energy and the average practice for not more than one-half of this.

The heat value of a ton of coal is some 30 million heat units. If it is burnt to produce electricity, there its value ends; if it is distilled in the manner adopted by gas engineers some 20 per cent. of the heat energy is made available in the gas produced, and some 60 per cent. left in the resultant coke, but in addition tar, ammonia, and other valuable products, are released.

The published figures of the costs and receipts of a large gas works are instructive. The cost of manufacture, excluding capital charges, amounts to 22·89d. per 1,000 cb. ft. of gas made. The receipts consist of:—

Gas	... ...	25·35d. per 1,000 cb. ft. of gas.	
Coke	... ...	7·46d.	" " "
Tar	... ...	2·03d.	" " "
Ammonia	...	2·57d.	" " "

These figures are sufficient evidence of the value of the process adopted. The process of distillation, while giving a maximum yield of gas, does not make the best possible use of the coal. In view of the demands for the various coal products, it is obvious that there may be room for variation of the method of carbonisation dependent on the relative values of and markets for the various products.

The development of the principle of carbonisation on broader lines has come from the needs of the iron and steel trades, the largest users of coke. Furnace and foundry coke in the past was produced in bee-hive ovens, wastefully; the evolution of the by-product oven has, however, changed all this, and now, in addition to producing coke for the ironmaster, the mining engineer produces gas, tar, ammonia, benzol and other valuable substances, and so makes efficient use of the raw material, including, incidentally, a greater yield of coke.

Whatever process is adopted for the extraction of the valuable products from coal, that process can only be carried on economically on a large scale, and therefore the distribution of coal energy, whether in the form of solid fuel, gas or electricity, must be on a large scale also. In other words, the essential centralisation of coal carbonising plants implies distribution of light, heat and power over large areas and in large quantities, and under such conditions electrical means are by far the most economical.

Up to the present time electricity has been generated in central stations by methods akin to those adopted by individual power users, only more economically due to the advantages of centralisation. That is to say, a public supply is merely a co-operation of users to take advantage of certain economies

The next step forward is a further co-operation of the electricity supply undertakings with other processes involving the use of coal: the first example in Yorkshire of co-operation of this kind has recently been set to work at the coke ovens of the Old Silkstone Collieries, in conjunction with the Yorkshire Electric Power Co. In this case the surplus gas from the coke ovens produces continuously day and night some 2,000 KW. which, by working the station in conjunction with their general system, the power company supply to their customers. Such an arrangement as this is only possible on a large scale, but its economic advantages are obvious.

So long as no other means of heating and cooking were available, the distribution of coal to dwelling-houses was inevitable, but with a recognition of the folly of burning coal, the alternative of burning coke or smokeless fuel (semi-coke) must increase, and if no other means of distributing energy were available, would eventually entirely alter the present practice.

Now regarding only convenience and cleanliness, the use of gas presents advantages over that of coke, and the use of electricity over both. Domestic labour must be reduced, the utmost cleanliness must be established, and the healthiest conditions maintained. On these three points electricity is superior as a means of distribution. But in regarding cost, one must recognise that the production of coke or semi-coke will be in the future enormously increased, and unless the demand increases with production, its price will fall to such a point that in many cases its cheapness will outweigh the advantages of its competitors.

Not to look too far ahead, then, one may safely conclude that a demand will exist for solid fuel in the dwelling house, marking a transition stage from coal to electricity. In the same way, dependent on the laws of supply and demand, coal gas and producer gas will find a place in the general scheme of distribution. But as for the production of electricity on scientific lines, gas, coke, oil and tar can all be used as fuel, there can be little doubt that domestic needs will be principally met by the supply of electricity.

For power purposes electricity generated in the primitive manner adopted by the individual power user is steadily displacing all other methods, and this because, in addition to its convenience, it can be supplied more cheaply than power can be produced in isolated plants. That it can be so supplied is due to the advantages of centralisation already mentioned; if we add the advantages of co-operation with other processes in extracting the valuable properties from coal, the advantages become enormously increased.

In the future distribution of energy, electricity must take a large, and I believe, predominating part, but its progress is not solely controlled by engineering and chemical problems such as those to which I have referred; one must also consider the legislative and financial conditions under which the supply of electricity must be developed. Technical difficulties may be overcome by individuals, but legislative obstacles will only be removed if the electrical industry moves the public to call for it.

The first step to be taken is to encourage a better understanding between the State departments, the municipalities, the power companies and others engaged in the business.

The legislation affecting the public supply of electricity has not been helpful to development on broad lines, and State control has, generally speaking, been repressive rather than helpful. The economical development of our natural resources deserves and requires a helping hand, and the utilisation of coal might well be regarded as equally worthy of State support as, say, the London Docks.

The veto of local authorities, the power of purchase granted by the Electric Lighting Acts and the general influence of municipal trading have not made for progress.

As a case in point, the fear in municipal minds of the effect of the competition of electricity on their gas undertakings may be instanced. Anyone familiar with the development of electric supply in this country knows that this has been one of the most potent reasons for the acquisition of electric lighting powers by local authorities, and where both gas and electricity supply are controlled by the local authority, future developments may anticipate similar opposition. Broadly speaking, the local authorities are afraid of the Power Companies, the gas engineers of their electrical brethren, and so on all round. The time has come for this partisan spirit to be swept away and for the problem to be dealt with on broader lines altogether; unless this is done progress must lag and the country suffer.

State control should aim at assisting those engaged in the industry to obtain the best results. Municipal spirit and local pride should not deny the advantages of new developments as they arise to the ratepayers, nor a share of the benefits to those individuals who by their enterprise develop more efficient conditions. Private enterprise, while best fitted to break new ground, would yet be assisted by the financial support which could be given by the State and the municipalities.

Where municipal trading is indulged in directly, the advantages of cheap money such as municipalities can raise on the security of the rates, are great, but the moral obligation not to speculate with such money is great also, and the natural effect of such trading is to discourage new developments which might depreciate undertakings already financed with ratepayers' money.

The best results can probably be obtained by a compromise; let private enterprise continue to develop improved methods, and if the municipalities desire to exercise some control of the developments, then let them assist in the finance.

Some years ago, in addressing this Institution, I suggested that municipalities might subscribe to debenture issues of public utility companies with advantage to all parties. The steadying effect of municipal capital would yet not act as a brake, and with their financial interest some measure of control would naturally be exercised.

In a public supply, service at the lowest rates can only be given if money is cheap, and cheap money demands adequate security. If the investor can be assured of State control of public utilities, coupled with reasonable protection, just regulations and a measure of financial support, we need have no fears for the future progress of electricity supply in this country.

Mr. T. Roles moved a vote of thanks to the chairman. He said that there was no doubt that if the various bodies who were supplying electricity could only be organised in such a way that they could be brought into line, the work of electricity supply would progress very much more quickly than it did at present. There were many small municipalities supplying electricity which, he thought, would do better to consider whether they could not combine with others or with a power company or some large municipality to put down a central station, and so cheapen things all round. The question of the utilisation of by-products of coal was a very important one. The gas people were now coming down to a point at which they said that they could turn out gas itself at about 4d. per 1,000 cb. ft., and so valuable were the by-products that in some cases they said they could put the gas into the gasholder free of cost. They also had to consider waste products. There was the gas from blast furnaces, and a good deal could yet be done with the steam exhausted from turbos of 40 to 50 lb. pressure.

The vote of thanks was seconded by Mr. Yerbury, and the Chairman briefly replied.

THE BRITISH STANDARD SPECIFICATION FOR CONSUMERS' ELECTRIC SUPPLY METERS.

By S. H. Holden, M.I.E.E.

(*Paper read before the* Institution of Electrical Engineers, *at Birmingham, November 12th*, 1913.)

The British Standard Specification No. 37 was published in 1907. In the opinion of the author this specification has not so far taken the position in relation to the electricity meter industry which it is desirable that it should do; and he proposes to make certain suggestions which it is hoped will tend to the greater usefulness of the above specification.

Manufacturers have much to gain by a general adoption of a standard specification among their customers. The preparation of specifications for electricity meters is quite special work, and it is curious to notice how frequently engineers of ability are betrayed into ridiculous mistakes when they attempt to draw up such a specification.

A further advantage of the general adoption of the Standard Specification is that foreign and Colonial purchasers, buying either direct or through merchants at home, would know that if a meter complied with the specification it was the best obtainable, and on that account standard English-made meters should enjoy a readier sale and command better prices than those supplied by competing manufacturers.

If consulting engineers and large purchasers were to adopt the same specification they would save themselves much unnecessary work, and would help to keep down the cost of meters to their clients by avoiding a multiplicity of patterns.

In the original Standard Specification no attempt was made to differentiate between alternating and continuous-current meters. It is desirable, however, to do so, as it is possible to obtain greater range and accuracy with an alternating-current meter having a pressure coil than with a continuous-current ampere-hour meter; and the best obtainable performance should be specified for each class of meter.

The following alterations and additions to some of the clauses, with one or two new clauses, are now offered for consideration and discussion.

Clause 2. "The following capacities, in amperes, shall be recognised as Standard: 3, 5, 10, 25, 50, 75, 100."

The 2½-ampere size is preferable to the 3-ampere size for single-phase meters. The list of sizes should be increased by adding 150, 200, 250, 300, 400, and 500 ampere. The 75-ampere size does not appear to be really necessary.

Clause 3. "The meter shall be contained in a substantial dust-tight metal case of sufficient strength . . . ."

After the word metal case it is proposed to insert the words "of cast-iron or pressed steel." Cases of soft metal or sheet joined together are not used on the highest class of meters.

Clause 6. This clause deals with the terminal box, but only specifies the size of the pressure-circuit terminal. It is therefore proposed to add "the main terminals shall each have two clamping screws. The depth of the hole into which the cable is inserted shall be at least twice its diameter. The following shall be the diameters of the holes for the cables: 10-ampere, 0·22 in.; 25 ampere, 0·32 in.; 50 ampere, 0·375 in.; 100 ampere, 0·435 in.; 150 ampere, 0·5 in.; 200 ampere, 0·6 in.; 250 ampere, 0·7 in.; 300 ampere, 0·8 in.; 400 ampere, 0·9 in.; 500 ampere, 1 in.

Clause 10. "The meter shall have a suitable place and means upon the front of the case adapted to receive and secure a label to be provided and fixed by the purchaser or his representative. The purchaser's label shall be a rectangular sheet 2 in. long, ½ in. wide, and not more than $\frac{1}{32}$ in. thick."

To this should be added: "It shall be affixed by two rivets, and the manufacturer shall provide two holes ⅛-in. diameter and 1¾ in. apart in a suitable position for this label." It is doubtful, however, whether the size specified for the purchaser's label is large enough.

Clause 11. "The dial plate shall indicate the total consumption directly in units, either by means of a number of index hands each travelling round a circular dial on which divisions are marked and figured to indicate units, tens of units, &c., or by means of counter wheels on which digits are marked to indicate units, tens of units, &c., provided that only one digit on each counter wheel shall be visible at a time.

The addition suggested to this is: "If the latter is adopted, the figures on all the wheels shall spring suddenly into position with the exception of those denoting units, which may move at a uniform speed." A counter which can allow of any doubt as to which of two figures is to be read on the higher multiples is inadmissible.

In Clause 12, the expression "kilowatt-hour" would be better than "unit," and the number of testing dials should be specified. It is therefore proposed to add: "Meters having a capacity of 2 KW.-hours per hour and under to have two testing dials reading $\frac{1}{10}$ and $\frac{1}{100}$ KW.-hour per division respectively. Meters above this capacity and up to 200 KW.-hours per hour to have one testing dial reading $\frac{1}{10}$ KW.-hour per division.

Clause 16. "The main circuit of the meter shall be so constructed that the total loss of power at full load, as measured at the main terminals, shall not exceed 15 watts, subject to the further restriction that the loss of pressure in the main circuit at full load shall not exceed 2 volts in any meter."

As this specification does not apply to electrolytic meters, the

2-volt limit is far too high ; ¾-volt is ample. Most engineers prefer to be furnished with definite figures for each size of meter for the fall of potential at full load ; a schedule is therefore suggested, from 0·75 volt for the 2½ or 3-ampere size to 0·075 for the 150-ampere size and upwards.

Clause 17. "The pressure circuit, if any, of the meter shall be so constructed that the total power spent in it shall not exceed 4 watts for each 100 volts of pressure."

The consumption in the pressure circuit of single-phase meters should not exceed two watts, and for continuous-current meters 7 watts, at the declared pressure, provided this does not exceed 650 volts.

Clause 19 deals with starting currents. A first-class single-phase meter should start with ½ per cent. of its full-load current at a power factor of unity. A continuous-current ampere-hour meter should start with 0·05 ampere if of 10-ampere capacity or under, and with ½ per cent. of full load, if over 10-ampere capacity.

Clause 20 relating to the error of a meter appears to be insufficiently rigorous and too clumsy for ordinary use. Alternating-current meters can easily be made accurate within 2 per cent. from one-twentieth full load to full load ; and the same applies to continuous-current ampere-hour meters except that the lower limit should not be less that half an ampere. No guarantee of accuracy above or below these limits should be asked for or given.

Clauses 25, 26, 27, relating to variations of pressure, frequency and power factor, all appear to lack definiteness, as the author has found that different interpretations are put upon them. The most usual interpretation leads to the absurdity that if, say, a meter is 2 per cent. slow at normal voltage and a 10 per cent. rise of pressure makes it correct, it must be rejected because the rise of pressure has caused more than 1 per cent. variation, while if the same rise of pressure makes it 1 per cent slower (that is, 3 per cent. total error) it will be accepted. It is suggested that the words "shall not cause an error" be altered to "shall not increase an error."

Variation of wave-form is not dealt with in the Standard Specification. For the sake of completeness it is suggested that a clause be inserted to the effect that a variation of wave-form of 10 per cent. from a true sine curve at any point shall not increase the error of the meter by more than 1 per cent.

Slight additions to the specification would make it cover polyphase meters ; and in view of the large number of such meters in use their inclusion is very desirable.

In conclusion, the author suggests that the Institution should urge the Engineering Standards Committee to publish, as soon as possible, a revised and completed specification for electricity meters, and that with a view to its wider use and circulation, the price should be reduced to 1s. per copy, in order that manufacturers may be able to include copies with their tenders. Those purchasing or specifying meters should also be urged to make use of the full specification, without additions as far as possible, especially when meters are purchased for export. And some distinguishing mark should be placed upon meters which are sold as complying with the British Standard Specification.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"W. H. B." writes :—"Following the very interesting reply given by your legal correspondent to 'Electric Supply' on page 77 of your current issue, I should be glad if he would favour me with his opinion on the following :—

"(1) It is proposed to supply electricity to several works—all adjoining—which are situated in the areas of two supply authorities. Each authority wishes to supply the works in its own area. The price required by one authority is lower than that of the other, although the factory requirements are practically the same in each case. Could the owners legally get over the difficulty by laying down motor-driven generators in a works within the area of authority A (who would supply at the lower price), and use the current produced therefrom in the works within the area of authority B ?

"(2) In the event of this scheme being carried out, who would really generate the current used in B's territory—the owner of the motor-generators or authority A ? If it be granted that the current is generated by the owner, I presume that authority B would have no voice whatever in regard to the supply to the factories situated in its own area."

*** The first question propounded is one which has frequently arisen in one form or another. In the first place it is clear, having regard to Sec. 6 (1) of the Electric Lighting Act, 1909, that the absence of consent will prevent the arrangement being carried out unless the Board of Trade is of opinion that consent is unreasonably withheld. It is said in a well-known text-book that "the section would include within its scope premises which can be more conveniently served by a neighbouring undertaking than by the undertaking covering the area in which the premises are situated, and premises situated in a district covered by no Electric Lighting Act or Order." There has, as yet, been no decision or case upon the section. Now, as to the suggested means of evading it. It appears to the writer that the method would be a mere device for driving a coach and four through an Act of Parliament and the Courts would hold this to be so. Energy in one form or another would have to pass from out of a supply area to its stalled customers. To permit energy so to pass would be to evade the express provisions of the Act.

As to (2) it is clear that the current would be used and consumed in an area other than that in which it was generated.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

SOUTH AFRICA.—H.M. Trade Commissioner in South Africa reports that the Collector of Customs on being asked to give a definition of the terms "bought in the ordinary manner" from the manufacturer or supplier "in normal quantities" for purposes of declaration of value for duty purposes, interpreted these terms to mean that duty will be levied on the current value of the goods bought "in a similar manner" from the manufacturer or supplier "in similar quantities." The Collector further intimated that the certificate which is required can be written across the invoice, stating that the prices enumerated thereon are current values for home consumption and, therefore, dual columns of figures are not necessary. In the event of the export prices of a commodity being lower than the home consumption current value, it will be necessary to have the dual columns of the prices for the articles. In the case of goods manufactured solely for the South African market, this fact must be clearly stated on the invoices.

ITALY.—The Customs authorities have decided that brass wire coated with copper of a thickness exceeding one half millimetre shall be dutiable at the rate of 20 lire per 100 kg., and that air suction electric ventilators are to be dutiable at the rate of 25 lire per 100 kg. (lire = 9·16d., kg. = 2·204 lb.).

MEXICO.—The Board of Trade have received telegraphic information to the effect that by a Mexican Presidential Decree of October 18th, the Customs duties on goods imported into Mexico were increased by 50 per cent., this percentage increase to be calculated on the sum of the Tariff rates of duty and the 10 per cent. surtax on those rates which was imposed on February 16th last. The rates of duty inscribed in the Tariff have now, therefore, to be increased by 65 per cent. in order to arrive at the total duty leviable. The new decree was to come into force on October 28th, and under it 10 per cent. discount is to be allowed on all certificates for payment of duties purchased prior to November 6th. The certificates referred to are to be purchased from the Government by currency at face value, and all duties have to be paid in this way.

Publication of Contract Prices.—The Stores and Contracts Committee of the L.C.C. recently made the understated recommendations respecting the reporting of values of stores contracts, but two members of the Council put down an amendment to refer the recommendations back :—

"It has been the practice when recommending or reporting the acceptance of tenders for stores, &c., to give where possible the value to the nearest £, based on the estimated quantity required, of each contract. The individual prices for the various items in the schedule are not given, only the total estimated value for the contract period of all the items allotted to each accepted tenderer. It has, however, been represented to us that in cases in which a tender is accepted for one or two items only the publication of this information may, and frequently does, disclose to other tenderers the actual prices quoted, although this is not the Council's intention. There is no doubt that the disclosure of prices quoted for stores operates to the Council's disadvantage, and we propose, therefore, in future, that, in cases in which the publication of the estimated value of a contract may lead to the disclosure of the individual price or prices quoted, the particulars, instead of being printed in our report, shall be laid on the table for the information of members. Under this arrangement exactly the same information as at present will be available for members. The course proposed has accordingly been followed in the statement, submitted to the Council on October 21st, 1913, and referred to in the first paragraph of this report, of tenders accepted during the summer recess. We recommend that the following be a regulation with regard to the stores service :—In cases in which the publication of the estimated value of a contract for stores, &c., may lead to the disclosure of the individual price or prices quoted, the particulars, instead of being included in the report of the Stores and Contracts Committee, shall be laid on the table for the information of members."

Inland Waterways.—The Birmingham City Council has adopted a resolution approving of the recommendations of the Royal Commission on Inland Waterways for the appointment of a central Waterways Board to acquire and improve the four waterways known as "The Cross," the centre of which is close to Birmingham. The Council expressed its willingness to bear part of the cost of the improvements.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,274. "Electric fittings specially adapted to fuses." V. Hope. October 27th.

24,275. "Trolley pointer guide for electric tram-cars." G. F. French. October 27th.

24,305. "Rotary converter with commutating poles." Akt. Ges. Brown, Boveri, et Cie. October 27th. (Convention date, June 30th, 1913, Germany.) (Complete.)

24,306. "Conversion or transformation of electric current." A. Scherbius. October 27th. (Convention date, October 25th, 1912, Germany.) (Complete.)

24,312. "Search-lights or projectors." Siemens-Schuckertwerke G.m.b.H. October 27th. (Convention date, October 26th, 1912, Germany.) (Complete.)

24,327. "Magnetising-machine." S. C. Newton. October 27th.

24,333. "Telephone systems with party-line service." Siemens & Halske Akt. Ges. October 27th. (Convention date, January 4th, 1913, Germany.) (Complete.)

24,337. "Rotary converters with commutating poles." Akt. Ges. Brown, Boveri, et Cie. October 27th. (Addition to 24,305/13. Convention date, September 20th, 1913, Germany.) (Complete.)

24,338. "Means for effecting the excitation of automatically reversible battery boosters." W. E. Highfield. October 27th.

24,347. "Process for heating electrical furnaces, more particularly applicable to the manufacture of aluminium nitride." Soc. Generale des Nitrures. October 27th. (Convention date, December 14th, 1912, France.) (Complete.)

24,355. "Magnetic separators." Fried. Krupp Akt. Ges. Grusonwerk. October 27th. (Convention date, November 27th, 1912, Germany.) (Complete.)

24,419. "Electric toasters." C. P. Madsen. October 28th. (Convention date, October 28th, 1912, United States.) (Complete.)

24,422. "Sockets for incadescent lamps." C. A. Vetter. October 28th. (Complete.)

24,441. "Electric signalling apparatus for railways." F. Mackintosh. October 28th.

24,450. "Arrangement for the automatic protection of air-cooled electrical machines against damage through ignition of the air-filters." Allgemeine Elektricitats Ges. October 28th. (Convention date, January 29th, 1913, Germany.) (Complete.)

24,458. "Utilization of oscillating-current energy." J. W. Lee and J. L. Hogan, Jun. October 28th. (Convention date, November 16th, 1912, United States.) (Complete.)

24,459. "Circuit arrangements for telephone installations with semi-automatic working." Siemens & Halske Akt. Ges. October 28th. (Addition to 6,664/13. Convention date, October 31st, 1912, Germany.) (Complete.)

24,471. "Electric batteries." F. S. B. de Mello. October 28th. (Convention date, December 4th, 1912, Brazil.) (Complete.)

24,472. "Electric welding-apparatus." J. M. Yount, T. Finigan, and E. S. Brannaman. October 28th. (Complete.)

24,496. "Electric hand lamp or torch." R. Gladstone, Jun. October 29th.

24,515. "Locking-device for electric lamps." J. Gordon and J. Gordon. October 29th.

24,516. "Improvements in turbine and centrifugal pumps to prevent overloading of electric or other motors, driving arrangements, and the like, used for driving such pumps." J. Taylor and L. W. Weil. October 29th.

24,524. "Magnetic locking and unlocking of miners' safety lamps." J. H. Rothwell, J. Roberts, and W. H. Roberts, trading as J. H. Rothwell & Co. October 29th.

24,525. "Caps or mouthpieces for telephonic transmitters and other sound instruments." A. Marr. October 29th.

24,559. "Electrolytic apparatus." J. T. Niblett. October 29th.

24,560. "Electrolytic apparatus." J. T. Niblett. October 29th.

24,565. "Element to be used in connection with electrically heating toasters, grills, roasters, and the like, also stoves and ovens for heating air, water, and the like." S. E. Foster. October 29th.

24,569. "Porous containers or diaphragms for voltaic cells." J. G. Lucas. October 29th.

24,586. "Electric ceiling-roses." G. Markt. October 29th.

24,593. "Electric switches or circuit-breakers." F. B. Holt and H. Smith. October 29th.

24,594. "Electric switches or circuit-breakers." F. B. Holt and H. Smith. October 29th.

24,620. "Electrical alarm for warning engine drivers when passing a signal standing at danger." L. L. Hartmann. October 30th.

24,657. "Thermo-electric generators." P. Ferra. October 30th.

24,673. "Conversion of alternating electric currents." A. Scherbius. October 30th. (Addition to 24,212/13. Convention date, October 31st, 1912, Germany.) (Complete.)

24,686. "Headstocks of electrically-driven lathes and other machine tools." H. Kienzle. October 30th. (Divided Application on 12,235/13, May 26th.) (Complete.)

24,688. "Magnetic chucks." T. L. Jones. October 30th.

24,699. "Electric liquid heaters." E. A. Raves. October 30th. (Addition to 14,562/13.) (Complete.)

24,720. "Arc lamps." H. Ayrton. October 30th.

24,754. "Electric re-fills." A. E. Segnitz. October 31st.

24,755. "Means for use in the manufacture of telegraph and like insulators." F. Hancock. October 31st.

24,770. "Electric arc lamps." F. E. Atherton. October 31st.

24,777. "Connections and fittings for electric conduits." C. Birch. October 31st. (Complete.)

24,809. "Mounting switches and other electrical apparatus in boxes." A. W. Sclater. October 31st. (Complete.)

24,817. "Production of electric current." D. Suchostawer. October 31st.

24,826. "Arrangement for the heating of liquids by means of an electric lamp." G. H. M. Debonniere. October 31st. (Complete.)

24,827. "Process for working a radiator heated by gaseous, liquid, or solid fuel, or by electric current or steam." H. Frank. October 31st. (Addition to 20,241/11.) (Complete.)

24,833. "Electric rotary indicator." McKenzie & Holland, Ltd. and W. A. Pearce. October 31st.

24,845. "Automatic switches or cut-outs for use in lighting systems on motor, railway, or other vehicles." D. V. L. Fellows. October 31st.

24,850. "Electric furnaces." I. Rennerfelt. October 31st. (Convention date, December 5th, 1912, Sweden.) (Complete.)

24,869. "Apparatus for shaping articles of pottery." F. Hancock. November 1st.

24,871. "Variable candle-power incandescent electric lamp and switch." W. G. Rhodes. November 1st.

24,882. "Apparatus for autographic and facsimile telegraphy." R. W. Anstey. November 1st.

24,898. "Apparatus for electrically lighting road vehicles and the like." E. P. Prior. November 1st. (Complete.)

24,899. "Construction of electric snap-action switch." E. M. Wildey. November 1st. (Divided Application on 1,471/13. July 18th.) (Complete.)

24,900. "Carbon electrode holders." A. Schwarz (Firm of.) November 1st. (Convention date, January 20th, 1913, Germany.) (Complete.)

24,907. "Electrical interrupters or vibrators." F. Knabl. November 1st.

24,911. "Electrostatic machines." E. Oppen. November 1st. (Convention date, October 14th, 1913, Germany.) (Complete.)

24,927. "Telephone exchange systems." Western Electric Co., Ltd. November 1st. (Franklin Tuthill Woodward, Belgium.)

24,928. "Switching apparatus for telephone exchange systems." Western Electric Co., Ltd. November 1st. (Franklin Tutgill Woodward, Belgium.) (Complete.)

24,936. "Galvanometers, voltmeters, ammeters, and like instruments." Gambrell Bros., Ltd., and A. Onwood. November 1st.

24,939. "Galvanometers, voltmeters, ammeters, and like instruments." Gambrell Bros., Ltd. and A. Onwood. November 1st. (Addition to 17,733/13.)

24,942. "Submarine audible telegraphy and signalling." E. Klupathy and C. Berger. November 1st. (Addition to 27,144/10. Convention date, November 3rd, 1912, Hungary.) (Complete.)

24,943. "Electric torches." G. Hitzelberger and New British Ever-Ready Co., Ltd. November 1st. (Complete.)

24,944. "Electric pocket lamps." G. Hitzelberger and New British Ever-Ready Co., Ltd. November 1st. (Complete.)

24,949. "Means for cutting out and reinserting the resistance in controllers of the drum type." E. M. Marvin. November 1st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps.)

1912.

Alternating Current Commutator Motors. British Thomson-Houston Co. (Allgemeine Elektricitats Ges.) 20,849. September 12th.

Illuminated Signs. A. W. Beuttell. 22,990. (Cognate Application 8189/13.) October 8th.

Indicator for Lamps for Motor Vehicles. G. W. Booth, J. F. Booth and A. H. Wilkinson. 23,211. October 11th.

Electrical Apparatus for Controlling Electric Motors for Railway Points or for other Purposes. J. H. Gath. 23,279. October 11th.

Cutters for Metal Electric Conduits. L. H. Marlor, T. G. Hann and J. T. Foster. 23,607. October 16th.

Motor Controlling Switches. W. E. Lake (Soc. Anon. Du Temple.) 23,669. October 16th.

Incandescent Electric Lamps and Holders therefor. A. W. Beuttell. 23,774. October 17th.

Driving Gear for Dynamo Machines for Lighting Vehicles from an Axle thereof. Julius Pintsch Akt. Ges. 23,854. October 18th. (November 1st, 1911.)

Electrical Heating Devices. A. F. Berry. 23,860. October 18th.

Electrical Relays. S. G. Brown. 24,043. October 31st.

Method and Means for the Intensification of Intermittent Electro-magnetic or like Impulses. A. M. Nicholson. 24,136. October 22nd.

Electric Organs and like Musical Instruments. J. R. C. Gale. 24,142. October 22nd.

Apparatus for Lighting and Extinguishing Gas from a Distance. G. Thommel. 24,165. October 22nd.

Fluid Meters. British Thomson-Houston Co. (General Electric Co.). 24452. Oct. 25th.

Driving of Magneto-Ignition Devices. D. H. O'Flaherty. 25531. Nov. 7th.

Reflectors for Electric Incandescent Lamps. C. Damey. 27276. Nov. 27th.

Control of Electric Motors. F. E. Case. 27837. Dec. 3rd. (Dec. 4th, 1911).

Electric, Automatic, or Hand-Operated Indicator or Signal Combining Advertisement Display to be Used in Public Places, Buildings, Vehicles, or Sea and River-going Vessels. A. G. Grundell. 28349. Dec. 9th.

Means for the Ignition of Lamps of Motor Vehicles. E. de F. Renouf. 29453. Dec. 21st.

Electric Switches. British Thomson-Houston Co. (General Electric Co.). 29812. Dec. 27th.

1913.

Electrical Switches. W. C. Horne. 764. January 10th.

Telephonic Systems. E. A. Graham. 2022. January 24th.

Suspenders for Electric Cables and the Like. P. Huntington. 2419. January 30th.

Process for Manufacturing Electric Transformers of Small Power. Vedovelli, Priestley, et Cie. 4090. February 17th. (February 26th, 1912.)

Rheostat. T. Rhodus. 4131. February 18th.

Telephone Attachment. N. Marx. 4502. February 21st.

Pendants or the Like, and more particularly Pendants for Electric Lamps. A. Luders. 5228. March 1st.

Actuating Devices for Electric Circuit Closers. G. D. Young. 5321. March 3rd. (March 29th, 1912.)

Electrical Advertising Signs, Devices or the Like. L. Martin and G. Nixey. 5637. March 6th.

Protecting Devices for Electric Circuits. Siemens Schuckertwerke Ges. 6164. March 12th. (March 12th, 1912.)

Apparatus for Regulating the Ignition of Internal Combustion Motors. Sir A. W. Ruyssenaers. 6544. March 17th. (March 18th, 1913.)

Circuit Arrangement for Telephone Exchanges provided with Selecting Devices. Siemens Bros. & Co., and T. Pettigrew. 7128. March 25th.

Telephone Circuits. Siemens & Halske Akt. Ges. 7130. March 25th. (March 23rd, 1912.)

Magnetic Separators. H. J H. Nathorst. 8485. April 10th. (April 18th, 1912).

Telephone Instruments, Sets Adapted for Two Lines. Siemens Bros. & Co., and E. A. Laidlaw. 9167. April 18th. (Addition to 25673/12.)

Counterweights for Pendant Electric Light Fittings. J. M. Doughty. 10422. May 3rd.

Electrolytic Cells. E. C. R. Marks. (Hooker Electrochemical Co). 12208. May 26th.

THE
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(J. A. Berly's).

1914 EDITION

IN PREPARATION.

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ELECTRICAL ACCIDENTS IN MINES AND THEIR PREVENTION.

EVER since the introduction of electricity in mines the question of the prevention of accidents and the risk of danger involved in its use has been a source of great concern, not only to the owners and managers of mines, but also to the workmen employed in and about the mines, the Government Inspectors, and manufacturing firms specialising in electrical machinery for mines, and in no other industry has the application of electricity been so much discussed. Why?

On another page we conclude our excerpts from the annual reports of H.M. Inspectors of Mines for the year 1912, and with one or two exceptions which, although even these ought not to have happened, can be described as pure accidents, all were clearly preventable had the installations been installed and maintained not only as they ought to be for the proper working and intelligent use of the apparatus, but according to the instructions contained in the special rules relating to the use of electricity in mines.

Year after year there is a recurrence of these accidents; every time an explosion takes place the first conclusion jumped to is that it must be due to electricity—and the wiseacres shake their heads and say it ought not to be allowed. Steam, compressed air, and hydraulic power can all be controlled and directed without danger or risk of fire, but with electricity—Ah! That's different! No one knows what it is, or how it can be kept from breaking out!—This may sound far-fetched and even foolish, but it accurately describes the attitude of the non-technical public towards this question, and every mining disaster intensifies the feeling.

Now why should this be? For a moment, let us examine how mining differs from other industries; and, first, we must consider whether it is more hazardous. Undoubtedly, as regards falls of roof and side it is, as no matter how carefully the roof may be supported, some totally unexpected and unforeseen break in the strata may occur which will cause a fall, and the majority of accidents in mines are from this cause. For the year 1911, for instance 56·3 per cent. of the accidents underground and 55·1 per cent. of the number of deaths, were due to falls of ground. But, with this exception, it cannot be said to be more dangerous than any other industry, and in many respects it has advantages in regard to length of working hours, wages and health conditions which more than compensate this risk. Even the number of these accidents could undoubtedly be reduced if proper care were taken; but as Mr. Redmayne says: "many of these accidents could not be foreseen. But I agree with Mr. Nicholson, 'in their anxiety to get coal, many hewers put off setting the necessary roof and coal supports until it is too late.' There is no doubt that many men have, unfortunately, lost their lives on this account."

The more important question, however, is that of the risk of an explosion; we dealt with this in our issue of November 7th, and, we think, clearly showed that the adoption of electric safety lamps, strict discipline regarding smoking and carrying matches, and the more careful use of explosives would very greatly minimise this danger, and what is more, as we have pointed out on previous occasions, the use of electric lamps by the better light obtained would tend to reduce the number of accidents from falls of ground. All other risks of accident in mining are practically the same as in

any other industry, and as it has been said that the safest place one can possibly be in is a railway carriage, so it may be said that the safest industry one can be employed in is that of mining. Electricity became necessary to the efficient working of mining operations in exactly the same way that it has become necessary to other industries, and it cannot now be dispensed with, any more than ordinary business people could do without the telephone.

Other industries, however, are probably more closely allied to mechanical engineering, and the actual operation of getting coal is not as yet a mechanical operation—though it is fast becoming one. Certainly mechanical engineering enters very largely indeed into the transportation and preparation of the mineral for marketing, but the actual working of the mineral itself is not mechanical, and, in fact, a "good pitman" is very frequently a "bad mechanical engineer." And here we have the crux of the whole question. A mining engineer must be trained in the science and art of mining, in which are embraced geology, the chemistry of gases, breaking ground, winning and working areas of mineral, ventilation, surveying, &c., and he only has time to study in a very elementary way the construction of the various mechanical appliances which are brought into use. He is not a mechanically-trained engineer; but as a mine manager he is by law responsible for all the mechanical and electrical machinery employed in or about the mine, and as a rule "he thinks he knows." But when electricity came to be installed, he did not know enough of this science to select proper machinery; he relied upon competing electrical firms, who knew nothing of mining, and the representative with the glibbest tongue and the lowest price got the order, and it was this sort of thing which led to the introduction of the electricity special rules as the only means of preventing bad workmanship and maintenance.

What is the remedy? It is quite simple, and merely needs the division of the responsibility between the "mining" engineer and the mining "mechanical and electrical" engineer. Train both properly in their respective departments, and make each responsible to the law, and it will pay. This is not the first time we have made this recommendation; we even went so far on one occasion as to suggest the formation of a Colliery Engineers' Association, and this led to the inception of the Association of Mining Electrical Engineers, which recently held its annual general meeting at Birmingham. Originally, we believe, the intention of its founders was to carry out the purpose suggested by us, and this is evidently borne out by the president, Mr. Anderson, when he says, "There was a danger at the start of drifting into Trade-Union tendencies"; but it was captured by the colliery managers, who soon put an end to any hopes the original founders of the Association had of improving their status. As one manager remarked: "We could not allow them (the electricians) to become independent. We must be top dogs." Now, Mr. Anderson deplores the lack of intelligent colliery engineers.

Continuing, Mr. Anderson goes on: "Unfortunately a number who joined at first with this object in view have now ceased membership." In June, 1913, out of 1,081 members only 120 were certificated members, but Mr. Anderson is very hopeful of the future, as "to be a member is a commercial asset of no mean value, and under this head I include (*a*) those who look for status, and (*b*) those out for trading purposes"—and we take it that 80 to 90 per cent. of the members are of the latter order. They will flatter the manager up to the skies to get an order, and blame the colliery electrician if anything goes wrong with it afterwards. And yet Mr. Anderson wonders why "it is very difficult to get really first-class men!"

Of the two occupations of coal hewer and colliery electrician, the former is probably the better off, as he gets about the same wages, works a less number of hours, has less responsibility, and is *absolutely independent*, as his Union will back him up in all that he does or asks for, but the electrician—poor fellow! Why is it difficult to get good men?

According to Mr. Anderson, "Many young men who enter the profession do not seem to realise the necessity for beginning their theoretical education at once, but rely solely on what years of practical experience may teach them. They do not seem to grasp the fact that a smaller number of years, combined with hard study, would make them competent and efficient professional men that all should aspire to become." We agree, but must point out that it takes the same study to become a colliery manager—and in the one case there is an open road to the highest position in the mining profession; in the other, there is no opening whatever to the great majority. A few may get decent positions which are limited to £200 or £300 a year, but even then there is *always* the colliery certificated manager *above them*.

Does the Association intend to improve the status of the colliery engineer or electrician? Not it. Ninety per cent. of the members are members for what they can get out of it in the shape of business, and all this talk of improving mining electrical engineering and the colliery electrician is merely the excuse for its existence. It is all very well to "let this Association in the first place show him the need and then the way to improve himself in matters electrical," but is it going to help him to improve his wages and his status? Is it going to make the position of "colliery engineer" a position of recognised responsibility, one worth having, and therefore one worth studying and training for? Until this is done we cannot see how electricity in mines will ever be rendered absolutely safe and efficient, however stringent the "special rules" may become. On the other hand, its rapid development, and the efficiency necessary for its economical and safe operation, may force the owners to say to the Home Office:—"We must have properly trained engineers for the mechanical side as well as the mining side of our mines, and it is necessary if certificates are insisted upon that one be given to each." Then, and not till then, will there be an end to the accidents and dangers of electricity in mines.

Pressure Rises.

Those who had the pleasure last week of hearing Mr. Duddell, for a second year President of the Institution of Electrical Engineers, discoursing on a subject of which he is a past master, will agree with us that his address constituted a delightful variation from the ordinary run, and recalled to mind his brilliant paper on the arc, of 13 years ago. A striking series of experimental demonstrations accompanied the address, and the fact that not one of them failed to "come off," as experiments are so apt to do, bore testimony to the manipulative skill with which they had been arranged. It is, perhaps, not generally known that the President is a highly skilled horologist, and it was largely owing to this accomplishment that he was able to perfect his oscillograph, as well as the many other instruments with which he has enriched the equipment of the electrical engineer, constructing the apparatus with his own hands—and, of course, brains.

Mr. Duddell disclaimed any pretensions to novelty in the phenomena which he described and illustrated, and doubtless it is true that most of them are dealt with in the voluminous literature on the subject; but it is one thing to know of their occurrence, and quite another thing to have them exhibited and explained in the lucid and entertaining style of an enthusiast, and we are certain that very many of the audience carried away with them entirely new conceptions of the nature and causes of "pressure rises," and of the seemingly insignificant but, in reality, exceedingly important oscillations which are liable to occur when any sudden change takes place in the conditions of an electric circuit. In a later issue we hope to reproduce an abstract of this fascinating address, though, unfortunately, it must necessarily be deprived of half its charm by the lack of the experimental illustrations.

The Olympia Motor Show.

That there is no abatement in the interest shown by the general public in motor-cars, was evidenced by the huge attendance at the annual Motor-Car Exhibition at Olympia, which was brought to a successful conclusion on Saturday last. The show was, as usual, confined to cars of what may be termed the pleasure type, in contradistinction to those of an industrial and commercial nature; and although, also as usual, it was almost entirely a display of petrol cars, there

was, from an electrical point of view, one feature of note—and that was the reappearance of the electromobile.

Although there was only a single vehicle of this type on view, it is an evidence that the great progress which has been made by makers of electric cars in America, coupled with the encouragement given to the movement by central station engineers in the United States, has at last given an impetus in the same direction in this country. So far as the petrol car is concerned, it was noticed that the show is becoming more and more a display of complete vehicles than of chassis, a feature which would seem to indicate that makers are now depending for sales more on the luxury and comfort of the bodywork than on the perfection of the mechanical portion, the name of the manufacturer having to be accepted as sufficient guarantee for the up-to-date character and reliability of the latter. The cars on view ranged from the very popular two-seater to the lordly limousine, the finish and equipment of some of the latter rendering them veritable palaces on wheels. As regards the prices of motor-cars, the position is a curious one, for while one person will say they are lower, another will assert the contrary. The truth is that while, generally speaking, no one particular car can be purchased for a less amount of money than last year, one procures in a 1914 model a much more completely-equipped vehicle for the same money ; and as the bulk of the equipment is of necessary fitments that have, in any case, to be purchased, cars may really be said to be somewhat cheaper.

So far as the power generation and transmission plants of automobiles are concerned there is very little new, the improvements being, to use a stock phrase, mainly confined to details, as was pointed out in the Review last week. Had it not been for the electric lighting installations that are now *de rigueur* on all large and costly cars, and the later innovation of electric engine starting arrangements, the Exhibition would have contained little of interest for the technical visitor. As regards the electric lighting systems, the variety of different dynamos is rapidly becoming almost as extensive as that of makes of cars. As we hope to deal with this section of the exhibits more at length in our next issue, it will suffice now to mention that a good deal of ingenuity has been displayed in dealing with the problem of producing a dynamo that shall maintain a constant voltage and output, despite the fact that the motive power is supplied by an internal-combustion engine that is run at an ever-varying rate of speed. As for the other great feature of the show—that of engine starters—some of the problems associated with this new departure were referred to by our special contributor in our last issue. So far only a few British manufacturers have definitely adopted an electric starter as a standard part of the car's equipment. The majority, although willing to fit them when specially ordered, are not yet fully convinced of the reliability of the various arrangements that have been introduced. Indeed, there are some who do not look on the departure with approval, one opinion having been expressed that it is like "using a steam hammer to crack a nut." While it must be admitted that some of the arrangements, from a lay point of view, err somewhat on the side of complication, there is no reason why the majority of the systems, when once their principle of operation is grasped by those motorists who drive their own cars, and also by professional chauffeurs, should not prove successful. In this connection, however, it will be necessary for all makers of electric engine-starters to issue plainly-written books of instruction as to the management and maintenance of their devices, so that they shall not prove failures from want of knowledge in this direction.

Copper.

There has been a sharp reactionary movement in the Copper Market since last writing, the main impelling cause of which was, without any doubt, the unsatisfactory position as regards the United States and Mexico, together with the severely reactionary tendency of the share markets both in Wall Street and in Europe. The combined adverse factors in these directions fairly frightened the "bulls" of copper, who, on the publication of the last American copper statistics, threw their holdings overboard in a half panic-stricken mood. It was not that these figures were bad, but that they showed an increase in the United States production of about 3,500 tons on the month, and of a small quantity in the refinery stocks. The output is still well below the highest points attained, but there can be no doubt that a gradual return to normal conditions is in progress throughout the Lake Superior district, and this must tend inevitably in the direction of steadily expanding supplies. It is the fear that this feature, which seems likely to synchronise with declining trade at home and abroad, will result in a considerable surplus of refined copper being accumulated, which instilled apprehension, and the price of the metal was very sharply depressed as a consequence of the realising which followed. No doubt the technical position has been cleared up a good deal by the wholesale selling indulged in during the prevalence of the panicky spirit, and that the market is now very heavily oversold cannot be questioned, but the real position of copper is rather obscure. While the supplies in first hands awaiting disposal cannot be anything but small, and while some of the leading producers are resolutely holding out for their extreme figures, other interests are meeting the demand at substantial concessions, and dealers are cutting in to get all the business they can lay their hands upon. With the last-named category price is not so much a consideration as the booking of orders, for the belief seems to have taken firm root that producers all round will be forced materially to reduce their rates before long if they are to quit output, and on this foundation bear sales of refined are being made. There are no important bull commitments open now, and confidence has been so much disturbed that it is unlikely that any concerted move in this direction will be seen in the near future. While the present uncertainty endures consumers cannot be expected to enter the market with any freedom. In fact, the last few weeks have seen the adoption of a most conservative attitude on their part, the reactionary tendency of the standard copper market naturally imbuing them with a strong sense of caution, and the early restoration of sufficient confidence to warrant the buying of material for forward delivery on anything like a fair basis is most improbable. The trade as a rule is resolved to hold off till such time as the prospects have cleared up, and this cannot be until political and financial considerations have eased down very considerably. The excellence of the entire statistical position has been brought to nought by a persistent series of untoward outside circumstances, but the chances are now in favour of adverse trade and increased production having the controlling power. The strike at the mines of the Rio Tinto property in Spain had little influence upon the market, for although this is the largest European producer, turning out something like 35,000 tons of copper a year, it has to be borne in mind that this output consists very largely of copper values rather than copper, and that the copper market as such has, therefore, not been much affected. The American trade in acid and other products of the cupriferous pyrites which the Rio Tinto Co. ship in huge quantities across the Atlantic, is, however, likely to be affected by the temporary suspension of supplies. The outlook for copper is for a rather quiet market with fluctuations, but for a long view the direction of prices is distinctly towards a lower level.

The last European statistics issued this week made quite a good showing disclosing as they did a further contraction in the stocks and in the visible supply, but they passed unnoticed. The feature has been the heavy premium which has developed on cash and near deliveries, and which fully bears out what has been said above, as to the extent of the oversold account. The premium is, however, a wholly disconcerting element, for it breeds additional distrust, and renders thereby the activities of buyers, both consumers and speculators, even more restrained than before. What is really wanted is a quiescent market for a few weeks, so that fresh bearings can be taken. At the moment there is an atmosphere of distrust which overpowers everything.

ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 804.)

There were no electrical accidents in No. 5 (Manchester and Ireland) District, and only one non-fatal accident in No. 6 (Liverpool and North Wales) District, but no particulars are given. In No. 7 District (South Wales) there were two non-fatal accidents underground, and one fatal and eight non-fatal accidents on the surface.

One of the underground accidents occurred at Albion Colliery (Glam.) on May 24th; the electrician received a shock while replacing the terminals of the controller of a hauling engine, and was only resuscitated after 20 minutes' artificial respiration by ambulance men. He said he had cut the current off, and it was supposed it might have been put on again by a man working near the switchbox; the current was at 440 volts pressure. The other was at Britannia Colliery on July 1st. A pump man was slightly burned by a flash caused by a fault on the starter transformer of a pump-motor working at 3,000 volts.

The fatal accident on the surface occurred at Gellihir Colliery on December 4th, when an electrician received a fatal shock while disconnecting the cable from the generator from a cable on a drum used for lowering a pump in the mine. He had either neglected to cut the current off, or, having done so, it had been switched on again by some person. The earthing of the cable was also defective. The voltage was 550, three-phase.

In No. 8 (Midland and Southern Counties) District there were two fatal and three non-fatal accidents. The two fatal accidents were underground, and are described as follows:—

In the first accident the deceased had taken charge of a coal-cutting machine worked by 500-volt, three-phase alternating current. The machine was temporarily stopped while its haulage rope was being extended for attachment to a newly-set prop, and while handling the rope the deceased received an electric shock which caused his death before he could be released. The machine was connected to the gateway switch by means of an unearthed trailing cable. On examination, it was found that the set-pin of one of the terminals in the plug-box of the machine had become loose, and had slacked back, so that its head was in contact with the body of the machine; consequently, it was "live" throughout, including the rope from which deceased received the fatal shock. By deceased's instructions this trailing cable had been loaded into a tub and labelled to go to the surface two days previously, and it should not have been in use; an earthed trailing cable was available for use, but it was a considerable distance away, and needed to be coiled up and placed in a tub before it could be fitted. Deceased probably was in a hurry to finish a "cut," and therefore brought the defective cable into use again to save time.

In the other case, deceased was superintending the re-erection of a steel girder for a roof support. One end of the girder was resting on a post, the other end was on the floor, and in that inclined position it pressed heavily on two insulated lighting wires carrying electric current at 550 volts, and cut through the insulation. While assisting two other men to lift the lower end of the girder, the deceased, who was standing upon an iron plate in contact with moist ground, received an electric shock which killed him instantly. The deceased should have seen that the current was switched off the circuit, according to the regulations of the colliery, before attempting to fix a roof support in the neighbourhood of the electric wires.

Of these the Inspector says: "It is obvious that neither of them should have occurred." We quite agree that in both cases there was some degree of carelessness on the part of the workmen, especially in regard to the latter, but what sort of a set-pin was it in the plug box which could so easily slack back? and surely the "electrician" should have seen that the cable was sent out of the pit if it was not fit to use.

Another accident which might have been much more serious occurred at West Cannock Colliery, South Staffordshire, by which a man received a slight shock, and a horse, which stood about 1,500 yards further in-bye, was killed. The current used was three-phase alternating, 650 volts, 50 periods per second. It was conveyed from the generator on the surface to a distributing station near the shaft bottom by an armoured cable, but from this point for a distance of 920 yards the cable was unarmoured. Beyond this for a further distance of 1,115 yards the cable was armoured. The metallic covers, motor frames, &c., were earthed to the surface through the cable armouring where available, but for the above 920 yards the earth connection was made by means of an old haulage rope $\frac{3}{4}$ in. in diameter, laid under the rails. The armouring of the shaft cable was connected at the surface by means of a similar rope 40 yards in length to two copper plates in wet clayey ground. The connections between this rope and the earth plates had been made by wire lacings, and were subsequently found to be loose and therefore defective. One arm of a three-throw switch had shorted on to the frame through a hard fibre tube on which the knife blades were mounted, the earthing rope fused at a corroded part near to which the man was standing with his feet upon the rope and his arms resting upon the unarmoured cable, and he received a shock which caused him to fall, but he was not burnt or otherwise injured. The horse which was standing on the rope 1,500 yards further in-bye was killed instantly. Tests had been made by the attendant in the generating house at 7 and 7.30 a.m. on the morning of the accident, but no indications of leakage were discovered.

The accident emphasises the great danger attending the use as earth conductors of old wire ropes which are worn, corroded or of insufficient size, and the necessity of making all connections efficiently, to secure electrical continuity. The old ropes in this case were at once cut out and copper conductors substituted, that on the surface being properly soldered and riveted to the earth plates.

Again, we might ask, Who was the *competent* electrician? and what training had he? and one might also ask whether he was a member of the A.M.E.E., or whether he held a certificate granted by this Association?

An alarming explosion occurred at Auckland Park Colliery in Durham about 2 a.m. on Sunday, October 27th, 1912, in the "Harvey" seam, to which the damage was practically confined. It was a very remarkable circumstance, inasmuch as *no one was in this seam* at the time of the explosion—which was also most fortunate—and the few persons in other parts of the mine were got out without experiencing any ill effects. The damage done was very considerable, and a separate report by Mr. R. A. S. Redmayne, H.M. Chief Inspector of Mines, and Mr. Nicholson, was only recently issued.

There was a current belief at the time of the explosion that it was due to electricity, and on this point the report says: "At an early stage of the investigations the electric cable in the Harvey seam was looked upon with suspicion, as a very probable cause of the explosion, and when it was found that one of the three cores was faulty, this suspicion was intensified." It was found, however, that the fault had been caused by the explosion, and was due to a large fall of roof, which, strangely enough, had driven the cable on to an iron spike, so that it penetrated the armouring and came in contact with one of the cores. A microscopic examination failed to show the "slightest sign of burning or arcing, and it was quite evident that . . . the spike had entered the cable after the current had been cut off." It was then suggested that it might have been caused by a joint box, on account of an incident that occurred at the Black Boy Colliery adjoining. "One morning . . . . the fore-shift men at this colliery were walking in-bye, when they saw a sudden burst of flame from a joint box." An examination of the box showed that there was a small hole at one side of the filler cap, but whether it had been there before the burst or was caused by it was not determined. The roof immediately above the hole was spluttered with bituminous compound, and a large sooty streak extended from the box right across the roof of the roadway. . . . On the box . . . . being opened it was found that the cause of the breakdown *was a loose terminal screw.* Very little bitumen had been lost and *there was no sign of arcing on the terminals.* . . . . The cause of the flashing . . . . was afterwards found to have been the result of some water from a three-way tap in

a motor house being accidentally allowed to impinge on a live lead at a switchboard. This caused a dead earth and a sudden rise in pressure, which found vent at the joint-box." We may here remark that this is not the first time that trouble, which might easily have resulted in serious accidents, has been met with in joint-boxes filled with bitumen, from the same cause. Apparently people will not remember that a joint is the weakest link in an electric circuit, and that, as it cannot be soldered, a large surface ought to be allowed for the connection, to reduce the current density much below that allowed for the solid cable, and that all bolts and nuts must be so made that they *cannot possibly come loose*. It is just as important as a high-pressure steam main, which must be tight and the bolts of which never work loose. The report continues :—"If flashing such as took place in the landing at Black Boy on a long-wall road, where there was little or no coal dust, had occurred at the joint-box on the main engine plane at Auckland Park, *there would have been little difficulty in accounting for the explosion*." As it was, however, proved that nothing was wrong with the joint-box at Auckland Park, it was unquestionable that whatever else might have been the cause it *was not electricity*.

Mr. Nicholson, in his annual report, mentioned that "two fires were due to short-circuits and arcing in South Durham coal mines" ; no details are given as to how the short-circuits occurred, but they point to the necessity of careful workmanship and supervision by competent and able engineers to prevent these occurrences, and not depending upon a man who gets labourer's wages and has no electrical or engineering training, to carry out the Home Office rules and regulations, even if he be armed with a written appointment by the colliery manager. The employment of competent men would be the means of reducing accidents and risk of accident, and the suggestion of the Inspectors "that all joint boxes should be securely built in with brickwork and well-filled with sand" would be unnecessary, as it is already unreasonable. This sort of thing only wants carrying a little further, when the cost of special work, due to rules and regulations, and merely to guard against crass ignorance and pure incompetence, on installing electricity will be so great that it will become prohibitive.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Diesel Engines.

I have read with interest the articles that have appeared from time to time in the ELECTRICAL REVIEW, and, in my humble opinion, you are suffering from a bad attack of "nerves."

You will have noticed that none of the engine builders are likely to get killed in the rush to put a reflux valve on the market, and also that they are very backward in even publicly discussing such a valve.

The Bray engine is a single-cylinder engine—would you advocate putting three such valves on a three-cylinder set ? And if you put this valve on the blast pipe, why not a check valve on the fuel pipe ?

Also why not an oil and moisture absorber on the H.P. delivery from the compressor ? In one station, I understand, the stand-by boilers are fired by the exhaust gases from their Diesel engine, so that on your line of argument they ought to have a reflux valve on the exhaust pipe to stop a flash back to the cylinder *viâ* a bad-fitting exhaust valve.

The Diesel engine requires simplifying not complicating.

The Diesel engine is not the wild untamed animal you would have your readers believe, but like boilers, engines, and gas plants will bite if not treated with the common attention all such plants require.

The majority of the accidents tabulated by Mr. Taylor are due to wear and tear, which, I believe, occurs in other prime movers and has been the cause of fatal accidents.

Of Mr. Taylor's recommendations only Nos. 5 and 6 appeal to me, and I hope that before the Home Office put in force any regulations they will submit the draft to all users of Diesel engines and hold an open inquiry to hear objections. A blast pressure recorder would be of service, and I should be glad to receive particulars and prices from makers of such instruments. Trusting you will soon recover—

C. J. Wood.

Sale U.D.C. Electricity Works,
November 17th, 1913.

[We have again read our editorial of last week on this subject, but we quite fail to detect any ground for our correspondent's suggestion that we are in a state of panic. The advantages of the Diesel engine have been frequently dwelt on in our columns ; surely it is permitted to us to comment on its drawbacks also, and to point out a means of doing away with one of them ? One reflux valve to each blast vessel would suffice, and as this was the whole extent of our proposal, our correspondent's derisive additions need not be discussed.—EDS. ELEC. REV.]

Wind-Power Electric Plant.

My attention has been drawn to an extract of the paper on "Wind-power for the Generation of Electrical Energy" (read by me before the Electrical Association of N.S.W.), which was printed in your issue of August 8th. The form of the abstract does not appear to me to do justice either to the paper or to the other forms of electro-windmill apparatus described therein ; for that reason I am writing to you, as you apparently have not been furnished with a full copy of the paper.

I am forwarding a galley-print copy under separate cover, and if you will kindly peruse this you will see that, although I have been careful to do justice to the Childs patent apparatus, I have drawn particular attention to other plants of a more economical type, and therefore more commercially practicable.

I have made special reference, amongst others, to the apparatus invented by Mr. Turnbull, which I have every reason to believe has successfully solved, as stated in the paper, the commercial problem involved, and which, in the plants so far constructed and in operation in N.S.W., has given the utmost satisfaction. It is as well, perhaps, to add, that I have no pecuniary interest in any electro-windmill concern, but feel that the efforts of a fellow-Australian deserve more recognition than in this instance has been given.

W. H. Myers, B.E. (Syd.),
Vice-President, Elec. Assoc. of N.S.W.

Sydney, *October 7th*, 1913.

P.S.—You will also see, from the copy forwarded, that one of the wind-velocity figures given in your abstract is not quite correct. The average wind velocity for the month giving the *minimum total wind-miles* in Sydney is 8·8 miles per hour ; this indicates a more favourable condition for windmill operation than that stated in the abstract.

[We had the full text of the paper before us, and the only modern plant described in it was the one to which our abstract related. The references to Mr. Turnbull's system, so far as we can identify them, are comprised within a dozen lines, and the author expressly refrains from describing the system, though apparently it was shown to the audience by means of lantern slides.

We regret that our abstract failed to indicate that the average wind-velocity given for Sydney related to the month in which the minimum average occurred.—EDS. ELEC. REV.]

Electric Clocks.

It is true that Mr. G. B. Bowell's name was associated with mine in the patents of 1895 and 1897, but I think it would have been kinder of his brother not to have claimed for him even reflected glory from his early association with the "Synchronome" system, as it calls for comments which I have never yet made, and which I hoped to have avoided altogether.

It is always futile to discuss which of two joint inventors had most to do with the genesis of an idea. Applying the

judgment of Solomon, it was Mr. Bowell who abandoned the babe shortly after its birth, and willed its slaughter. He has had nothing to do with it since 1898, and took no interest in the Institution papers on the subject in 1899 and 1910. The system as it stands to-day has been created and commercially established, in spite of him and not with his assistance. Facts speak louder than words; and it is surely inconsistent for his brother to claim for him a share in the elucidation of the principles of electric time service, which he has habitually transgressed, presumably in the honest belief that they are erroneous or unimportant.

F. Hope-Jones, M.I.E.E.

Clerkenwell, *November 18th*, 1913.

Remarkable Motor Records.

Referring to your interesting article under the above heading in your issue of October 10th, I think you will find that the motors do not develop 120 B.H.P. at 230 R.P.M. They would develop this output at maximum speed, *i.e.*, 650 R.P.M., and at lower speeds the B.H.P. would be proportionately reduced. Even so, the records are sufficiently remarkable.

Sigma.

Calcutta, *October 30th*, 1913.

[When our correspondent receives our issue of last week, he will see that the field strength at 230 R.P.M. is more than three times as strong as at 650 R.P.M. Consequently, the full output can be obtained at both speeds.—Eds. Elec. Rev.]

In my letter of last week, referring to this matter, I gave the starting current as 50 amperes, but find upon inquiry that it is only 16 amperes.

The current taken to run the motor light at lowest speed is 6 amperes, therefore only 10 amperes are required to start up through the gearing.

H. Chitty.

London, N.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS, 1912.

The following statement showing the imports of electrical and other materials into the various Straits Settlement ports in 1912, is taken from the recently compiled trade statistics. The figures for 1911 are given for the purposes of comparison and notes of any increases or decreases have been added.

Imports into Singapore.

	1911. Dollars.	1912. Dollars.	Inc. or dec. Dollars.
Telegraph and telephone materials.—			
From United Kingdom	123,000	245,000	+ 122,000
,, Belgium ...	39,000	6,000	— 33,000
,, Germany ...	28,000	—	— 28,000
,, France	—	27,000	+ 27,000
,, Other countries ...	9,000	10,000	+ 1,000
Total ...	199,000	288,000	+ 89,000
Tramway and railway materials.—			
From Belgium ...	21,000	34,000	+ 13,000
,, Germany ...	1,000	11,000	+ 10,000
,, United Kingdom	102,000	68,000	— 34,000
,, Other countries	2,000	—	— 2,000
Total ...	126,000	113,000	— 13,000
Electrical machinery.—			
From United Kingdom	181,000	210,000	+ 29,000
,, Germany ...	14,000	39,000	+ 25,000
,, Italy	11,000	17,000	+ 6,000
,, Belgium ...	6,000	1,000	— 5,000
,, United States ...	4,000	1,000	— 3,000
,, Other countries	20,000	29,000*	+ 9,000
Total ...	236,000	297,000	+ 61,000

*Japan, 10,000 dollars.

	1911. Dollars.	1912. Dollars.	Inc. or dec. Dollars.
Engines, boilers and parts.—			
From United Kingdom	330,000	220,000	— 110,000
,, Germany ...	11,000	2,000	— 9,000
,, Netherlands ...	20,000	—	— 20,000
,, United States ...	12,000	10,000	— 2,000
,, Other countries	45,000	24,000	— 21,000
Total ...	418,000	256,000	— 162,000
Machinery, other (except sewing machines).—			
From United Kingdom	686,000	649,000	— 37,000
,, Australia ...	18,000	8,000	— 10,000
,, Germany ...	26,000	48,000	+ 22,000
,, United States ...	83,000	79,000	— 4,000
,, Other countries	66,000	129,000†	+ 63,000
Total ...	879,000	913,000	+ 34,000

† Belgium, 32,000 dollars; Holland, 10,000 dollars.

Lamps and lampware.			
From Belgium ...	6,000	3,000	— 3,000
,, Germany ...	238,000	186,000	— 52,000
,, United Kingdom	148,000	128,000	— 20,000
,, United States ...	12,000	16,000	+ 4,000
,, Other countries	32,000	57,000‡	+ 25,000
Total ...	436,000	390,000	— 46,000

‡ Austria, 31,000 dollars.

Imports into Penang.

Electrical machinery.—			
From United Kingdom	56,000	66,000	+ 10,000
,, Germany ...	39,000	38,000	— 1,000
,, Other countries	7,000	6,000	— 1,000
Total ...	102,000	110,000	+ 8,000
Engines, boilers and parts.—			
From United Kingdom	429,000	679,000	+ 250,000
,, Germany ...	38,000	33,000	— 5,000
,, Belgium ...	8,000	12,000	+ 4,000
,, United States ...	22,000	6,000	— 16,000
,, Other countries	21,000	31,000	+ 10,000
Total ...	518,000	761,000	+ 243,000
Machinery, other (except sewing machines).—			
From United Kingdom	54,000	36,000	— 18,000
,, Belgium ...	4,000	3,000	— 1,000
,, Germany ...	3,000	6,000	+ 3,000
,, Other countries	10,000	3,000	— 7,000
Total ...	71,000	48,000	— 23,000
Lamps and lampware.			
From Austria ...	—	1,000	+ 1,000
,, Belgium ...	3,000	4,000	+ 1,000
,, Germany ...	47,000	56,000	+ 9,000
,, United Kingdom	61,000	81,000	+ 20,000
,, Other countries	7,000	7,000	—
Total ...	118,000	149,000	+ 31,000
Telegraph and telephone materials.—			
From United Kingdom	23,000	40,000	+ 17,000
,, Other countries	3,000	2,000	— 1,000
Total ...	26,000	42,000	+ 16,000
Tramway and railway materials.—			
From United Kingdom	6,000	2,000	— 4,000
,, Belgium ...	—	10,000	+ 10,000
Total ...	6,000	12,000	+ 6,000

Imports into Malacca.

Telegraph and telephone materials.—			
From United Kingdom	2,000	1,000	— 1,000
,, Other countries	—	—	—
Total ...	2,000	1,000	— 1,000
Electrical machinery.—			
From United Kingdom	1,000	—	— 1,000
Engines, boilers and parts.—			
From United Kingdom	1,000	4,000	+ 3,000
Machinery, other (except sewing machines).—			
From United Kingdom	34,000	15,000	— 19,000
,, Other countries	20,000	9,000	— 11,000
Total ...	54,000	24,000	— 30,000
Lamps and lampware.			
From United Kingdom	2,000	1,000	— 1,000

N.B.—Dollar = 2s. 4d.

ADJUSTABLE SPEED ALTERNATING-CURRENT MOTORS FOR PRINTING PRESS WORK.

Those who follow the progress of the alternating-current motor closely, have been aware, for some years, that it was theoretically possible to produce an alternating-current commutator motor having the same characteristics as the direct-current shunt-wound motor—namely, a speed which is adjustable and at the same time independent of the load; but it will come probably as a surprise to the average user of alternating-current motors that such a motor exists, and is capable of as wide a field of application as the similar direct-current motor, many thousands of which are put into service every year.

The present article describes one only of the many possible applications of this type of machine—namely, the application to printing press work.

The machine may be used either on single or polyphase circuits, its advantages being particularly marked on single-phase circuits, since on such a circuit no satisfactory printing press motor has hitherto existed, even for running at a single speed; in order,

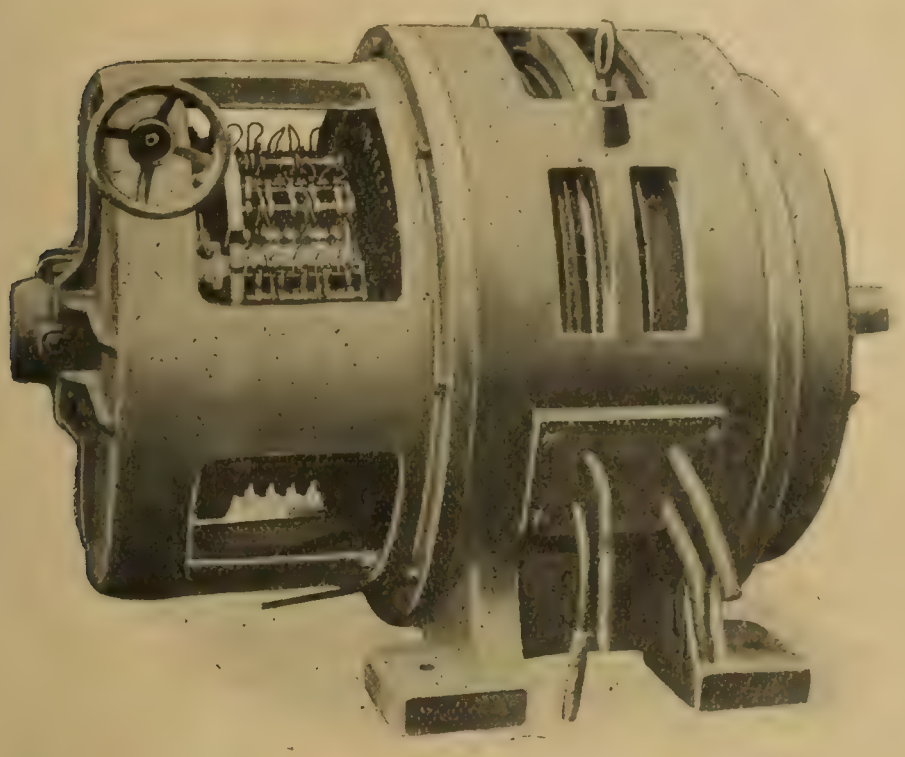


Fig. 1.

therefore, to show the motor operating under the most difficult conditions, we may refer to a single-phase installation recently completed at the works of Messrs. Harrison & Sons, Printers in Ordinary to His Majesty, at Hayes, Middlesex.

Before describing this installation, it may be of interest to give some particulars of the motor, its construction and general performance.

The motor, which is built under the Punga & Creedy patents, and is being placed on the market by Messrs. F. Parkinson & Co., of Leeds, is shown in fig. 1.

The stator consists of a cast-iron frame which forms the base of the motor and also supports the bearing brackets; this frame carries the laminated-iron stator core which is of the usual induction-motor type and contains a number of semi-closed slots, in which the single-phase stator winding lies.

The rotor consists of a laminated-iron core mounted on a strong cast-iron spider and carrying a drum winding, similar to



Fig. 2.

that of a direct-current machine, and connected to a commutator, built up of hard-drawn copper bars, insulated by means of pure mica.

The brush holders are of standard design, containing carbon brushes, in every way similar to those of a direct-current machine.

The standard machine is fitted with ball bearings in order to reduce the friction and lessen the necessity for frequent attention; these bearings are of the best quality obtainable, literally designed for the whole range of outputs and so arranged as to be absolutely dust-proof.

Printing press work requires, in addition to the motor, a speed regulating controller and a starting switch arranged so as to permit of "inching" and capable of being fixed in any desired position on the press; the speed regulation is effected by means of an ordinary dial-type controller, having in standard designs 10 stops, corresponding to the 10 different speeds.

The contacts are arranged to run under oil, whereby sparking and burning is absolutely prevented, and it is found in practice that such controllers, though in constant use, show no signs of wear on the contacts. A view of this controller is given in fig. 2.

The starting switch can be arranged in two different manners according to whether a remote control is used or not. The most usual arrangement shown in the view, is that corresponding to a direct control, the use of intermediate solenoids, in this case, being avoided. A small drum-type controller is fitted on the printing press, as shown, the contacts running in oil for the purpose mentioned above.

A notable characteristic of this type of motor is the absence of starting resistance of any kind, it being standard practice to throw the motor direct on the line, whereupon it can be arranged to absorb not more than twice full-load current, and will give a starting torque of from 2 to 2½ times full-load torque. By means of this drum-type controller it is possible to "inch" the printing press with exactly the same ease and accuracy as in the case of a direct-current motor, a result which is unique on single-phase current. Of course, no counter shaft with fast and loose pulleys is required, the motor being belted or geared direct to the printing press.

A number of small knife switches may be fitted in series at various points on the press to enable the operator to stop the

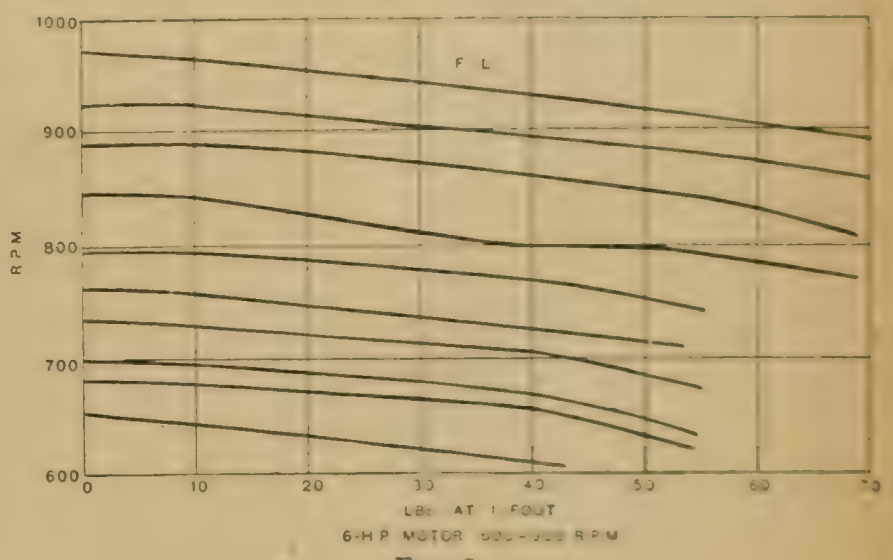
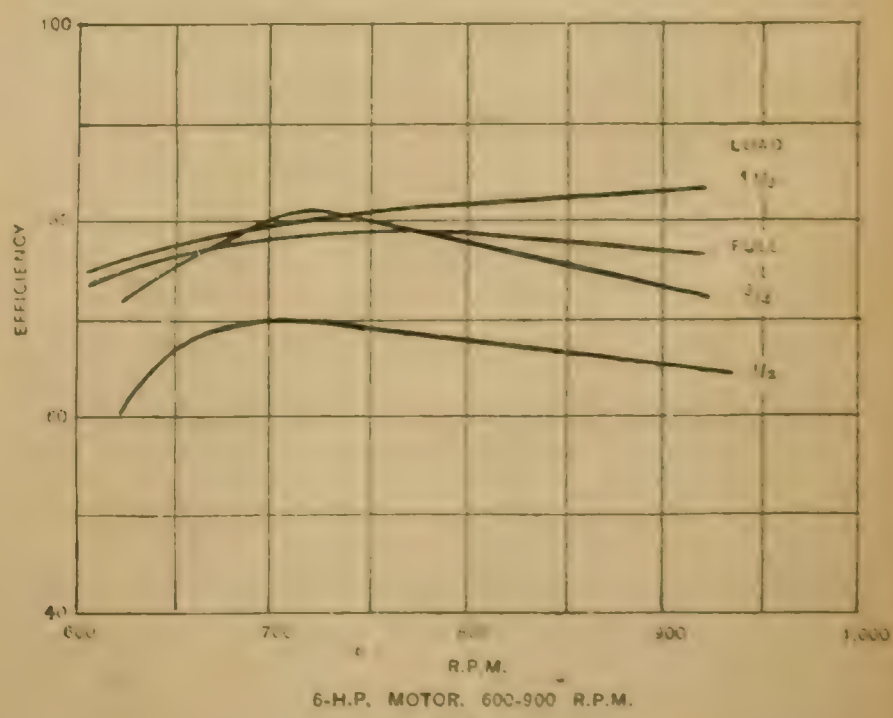


Fig. 3.

apparatus from wherever he stands. In the case of remote control, the control is effected by means of a small pilot switch exactly the same in every respect as that used with a direct-current installation.

Figs. 3, 4 and 5, show the speed-torque curves and the efficiency and power-factor curves of the machine from half load to 33 per cent. overload, on single-phase current; it will be seen that the efficiency is fully equal to that of a direct-current motor, and



6-H.P. MOTOR. 600-900 R.P.M.

Fig. 4.

remains approximately the same for the full-speed range, there being, perhaps, a slight drop at the lowest speeds.

Another unique feature of this type of motor is its extremely high power-factor, which will appeal more especially to central station engineers. It will be seen from the curves that the power

factor at full load averages 95 per cent. over the entire range of speed. From the users' point of view, this means that whereas other alternating-current motors take from 20 to 25 per cent. more current than a direct-current motor does to do the same work, even when the efficiency is the same in both cases. the motor described takes about the same current only, and consequently enables a certain economy in wiring to be realised.

There is no need to enlarge on the importance of high power-factor to the central station man; if all the motors on the average alternating-current circuit had as high a power-factor as the motor for which curves are shown, it would be possible to carry the load with about 25 per cent. less plant; or, in other words, carry a 25 per cent. greater load with the same plant.

Fig. 3 shows the speed-torque characteristics of the motor. It will be seen that the speed drop between no load and full load is very slight, amounting to 3 per cent. only, which is certainly no more than that of the average direct-current motor.

On the whole, therefore, the makers feel fully justified in their claim that their alternating-current printing-press motor is equal in every respect to the standard direct-current motor used for the same work, while, in some respects, it is superior. It may be added that the commutation of this machine is claimed to be quite equal to that of a direct-current motor, as it runs on full load without any trace of sparking.

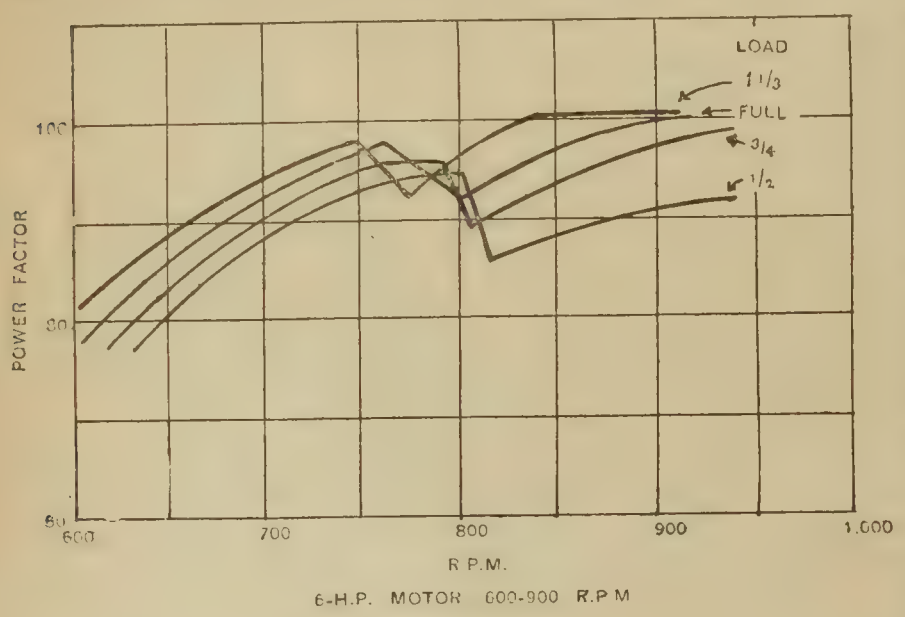


Fig. 5.

On account of the necessity of using a variable-speed motor and the fact that it has hitherto been impossible to obtain one to operate on alternating currents, a very common method of equipping printing establishments, situated in a district where alternating-current supply exists, is to install a motor-generator set, and the presses are then equipped with standard direct-current motors in the usual way; this has serious disadvantages in high first cost and low efficiency. The high first cost renders it out of the reach of all but establishments of considerable magnitude, and the net result is that small establishments are unable to take advantage of the variable-speed drive at all, if they are situated in an alternating-current district, while if this district is single phase they are worse off still, as the use of a countershaft to permit the motors to start on no load becomes essential. "Inching" by means of the motor often becomes a difficult operation, so much so that the presses often have to be pulled round by hand, which is, to put it mildly, a nuisance.

But the effects of the low efficiency of the motor-generator drive are still more serious. Let us consider the case of operation of a direct-current motor, operated through a motor-generator drive, as compared with an alternating-current motor, of equal efficiency, operating direct from the line; assume a very common price of 1d. a unit for electrical energy. Take a standard 6-H.P. motor, operating 48 hours a week, at an efficiency of 80 per cent., it will consume approximately 270 units a week on full load, or 3,510 a quarter of 13 weeks, costing nearly £14 13s. 4d. Now, if we have a motor-generator set feeding the motor, and we assume 90 per cent. efficiency for the large motor, and 90 per cent. for the generator, the overall efficiency of the set at full load will be only 81 per cent., about the same as that of the small motor. The power consumption will, therefore, be multiplied in the ratio of 100 to 81, or instead of the energy costing £14 13s. 4d., it will cost £18 2s. Hence by the elimination of the motor-generator set we save £3 8s. 8d. every quarter on a single motor. The efficiencies given above for the motor-generator set assume that it is fully loaded all the while, but this is far from being the case. Such a machine usually feeds a considerable number of motors, and if some of these motors are not running, the set will be only partially loaded, and this overall efficiency, instead of being 81 per cent. may fall to from 65 to 75 per cent., whereupon still worse results, as regards cost, are obtained.

Standardisation of Plugs.—The question of the standardisation of two-pin plugs and other small appliances in common use by the general public, was brought up for consideration at the Council meeting of the I.M.E.A. held on the 14th inst., and a sub-committee was formed to deal with this matter, Mr. A. C. Cramb, of Croydon, being appointed honorary secretary.

THE TRADE OUTLOOK IN CANADA.

We reproduce the following interesting review of the prevailing trade position in Canada, and the factors likely to influence the course of business next year, from our esteemed contemporary, the *Canadian Electrical News*:—

Whether or not the year 1914 will be an active period for us industrially, depends, in the main, on two factors: (1) the natural demand for manufactured products, and (2) our financial ability to purchase these products. Without question there is only one answer to the first. Canada's capacity for almost unlimited development is established beyond the shadow of a doubt, so that our manufacturers may be assured of an ever-increasing demand for practically every class of manufactured articles. It remains then to discuss only the ability of Canadians as individuals, municipalities or private companies to provide the purchase price. During the past summer, tight money has been a very real obstacle in the way of certain lines of activity. This condition was brought about partly by the unusual requirements of the European continent; also to a considerable extent by the amount of money that had become tied up in realty investments from one end of the Dominion to the other; but these conditions were intensified by the conservative, ultra-conservative we believe, attitude of our banks. Arguing that the signs foreshadowed a repetition of the crisis of 1907 and similar previous periods, and believing that prompt action would save the situation, they have followed the policy, apparently quite consistently, of lending no money which, as they thought, could by any possible chance be used to encourage the general extravagance to which Canadians were rapidly becoming habituated — the result largely of a number of years of unusual prosperity and plentiful money which had turned the heads of a large percentage of our citizens. This action of the banks has caused a great deal of discomfort to even their most deserving customers, and while it is generally conceded that caution, in reason, was the wisest course that could have been followed, it appears to us that the banks, by taking the extreme course, have unnecessarily curtailed the circulation of money, and have done much towards producing the very condition —a trade reaction—they sought to prevent. Just how far their course was justified is difficult to determine, and it has undoubtedly placed the banks in a sound position, so that at no time have they had to refuse assistance for developments which, in their own judgment, they have considered necessary. As a result, the larger industrial life of the country has not suffered seriously, nor is there any sign of it in the future, for want of sufficient capital. Certain industries report the biggest year's business in their history.

As already indicated, the extent of the demands to be made on our factories during the next 12 months will depend on the amount of money in the hands of (1) the individuals, (2) municipalities and (3) private corporations. Our recent bountiful harvest has been an all-important circumstance, which will mean that the general public is pretty well supplied with ready money. The farmer only knows through the newspapers that money is scarce. As a result, the small retailer of general supplies—such as hardware, boots and shoes, &c.—except in the larger centres, will probably not experience any diminution in trade; this means continued prosperity for the wholesale dealer and manufacturer. In the building industry, is it not a fact that practically every city and town in Canada is under-supplied with both public and residence buildings, and the population still continues to increase at a rapid rate? While building permits issued during the last month or two indicate a slackening in this line of trade, this, we think, is explained in large measure by the very general feeling that both workmen and supplies will be obtainable at lower rates; also, due to tight money, a certain number of sacrifices have been thrown on the market. We see no sign of a diminished demand, however, and this slight reaction will just mean an increased activity in building trades of all kinds as soon as the money situation has readjusted itself. With an already inadequate supply of buildings, an ever-increasing population, and a fair distribution of money among the middle classes, the demand for all kinds of building materials seems assured.

With the larger municipalities and private corporations the outlook may not be so entirely optimistic. These have found it necessary, often, to go outside of Canada for their supply of money, which has not been so readily forthcoming during the last few months, on account of similar demands from other sources. Canada's natural resources, however, constitute a splendid security, which stands behind all her industrial undertakings, and we are confident that, even in a world competition, she can obtain the necessary supply of capital; perhaps, just at this time, at a little higher rate, but not so high that the resultant developments will not amply justify the increased cost.

And after all has been said on both sides, Canada's immediate and ultimate prosperity is inseparably tied up with the prosperity of her great rural population, which, at the present moment, is possibly not equalled in any other country in the world. Our crops, just harvested, will put into the pockets of the farmers during the next few months in the neighbourhood of $300,000,000. This will soon find its way through the usual channels to the manufacturers. To this sum might be added dividends from investments which are being distributed to the general public at the annual rate of something over $150,000,000. This will also indirectly reach the manufacturer. The extent to which the natural frugality of the average citizen will assist in the readjustment of conditions is, of course, difficult to determine in dollars and cents, but there is no doubt that at a time like the present a general policy of curtailment is being followed by most of us, and

these accumulations will be ready for circulation as soon as the general public judges the opportune moment has arrived.

Summing up the situation, while we anticipate that difficulties will continue to be encountered for some time in obtaining large sums of money abroad, this condition, we believe, will be more than offset by favourable local factors, of which we may mention :—

1. The unsatisfied demand for every kind of manufactured product.

2. The unexampled prosperity of our great rural population.

3. The good security and high returns of Canadian investments, which means ability to borrow abroad.

4. The present low conditions of stock supply ; it is generally conceded that the retailer is running very low, following the general policy of caution.

A TWO-RATE TARIFF SYSTEM WITHOUT TIME-OPERATED CONTROL.

By H. H. Perry, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *at Manchester, November 18th*, 1913.)

It seems ridiculous to charge at certain times of the day a low rate for power and another rate for lighting for the dual supply, and further, it is equally absurd to exact the full penalty price from a consumer when he is using only a fraction of his maximum lighting load, assuming for the moment that no heating is in use.

The object of this paper is to show :—

1. That the use of electricity can be extended, with advantage both to supplier and consumer, by granting facilities to the latter

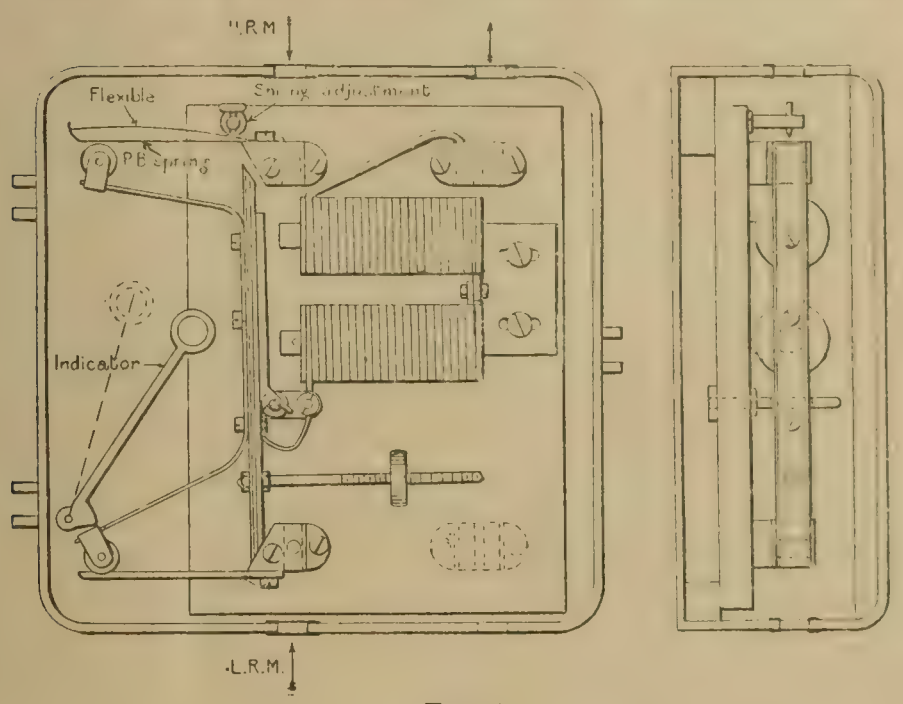


Fig. 1.

for using his lighting circuits during "off-peak" hours at a low-rate charge ; and

2. That the multiplication of domestic power circuits, while being an advantage, is not always necessary for securing a low-rate charge.

A simple change-over switch, automatically rocked, can combine or separate the two rates at will. Such a method needs two meters, and therefore resolves itself into a two-rate system.

But why go to expense in order to change a consumer's meter over from the high rate to the low rate when a magnetic change-over switch will automatically do this ?

As shown in fig. 1, an ordinary single-pole change-over switch is employed, one arm of which is magnetically attracted by the lighting-circuit magnetising current. It is freely pivoted about its centre, and a balance weight is provided on the other arm, the position of which is adjusted to give any proportion of the consumer's lighting between, say, 5 per cent. and 95 per cent. at the low rate. In isolated cases it may be practicable to give a higher percentage.

Auxiliary contacts are provided for maintaining continuity of the circuit when changing over : without these, the practical every-day working of the switch would be impossible. No mercury cups are used.

Demagnetising turns on the magnet or a separate counter-magnet, are provided for the purposes to be described in connection with fig. 4.

The switch is normally on the low-rate side, and two of the ordinary stock pattern of meters are employed a practice which is daily becoming more common for domestic circuits owing to the demand for power.

The connections shown in fig. 2 would be used for a consumer taking practically all his current for lighting, no separate circuit being provided.

All the current passes through the high-rate meter (H.R.M.) or the low-rate meter (L.R.M.), and the switch is adjusted by the balance weight or by the air-gap so that all currents less than a given fraction of the maximum current (5-25 per cent.) are registered on the low-rate meter.

Fig. 3.—A separate power circuit is used, connected to the switch as shown, and two meters are therefore necessary under ordinary tariff conditions. The low-rate meter (L.R.M.) will therefore register the whole of the power load, and up to 25 per cent. of that required by the lighting, when the switch is on the low (or left-hand) side. When the switch is on the high (or right-hand) side, L.R.M. will meter the power only, and H.R.M. only the lighting. Both in this case and in fig. 4 the meters are required to operate simultaneously.

Fig. 4.—The consumer has the option of these connections provided certain heating apparatus, such as a complete cooker, a system of radiators, or other power, is adopted, whether purchased outright or hired.

So long as the heater system is in use, L.R.M. will meter all power and any desired proportion of the lighting, since the pull of the magnet is neutralised to the required extent. Otherwise the operation is the same as in fig. 3 ; that is to say, the lighting reverts to H.R.M. after 5-25 per cent. has been exceeded.

To provide equal and opposite magnetising ampere-turns with equal current flowing in each circuit would court financial ruin if the heating system were maintained over the lighting peak ; it is probable, therefore, that the opposing forces would generally be designed so as not to have a greater ratio than 1 : 2, or even as low as 1 : 4, until heating apparatus reaches a very much higher point of efficiency and commands a ready sale to every consumer.

Provided always that the heating peak, assuming that there is one only, does not coincide with the lighting peak in magnitude and length of time, the arrangement of fig. 4 should undoubtedly prove acceptable. The mere granting of a low flat rate for power by many authorities to-day is an admission that the diversity factor is large enough to allow the coincidence of double peaks to be ignored. It has the immense advantage of giving to the consumer facilities for using dozens of forms of really useful appliances (together with light) from the existing lighting circuits at a low rate, and the load so provided should do much to improve the load factor, especially during the two summer quarters.

There are many cases of "necessitated" lights, the first to be switched on and the last to be switched off, which ought to be distinguished from occasional lights. As already pointed out it seems misleading to charge a consumer an apparently high rate on these. It is highly probable that a number of consumers would burn one or more lights throughout the night as a protection against burglary, provided that the cost were small and readily checked.

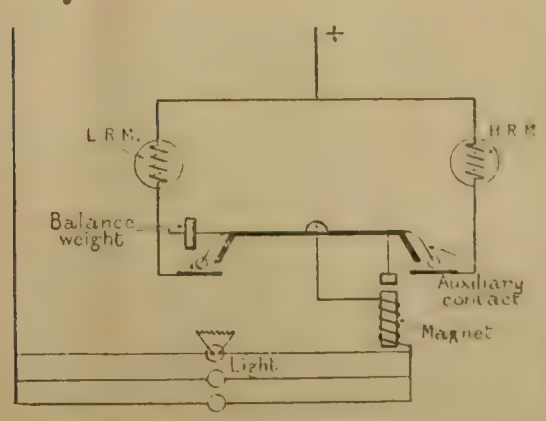


Fig. 2.

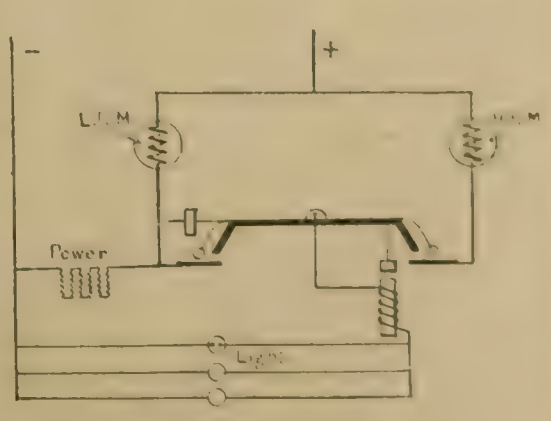


Fig. 3.

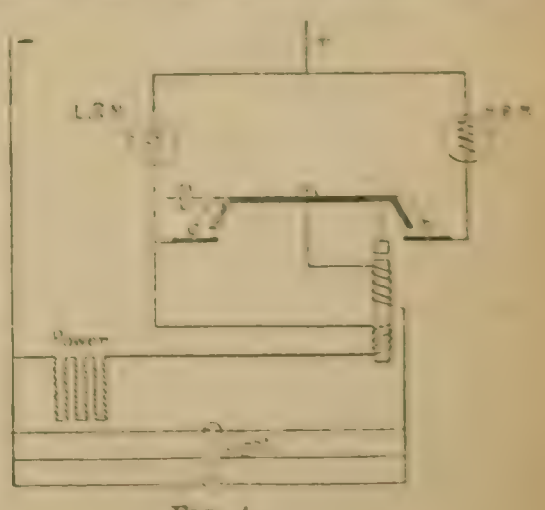


Fig. 4.

Up to the present, two-rate clock or centrally controlled systems have not made great headway, for the following reasons :—(1) The high cost of meters (clock controlled) ; (2) expert workmen are required for clock repairs ; (3) monthly winding ; (4) prolonged period of testing. And in the case of central control by a system of mains :—(5) High initial outlay ; (6) cable faults.

If heating by electricity is to be made familiar and profitable, it is a *sine quâ non* that a hiring department be inaugurated from the commencement—not only from an introductory point of view, but as an educative agency always at the service of the consumer. It is well known to engineers that a watchful eye is generally needed for undersized plug circuits when heating appliances are in use.

Before concluding, it may be useful to revert to a few points in connection with the instrument device, the working of which I have already explained.

1. The armature will rock to and fro with a change of only 0·3 ampere for a 10-ampere instrument. The magnetising loss at full load is approximately 4 watts with continuous current and 8 to 10 watts with alternating current.

2. The auxiliary contacts never have to carry more than 25 per cent. of the lighting load, except when the arrangement of connections shown in fig. 2 is employed and a large power load is carried, which is most unlikely. Both contacts are, however, designed to carry full load, so that continuity is assured; the top one only is provided with a flexible phosphor-bronze spring, which tends to give the consumer the benefit by resisting the connection with the high-rate meter.

3. Both auxiliary contacts are fitted with rollers, which relieve friction and tend to revolve with each rock-over motion. They are so pivoted that the break in the circuit as the position of equilibrium is approached is as short as possible. The inductive spark due to the magnetising current is then negligible.

4. A simple indicator, governed by the magnetising current, shows the rate in use. The balance weight can, if required, be sealed against fraudulent adjustment.

5. The complete switch in a sealed case measures 7 in. × 7 in. × 2½ in.

In an appendix methods are shown of using one meter only for a two-rate system, of 3 or 5 amperes capacity, reasonable accuracy being obtainable at low powers.

A shunt circuit is provided, with a make-and-break contact actuated by the auto-switch, and the usual stock size of meter can be used without internal alteration for two-rate use.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Cables for South-Western Railway Electrification.

The contract for the supply and erection of the cables for the electrification of the South-Western Railway Co.'s suburban lines has been placed with Messrs. Siemens Brothers & Co., Ltd., Woolwich. The leading particulars are as follows:—

Three-phase current, 11,000 volts, frequency 25 cycles per second. The cables (see fig. 1) are three-core, paper insulated,



Fig. 1.—Section of Cable for S.W. Railway Electrification

lead covered, jute served and armoured with a layer of galvanised steel wires, and served all over with jute.

The approximate quantities of three-core cable to be used are as follows:—34 miles 0·2 sq. in., 21½ miles 0·15 sq. in., 19 miles 0·06 sq. in.

The chief particulars of the cables are as follows:—

Section sq. in.	No. of wires.	Diameter of wire varying from	Thickness of dielectric between conductors and between any conductor and lead.	Thickness of lead.	Overall diameter of cable.
0·2	53	0·06 to 0·114	0·36 in.	0·16 in.	3·17 in.
0·15	33	0·054 to 0·11	0·36 in.	0·15 in.	3·01 in.
0·06	22	0·048 to 0·068	0·35 in	0·13 in.	2·65 in.

The cables are being erected on brackets, supported on stakes driven in the ground, and were subjected to a test pressure of 25,000 volts between any core and lead.

The work is being carried out under the superintendence of Mr. Herbert Jones, M.I.E.E., chief electrical engineer to the railway company.



Fig. 2.—Consignment of Cable for Railway Electrification.

Fig. 2 illustrates the first batch of finished cable before dispatch from Woolwich works.

Electrically-Driven Watering Cart.

A correspondent who has followed our articles on the electrical vehicle question, sends us the photograph reproduced in fig. 3, of an electrically-driven watering cart in use in Turin. The



Fig. 3.—Electrical Watering Cart, Turin.

accumulators are fitted immediately under the driver's seat, and the back axle is chain driven from the motors.

Our correspondent points out that this type of vehicle would be welcomed by central stations, as it would give a useful addition to the summer load.

Silvertown Motor-driven Reducing Gear.

Fig. 4 illustrates one of a number of special reducing gears designed by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, to operate the damper of a bank of boilers.

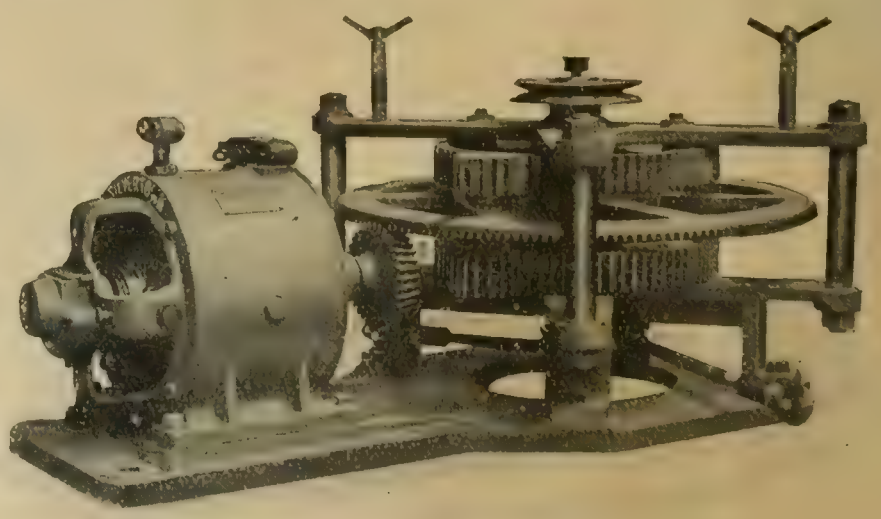


Fig. 4.—Electrically-driven Damper Gear.

The reducing gear consists of a combination of bevel and epicyclic-spur gearing, which rotates a vertical shaft. A crank is fitted to the lower end of the shaft, which operates two connecting

rods attached to the cranks on the damper. The gear ratio is 1,295 : 1; the motor is a Silvertown "Z 15" type, and develops 1½ B.H.P. at 1,295 R.P.M.

The chain wheel fitted on the top of the gear serves to drive an indicator erected in the stoke-hole, and thus the stoker can see at a glance the exact position of the damper.

As the motor and gear are installed over the boiler flue, a metal cover is fitted over the complete gear to exclude dust as far as possible; the arrangement of the gear renders it impossible for the dampers to jam when closed, should the motor be allowed to over-run.

LEGAL.

British Vacuum Cleaner Co., Ltd., *v.* James Robertshaw and Sons, Ltd.

This case last week came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Swinfen Eady and Phillimore. upon the appeal of the defendants from a judgment of Mr. Justice Sargant, in the Chancery Division, in favour of the plaintiffs' patent.

The plaintiffs, the British Vacuum Cleaner Co., Ltd., brought the action against the defendants, James Robertshaw & Sons, Ltd., for an injunction to restrain the alleged infringement of Letters Patent (No. 17,433, of 1901), granted to Hubert Cecil Booth for "Improvements relating to the extraction of dust from carpets and other materials," of which Letters Patent the plaintiff company were the owners. The plaintiffs also claimed damages. In the specification it was stated that it was essential for practical success to drive by power the pump employed for producing a vacuum, and to maintain a vacuum of at least 5 lb. per sq. in. in the filter on the side of the filtering medium where the air and dust entered when the apparatus was at work, and that it was only to extractors working with a considerable vacuum that the claims related. The first claim was for the combination of an extracting implement connected with a power-driven suction pump and dust collecting means interposed between the said implement and pump substantially as, and for the purpose, specified. In a previous action the House of Lords held that there was subject-matter in the patent in question, and that it was valid. In the present action the plaintiffs complained of threats to infringe, and of actual infringement, by the defendants. The alleged infringing machine had suction bellows instead of a cylinder pump.

The defence was that the plaintiffs' patent was invalid upon the ground that the alleged invention therein contained had been anticipated by specifications published by James Joseph Harvey, of Kidderminster, in 1893 and 1894, and the prior user of machines made under Harvey's patent. Defendants further denied infringement, on the ground that the patent sued on did not cover suction bellows, although worked by motor, and on the ground that the machine complained of did not work with a 5-lb. vacuum.

Mr. Justice Sargant held that the statement as to a vacuum of 5 lb. was directory only; that the plaintiffs' patent had not been anticipated; that the defendants had threatened to infringe, and had infringed, the plaintiffs' Letters Patent. His Lordship accordingly granted the plaintiffs an injunction, an inquiry as to damages and the delivery up and destruction of infringing articles, and ordered the defendants to pay the costs of the action. The inquiry as to damages was stayed pending the present appeal.

Mr. Walter, K.C., and Mr. J. Hunter Gray (instructed by Messrs. Farrar & Co.) appeared for the appellants; and Mr. T. Terrell, K.C., and Mr. Colefax, K.C. (instructed by Messrs. Hasties), for the respondents.

Mr. Walter, upon the issue of infringement, contended that what the defendants did was not within the plaintiffs' patent, Booth's specification being limited to 5 lb. vacuum substantially, and he contended that a machine such as the defendants, giving 2½ to 3 lb. vacuum, did not infringe. If the patentee's specification was construed, as he contended it should be, his clients did not attack the validity of the patent, but if it was not so construed he submitted that the machines which had been used would cover the plaintiffs' patent, and so anticipate it.

The hearing was continued on Monday, and at the conclusion of counsel's argument, the Court reserved judgment.

Benkert *v.* Harman Allen Manufacturing Co.

In the Shoreditch County Court, on November 11th, before his Honour Judge Cluer, Elizabeth Benkert, a widow, of 48, Wilson Street, E.C., sued the Harman Allen Manufacturing Co., of 7, Fort Street, Spitalfields, for £6. It appeared from the evidence that the defendants estimated for two new field coils, impregnated, to be fitted to a 1½-H.P. electric motor, and assemble, test and deliver same, at a cost of £3 19s. 6d. After it had been in use for a little while, it was suddenly found that the insulation had burned out, a most incomprehensible thing, as it should have lasted for years. Some correspondence ensued, but both took up a dignified attitude, one side saying they would not go to inspect it, as there was no doubt the damage had been done by dampness, whilst the other side would not take it for inspection.

Judge Cluer positively declined to look at the correspondence, as he said no good could be done by reading what was written by so-called business people who would act like it. It was like a couple of ladies disputing on the etiquette of which had to call on the other first, or a pair who are quarrelling as to who shall raise his hat first.

The Plaintiff said the work had been put right by Messrs. Anderson & Anderson, and had cost £6, for which they were asking payment.

David Anderson, engineer-in-charge to the East Ham Corporation, said he examined the work, and found that one coil had burned out through defective insulation. One layer of tape was not sufficient for 500 volts.

The Defendant said the work was not guaranteed, so that they could not be held liable. It was not a question of bad work, but of dampness.

Judge Cluer said there might not be a specific guarantee as to the work, but everybody knew that in that class of work it was understood that it would last a reasonable time if the work was properly carried out. In this case it was not properly carried out, apparently, as it went wrong almost immediately. He gave a verdict for the plaintiff for £5 15s. 6d., and costs.

Electric Shock Claim.

Before the Sheriff-Principal of Fife, a boy who had received a shock by putting his hand on the snib of a window in the Lochgelly Opera House connected with a live electric wire, claimed damages for injuries thus sustained. On behalf of the defender, the lessee, it was pleaded that he was entitled to take unusual means of protecting his property against interference, and that, in any event, the boy had no right to interfere with the snib.

The Sheriff dismissed the action as irrelevant.

BUSINESS NOTES.

Consular Notes.—China.—The British Consul at Foochow reports that the works of the Foochow Electric Light Co. were completed in March. The light is laid on to the city, and several outlying districts, including the foreign quarter in Nant'ai. The main streets of the suburbs are also lit, and electric lamps have replaced the Kitson lamps hitherto used on the large bridges connecting Nant'ai with the mainland. The plant, purchased through a Japanese company and erected under the supervision of a Japanese engineer, is of best British manufacture. The current is good, but on the south side of the bridges is only laid on at night. The manager and staff of the company are Chinese.

The Consul at Nanking states that the Nanking Electric Light Co., a Chinese concern, is reported to have now established itself on a satisfactory footing and to be making a small profit. The practical working is not always all that could be desired. The Telephone Co., also Chinese, is a very inferior installation.

Peru.—The British Consul at Cerro de Pasco states that the Cerro de Pasco Mining Co. and the Morococha Co. have taken possession of the rivers and waters between Oroya and Morococha for the purpose of erecting a powerful factory to serve both the companies for lighting and power. They have started to erect the plant, which is expected to be ready in about a year's time.

Brazil.—The Consul at Rio Grande reports that the tramway system of that city has been bought by the concessionaires of the port works, and has been electrified. All the material employed has been imported from the United States. The city of Pelotas, an exception to most of the towns in the State, has not up to the present had the electric light, but an electric power station will shortly be established for electrifying the tramways and for other purposes; the contract was secured by a firm from Buenos Ayres. A great many of the small interior towns are lighted by electricity. There has not, so far as the Consul knows, been any interest shown in these enterprises by British firms.

Sweden.—The American Consul at Goteborg, in a recent report, refers to a meeting of the board of managers of the Goteborg electric light and power plant, a municipal enterprise, at which the director brought forward a novel plan to introduce electricity into the one and two-room flats. Of the 30,000 apartments of two rooms and kitchen or less in Goteborg, only 3,100 are supplied with electricity. The chief reason for this is the expense of installing a special meter post for each two-lamp apartment. The house-owners have not felt inclined to go to such expense, and the tenants have not been willing to spend so much on apartments that they might occupy for only a short time. The director of the electric plant proposes to join all the small apartments in a house with a common current limiter, the rental for the number of lamps for which the limiter is adjusted to be paid by the house-owner to the electric company, and the house-owner to be reimbursed by additional rental for each apartment. This system has been tried in four houses, averaging 21 apartments each, and the results have been satisfactory. The installation costs per house were reduced about 40 per cent. The cost of current will amount to 50 öre (6½d.) per lamp per month, or 1 crown (1s. 1½d.) per month for two lamps. At present the consumer pays 15 crowns (16s. 10½d.) per year for two lamps, plus the current limiter.

The Consul at Stavanger also reports a cheapening of current in that town for cooking and heating purposes. The rate was formerly the same as for lighting, viz., 14 öre (2d.) per KW.-hour. The new rate is 2 or 4 öre per KW.-hour, depending on the time of day when the current is used. To further encourage the use of electricity for household purposes, the engineer of the municipal electric plant has organised a class for housewives for instruction in the use of

electrically-heated cooking apparatus. Electric lighting is universally used in the Stavanger district as a result of the cheap hydro-electric power made possible by the many waterfalls. Even the peasants and fishermen dwelling on the fjord islands have electric lighting in their homes. The Consulate is well equipped with electric light, which, during the winter months, is used during the day as well as in the evening.

Norway.—The American Consul at Christiania reports that the use of electric appliances is limited in Norway, notwithstanding the fact that electricity is used everywhere, and that it is furnished to consumers at very low rates. Appliances having the largest sale are electric irons, fans, chafing dishes, one and two-hole broilers, and small hot or cold air blowers for drying the hair. The cost of electric current furnished to householders is 3½d. per KW.-hour. For technical purposes the rate is 2½d. per KW.-hour. On yearly contracts the rates are lower—2½d. per KW.-hour for domestic use, and for technical purposes £5 per H.P. up to 15, and about £4 per H.P. if more than 15 H.P. is used. In other Norwegian cities the rates are also low. Electricity is used for heating purposes and for general cooking to a very limited extent. A few householders whose space is limited or where the use of coke stoves is impracticable, employ electric heaters and ranges, and a few amusement places, in operation for only two or three hours a day, find electric heating convenient. With coke at 16s. 8d. or 18s. 8d. a ton, and wood 10s. 6d. or 12s. 6d. a load, heating and cooking by electricity are considered too expensive at the present price of electric current, though a contemplated reduction in rates may bring about decided changes. The original cost of electric appliances is also too great to permit of their universal use. A few appliances are now being manufactured in Norway, but the majority are imported from Germany, with smaller quantities from the United States, Sweden and England.

Lapland.—The American Commercial agent reports that the richest and probably the largest iron-ore mine in the world is located at Kiruna, Lapland, in latitude 68½° north, which is about the same as the northernmost boundary of Alaska. The climate is somewhat milder than in Alaska, and these mines are worked the year around. About 1,600 men are employed and the equipment is the most modern machinery obtainable. Machine tools for the repair shop, air compressors, and rock drills, and several of the largest steam and electric shovels, are of American make. Orders have been placed with an Ohio company for a large addition to their electrical shovel equipment, the machines of this concern having proved superior to other makes which have been used in the mines.

The plant is at present operated by steam power, the coal supply coming from England and Spitzbergen. Steam coal is delivered here for about 18s. 8d. per ton. The electrification of the mines is in progress, and this power will be used exclusively as soon as the new power plant of the State of Sweden, now under construction at Porjus Falls, is completed. The transmission line is completed, and it is expected that the power station will be ready to deliver current early in 1914. 150,000 H.P. will be the capacity of this station, and transmission will be at 78,000 volts over a distance of 150 miles. The State railway between Kiruna and Narvik is being electrified and will be operated from this station. The ore is shipped from Kiruna to Narvik on the Norwegian coast by rail, and from there by water to Germany, a small percentage finding its way to other countries. The equipment is being rapidly increased and will soon be sufficient to ship more than 10,000,000 tons per annum.

Up to the present time about 25,000,000 tons of ore have been shipped. The ore is magnetite and contains from 53 to 68½ per cent. iron.

Electrical Trade in Greece.—According to an Austrian Consular report on Greece, electrotechnical articles are daily finding an increased sale, as large installations are being carried out or are projected. Numerous firms have been established during the past 10 years for the sale of the smaller installation material, whose requirements are mostly supplied from Germany. An extensive trade is done by these firms, whose financial standing is of a satisfactory character. The chief customers for electrical installation and kindred articles are the Electrical Co., the Gas Co., and the General Post and Telegraph Administration. To be able to promote business relations with these latter, well-introduced local agents must be employed, otherwise sales will be hard of attainment. In the coming three years large installations in the department of telegraphs and telephones are projected, with which is bound up a considerable call for appropriate material. The Gas Co. and the Electric Co. place most of their orders for material with their parent houses in Paris. Nevertheless, orders are placed elsewhere for particular articles. On such occasions they turn to the leading European makers with the invitation to submit offers, and choose finally the most competent who quote the lowest prices. Goods thus indented for comprise dynamos, motors, electrical fittings, high-pressure cable and transmission lines, a variety of installation accessories, electric lamps and instruments, and electrolytic copper. France is among the suppliers of dynamos, motors, transformers, electrical instruments and electrolytic copper. Switzerland is also a contributor, but more particularly of high-pressure wire and electrolytic copper. Transmission lines are supplied from Belgium, electrical instruments from England, and low-pressure wire from Sweden. High-pressure wire is at times procured from Hungary, and electrical apparatus and instruments from Austria. Electric motors and dynamos are in comparatively small request, as the Electric Co. in the capital generally sells current at too high a price. A tendency, however, is observable, and especially in the cases of newly-starting firms, to employ electric motors. Many motors and dynamos are also supplied by the Electric Co. itself, or else procured through agents abroad.

South African Customs Invoice Regulations.—The South African Section of the London Chamber of Commerce (Incorporated), and the South African Merchants' Committee have recently made representations to the High Commissioner for the Union of South Africa relative to the Regulations under the Customs Management Act of the Union of South Africa, under which it is laid down that invoices shall contain :

1. A statement in a prominent place as to the current value for home consumption in the open market for similar goods at the place of purchase, bought in the ordinary manner and manufactured or supplied in analogous quantities ; and
2. That the invoice shall also clearly show the cost of packing and packages.

As a result of the correspondence with the High Commissioner referred to, it is recommended (except as regards definite contracts, to which reference is made later), that suppliers should give effect to these Regulations in the following manner :—

(*a*) In cases where the price charged on the invoice and discounts allowed and the home consumption value are alike, sign a declaration to the following effect :—

"I declare that the values appearing on the body of this invoice represent at the date of the invoice the open market value of the goods if sold for home consumption in Great Britain, and that the discounts shown are the same as those granted on similar quantities sold for consumption in Great Britain."

(*b*) In the instances where the price charged on the invoice and discounts allowed and the home consumption value are divergent, enumerate the latter on the invoice in a parallel money column and declare that "the discounts for similar quantities for home consumption are . . . . ."

Where the price charged the consumer is a contract price, the invoice must clearly indicate the current value for home consumption at the date of the contract, thus :—

—	Current value for home consumption.	Selling price to purchaser in South Africa.

and the words "at the date of contract" substituted for "date of the invoice." In all cases the cost of packing and packages must be given. The declarations must be signed, and the figures given authenticated, by either manager, principal, director or secretary of the firm or company making the same. From communications with the Commissioner of Customs of the Union of South Africa, it is understood that if the above recommendations are carried out by the suppliers, they will meet the requirements of Clause 103 of the Regulations published under the Sections of the Act referred to. The Commissioner of Customs intimates that should any general laxness become apparent in the signing of such certificates, the value and discount for home consumption will be insisted on in the body of the invoice for the several items thereon.

Catalogues and Lists.—The Cable Accessories Co., Ltd., Britannia Street Works, Tividale.—New catalogue of 100 pages (No. 7), containing illustrations, brief particulars, with prices and code-words, of a variety of "Sceaco" water-tight electric light fittings, single light vertical and mill fittings, cluster light fittings, street lighting lanterns, shop window fittings, globeless fittings for street lighting, hand lamps, ships' fittings, cargo cluster fittings, bulkhead or sconce fittings, arc lamp winches, and various accessories.

Messrs. Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.—New edition of sectional catalogue No. 1,132. Its 48 pages are occupied with fully-illustrated matter relating to "Sturtevant" forge plants and forges. The opening pages show pictures of a number of engineering and other works where their smoke and fume-exhausting system is employed. Particulars of stationary and portable forges, motor-driven forge fans, &c., follow.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 745 gives descriptive notes and tabulated prices and code-words of the "Monarc" and "Aston" enclosed arc lamps, and "Aston" automatic weight-relieving contact gear.

The Mica Lubricant Co., 63, King Street, South Shields.—Illustrated circular relating to "Micaline" lubricant for electric cars, mica grease and packings, automatic lubricators, &c.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—Sixteen-page pamphlet giving prices and particulars of centrifugal and plunger pumps in combination with Westinghouse cross vertical enclosed oil engines.

Messrs. Landau & Co., St. Ann's Chambers, Orchard Street, Westminster, S.W.—Several illustrated lists describing and giving prices of the "Lanco" electric heating cushions for bed or poultice use ; the "Lanco" electric rug and foot-mats ; and the "Lanco" electric heater for heating and boiling liquids by immersion.

The Railway Truck Supply Co., 81, Gracechurch Street, London, E.C.—Twenty-four-page illustrated catalogue of electric trucks for baggage and freight service, as supplied by the Elwell-Parker Electric Co., for whom the firm are representatives for Great Britain and the Colonies.

Siemens Brothers Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—Price List No. C.L. 2 (Second Supplement) dealing with electrical illumination devices for Christmas and festive decorations, which they supply in great variety ready wired for connecting to circuits from 100 to 250 volts. Illumination lamps of many varied shapes are available for use on Christmas-tree decoration, including representations of fruit, flowers and

birds. All these types can be obtained with clip contacts simplifying wiring. Members of the trade can have copies of the list on application.

The Gledhill-Brook Time Recorders, Ltd., 43, Market Street, Huddersfield.—24-page pamphlet, containing illustrated particulars of their "Empire" time recorders, "Empire-Clipper" recorders and job-costing equipments, and specimen cards showing their use.

Messrs. A. West & Partners, 91-98, York Street, Westminster, London, S.W.—A very useful catalogue of 200 pages, containing a vast quantity of information, with prices and a profusion of illustrations, regarding a great variety of surveying instruments, drawing office instruments, stationery and equipments, architects' and engineers' photographic, photo and plan printing materials and apparatus, filing cabinets and other office furniture.

The Peel-Conner Telephone Works, Ltd., Salford.—48-page bulletin (No. 3), containing excellent large half-tone pictures, line diagrams and descriptive matter relating to some of the exchange equipments that they have installed for telephone administrations at home and abroad. We are sure that the publication will be of interest to all telephone engineers, and they can secure copies on application.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—The firm are issuing to electric light consumers, preference being given to users of Siemens lamps, copies of a picture in colour, which attractively and quite unobtrusively advertises "Wotan" lamps. The prints are issued ready for framing. There are other features in the picture beside the lamp, which in some cases may divide the admirer's attentions.

A Canadian Electrical Store.—In the accompanying pictures we show a couple of views in the premises of the Sun Electrical Co., Ltd., at Regina, Saskatchewan, who are claimed to have the best equipped electrical showrooms in Western Canada. This is one of the firms for whom Messrs. Chiswell & Co., of



Views in a Canadian Electrical Store.

Kingsway, W.C., are acting in the capacity of European purchasing agents. The Canadian Sun Co. is not connected with an English company of a similar name. The lines of manufactures that it handles—fittings, cooking apparatus, telephones, power equipment, &c.—are mostly of British manufacture, and some of the articles appearing in these illustrations have been specially made to meet Canadian requirements.

Lead.—Messrs. James Forster & Co. report as follows under date November 15th: "The débâcle in the copper market this week, together with the pessimism which is so marked a condition of all markets outside metals, has had its natural effect on the lead market notwithstanding the intrinsic position of the metal, and we have had a recession in values for all positions of considerable importance. So very little lead has come in; the large arrivals expected end of last week and this have not made their appearance, and the difficulty and inconvenience the delay has caused are very serious. The lead is urgently wanted. In normal times the bare condition of consumers' stocks and the absence of any lead in the shipping ports would have maintained prices, but these are not normal times, and despite the scarcity we have a falling market and very little selling is sufficient to act adversely on values. Closing prices last week were: October £20 12s. 6d., November £19 17s. 6d., December £19 10s., and January £19 5s. Last night's market developed into a regular slump and closed at lowest, November at £18 12s. 6d., December £18 7s. 6d., March £18, with buyers for prompt at £19, and February £18 2s. 6d."

Whist Drive.—Messrs. A. Reyrolle & Co.'s employés held their annual whist drive and dance in the Hebburn Co-operative Hall on Friday last. The event was the most successful yet held. After whist and supper, prizes for the works' annual sports were presented by Mrs. Reyrolle, who was presented with a handsome bouquet. Mr. H. C. Stuart, of the purchasing department, then moved a vote of thanks to Mr. Reyrolle, and referred to the very cordial relations existing between the officials and workmen. Mr. P. Wright, of the switch department, seconded, and Mr. Reyrolle suitably replied. A programme of dancing, &c. followed.

Bankruptcy Proceedings.—W. R. Wa[illegible], electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor was fixed to be held at the County Hall, Northampton, on November 14th when the statement of affairs showed liabilities amounting to £[illegible] and assets estimated to realise £75, leaving a deficiency of £[illegible]. Mr. W. G. S. Fawkes (Messrs. Scriven, Terry & Fawkes) attended on behalf of interested parties but the debtor was not present. The Official Receiver stated that the debtor had gone to a situation at Bury Lancashire. In view of what transpired at the previous hearing he had written to debtor, pointing out that it would be necessary to furnish an amended statement of affairs before he could pass his public examination. The book debts, which were first put at £128, and later at £84, estimated to produce £75, as a fact had only produced £25 7s. 10d. The Official Receiver had pointed out to the debtor that he had not complied with the conditions of the Bankruptcy Acts, and that it rested with him whether he passed his public examination. The debtor had replied that he had no money for his railway fare to Northampton. The Official Receiver submitted that if the matter was not properly cleared up the case must be adjourned *sine die;* but, in order to give the debtor an opportunity to comply with the requirements, he would apply for an adjournment. The Registrar accordingly ordered the case to stand adjourned.

Woolf Barnett, electrician, 269, Mile End Road, E.—The public examination was held on November 12th, before Mr. Registrar Hope, at the London Bankruptcy Court. The accounts showed liabilities £59 16s. 4d. and assets nil. In the course of his evidence, the debtor stated that he came to this country from Poland 33 years ago, and had not been naturalised. His failure was due to liability incurred on behalf of his son, who was also in the court. The examination was concluded.

Prested, —— (male), St. John's Park, Holloway, N., electrical engineer.—Receiving order made November 12th, on creditors' petition. First meeting November 26th; public examination December 19th; both at Bankruptcy Buildings, Carey Street London, W.C.

John Samuel Richards, Marfleet, Kingston-upon-Hull, electrician.—Receiving order made November 10th, on debtor's own petition. First meeting November 25th, at Official Receiver's office, York City Bank Chambers, Lowgate, Hull. Public examination December 8th, at Guildhall, Hull.

Callender's Cable Works Prize Band.—On Saturday last the above band, connected with Callender's Cable and Construction Co., Ltd., gave a concert in the works' dining hall. Among the officials of the firm present were Mr. J. O. Callender, Mr. A. R. Kibblewhite, Mr. S. Goodman, &c. During the evening the 50-guinea shield (first prize of the Preliminary Shield Section) won at the Crystal Palace contest on September 27th this year, was presented, Mr. Iles, the founder and director of the great annual band festival, handing the shield to Mr. T. O. Callender, the managing director, who presided. The band has competed seven times in this festival, winning three first, two second, and one third prizes. It has had a successful contest season, having entered six competitions and winning prizes on each occasion—three firsts and three seconds. Its record to date is:—20 contests entered; prizes won, 16. Congratulations!

Shipping Exhibition.—In connection with the Shipping, Engineering and Machinery Exhibition, which is to be held at Olympia, from September 25th to October 17th, 1914, we are informed that a Royal Commission has been appointed by the Netherlands Government for the purpose of organising a collective exhibit of Dutch shipping (naval and mercantile), shipbuilding and engineering on this occasion. Among the members are many of the most important business men in Holland, including the burgomasters of Rotterham and Amsterdam.

Canadian Business Tours.—According to the *Times*, arrangements are on foot for a visit of Canadian business men to Great Britain in March or April next and for a return visit of British business men to Canada in August. Mr. C. F. Roland, Commissioner of the Winnipeg Industrial Bureau, is in London in connection with the matter.

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Book Notices. — *Recherches Experimentales sur le Coupage des Fers et Aciers par les Chalumeaux à Jet d'Oxygène.* By R. Amédée. Paris: Union de la Soudure Autogène. Price 3 fr.—In this brochure is given a full account of the method of cutting steel with the oxyhydrogen and oxyacetylene blow pipes, in minute detail. Numerous micro-photographs are reproduced to illustrate the physical processes involved, and the influence of impurities in the oxygen, and of variations in the pressure of the gas, is discussed. The effect of the operation upon the metal in the neighbourhood of the cut is described, and the consumption of the gases employed under given conditions is given. The work should be of great value to those who contemplate the use of this powerful modern agent.

The "Mechanical World" Pocket Diary and Year Book, 1914. Manchester: Emmott & Co., Ltd. Price 6d. net.—New matter on steam turbines, milling and gear-cutting, keys, pipe threads, pipe joints, weights of nuts, &c., has been included, and the work as a whole revised. It is wonderful value for the money.

La Soudure Autogène. By l'Institut Scientifique et Industriel. Paris: *Mois Scientifique et Industriel.* Price 2.75 fr.—This book describes and explains the various processes of autogenous welding in use, with their advantages and drawbacks, and gives practical directions for their operation, together with details of cost. Hydrogen for this purpose is best prepared by electrolysis, and some particulars are given of commercial apparatus for this purpose; the cost is from 1 to 1½ fr. per m^3. One chapter is devoted to electric welding, including spot and seam welding. The work is very complete and detailed, and deserves hearty commendation.

Second Report of the Committee on Reinforced Concrete. London: William Clowes & Sons, Ltd. Price 2s. 6d. net.—The Committee of the Institution of Civil Engineers, which presented this report in July last, is presided over by Sir William Matthews, with Dr. Tudsbery as secretary. Since the first report, issued in June, 1910, research has been carried on in various directions, and a quantity of very valuable information has been brought together in the volume under notice, which includes reports on tests of plain and reinforced concrete slabs, percolation tests at the N.P.L, tests on columns and beams, calculations, formulæ, &c., with descriptive reports of work actually carried out.

"Application of Electric Power to Mines." By W. H. Patchell. London: Constable & Co, Ltd. Price 10s. 6d. net.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, No. 9, September, 1913. Liége: The Association. Price 4 fr. 50 c.

"*Journal* of the American Society of Mechanical Engineers." November, 1913. New York: The Society. Price 35 cents.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXIX, No. 5. November 10th, 1913. Cardiff: The Institute. Price 5s.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXX, No. 4. October, 1913. Philadelphia: The Club. Price $2.

"The Practical Metallography of Iron and Steel." By J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 3s. net.

"Text-Book of Applied Mechanics." Vol. V. Eighth Edition. By Andrew Jamieson. 1913. London: Charles Griffin & Co. Price 7s. 6d.

"Electro-Thermal Methods of Iron and Steel Production." By J. B. C. Kershaw. 1913. London: Constable & Co. Price 8s. 6d. net.

"The Hidden Danger and How to Avert It." Doncaster: *The Doncaster Chronicle.* Price 3d.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 6. October, 1913. Toronto: The Society.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 11. November, 1913. New York: The Institute. Price $1.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 7. October, 1913. New York: The Society. Price 75 cents.

"The Physical Review." Vol. II, No. 4. October, 1913. Lancaster, Pa.: The American Physical Society.

"Les Surtensions dans les Distributions d'Energie Electrique et les Moyens d'en Prévenir les Inconvénients." By S. van Dam. 1913. Amsterdam: Van Mantgem & de Does. Price 10s.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. October, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"Atti della Associazione Elettrotecnica Italiana." Vol. XXII. Nos. 19 and 20. October 15th and 31st, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50 each.

"Aufstellung liegender Wasserturbinen für Gefälle von 3 bis 30 m." In German, English and French. By Johann Hallinger. Munich: J. C. Huber.

Messrs. Crosby Lockwood & Son, of 7, Stationers' Hall Court, London, E.C., have just issued a new illustrated catalogue of 108 pages of their scientific, technical and industrial works. Copies will be sent to any reader interested, on application.

British Engineers' Association.—We commend to the sympathetic consideration of all of our manufacturing readers who are not already connected with the above Association a 32-page booklet that has just been issued dealing with its possibilities and its achievements, and setting forth reasons why eligible firms should join. As our readers know the Association is, in the first instance, centring its attention upon the Chinese market, and the pamphlet, therefore, contains a good deal of information bearing upon this subject. The Association and the merchants, the Hong Kong University, German and American influence on Chinese education, are among the topics briefly touched upon. Firms likely to be interested should ask the secretary for a copy of this booklet; the offices of the Association are at 32, Victoria Street, S.W.

Liquidations.—The Universal Cable Code (Parent) Co., Ltd.—A petition for the winding up of this company has been presented by Herman Schneider, merchant, and will he heard on December 2nd.

Ohio Power Syndicate, Ltd.—A meeting will be held at 66, Bishopsgate, London, E.C., on December 22nd, to hear an account of the winding up from the liquidator, Mr. E. J. Trollope.

The Preston Electric Co, Ltd.—A meeting of creditors will be held at 12, Bennett's Hill, Birmingham, on November 24th, at 12 o'clock noon.

J. Defries & Sons, Ltd.—A meeting will be held at 4B, Frederick's Place, Old Jewry, on December 15th, to hear an account of the winding up from the liquidator, Mr. A. F. Whinney.

Trade Announcements.—Mr C. E. Wilson, of Johannesburg, and Mr. F. Peabody Rice, of the same city, have entered into partnership, and will carry on business under the firm name of Peabody Rice & Wilson, with offices at 22, Standard Bank Buildings, Harrison Street, Johannesburg. Mr. Wilson has been in charge of the South African interests of the British Insulated and Helsby Cables, Ltd, for many years.

Mr. E. Wallis, electrical contractor, has taken over the business of the late Mr. R. Cloake, of 26, High Street, Sevenoaks, and will carry it on under the style of Cloake & Wallis.

Deed of Assignment.—H. J. Bentley (Bentley and Co.), electrical engineer and ironmonger, Manchester.—Creditors must send in their claims, &c., by November 29th to the Trustee, Mr. J. W. A. Hirst, 28, Queen Street, Albert Square, Manchester.

Lead Coating of Metals.—The efficient protecting of iron and steel from corrosion and the preserving of tubes, castings and other metallic articles from acid fumes and corrosive liquors, has always been of great interest to engineers and others. In the accompanying figure is shown a group of articles which have been



Lead-coated Metal Articles.

successfully coated with lead to a thickness of about $\frac{1}{16}$ in. The figure shows castings for centrifugal machinery, roof glazing bars and plates, springs, bolts and nuts, &c. These articles have been leadised by the electrolytic deposition of lead by Messrs. Lead, Ltd., of 1 and 2, Old Pye Street, Westminster, S.W.

Sweden.—A new electro-metallurgical company has recently been formed at Arboga, in Sweden, for the purpose of building a new works for the manufacture of corundum, silicon carbide and ferro-alloys. The company has a capital of £11,100 in fully-paid shares, and the well-known Swedish metallurgist, Engineer Grönvall, is one of the promoters.

It is reported from Stockholm that the Almänna Svenska Elektriska A/B has formed a subsidiary company at Copenhagen, with the view of getting into a better position for supplying the Danish market.

Correction of Advertisement.—We are asked to announce, in connection with the B.T.H. Co.'s Veluria reflector advertisement in our issue of November 7th, that the prices of the 60 80-watt and 200-watt extensive type reflectors were incorrectly stated. The price of the 60-80-watt reflector is 3s. 6d., not 3s., as printed; and that of the 200-watt reflector is 19s., not 19s. 6d., as printed.

Lifting Magnets in Steel Works.—Having accumulated an enormous amount of scrap metal, in the course of 20 or 30 years, one of the largest steel works in this country decided to resort to lifting magnets for its removal, and obtained one from the Witton-Kramer Electric Tool and Hoist Co. (for whom the General Electric Co., of Queen Victoria Street, London, E.C., are the sole selling agents); the magnet is 42 in. in diameter, and is suspended from a travelling jib crane. By this means the difficulties of handling turnings and other scrap are obviated.

LIGHTING and POWER NOTES.

Acton.—In a letter to the U.D.C., laid before its Works Committee last week, the Metropolitan Electric Supply Co. stated that the failure of the supply of electricity to the pumps at the sewage disposal works on the 20th ult., was due to an accident at the Willesden works. The surveyor stated that if there were a serious breakdown whilst a storm was in progress the matter would be grave. Several breakdowns in the local supply had taken place during the last three years, but since the company had installed its new plant in Acton Lane no complaint had been made.

Argentina.—The Bolivar T.C. has approved the specification for the electric lighting of that town and tenders will shortly be called for.

The concessionaire of the electric light stations in Ramos Mejia and San Justo expects to have the installations completed by the middle of December.—*Review of the River Plate.*

Australia.—The Melbourne Harbour Trust Commissioners have prepared a scheme for substituting electricity for gas lighting in all cargo sheds, wharfs and roads at Victoria Dock, the north side of the river from the dock head to Queen's Bridge, and on the south side from Queen's Bridge to the dock. The estimated cost is £5,079, and it is anticipated that two of the three sections will be in operation by the end of the year.

The Brunswick Council has decided to borrow £7,000 for extensions to the electric supply scheme.

Bannockburn.—A system of electric lighting is to be installed, the power being obtained from Bonnybridge.

Barnes.—Proposed Loan.—The U.D.C. is seeking sanction to borrow £7,500 for the purchase of mains and services.

Barton.—At a meeting of the R.D.C. on the 12th inst. it was decided to oppose the Manchester Corporation Bill which seeks powers in regard to Trafford Park. The clerk was authorised to obtain the necessary legal assistance.

Bentham.—E.L. Scheme.—The formation of the Bentham Electric Light Co., in an interesting instance of a kind of village development which, in the West Riding of Yorks., seems likely to increase. Bentham is an old-time village of the larger sort on the north-western edge of the county, within a very short distance of Lancaster; there is a gas supply, but many of its people are still living in the oil lamp era. The new electric supply company has been formed by some local residents, and current is to be supplied at 5d. per unit, at which figure it will compete successfully with the local gas supply.

Bradford.—L.G.B. Inquiry.—An inquiry was held by Mr. T. C. Ekin, on Thursday last week, in connection with the application of the Corporation for power to borrow £91,250 for extensions at the electricity works. Evidence was given by the deputy town clerk and the engineer, Mr. T. Roles, that owing to the increased demand for electricity for power purposes—particularly for the driving of textile works—the Committee had decided to apply for a loan for extending the plant. At present all the power that the turbines were capable of generating was being used, and if the extensions were not proceeded with very shortly they would be threatened with a breakdown. Had it not been that trade was slack, it was pointed out, the electricity department would be in an even worse position than it actually was. There was no opposition to the application.

Canada.—Mr. W. C. Hawkins, managing director of the Dominion Power and Transmission Co., has announced officially that the company will build an auxiliary plant at the foot of James Street, Hamilton, on the bay front, to develop 90,000 H.P., and that the plant and equipment will cost $3,500,000. The work is to be commenced next year, so as to have the plant in operation by next autumn. This plant will remove all possibilities of interruption by needle ice, and will always be in condition to supply power at short notice.—*Canadian Engineer.*

Chesterfield.—The T.C. is applying for powers to extend its area for the supply of electricity to the parishes of Brampton, Walton and Tapton.

Chiswick.—Proposed E.L. Purchase.—The acquisition by the U.D.C. of the undertaking of the Chiswick Electricity Supply Corporation, Ltd., is to be considered at the next meeting of the Council, and a proposal made that application should go forward in the next session of Parliament for an Act to obtain powers for this and other purposes.

Continental Notes.—Sweden.—The Höganäs-Billesholm A/B, the only Swedish coal mining company, has recently opened up a new shaft at Ormestorp, and thereby increased the output very considerably. As part of the production consists of coal of an inferior quality, the company has decided to employ the quantity which is not used at its own works, for the production of electrical energy on the spot. The plant will be constructed with a capacity of 7,000 KW., of which 2,000 KW. will be employed for the company's own purposes. Other 2,000 KW. has already been disposed of to the South Swedish Power Co., which needs the supply as a reserve for its own stations, which are now worked to their full capacity. The remainder will be disposed of to various industrial concerns in the surrounding districts as well as to municipalities and private people. As such a large quantity as 2,000 KW. is to be kept in reserve for the above-mentioned power company, the new power station will only occasionally be worked to its full capacity. The plan of usefully employing inferior coal in this way instead of selling it at a nominal profit or perhaps in some cases, without any at all, in order to get rid of it, speaks for itself, and it is expected that the company will derive great benefits from it.

The Trollhättan Electrical Works, which belong to the State and which have their source of energy in the Trollhättan waterfalls, are now going to be completed by the addition of four new sets to the present power plant, which comprises eight sets of 10,000 E.H.P. each. When completed, the whole plant will comprise 12 sets of 10,000 H.P. each, and will thus be capable of supplying 120,000 H.P., with one set in reserve.

The authorities have now decided to ask the Swedish Riksdag for the sum of £166,000, which will be required for carrying out the proposed extension. To judge from the above-mentioned sum, it seems as if the last four sets will be considerably cheaper than the average price for the first eight sets, and this will help to reduce the cost price of the energy considerably, the more so as only one-twelfth of the whole plant need be kept in reserve, instead of one-eighth as at present. The eighth turbine and generator are now being installed, and nearly the whole of the power available has been disposed of, for which reason preparations with the view of increasing the production must be made in good time. The demand for energy by new consumers, industrial as well as private, is very lively, and there are a number of contracts under negotiation.

Norway.—According to the local Press, extensive work is in progress at the Glamfjord, near Bodö, for the harnessing of a waterfall capable of affording from 60,000 to 80,000 H.P. The height of the fall is not less than 500 metres.—*Board of Trade Journal.*

Luxemburg.—Tenders have lately been invited by the municipal authorities of Ettelbruck, in the Grand Duchy of Luxemburg, for the concession for the public electric lighting of the town during a period of 30 years.

Cromer.—E.L. Transfer.—The U.D.C. has received from the B. of T. a copy of the draft deed of the transfer of the Electric Light Order. When presented to the Council on November 11th, the clerk said it seemed to him that many of the provisions put into the agreement with Messrs. Edmundsons were struck out; and from what he could see, the B. of T. had cut out much put in for the protection of the Council. Discussion on the matter was deferred to a later meeting.

Crosland Moor (near Huddersfield).—Workhouse Lighting.—At the last meeting of the Huddersfield B. of G., reference was made to the lighting of the Crosland Moor Workhouse, and though some opposition was experienced to a resolution that electric light should be installed, a proposition was eventually carried to that effect by 31 votes to 22.

Crowle.—Proposed E.L. Scheme.—At the last meeting of the U.D.C., letters were read from the Grassington Electric Supply Co., Messrs. T. Smith & Co., of Aberdeen, and the Kettlewell Supply Co., with reference to an electric supply in a township such as that of Crowle. After discussion, it was decided to postpone consideration of the question for three months.

Edinburgh.—Prov. Order.—The E.L. Committee has resolved to recommend the T.C. to apply for a prov. order to supply electricity to the suburban parishes of Cramond, Corstorphine, Colinton, Liberton and Newton.

Gelligaer.—The U.D.C. has given notice that it intends to apply for a prov. order to supply electricity within the area. Efforts will be made to secure the revocation of the Rhymney Valley and General E.L. Co.'s order in so far as it relates to the Council's area.

Giffnock (Renfrewshire).—The Ratepayers' Committee has instructed its representatives to request the Clyde Valley Electric Power Co. to bring its cables into the district, in order that the many new buildings recently erected, and in course of erection may have the benefit of electric lighting.

Great Yarmouth.—The T.C. has decided to reduce the charges for energy for heating purposes, from 2½d. to 1½d. per unit.

Hitchin.—Proposed E.L. Transfer.—At the last meeting of the U.D.C. a letter was read from the National Electric Co., Ltd., asking if the Council would be prepared to negotiate for the transfer of its electric lighting order to a company; if so, the company would like to investigate the matter with the object of putting forward a proposition. A long discussion ensued, in the course of which a motion that the matter be referred to the Roads Committee for consideration was agreed to.

Hebburn-on-Tyne.—Report on E.L. Cables.—At meeting of the U.D.C. on the 10th inst., a report on the E.L. cables in Hebburn-on-Tyne was submitted by Prof. W. M. Thornton, of which the following is a summary:—The cables are insulated with vulcanised bitumen, and have been laid for 12 years; they supply continuous current at 240 and 480 volts, the pressure to earth being 240 volts. The leakage upon them at the present time is large, owing to the influence of continuous current in forcing moisture through the insulation wherever the bitumen in which they were laid is cracked; the supply company is now changing the current

from continuous to alternating, the effect of which will be to prevent the accumulation of moisture in the cables, and, after the present imperfect parts have been worked out, to stop the development of faults from this cause. This has previously been done at Monkseaton, Seaton Delaval and Hirst, with the result that trouble with cables has entirely ceased at each of these places, where before it was serious. The high-pressure cables are quite satisfactory, and no trouble may be expected from them. The cables were exposed at two places, in Cuthbert Street and Swindon Street, and were found to be in good condition. The foundations of the houses were also much better than in Lyons Street, where they were made of large open stones. Three lengths of cable were tested. Two pieces 6 ft. long were buried in earth after a bare place had been cut on each. Pressure at 240 volts, both continuous and alternating, was then applied for five days, and the cable exposed to continuous current was found to have been much more destroyed than that to which the alternating pressure had been applied. A 15-ft. length, which had not been otherwise cut, was buried in its trough with bitumen and wood complete, and withstood 1,000 volts alternating for a quarter of an hour. It was then tested for breakdown, and failed at 10,000 volts after a minute. Except where there are existing faults, the cables may then be expected to have many years of life with alternating current, and after the present faults have been removed there will be practically no risk of disasters similar to that in Lyons Street. Before dealing further with the cables laid, a three months trial should be given to the new system. The Council decided to hold a special meeting to further consider the report, on the 27th inst., at which Prof. Thornton has been asked to be present.

India.—An interesting historical sketch of the career of the Calcutta Electric Supply Corporation, Ltd., has recently been issued by the directors.

The Calcutta Electric Lighting license of 1896 was granted to Messrs. Kilburn & Co., agents in Calcutta for Messrs. Crompton, the preliminary concern being known as the Indian Electric Co., Ltd.; in 1897 the name of this company was changed to its present one, and in 1899 current was first supplied from a 1,000-KW. station in Emambagh Lane. Additional generating stations were opened at Alipore (750 KW.), 1902; Ultadangha (1,200 KW.), 1906; and Howrah (165 KW.), 1906, and in 1910, owing to the general development in lighting and power supply, the erection of a new H.T. power station was commenced at Cossipore, the plant being brought into use in 1912; three new sub-stations have been equipped, and the old generating stations are now provided with suitable A.C.-D.C. transforming plant. To serve the Howrah sub-station, two 1,000-KW. cables had to be laid across the River Hooghly.

At the end of 1912 there were 230 miles of underground, and 124 miles of overhead mains, a total of 354 miles in use.

There were supplied over 40,000 ceiling fans, 370,000 8-C.P. lamps, and nearly 2,000 motors, varying from ¼ to 300 H.P. in size.

The output sold for 1912 was 12,043,398 units, which figure, it is expected, will be very largely increased now that modern plant is at the disposal of the company.

It may be added that only a small percentage of the 60,000 H.P. in Calcutta mills, &c., is being supplied at present.

Leeds.—HALF-YEAR'S RESULT.—A summary of the E.L. accounts for the half-year ended September 30th, shows that the revenue amounted to £54,814, as compared with £46,047 for the corresponding period of last year, but working expenses and loan contributions (calculated for half a year) increased more than proportionately, so that the half-year's result was about £300 worse than for the same period last year. The sales of current for private lighting purposes show a greater increase than has occurred since the introduction of metal-filament lamps six or seven years ago; this increase was to some extent due to the reduction of price which took effect on October 1st, 1912, and the growth of the output has more than neutralised the loss in the price, the revenue from this source having increased by £1,011. The increase in the number of units sold was 311,532 (20·55 per cent.), which compares with the increase of 265,956 units over the whole of the preceding year. The growth of the power supply was beyond all precedent, the units sold for power and heating purposes being 2,334,622 (37·57 per cent.) more than in the first half of the year 1912-13. The aggregate capacity of the motors installed on consumers' premises has grown during the half-year from 22,096 H.P. to 24,470 H.P., an increase of 2,374 H.P. (10·74 per cent.). The increase during the past 12 months has been 4,540 H.P. (22·82 per cent.). The consumption of current per H.P. of the motors, &c., connected has been 339 units, compared with 325 units per H.P. in the previous corresponding half-year. The sales of energy to the tramways department for traction purposes have also increased, and arrangements are in progress for facilitating a further growth in this direction. The total sales for the half-year, 12,858,263 units, show an increase of 33·54 per cent. over the sales for the first half of 1912-13, and the total income was greater by 19 per cent.

London.—WOOLWICH.—The L.C.C. has sanctioned the borrowing by the B.C. of £1,500 for mains, £1,100 for services, £630 for meters, and £1,000 for hire-purchase. Application is to be made for sanction to borrow £2,875 for main extensions.

BERMONDSEY.—The Finance Committee of the B.C. reports that the assessment of the profits of the electricity undertaking, for income-tax purposes, had been agreed with the Inland Revenue authorities at £4,367, after allowing for depreciation of machinery and plant.

Loughborough.—The L.G.B., before sanctioning the proposed loan for extensions, has informed the T.C. that the proposed change of system from direct to alternating current required the approval of the B. of T., and it would defer its consent until the approval had been obtained. Approval has been applied for.

Newcastle-on-Tyne.—A meeting of the electrical section of the Newcastle-on-Tyne and Gateshead Chamber of Commerce was held on the 17th, when a discussion took place on the Electric Lighting Bill, which it is expected will be promoted in Parliament next Session. A communication was read from which it appeared that although there are no external evidences of progress being made, the interested parties are undoubtedly coming together, and it is anticipated that the promotion will be successful. It was thought that it would not be surprising if the Government took up the measure. In the meantime the only new clause suggested is one giving to contractors hiring-out apparatus to consumers, the same protection as is provided to local authorities under the Electric Lighting Acts, *i.e.*, to exempt them from distraint. It was resolved that the question of tariffs for cooking and lighting should be dealt with at the next meeting of the Section.

Newcastle-under-Lyme.—Last week a series of demonstrations of electrical cooking was given in the town, by Mr. F. S. Grogan.

New Zealand.—The municipality of Feilding has decided to borrow £10,000 for electric light and power purposes.—*N.Z. Shipping and Commerce.*

Pontefract.—The B. of G. has entered into an agreement with the tramway company *re* the provision of electrical energy, and a sub-Committee has been appointed to interview the general manager and to report thereon.

Sheffield.—On Thursday morning last week, a cable burn-out occurred in connection with the large and most recently installed turbine in the power house of Messrs. Vickers's River Don Works, and, as flames appeared, the power was shut off, and the works brigade extinguished the fire. The remaining turbines were also shut down, but later in the day work was partially resumed.

South Africa.—In connection with our reference last week, to the large electrical winder for the East Rand Proprietary Mines Co., Ltd., we are informed that the order for the electric equipment has been placed with the British Westinghouse Co. This comprises two 1,500-B.H.P. 550-volt 33·4-R.P.M., D.C. motors direct coupled to the winding drum, one on either side. These are supplied with current from a motor-generator set operating on the Ward-Leonard system, and comprising a 4,200-B.H.P. three-phase 25-period 3,000-volt A.C. motor direct-coupled to two 1,375-KW. 550-volt D.C. generators, with a direct-coupled exciter for the generators and the winding motors. All the necessary control gear and switch-gear are also being provided by the electrical contractors.

The Municipality of Prince Albert (Cape Province) has obtained the approval of the ratepayers to raise a loan of £10,000 for lighting the town by electricity, and other works.—*Board of Trade Journal.*

South Hetton and Haswell.—On November 13th the electric lighting question was discussed by the Local Ratepayers' Association, at whose meeting a representative of the Electric Supply Co. attended, and gave particulars regarding a supply, together with the scale of charges. It was explained that there was already a sub-station at South Hetton, removing any difficulty regarding the supply there, but in respect of Haswell, a sub-station would have to be erected at a large cost. It was decided to await further particulars, and to take steps to ascertain the probable number of consumers in the district.

Southend-on-Sea.—Recently 40 members of a local yacht club enjoyed an electrically-cooked dinner, the arrangements for which were made by Messrs. Gillespie & Beales at the request of Mr. Birkett, the borough electrical engineer.

Slaithwaite.—The U.D.C. has decided to apply for a prov. order to supply electricity within the Council's area.

Swinton.—The improved system of electric lighting along the South Lancashire tramway route is now completed. Instead of two 34-C.P. lamps on each pole, there are two 100-C.P. lamps.

The Council has declined to accede to a request contained in a petition from residents that the electricity supply should be extended to the Moorside district. To give the supply would entail a loss.

Tasmania.—The Government has decided to purchase the works of the Hydro-Electric Co. It is estimated that it will require about £70,000 to complete the scheme. The company is to have its share capital returned with a deduction, but will receive £46,000, which has to be spent in starting carbide and metallurgical works.

Torpoint (Devon).—The U.D.C. has obtained counsel's opinion as to the legal points raised in respect of the agreement relative to the E.L. scheme for the town, and has decided to discuss the whole matter *in camera*

Taunton.—On October 31st the Mayor opened a first instalment of 12 Workmen's Dwellings, which have cost £143 each; in addition to water, rates, &c., the unrestricted use of a 25-C.P. (30-watt) electric lamp in the living room (so placed as to shine into the scullery when the door is open) is included in the rental of 4s. per week, for which it is understood that the Electricity Department is to receive 3d. per week per house. Assuming four hours' average use per day, this will work out at something over 3d. per unit.

Troon (Ayrshire).—Proposed E.L.—The T.C. is considering the question of the lighting of the town by electricity, and is to approach the Councils of Ayr and Kilmarnock as to the terms upon which a supply would be provided.

Tynemouth.—The Corporation accounts for the past year state that in the electricity department the gross income was £19,157, a record for the works. The trading expenses amounted to £11,942. The net profit on the year's transactions was £944, reducing the outstanding deficiency to £701.

Uruguay.—The office of Traffic and Conservation of the Port of Monte Video has reported to the Council of Administration of the port recommending the purchase of five more electric cranes.—*Review of the River Plate.*

Wakefield.—The City Council has decided that on and after April 1st, 1914, the price of electricity for lighting should be reduced from 4½d. to 4d. per unit. At the meeting the chairman said the department had rounded the corner, and would, no doubt, reap advantage in the future by reason of the reduction in price.

Wallasey.—L.G.B. Inquiry.—Mr. T. C. Ekin conducted an inquiry on Tuesday, last week, into applications by the Corporation to borrow £65,000 for the extension of the electricity works. Mr. W. H. Cook, the town clerk, explained that the department was in an excellent financial position, and there was a distinct demand for electricity by large power users. Two or three large flour mills had made inquiries for a supply of energy, and factories and further mills might be expected to be erected on vacant land at Seacombe, especially if the Corporation was able to offer the owners facilities for a cheap supply of power. The site of the new generating station was in Dock Road, Seacombe, adjoining the gas works, and it was proposed to disuse the Seaview Road station as a generating station, but to utilise it as a transforming and converting station. It was stated that the outstanding debt on the works it was proposed to scrap was about £24,000. Alderman Dawson, chairman of the Finance Committee, explained that three years ago they got above their statutory maximum reserve, and instead of placing £1,000 to it, they had to contribute £150. They were also limited in their profits to 5 per cent. Up to March 31st last the reserve fund was £9,169. With interest and the present year's contribution it would be £10,500 next March, and by the time they wanted to use it for the present proposal he assumed that it would be at least £11,500. That would leave a shortage of £12,500 on the £24,000. The price of electricity had come down during the last ten years, from 5d. to 3½d. per unit. The original debt on the plant was £92,000. They had repaid £30,000, and in March last there was £62,000 unpaid. The outstanding debt on buildings not affected by the proposition was £11,000, and the total outstanding debt in March last was £73,000. Of that sum the debt on plant, which would remain on buildings and land which were not affected by that proposal, was £49,000, and the amount of the debt upon plant proposed to be scrapped was £24,000. This £49,000 was live debt and £24,000 dead. The Council asked for a scheme for £65,000, and perhaps the Board would grant a loan of £41,000 under ordinary conditions and a further loan of £12,500 for five years to help them over the stile. That would use the £11,500 in reserve to complete the £24,000 required.

Another application was for the approval of the Board of the re-allocation of land in Seaview Road, Liscard, for purposes of the electricity and tramway undertakings. The land, it was stated, was required by the Tramways Committee as a site for new workshops, and is at present held by the Electricity Committee.

Warrington.—In connection with the extension of the electricity works at Howley, the Electricity and Tramways Committee has accepted tenders for additional plant and buildings at a total cost of £14,550.

Waterloo-with-Seaforth.—The Liverpool District Lighting Co., Ltd., has informed the U.D.C. that the directors have decided to increase the price of energy for lighting by 1d. per unit from December 1st next, making the standard rate 6d. per unit instead of 5d. There will be no advance in the price of current for heating, cooking, or power.

West Bromwich.—The T.C. has decided to supply electricity for lighting and power to Johnson's Iron and Steel Co., Ltd., at ½d. per unit, on a guaranteed minimum demand equal to £500 per annum for five years.

Weston-super-Mare.—Public Lighting. At a meeting of the U.D.C. the question of the lighting of the boulevard with gas or electricity was discussed. The Council had before it an offer from the Weston-super-Mare and District Electric Supply Co., for lighting the boulevard with four centrally suspended lamps and six other lamps hung at intermediate points in pairs, the total guaranteed candle-power of these lamps to be not less than 3,600. The price quoted for the installation was £42 per annum on a five years' contract. The Gas Co. also quoted, but it was resolved to accept the terms offered by the Electric Supply Co.

TRAMWAY and RAILWAY NOTES.

Ashton.—Representatives of the Tramways and Highways Committees of the Corporation have made the following arrangements for the maintenance of the tramways for three years:—The Tramways Committee to contribute to the Highways Committee £550 per annum to cover cost of maintenance of the tramways; to pay the actual cost for materials and labour necessary in case of renewals, and to provide all rails, points or any other steelwork required; no renewals to be executed without first being reported to the tramways department.

Argentina.—The Government has been authorised to grant concessions to the Lacroze Tramway Co. for constructing and working branches to its existing electrical tramway system, the branches to be not more than 20 km. each in length. The company has forwarded plans for 12 such branches, and the necessary contract will be prepared.

The Government of the Province of Cordoba has forwarded to the Provincial Legislature a petition from the South American Railless Traction Co., in which it applies for a concession for working this system in various cities in the province.

Mr. J. Basante has applied to the Municipality of Villa Rica for a concession to establish a telephonic service between the town and the railway station, also for tramway and electric lighting concessions.—*Review of the River Plate.*

Australia.—According to the *Standard*, Messrs. Jones and Molomby, officials of the Victorian Government Railway Department, are coming to London shortly, to obtain an insight into the methods of working the electric railways, in view of the electrification of the Melbourne suburban lines, which is now in progress.

Bradford.—The protests made in the city with regard to platform fare collection on the tramcars has not been without its effect, for the Tramways Committee has decided to experiment with the invention of a local conductor, who has patented a device which, it is hoped, will obviate the crowding of passengers on the car platform. The idea is a "change bag" containing a number of pockets each containing the requisite amount of change according to the silver tendered. It is thought that by the adoption of this idea the inevitable delay resulting from the necessity of sorting and counting the change will be obviated.

Bury.—With a view to doubling the tramway in the main streets, the T.C. intends to apply to the L.G.B. for a prov. order giving it powers to compulsorily acquire lands for the purpose of widening nine roads and streets.

Chesterfield.—The T.C. is seeking powers to construct two lines of electric tramways, one to extend from the junction of Sheffield Road and Newbold Road, to join an existing line in the latter thoroughfare, and the other to extend from Sheffield Road to the parishes of Newbold and Whittington.

Chile.—According to the *Review of the River Plate*, the Government is anxious to arrange for the electrification of the railway between Santiago and Valparaiso as soon as possible.

Continental Notes.—Italy.—The construction of the electric railway from Milan to Genoa will be commenced as soon as the Chamber of Deputies has granted the £6,000,000 necessary for this work. At present the great difficulty is to decide upon the exact course which the line is to take, as several plans have been proposed whereby the original track of about 94 miles is to be shortened by from 12 to 16 miles.—*Board of Trade Journal.*

Germany.—The Mackenzie, Holland and Westinghouse electric signalling system has been installed on the Spittelmarkt-Alexanderplatz section of the Berlin Hoch und Untergrundbahn.

Denmark.—A Danish engineer from Aarhus has recently invented an electrical system, by means of which the stopping signals of the railways are put into direct connection with the brakes of the trains. It will thus become possible at any time to stop the trains from the nearest station, whenever it may be required, and no matter where the train may be at the moment. The Danish State Railways have agreed to carry out the necessary experiments in order to ascertain whether the system can be adopted in the service.

Glasgow.—The Tramways Committee is to consider a proposal for the replacing of the present sign-plates for stopping places with illuminated signs.

Gloucester.—The T.C. has approved of the proposal to place the tramways under the management of Mr. F. H. Corson, the borough electrical engineer, and a sub-committee has been asked to report on a detailed scheme.

Japan.—Railless Traction Schemes.—It is announced from Tokio that a company is in course of formation there with a capital of £300,000, and the title the Railless Electric Tramway Co., to introduce the railless traction system into Japan. It is proposed to establish such lines in Tokio, Yokohama, Shidzuoka, Nagoya, Utsunomiya and Sendai.

Leith.—Tramways Extensions.—A report prepared by the tramways manager, the burgh surveyor, and the burgh chamberlain on the question of tramways extension, has been submitted to the Tramways Committee of the T.C. It is pointed out that a tramway along Bonnington Road from Great Junction Street would naturally have to be considered in the event of Edinburgh Corporation promoting a scheme of tramways along Broughton Road westwards, but meantime it was understood the proposal was to run motor-'buses on that route. In the southern district extensions that might be considered were (1) Seafield and Portobello; (2) Salamander Street; and (3) Easter Road and Iona Street. The extension to the top of King's Road, Portobello, appeared to be the most feasible which had been considered. Regarding the Salamander Street extension, it was stated the cost of a single line from Bernard Street to the existing Seafield car terminus would be about £10,500, and of a double line about £15,500.

London.—Bermondsey.—The General Purposes Committee of the B.C. has reported on the proposal of the L.C.C. as to the horse tramways in Southwark Park Road. In November last the Borough Council was asked to consent to the electrification of the tramway on the overhead system, and it refused consent to any system other than the conduit. A few weeks ago representatives appointed by the B.C. interviewed several members of the L.C.C. with regard to the matter, and it appears that the sole reason why the L.C.C. desired not to reconstruct the tramways on the conduit system was one of expense in the matter of street widenings, which would be approximately £60,000 more than if the overhead system was adopted. Having fully considered this point, the Committee has decided to inform the L.C.C. that in its opinion it would appear from the figures submitted as to the relative cost of the two systems that the L.C.C. proposes in connection with the overhead system of electric traction, to construct a line with fewer loops and more single line than would be the case if the conduit system were adopted, inasmuch as there is a difference of over £60,000 in the cost of the widenings as between the two systems, which strengthens the B.C. in its opinion that it would be inadvisable to give its consent to the overhead system.

L.C.C.—The Highways Committee, as the result of experimental trials of petrol-electric cars on the Tooley Street route, has decided that this system of traction would not be suitable for use on the Burdett Road—Grove Road route as originally proposed.

Electric Ambulances.—At the last meeting of the Metropolitan Asylums Board, the Ambulance Committee reported having had under consideration the practicability of using electrically-driven ambulances. The Committee has always recognised that electricity provides the most suitable form of traction for ambulances employed in the conveyance of acute cases, but hitherto has not recommended the purchase of ambulances other than petrol-driven, by reason of the difficulties which the use of electric vehicles presented, and not the least of these was the excessive cost. Recent developments in electric traction have, however, caused it again to consider the question, and it now recommended that application be made to the L.G.B. for sanction to entering into a contract with "Cedes" Electric Traction, Ltd., for the supply of two chassis for £265 each, and two batteries for £80 each, without, in the first place, advertising for sealed tenders; this was agreed to.

Tottenham.—The U.D.C. has decided to have all tramway centre poles in the district removed, with the exception of those on three refuges.

Deptford.—The B.C. has reduced the rateable value of the L.C.C. tramways within the borough from £12,263 to £2,250.

We learn that the G.P.O. is carrying out some trials in the London district with one of the three-wheel Torpedo electric delivery vehicles illustrated in a recent issue.

Ramsbottom.—At a meeting of the Council on November 13th, it was announced that orders for two new cars for the railless system were to be placed as soon as possible, but that before doing so a small Sub-Committee intended to visit different works with a view to getting better cars than those at present in use.

Reading.—Tramway Extensions.—The T.C. is seeking powers to construct two new lines of tramways, one from Randolph Road to Caversham Bridge, and the other from the latter point to Church Road, Caversham, together with five routes for trolley vehicles.

Southend-on-Sea.—Proposed Loan.—The T.C. on November 10th decided to apply to the B. of T. for a loan of £5,000 for doubling the tramway track from the borough boundary to Leigh-on-Sea Church.

Stirling.—A Tramway Report.—In an exhaustive report the chief officials of the T.C. deal with the proposed electrification of the local tramways. A system of municipal tramways between Bridge of Allan and Bannockburn (about seven miles) *via* the burgh of Stirling, is dealt with, and the question of further extension to the neighbouring burghs and villages of Cowie, Denny, Dunblane, Tullibody, Cambus and Alloa, Blairlogie, Menstrie, &c., serving a total population of 65,216, is considered. The estimated cost of the scheme between Bridge of Allan and Bannockburn is £78,100, and the yearly income is set down at £9,744, while the working expenses are given at £4,981.

Tasmania.—The Launceston City Council has approved of a Bill authorising the Council to run railless tramways and motor-'buses, and to borrow £30,000 for tramway purposes.—*Australian Mining Standard.*

York.—A special meeting of the City Council was held last week to consider the advisability of applying for powers to extend the present tramway system, to run railless vehicles, and other purposes. It was decided that the Light Railway Commissioners should be asked to grant power to extend the permanent tramways from Nessgate to Hull Road, and also from the Haxby Road terminus to a point beyond the cocoa works. Clauses were inserted in the Bill dealing with railless tramways, to obtain further powers for the extension of the electricity undertaking.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The United River Plate Telephone Co. has purchased the telephone businesses existing in Rio Cuarto and Bell Ville, and it is probable that these two towns will be connected up with the city of Cordoba. In the latter city the company is installing an automatic telephone exchange, the first to be erected in Argentina.—*Review of the River Plate.*

Automatic Telephone Service.—According to the *Times*, as the result of experience gained with the automatic telephone exchanges at the General Post Office, Epsom and Hereford, 10 additional exchanges are now being equipped, and will be in operation in a few months. These exchanges are situated in Leeds, Portsmouth, Newport (Mon), Darlington, Dudley, Accrington, Stockport, Grimsby, Paisley and Chepstow, and the system will probably be employed also at Manchester, Liverpool and Newcastle. The Portsmouth installation will deal with 5,000 lines, and that at Leeds will run into five figures. Whether automatic telephony will ever be practicable in London is doubtful.

French Indo-China.—A sum of 596,800 fr. has been allocated by the Government for the construction of a wireless telegraph station at Saigon.—*Board of Trade Journal.*

International Conference.—The International Conference on the Safety of Life at Sea was opened in London last week. One of the subjects that will be dealt with is that of wireless telegraphy on board ship.

Norway.—The wireless station at Rundemanden, in the neighbourhood of Bergen, has now been one year in operation, and has successfully passed the severe trials of a Norwegian winter on the coast of the North Sea. It has been found necessary, on account of the experience gained, to make some improvements, among which may be mentioned the erection of four masts of a height of 42 m., at a distance of about 100 m. to the north, south, east and west of the iron tower, to support the antennæ radiating from the top of the tower. Previously the wires were stretched over a distance of 250 m. from the top of the tower to short masts of wood. During the heavy storms of last winter they were frequently broken, and although they were easily repaired, the station was put out of action while the repairs were going on. The power cable has been strengthened in those places where it was most exposed to the weather, as interruptions often took place, but it is thought that such will be prevented during this winter. The attendants are now prepared to face practically anything in the way of severe weather without fear of the station being put out of operation.

Richmond.—The T.C. is entering into an agreement with the Post Office, for a period of five years, for utilising the telephone system for the purposes of fire calls.

Telegraphy and the Panama Canal.—The *Telegraph and Telephone Age* of November 1st tells how the dike at Gamboa, on the Panama Canal, was removed by a huge blast of dynamite.

The Western Union Telegraph Co. utilised a circuit from Washington to Galveston, a distance of 1,556 miles. At Galveston, connection was made with the Mexican Telegraph Co.'s cable to Coatzacoalcos, 792 miles, thence over the landline across the Isthmus of Tehuantepec to Salina Cruz, 163 miles. At Salina Cruz, the circuit continued through the Central and South American Telegraph Co.'s cable to San Juan del Sur, Nicaragua, 690 miles, thence to the company's station at St. Elena, Ecuador, 1,034 miles. The last stretch of the cable circuit from St. Elena to Panama was 920 miles. At Panama, the cable was connected to Gamboa dike, a 17-mile landline, furnished by the Panama Railroad Co.

At all the cable stations Muirhead gold-wire cable relays are used, and the closing of the key at Washington by President Wilson sent the blasting signal direct to the dynamite charge at Gamboa dike without the intervention of human hands. When the relay at Gamboa was thus closed, the charge in the dike immediately exploded, thus practically completing the greatest engineering feat in the history of the world.

President Wilson closed the key at Washington at 2.01 p.m., and the explosion took place at 2.02. The return signal announcing the success of the event was received at New York at 2.02½. The total length of the circuit from Washington to Gamboa dike was 5.172 miles, and the length of the return circuit *via* Colon to New York was 2.310 miles.

Wireless Amateur Convicted in U.S.A.—The first case of violation of the Radio-communication Act of August 13th, 1912, was recorded on October 20th, in the United States District Court, New York. Herbert Myers, of Ninety-fourth Street, New York, was charged with violating the law by using wireless apparatus which would affect inter-State communication, without having obtained the necessary licence. He had been warned by the radio inspector, but he disregarded the admonition. He was fined $50 by Judge Mayer and ordered to destroy the apparatus.—*T. and T. Age.*

Wireless Heroes.—At Marconi House on November 13th, in the presence of a large number of students attending the day classes at Marconi House and others connected with the company. Mr. G. Marconi presented gold watches to the operators on the *Volturno*, Mr W. Seddon and Mr. C. J. Pennington, and also to the operator in charge on the *Templemore*, Mr. R. Emanuel, in recognition of the manner in which they carried out their duties on the occasion of the burning of these vessels.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

Aberdeen.—November 27th. Great North of Scotland Railway Co.—Tenders for supply during 6 or 12 months of electric light materials. Particulars (1s.) from the Stores Superintendent, 80, Guild Street, Aberdeen.

Belgium.—Neufchateau.—December 1st. Tenders are invited for a concession to establish and work an electric installation. Deposit, 5,000 fr. Particulars from the Hotel de Ville, Neufchâteau.

Antwerp.—January 27th. Supply and erection of six electric cranes for the harbour at Antwerp. Deposit, 20,000 fr. Particulars (0 30 fr.), Hotel de Ville, Antwerp.

Birkenhead.—December 2nd. Corporation. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P. See "Official Notices" to-day.

Chatham.—November 27th. The T.C. is inviting tenders for the supply during 1914 of incandescent electric lamps; the Borough Surveyor, Town Hall.

Crompton.—January 10th. Refuse destructor, for the U.D.C.; Mr. F. F. Gartside, Surveyor (returnable deposit of £2 2s.).

Durham.—November 27th. Sewage-screening apparatus and fixing of electrically-driven machinery, for the T.C.; Taylor and Wallin, engineers, Cathedral Buildings, Newcastle-on-Tyne (returnable deposit of £2 2s.).

Edinburgh.—The Commissioners of Works invite tenders for the execution of the electric bell work in the buildings in their charge in the Edinburgh district during a period of three years from January 1st, 1914. H.M. Office of Works, Storey's Gate, London, S.W.

France.—Paris.—November 26th. Supply of requirements of apparatus parts for three years, in one lot; Sous-Secrètariat des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

Gateshead.—November 25th. Electric lamps, electric wires and cables, electrical sundry fittings, arc lamp carbons, glasses for electric arc lamps, &c., for the North-Eastern Railway Co. Mr. E. H. Clark, Stores Superintendent, Gateshead.

Hungary.—Tenders have just been invited by the municipal authorities of Brasso for the establishment of a central electric lighting station in the town.

Italy.—Rome.—November 25th. Supply of an 80-ton capacity travelling bridge, to lift locomotives for the Rimini machine shop. International adjudication. Italian State Railways Bureau, Rome.

London.—L.C.C.—November 26th. Installation, 140 lighting points, at Hammersmith Trade School for Girls, Lime Grove. See "Official Notices" November 7th.

November 26th. Installation, 244 lighting points, at Lancaster Road Elementary School, Notting Hill, W. See "Official Notices" November 14th.

December 3rd. Installation, 225 lighting points, at Chester Road Elementary School, St. Pancras, N.W. See "Official Notices" to-day.

Fulham.—November 26th. Corporation. 2 [illegible] kW. turbo-alternator and condensing plant. See "Official Notices" November 14th.

Shoreditch.—December 10th. Corporation. Sub-station plant (transforming and converting plant, starting and [illegible] apparatus). See "Official Notices" to-day.

G.P.O.—January 5th. Telephone switch cabinets for the P.M.G. See "Official Notices" to-day.

Manchester.—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" November 7th.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

December 31st. Auckland Harbour Board; Electric winch for 600-ton slipway.—*Tenders.*

Plymouth.—December 1st. Corporation. Contract No. 31. Ironclad high-tension switch panels. See "Official Notices" November 14th.

Pontypridd.—November 25th. Electric light installation, Cottage Homes, for the B. of G. Mr. Wm. Spickett, clerk; (returnable deposit of 10s. 6d.).

Rainhill (near Liverpool).—November 24th. Wiring and fittings for new ward, Lancashire County Asylum. See "Official Notices" November 7th.

Spain.—December 29th. The Harbour Works authorities at Valencia are inviting tenders for an electrically-operated elevator for the unloading of wheat and other food stuffs.

The municipal authorities of Saldana (Province of Palencia) are at present inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Torpoint.—November 26th. Public lighting, for the U.D.C.; Rolands & Beaumont, engineers, Council Offices.

Turkey.—The Turkish Ministry of Posts and Telegraphs in Constantinople is at present inviting tenders for the supply of 12 reels, each 1,643 ft. long, of 16-conductor paper-insulated submarine cable.

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

West Hartlepool.—December 3rd. Corporation. Car bodies and trucks; electrical equipments for cars, points and crossings. See "Official Notices" to-day.

York.—November 25th. Telegraph apparatus, telegraph wire and line stores, for the North-Eastern Railway Co.; Mr. C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Australia.—The following tenders have been accepted by the Commonwealth:—

Melbourne.—

250 tons hard drawn copper wire, 200 lb. per mile, £85 6s. per ton, £21,325.—B.I. & Hel by Cables, Ltd.

500 magneto telephones, £1 [illegible]; 30 Morse keys, £30; 1,200 lb. Blake's insulated staples, £177.—I.R., G.P. & Telegraph Works Co., Ltd.

200 common-battery table pattern telephones, £[illegible]; 1,000 wall pattern telephones, £1,500; 500 common battery telephones, with generators, £1,410; 100 telephonometers, £125; 75 telephone sets, £94; 1,500 common battery table telephones, £1,[illegible]; 700 common battery wall telephones, £631; 3,500 common battery wall telephones, £5,306.—Western Elec. Co., Ltd.

300 common battery table telephones, £720; 150 magneto table telephones, £375.—J. Bartram & Son Pty., Ltd.

25 miles wire, two twisted conductors, £112.—John C. Fuller & Son, Ltd. (J. Paton & Co.)

100 Obach cells, £7 10s.; 6,200 dry cells, £616.—A. J. Sage & Co.

Sydney.—

Eight multiple magneto switchboards, £2,752; spare equipment, £276; 2 miles 42-wire switchboard cable, 1s. 4d per yd.; 2 miles 63 wire switchboard cable, 1s. 10d. per yd.—James Paton & Co.

[illegible] *Record.*

Kadina Corporation (S.A.):—

68-kw. D.C. generator, by Electric Construction Co., £461.—Newton McLaren, Adelaide.

Tudor battery, 125 cells, £674; and motor-driven booster, £110.—Australian Metal Co.

100-144-B.H.P. Premier gas engine, direct coupled, two-cylinder, w suction gas producer, £1,315.—Clutterbuck Bros.—*Tenders.*

Melbourne.—The P.M.G. has accepted the following tenders for submarine cable:—

Ten nautical miles, shore end, £3,432; 10 nautical miles, intermediate type, £2,020; 10 nautical miles, main or deep-sea type, £1,310.—W. T. Henley's Telegraph Works Co., Ltd.—*Australian Mining Standard.*

Department of Home Affairs, N.S.W.—Transformers for the power plant; Federal capital, £1,214.—Australian Metal Co., Ltd. —*Australian Mining Standard.*

The Melbourne City Council has accepted the tender of Messrs. Siemens Bros. Dynamo Works Co., Ltd., for the supply of insulated copper cables. A quotation at a figure £180 below that of Siemens Bros. was submitted by A.E.G. Co., but the Council gave preference to British manufacture, and therefore accepted the higher figure.—*Tenders.*

Barnsley.—The Corporation has placed a repeat order with Messrs. Edward Bennis & Co., Ltd., for four of their machine stokers and self-cleaning compressed-air furnaces for the electricity works.

Canada.—The *Canadian Electrical News* reports the placing of contracts as follows:—

OTTAWA, ONT.—Ottawa and Hull Power and Manufacturing Co. have decided to increase their power plant by the addition of two water-wheel type alternators, each 6,750 K.V.A., 120 R.P.M., 2,300 volts, and also two transformers, each 6,750 K.V.A., 2,300-12,000 volts. Contractors, the Canadian General Electric Co., Ltd.

CALGARY.—The Imperial Wire and Cable Co. Supply of 40,000 ft. of lead-covered, paper-insulated underground cable.

ROUGEMONT, P.Q.—Equipping the sub-station at Rougemont, P.Q., of the Montreal and Southern Counties Railway; a 300-KW. motor-generator set, a bank of transformers, high and low-tension switchboards, lightning arresters and switching apparatus. Contractors, the Canadian General Electric Co., Ltd.

SWIFT CURRENT, SASK.—A contract for the erection of a new power house has been awarded to G. C. Gillstrom Contracting Co.

Highfield.—The Walsall Electrical Co., Ltd., have received the order for the switchboard for Highfield Infirmary from Messrs. Dargue Griffiths.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cable and wire.—B.I. and Helsby Cables, Ltd.; Hooper's Telegraph and I.R. Works, Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co., and Smiths, Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. and Co., Ltd.
Copper conductors, &c.—Western Electric Co., Ltd.

POST OFFICE.

Telegraphic apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—W. T. Henley's Tel. Works Co., Ltd.; Siemens Bros. and Co., Ltd.
Telegraphic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Oates & Green, Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliffe and Co., Ltd.
Telegraphic ironwork.—Baldwins, Ltd.; Bullers, Ltd.; J. Elwell, Ltd.; D. Willetts, Ltd.
Insulated tails.—Estler Bros.
Bronze wire.—F. Smith & Co., inc. in London Electric Wire Co. and Smiths, Ltd.
Electric light wire.—B.I. and Helsby Cables, Ltd.
Flameproof wire.—London Electric Co., and Smiths, Ltd.
Vulcanised india-rubber wire.—Johnson & Phillips, Ltd.
Electric lifts, Glasgow.—Gimson & Co. (Leicester), Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Wireless telegraphy apparatus.—Marconi's Wireless Telegraph Co.
Motor-alternator.—Lancashire Dynamo, &c., Co.

CROWN AGENTS FOR THE COLONIES.

Electric light fittings for railway carriages.—J. Stone & Co., Ltd.
Electric train staff instruments.—Railway Signal Co., Ltd.
Engine pumps.—Rees Roturbo Manufacturing Co., Ltd.
Telephone wall sets, &c.—Western Electric Co.

COMMISSIONERS OF PUBLIC WORKS, IRELAND.

Buildings, alterations and additions to, Corkbeg Wireless Telegraph Station, Co. Cork.—J. J. Healey.

London.—L.C.C.—The Highways Committee has received tenders for the supply of six motor-cars required for use in the tramways department, and for the purchase of the six cars now used. The offer of the Enfield Autocar Co., Ltd., of Birmingham, at £1,986 (less £210 offered for the six present cars) is recommended.

The Metropolitan Asylums Board is about to enter into a contract with the "Cedes" Electric Traction, Ltd., for the supply of two electrically-driven ambulance chassis for £265 each, and two batteries for £85 each.

STOKE NEWINGTON.—The tender of the British Thomson-Houston Co., Ltd., has been accepted by the B.C. for a biennial supply of meters of assorted sizes.

BERMONDSEY.—The following tenders have been accepted by the Council:—

B.I. and Helsby Cables, Ltd.—Two-way feeder pillar.
Sykes & Sugden, Ltd.—Seven-way disconnecting box (including patterns).

Loughborough.—Subject to sanction to a loan being obtained, the T.C. has accepted the following tenders for plant, &c., for the electricity works:—

Siemens Bros.—Rotary converter and switchgear.
Brush Electrical Engineering Co., Ltd.—Ljungstrom Turbo-alternator, with condenser and transformer.
Swan, Ratcliffe & Co.—Boiler seatings.
H. Hammond.—Extensions to buildings.

Runcorn.—The U.D.C. has accepted the tender of the British Westinghouse Electric, &c., Co., Ltd., for the supply of spare parts for pumps, motors, &c., at the waterworks, at £33.

Sleaford.—The U.D.C. has accepted the tender of Messrs. Pattinson for coal for the electricity works, at 18s. per ton.

Sunderland.—The T.C. has accepted the following tenders:—

Union Cable Co.—Cable.
I.R. & G.P. Co.—Cable.
E. Green & Sons.—New sections and parts for economiser.
Four Synchron life-savers.

Twickenham.—The tender of Messrs. J. B. Marr and Co., Ltd., for alterations, &c., to the E.L. installation at the library has been accepted.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Local Section).—Friday, November 21st. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Steam Boiler Working in Electrical Power Stations," by Mr. J. W. Jackson.

Manchester Electro-Harmonic Society.—Friday, November 21st. Concert. (See "Notes" to-day).

Junior Institution of Engineers.—Friday, November 21st. At 39, Victoria Street. Paper on "Maintenance (Electrical)," by Mr. T. A. St. Johnston. Friday 28th. Paper on "Patent Protection," by Mr. A. Abbey.

Garrick Dramatic Society.—Saturday, November 22nd. At 8 p.m. At Royal Court Theatre. "The Voysey Inheritance." To assist funds of Electrical Trades Benevolent Institution.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, November 26th. At 7.30 p.m. At the University. Mr. Evershed's paper. See below.

Institution of Civil Engineers.—Wednesday, November 26th. Students' visit, Metropolitan Railway Line—Widening works and power station, Neasden.

Faraday Society.—Wednesday, November 26th. At 8.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Various papers.

Institution of Electrical Engineers.—Thursday, November 27th. At 8 p.m. At Victoria Embankment. Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

Greenock Electrical Society.—Friday, November 28th. At 7.45 p.m. At Temperance Institute, West Stewart Street. "Steam Turbines," by Mr. J. H. Parker; "The Entz Reversible Booster," by Mr. P. Kerr.

North-East Coast Institution of Engineers and Shipbuilders (Graduates' Section).—Friday, November 28th. At 7.30 p.m. At Westgate Assembly Rooms, Newcastle-upon-Tyne. Conversazione.

Physical Society of London.—Friday, November 28th. At 5 p.m. At Imperial College of Science. Papers by Prof. H. L. Callendar, Mr. F. J. Harlow and Prof. J. A. Fleming. Also an exhibition of a double-fibre string galvanometer, by Mr. W. Apthorpe.

Manchester Association of Engineers.—Saturday, November 29th. At Grand Hotel, Aytoun Street. Paper on "Pattern-making Department in an Engineering Works," by Mr. T. Roberts.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, November 24th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.
Tuesday, November 25th.—"B" Company. Ditto.
Wednesday, November 26th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.
Thursday, November 27th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.
Friday, November 28th.—"D" Company. Technical instruction, 7.30 to 10 p.m.
Saturday, November 29th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Captain R.E., Adjutant.
For Officer commanding L.E.E.

Tramway Workers' Wages.—The Highways Committee of the L.C.C. reports that an agreement has been arrived at by the Rolling Stock Conciliation Board fixing a flat rate of 30s. a week for car-washers; those already in receipt of 30s. a week for 12 months to be granted a rise of 1s. per week. Controller repairers and light power attendants are to receive a flat rate of pay of 8d. an hour.

NOTES.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At the monthly meeting on Friday last, of the East of Scotland Branch of the Association at Dunfermline, an address was delivered by Mr. C. C. Reid, Cowdenbeath, on "The Repair and General Maintenance of Electrical Plant in Collieries." The speaker referred to the great expense involved for general repairs and renewals of the average electrical installation at a colliery; he knew of no branch of mining where economy and carefulness had received less consideration than the electrical repair department. He suggested, as a remedy, that a proper electrical stores department should be kept in connection with each colliery, under the control of a person who would be responsible for the stock of spare parts, &c. His experience was that the more difficult it was for a man to get a spare part, the more disposed he was to take care of what he actually got. Proper inquiry should be made into all the leakages of electrical material, and a register should be kept for each motor at the colliery, in which particulars should be systematically entered of each repair and breakdown.

At a meeting of the West of Scotland branch of the Association, at Glasgow, on Saturday evening, Mr. J. P. C. Kivlen read a paper on "The Specifying and Buying of Mining Electrical Plant." The author's chief aim was to give prominence to a number of details often overlooked when ordering material or installing apparatus, and to offer suggestions that would be beneficial alike to manufacturer and customer. The interests of manufacturer and consumer were so closely interwoven that it behoved the former to give every consideration to the actual requirements of the latter; in turn, the consumer ought carefully to discriminate, and buy only one class of material—the best. That such consideration had not been given in the past was generally known. A great many British firms did not, or would not, appreciate mining conditions. Six copies of the specification were sent out to first-class firms for certain apparatus some time ago. These gave the manufacturer full and definite instructions as to what was wanted, with an offer of blue prints, if necessary. The result was that there were only two legitimate offers, three apologetic letters regretting inability to quote, and an offer of unsuitable stock material. The customer had also a duty to perform in that he should carefully define his requirements. If cable-makers would now arrange to give them a concentric cable with twin-shunt cores for field connecting in the case of a reversing-shunt machine, or multiple core in the case of a reversing compound-wound motor, they would confer a great boon on direct-current underground working. Straggled wiring would, as a consequence, be completely obviated. Then, again, development could not always be foreseen, and when ordering fuse or distributing-boxes, preference should be given to material that could be extended, by simply placing one piece of apparatus against another, and interconnected by bus-bars. This class of apparatus was now on the market for concentric working. Nothing smaller should be used than a 25-ampere fuse bridge. An ammeter was desirable on every motor. When ordering instruments for concentric working it should be pointed out that there was a continuous potential difference of, say, 500 volts between the working parts and the case when operating. The lack of proper appreciation of this point was responsible for 90 per cent. of the instrument failures. As regards the generator, if a new machine had to be ordered they should have it over-compounded from, say, 500 to 520 volts. A coal-cutter load was somewhat similar to a tramway load on a small system, and tramway type generators saved the necessity of voltage regulation to a large extent. They should not use fuses in the main circuits, but should instead install good trip gear. If fuses were decided on they should place them at the back of the board on brackets clear of inflammable insulation and not in line with the attendant's eyes as was usually done. Even the heaviest porcelain was sometimes wrecked. Every manufacturer should be asked to quote on the same basis. Secondhand electric machinery should be severely left alone excepting in cases of breakdown or urgency. This particularly applied to three-phase motors.

At a joint meeting of the Notts and Derbyshire branch of the Association and the Midland branch of the National Association of Colliery Managers at Nottingham, on November 8th, Mr. E. Kilburn Scott read a paper on "Large Prime Movers and Boilers for Power Houses." Amongst other items, he described boilers fired with coal dust, and with gas. Emphasising the importance of economical utilisation of our coal resources, he advocated the concentration of generating plant in very large power stations in the colliery districts, of, say, 100,000 kw. capacity, using large turbo-generators supplied with steam from gas-fired boilers, with by-product recovery plant. For a continuous load such a plant could supply energy at less than 0·1d. per unit.

Institution of Engineers and Shipbuilders in Scotland.—In the course of his presidential address on October 21st, Dr. R. T. Moore dealt with the subject of coal mining. He described electrical power transmission as the only satisfactory solution of the problem in mining, and the greatest improvement which had taken place since the invention of the steam engine. A permanent increase had taken place in the price of coal, due to increase of wages, reduction of hours of labour, legislation, and exhaustion of the cheaply-worked seams. Since the Eight Hours Act came into force the output per person employed underground in the United Kingdom had fallen from 374 tons per annum in 1906, to 311 tons in 1912, in spite of the increase in number of mechanical coal-cutters from 1,612 in 1908 to 2,444 in 1912. At the present rate of increase of output the coal supplies of this country and the Continent would last for 300 years; the world's store of coal for 600 years. While Great Britain contained 189 thousand million tons, Canada possessed 1,235 million tons, and the President suggested that within 300 years long-distance electrical transmission across the Atlantic might be possible. Every endeavour, he said, should be made to save the coal, and the erection of large central electric stations for the distribution of power tended in that direction.

At a meeting of the Victorian Institute of Electrical Engineers on October 2nd, a paper was read by Mr. E. B. Brown, M.Sc., on "Electric Speedometers and Tachometers."

Junior Institution of Engineers.—On Monday a paper was read by Mr. Ernest King on "The Institution and its Work," concluding with the following summary of the progress of the engineer who joins it:—"He begins by receiving help, he continues with helping himself, he ends in helping others, and in thus helping others he experiences what is undoubtedly one of the great 'pleasures of life.'"

Leicester Association of Engineers.—On Friday last Mr. C. G. Conradi read a paper on "Workshop Electrification."

The North-Western Centre of Post Office Electrical Engineers held a meeting at Preston last week, when a lecture on "Automatic Telephony" was given by Mr. B. O. Anson, automatic telephony expert attached to the Engineer-in-Chief's office, London.

Iron and Steel Institute.—The next annual meeting and the annual dinner will take place on May 7th and 8th, 1914. The autumn meeting will be held in Paris, September 18th and 19th having been provisionally fixed for the business sessions.

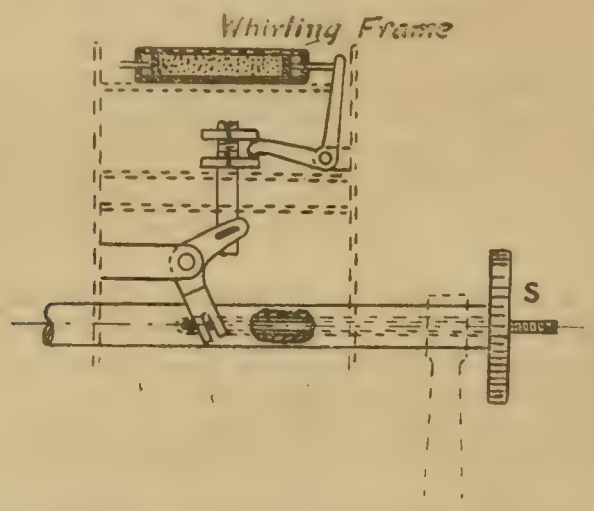
Electricity Supply Rifle League.—The following matches were decided during October:—Brompton (Mugford, 99), 568; *v.* Ilford (Bailey, Haeger, 97), 573. Brompton (Willis, 98), 567; *v.* Westminster (Neville, 98), 578. Central (Gaze, Robinson, Wells, 96), 570; *v.* Ilford (L. Tuffnell, 97), 552. Central (Gaze, Law, 97), 566; Shoreditch (Ebner, 97), 566. Hackney (Self, 96), 565; *v.* Poplar (Randall, 92), 527. Hackney (Hilling, 98), 551; *v.* St. James's (Cockburn, 99), 552. Poplar, 528; *v.* St. James's (Cockburn, 97), 549. Shoreditch (Weekes, 95), 559; *v.* Stepney (Dubbib, 97), 553. Stepney (Heaviside, 94), 511; *v.* Westminster (Partridge, Neville, 97), 566. The following are the positions to date:—

	Matches					Scores.	
	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	12	11	1	0	22	6,844	6,550
Shoreditch ...	12	9	2	1	19	6,816	6,560
Ilford ...	12	9	3	0	18	6,758	6,513
Central ...	12	8	3	1	17	6,766	6,581
Brompton ...	12	6	6	0	12	6,712	6,602
St. James' ...	12	5	7	0	10	6,474	6,633
Hackney ...	12	3	9	0	4	6,522	6,556
Stepney ...	12	2	10	0	4	6,459	6,512
Poplar ...	12	0	12	0	0	5,865	6,709

Multiplex Radiotelegraphy.—Ricardo Moretti has recently patented a system of multiplex radiotelegraphy depending on selective resonance. A number of transmitters are arranged at the sending station so that variations of definite frequencies can be set up in the high-frequency current supplied to an oscillating circuit coupled directly or inductively to a single aerial. At the receiving station, there are connected in the circuit of a single wave detector, telephone receivers, each of which responds only to a tone of predetermined pitch. Transmission proceeds exactly as in wireless telephony, in that there are radiated from the antenna high-frequency oscillations which are changed in pitch by a microphone or other means. In one arrangement, Moretti uses a number (say three) of sound pipes each emitting a characteristic note when supplied with compressed air (under the control of switch keys). To permit of separation of the individual tones at the receiving station, a "monophone" is substituted for the ordinary telephone receiver. A monophone is, as its name indicates, a telephone receiver, the diaphragm of which is set in vibration only by a certain definite frequency of stimuli. Each monophone at the receiving station reproduces only the signals sent out at corresponding frequency from the transmitting station, and thus as many messages can be sent simultaneously from, and received simultaneously by, a single aerial, as there are sound pipes and monophones.

In an alternative arrangement, Moretti replaces the sound pipe by electromagnetically operated tuning forks which, under the control of the several sending keys, set up intermittent currents of definite frequencies in the windings of a single iron core which actuates the diaphragm of a microphone in the antenna circuit. This arrangement is essentially that of a telephone relay, except that a number of relay windings are employed instead of a single winding. At the receiving station, the antenna is coupled inductively to a resonant circuit containing a thermo-electric detector, across which are shunted the three monophones. The latter analyse the complex oscillations received as in the previous case. Either of the systems described above is applicable to the simultaneous reception in one station of signals emitted by a number of stations.

Porous Accumulator Plates.—The process recently evolved by Prof. H. T. Hannover (Rector of the Copenhagen Technical College), for the production of porous accumulator plates, is based upon the fact that the predominating metal in an alloy solidifies first, and leaves the eutectic disseminated for a time in liquid form throughout the mass. Conversely, during reheating, the eutectic melts first, and may be removed by centrifugal force or other means, thus leaving a honeycombed mass of metal of high porosity. The lead-antimony eutectic contains 13 per cent. antimony and 87 per cent. lead, so that in a 96 per cent. lead alloy,



27 per cent. of the lead will go to form the eutectic, which solidifies at about 228° C., the remainder of the lead having solidified at 322° C. The small percentage of antimony remaining in the lead matrix after expulsion of the molten eutectic is said not to affect the electrochemical capacity of the plates, but appreciably increases their strength.

After trying various other methods, Prof. Hannover concludes that the best method of expelling the eutectic is by whirling. Cakes of the alloy are mounted in suitable frames carried by the arm of a whirling machine, and the discharge side of the plate is covered by gauze backed by a grating. To prevent cracking of the surface of the plate, it is necessary to tighten up the mould clamps as the eutectic is expelled. This adjustment is effected by the linkwork shown in fig. 1, and actuated by a hand wheel on the spindle S. If the moulds be filled while in the whirling machine, with a view to expelling the eutectic during cooling, instead of after reheating, the molten metal runs through the gauze, but it should be possible to overcome this difficulty.

Tests made in the shops of the Danish State Railways on Planté plates prepared by this process show the maximum safe charge and discharge current to be increased considerably, and it is claimed that the Hannover plates are very suitable for automobile and submarine use. It is easy to prepare plates of more than 50 per cent porosity by the above means, and assuming the number of pores to average 13,000 per sq. in. (as found by microscopical examination), and to be of circular section and perpendicular to the surface of the plate, the total surface of the latter is about 130 times its natural superficial area in the case of a plate 5·5 × 3·25 × 0·25 in. Though porous metals prepared by the Hannover process have only been applied to the manufacture of accumulators as yet, it is hoped that they will prove applicable to metallic filters, self-oiling (honeycomb) bearings, catalysers, soldering sticks and various classes of ornamental work.

Electric Lighting and Engine Starting on Motor-Cycles.—Following the general adoption of electric lighting on motor-cars, and the later development of electrically-operated engine starters, comes the news that one of the leading American motor-cycle concerns—the Hendee Manufacturing Co.—is fitting some of its 1914 models of "Indian" motor-bicycles with a dynamo-motor which is employed for both functions. The combination machine, which has four poles and four sets of brushes, is mounted slightly in advance of the engine, to the crankshaft of which it is connected by a chain. As a generator it commences to supply current to the battery at a speed of 8 or 12 miles per hour, according to whether the high or low gear is in operation, an automatic cut-out breaking the connection between the dynamo—which is in operation the whole of the time the engine is running—and the accumulators when the latter are fully charged. The machine is fitted with both a head light and a tail lamp, thus meeting the requirements of the law as lately defined by the Divisional Courts, to the effect that a motor-cycle, as well as a motor-car, must have a rear light. We understand that one of the new motor-cycles will be on view at the Cycle and Motor-Cycle Exhibition, which opens at Olympia on the 24th inst., when doubtless it will attract attention on the part of the many motor-cyclists who are now found in the ranks of electrical engineers.

Electrical Trades Benevolent Institution.—We trust that during to-day and to-morrow many of our readers will be calling on the telephone to Mr. F. B. O. Hawes, the secretary of the Electrical Trades Benevolent Institution, ordering tickets for the dramatic performance which is to be given at the Court Theatre, to-morrow (Saturday) evening, by the Garrick Dramatic Society. The particulars were given fully in our issue of November 7th (page 761). At the time of writing, we are sorry to learn that the applications have been far less satisfactory than they were last year. Mr. Hawes's telephone number is "Brixton 1833," and his address is 18, Park Mansions, Vauxhall Park, South Lambeth Road, London, S.W.

The Debenture—Its Use and Abuse.—We have received from Mr. H. W. Jordan, company registration agent, an advance copy of a lecture to be delivered by him before a City Secretarial Association on the subject of "The Debenture—Its Use and Abuse." If the members of the Association referred to are really experienced secretaries of public companies they will certainly not be instructed; but they will, no doubt, appreciate the lighter vein of some of the matter presented. A chapter is devoted to "freak debentures," in which, among other things, the writer refers to "Church Debentures," "Chapel Debentures," and other mixtures of so-called religion and mammon. Perhaps the most important part of the pamphlet is that which notices the abuse of the debenture, and, in the course of his remarks, the writer assumes that X is an owner of an unsound business, and that things are going from bad to worse. A brilliant idea occurs to him. Why not form a company to acquire the undertaking; write up the goodwill, and sell the concern for a large sum, to be satisfied by the issue to X, or his nominees, of debentures? Then, all that remains for him to do is to go on drawing for a year or so a handsome remuneration as managing director, discharging the liabilities incurred prior to formation, incurring new ones freely, and, as soon as a creditor levies execution, to enforce his security. The Receiver appointed on his behalf by him will dispose of the assets for what they will fetch; and as the amount will probably be less than the face value of the debentures, the sum will be handed over to the holder. He can laugh at the unsecured creditors. By this means the vendor has not only avoided bankruptcy, but he has actually enriched himself at the expense of the obliging creditors, who are robbed under the cloak of the Company Act, for the goods supplied by them are sold for his benefit as the holder of the debentures. No longer has the unsuccessful trader to face the prospect of being harassed in all sorts of ways, perhaps turned out of home, spurned by acquaintances, and ultimately adjudged bankrupt—and much more, though the picture is by no means well drawn. As an alternative to pocketing the proceeds of the sale, X, the debenture-holder, may himself take over the assets in satisfaction of his "claim." If so disposed, he may forthwith form another company to acquire the assets, again taking debentures for them, and in process of time once more obtain possession of the undertaking. This procedure may be repeated *ad infinitum*, the sufferers being powerless to interfere. Mr. Jordan informs us that one individual who was adjudicated bankrupt in 1899, has, in fact, since that date performed the operation no fewer than 13 times, and apparently he is still going strong, for not long ago he registered his fourteenth company.

Tungsten Lamp Patents.—After protracted proceedings, extending over two or three years, the German Patent Office has decided definitely, despite the opposition of 16 firms, in favour of the fundamental patent for drawing tungsten wire for metallic-filament lamps. It will be remembered that the General Electric Co., of the United States, after experiments which were spread over a period of years, succeeded in devising the particular system whereby it was possible to draw tungsten wire of a convenient thickness, or rather thinness, for lamp filament. As a result of the existing interchange arrangements existing between the General Electric Co. and the Allgemeine Elektrizitäts Gesellschaft, of Berlin, the German patents for the new process were vested by the former in the latter, and the special agreements between the two companies permitted of the patent rights also being exercised by the Siemens & Halske Co. and the German Incandescent (Auer) Gas Light Co., whilst the Bergmann Co. was subsequently also brought within the field by the grant of a licence. As the Patent Office has now given a decision in regard to the patents, these four firms stand to benefit from the result. On the other hand, other firms have not been slow in coming forward to declare that they are not affected by the action of the Patent Office. The Julius Pintsch Co., for instance, states that the decision is of no importance in the case of Sirius lamps, which are made according to the company's own patented process, whilst Voigtlander & Lohmann point out that any firms are able to manufacture glow lamps with tungsten wire in so far as the wire is not made on the basis of the patent to which the decision refers, but is produced by any other convenient method.

Whist Drive.—A successful whist drive and dance in connection with the Ilkeston Corporation Tramways Benevolent Fund was held in the Town Hall, Ilkeston, on Wednesday evening, November 12th. The large ballroom was packed to its utmost capacity, between 200 and 300 ladies and gentlemen sitting at the whist tables, and nearly 200 taking part in the dancing programme. Amongst those present were:—The Mayor (Councillor J. A. Macdonald), the Town Clerk and Mrs. S. F. James, Ald. Samuel Shaw (chairman of the Tramways and Electricity Committee) and Mrs. Shaw, Mrs. L. C. F. Bellamy and Miss Leghorn, Liverpool; Councillor J. E. Bestwick and Mrs. Bestwick, Councillor and Mrs. T. Pounder, Councillor and Mrs. Starr, Councillor W. Nocn, &c. The M.C.'s for whist were Mr. L. C. F. Bellamy, manager and engineer, and conductor T. Hayday; and for dancing, motorman A. Perkins and conductor T. Wesson. The secretarial duties were carried out by the chief clerk, Mr. F. Hawley. The whist drive prizes were distributed by Mrs. Shaw. The evening was voted one of the most enjoyable and successful ever held in Ilkeston.

Inquiries.—Makers or English agents for "two ball" adjusters, as used in U.S.A. in place of counterweights, and of Sicilian marble for electrical work, are asked for.

German Enterprise in Russia.—It is stated that the Electrical Enterprises Co., of Berlin, has entered into negotiations with a view to the erection of a generating station for supplying the western and south-western suburban districts of the city of Warsaw. Concessions have already been secured for many years from some of the local authorities concerned, whilst negotiations are pending with others and are near a conclusion. The station would have an initial capacity of from 8,000 to 10,000 H.P., and it is reported that a Russian company would be formed to undertake the management.

The Electric Lighting (1886) Co., of St. Petersburg, which has a station in course of erection at Bogorodsk, proposes to transmit a portion of the energy to Moscow for distribution from the company's existing works in that city. As the scheme has been subject to criticism in municipal circles in Moscow, the company has emphasised the fact that the power to be transmitted will only represent a small proportion in relation to that which is at present produced in the Moscow station, as by far the largest number of units will be required for Bogorodsk and vicinity. The capacity of the new station is to be 25,000 H.P. in the first place.

The Sosnowice Electricity Co., which has been constituted with a capital of £400,000, has yet to receive confirmation of its articles of association from the Government. It is expected that the projected station on completion will experience a favourable development in consequence of the scope offered by the great industrial activity in the districts of Sosnowice and Dombrova.

The Electro-Harmonic Society.—The concert on Monday last (Ladies' night) may fairly be classed as one of the most successful ever held by the Society. The enthusiasm of the audience was clearly manifested by the encores demanded for almost every item—sometimes double encores—and the great majority stayed until the very end, in spite of the notoriously inconvenient crush in the cloak rooms that is invariably experienced about 11 o'clock. The programme was attractive, the artistes were in good form, and the audience was in the right mood to appreciate the entertainment.

For the first time on record, the Committee put into practice the rule—hitherto a dead letter—that seats cannot be reserved for late-comers after 7.50. This was effected by sending commissionaires round to readjust the chairs—and to keep them "rectified"—and we trust this laudable practice will be maintained, to the greater comfort and convenience of the general body of the members.

Manchester Electro-Harmonic Society.—The second concert of this society is to take place this evening at Manchester. An excellent programme, with many intervals for social intercourse, has been arranged, the artistes being: Mr. Bridge Peters, baritone; Mr. Sydney Coltham (Westminster Abbey), tenor; Mr. Wilfrid Ludlow, entertainer; Mr. Bennett North, accompanist. For the December concert the following artistes have been engaged:—Soprano, Madame Annie Walker (London and provincial concerts); solo clarionet, Mr. Harry Mortimer; solo violoncello, Mr. Seth Lancaster; at the pianoforte, Mr. Chas. Kelly; entertainer, Mr. Foden Williams; accompanist, Mr. A. H. P. Martin.

Fatality.—GRIMETHORPE.—An inquest was held on November 12th, at Grimethorpe, near Barnsley, on the body of a screen boy named Fred Dunning (13), who was killed at Grimethorpe through touching a live electric wire. According to the evidence of another screen boy, the deceased had asked him if he would touch an electric wire which was placed out of reach of the boys and could only be touched by standing on the rail of a fence. This he refused to do, and Dunning said he would chance it. He, thereupon, got on to the rail and caught hold of the wire with his hand and was immediately killed. It was stated that the wire was about to be taken away owing to certain improvements in the colliery, and the jury expressed a wish to see the place in order that they could determine whether the boys were properly protected whilst at work and whether they thought there was any neglect. The inquiry was, therefore, adjourned until Tuesday last.

London Electric Supply Companies and the Purchase Date.—According to yesterday's *Times*, the County of London Electric Supply Co. announces that application is intended to be made on its behalf alone, or in conjunction with other London electric companies, in the ensuing Session of Parliament to bring in a Bill "for the purpose of giving the company or companies power to carry into effect agreements for the postponement of the date at which the London County Council may proceed to purchase the undertakings of the London electric companies or any of them, and for the variation of the terms and conditions under which such undertakings are purchasable, and making new provisions in regard thereto."

Lead Poisoning.—In the course of a lecture at the Royal Institute of Public Health, on Thursday last week, Prof. Sir Thomas Oliver described the electrolytic bath process for removing lead from the bodies of persons suffering from lead poisoning, invented by Mr. T. M. Clague, of Newcastle, to which we recently drew attention. In the case of a poisoned workman, after three or four baths, the morbid symptoms disappeared, and lead was found in the water and on the electrode, while the man's health was greatly improved. It is hoped that the treatment will be given a wide trial, and will be found successful in general application.

An Electrically-Driven Weaving Shed at Bradford.—Recently the Bradford Electricity Committee inspected the new weaving shed erected by Messrs. J. Emsley & Co. and electrically equipped by the electricity department. The shed contains 316 five-quarter to seven-quarter looms arranged in seven groups, six comprising approximately 54 looms each and the seventh about half that number, each group being driven from a separate line shaft. The looms are placed at right angles to the shafts and are each driven by a half-turn belt. This has resulted in a reduction of about 30 per cent. in the shafting and the power required to run it. The power to the line shafts, which run at a speed of from 185 to 200 R.P.M., is transmitted from seven 25-H.P. three-phase induction motors by means of Westinghouse chains running in oil baths, the motors being placed approximately in the centre of the shafts. For driving the dressing frames a 15-H.P. motor is provided, also chain driven. Other motors installed include two of 5-H.P. each, driving a Gimson lift and an induced draught fan.

The shed is ventilated by 14 24-in. electrically-driven reversible fans. The installation is controlled from a switchboard situated in the basement; all the power circuits are run to a common fuse board, a meter being placed in each circuit. An oil switch, which controls the supply of current to the whole of the power circuits, can be operated in cases of emergency by means of push buttons situated in various parts of the shed. The premises are lighted by means of 741 40-watt lamps and 35 63-watt lamps, the latter of which are arranged as pilots for providing general illumination throughout the shed when the loom lights are not in use. There are also 62 5-ampere plugs at various points for the purpose of effecting temporary lighting where required. The whole of the lighting is divided into three main circuits, which in turn are split up into a number of sub-circuits each controlling not more than 12 lights.

In the piece room special attention has been given to the lighting of the menders' benches. Cooper Hewitt mercury vapour lamps (fitted with colour correcting shades) have been installed for inspecting pieces. The kitchen is equipped with an electric oven, a large hot cupboard capable of warming 50 dinners, and two electric water boilers, each holding nine gallons and capable of boiling four gallons of water in 15 minutes.

Postal Servants.—At an interview with a deputation representing nearly 100,000 postal employés on Wednesday, the Postmaster-General, Mr. H. Samuel, stated that the Government had decided not to enforce the recommendations of the Holt Committee in the direction of longer hours for certain classes without increase of pay. He reviewed the advantages and privileges enjoyed by postal servants, and stated that the Government agreed that the rates of pay recommended by the Committee were adequate. The increase of 15 per cent. demanded could not be granted, but the Government would authorise the immediate application of the new scales, which would benefit a very considerable proportion of the staff. The total estimated annual cost of the concessions arising out of the Holt report would be 1¼ million pounds. If a strike took place, things would not go on as before; the country would demand that measures should be taken which would render the recurrence of such an event impossible.

Licensing Electricians on the Rand.—The *Rand Daily Mail* says that the Johannesburg Town Council last month had before it new by-laws relating to the licensing of electricians. It is suggested that the examination required under these by-laws be carried out by the authorities of the South African School of Mines and Technology, as is at present done in the case of the plumbers, the Board of Examiners to be composed of the following:—(1) The general manager of the Council's electric supply department, or his authorised representative; (2) the Professor of Electrotechnics of the School of Mines; (3) a representative of the electrical section of the Master Builders' Association; and (4) a representative of the electricians. Both of the two latter examiners to be elected annually.

Cadder Colliery Fire.—The report of Sir H. Cunyghame to the Home Secretary on the cause of the fire at Cadder Colliery on August 3rd, was issued last week. It states that all the expert witnesses agreed that the fire was most probably due to lights or matches; he did not consider that electricity was the cause of the fire, and, generally speaking, the electrical installation was a good one. If an independent telephone circuit had existed along the return airway it might possibly have saved all the men.

Wind-power Electric Plant.—With reference to the letter on this subject in our "Correspondence" columns to-day, we may refer readers who are interested to an article in our issue of December 20th, 1912, in which we described the wind motor invented by Mr. Turnbull.

Appointments Vacant.—Three switchboard attendants, 8-hour shifts, for Birkenhead Corporation (30s. to 35s.). Switchboard attendant for Stoke-on-Trent Corporation (27s. 6d.). Junior switchboard attendant for Salford Corporation (26s.). See advertisement pages to-day.

Tramcars held up by a Cat.—A cat on Thursday held up a line of tramcars and took a free ride on a car. Near Kennington Gate the cat sat on the track: the approaching car stopped and the cat ran underneath. For a quarter of an hour the cars came on, and at last it was decided, after the flooring had been vainly taken up, that the first car must go on its way. At Blackfriars the cat was found sitting on the motor, uninjured except for a graze on the nose.—*Standard*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Whitehaven T.C. has confirmed the appointment of MR. LIONEL B. HOGARTH, of Morecambe, as the borough electrical engineer.

The *Australian Mining Standard* states that MR. ALFRED SMYTH has been appointed overhead superintendent in the Melbourne electric supply department, at a salary of £286, rising to £338.

MR. VINCENT A. PASK, of the Hull electricity department, has been appointed charge engineer at the Bootle Corporation electricity works.

MR. PERCY HODGES, who has been engaged at the Blackpool Corporation electricity works, has accepted an appointment at Valparaiso. Mr. C. Furness, chief electrical engineer, on behalf of the staff at Blackpool, has handed to Mr. Hodges a gold Waltham watch, a travelling trunk, and a fountain pen.

MR. T. E. BOOTHBY is leaving the Greenhill Works of the Oldham Corporation electricity department, to take up the position of shift engineer at the works of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

General.—It is announced that MR. GEORGE BALFOUR, M.I.E.E., of Messrs. Balfour, Beatty & Co., has been elected a director of the United Electric Tramways of Monte Video, Ltd.

MR. H. V. ROWE, who has left the British Insulated and Helsby Cables, Ltd., Helsby Works, to take up an appointment at Liverpool, has been presented by the office staff at Helsby with a dressing case.

COUNCILLOR G. H. COOP, electrical engineer, has been elevated to the aldermanic bench at Ashton-under-Lyne.

The *Standard* states that the HON. ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission, has rented Hilton Lodge, near Derby.

MR. J. R. DAGNALL was last week appointed chairman of the Manchester Corporation Electricity Committee, and MR. ALDERMAN WALKER, vice-chairman.

The Royal Society has awarded the Hughes Medal to DR. ALEXANDER GRAHAM BELL, on the ground of his share in the invention of the telephone, especially the construction of the telephone receiver.

A special meeting of the contributors to the Benevolent Fund of the Institution of Civil Engineers has been called for December 1st, for the purpose of appointing a trustee in place of the late Sir W. H. Preece.

The Electrical Co., Ltd., have appointed MR. G. S. HELME (late of the Lancashire Dynamo and Motor Co.) to be their engineer and sole representative in Scotland. Mr. Helme will take up his appointment immediately, his headquarters being the company's present Glasgow address, Baltic Chambers, 50, Wellington Street.

MR. M. C. SHEPHERD, who for some years has conducted the paraffin and petrol engine department of Messrs. Belliss and Morcom in London, on Thursday severed his connection with that firm.

Mr. HERBERT BROADBENT, chief electrical engineer to the Corporation of Perth, W.A., is in this country for a few weeks, on a business trip. His address is c/o Mr. Frank Broadbent, 4, Queen Street Place, E.C.

Obituary.—MR. THOS. SMITH.—The death took place on November 14th of Mr. Thos. Smith, for over 20 years on the staff of the Liverpool Corporation Electric Supply Department. He was 71 years of age.

Will.—The late MR. T. FRAME THOMSON left £52,084 gross and £47,183 net personalty.

NEW COMPANIES REGISTERED.

Sunturbo Engineering Co., Ltd. (132,158).—This company was registered on November 13th, with a capital of £220,000 in £1 shares (160,000 7 per cent. cum. pref.), to acquire (1) that portion of the business carried on by the Sun Patent Evaporator Co., Ltd., at Tower Buildings, Water Street, Liverpool, as the manufacturers of Patent Sunturbo Pumps, and (2) as a going concern the business formerly carried on by Peter Pilkington, Ltd., of Bamber Bridge, Lancs., to carry on the same, and the business of engineers, founders, smiths, metal workers, electricians, manufacturers of pumps and mechanical and engineering devices and contrivances in connection with pumps and pumping machinery, &c. The subscribers (with one share each) are:—W. E. Hall, 79, Queen Street, E.C., chartered secretary; W. J. Watchurst, 103, Stradella Road, Herne Hill, S.E., master printer; G. Paine, 74, Swaffield Road, Wandsworth, S.W., clerk; A. Howarth, 79, Queen Street, E.C., engineer; H. C. Mossop, 79, Queen Street, E.C., solicitor; Winifred Briggs, 52, Pretoria Avenue, Walthamstow, E., stenographer; Gertrude Earp, 28, Overhill Road, Dulwich, S.E., stenographer. Minimum cash subscription, seven shares. The first directors are G. W. Grimshaw, Glengarry, Lytham; G. B. Atherton, Tower Buildings, Liverpool; H. W. Boultbee, Silverne, Whitby, Cheshire; A. Howarth, 79, Queen Street, E.C.; W. Norris, Bamber Bridge; F. K. Woodroffe, Cabra House, Newton La, Chester; and G. A. Child, Oaklands, Edenbridge; qualification, £200; remuneration (except managing director), £150 each per annum (chairman £200) and 5 per cent. of the net profits, after deducting 10 per cent. upon the paid up capital, and such sum as may be placed to reserve. Registered office 79, Queen Street, E.C.

Cumberland Waste Heat Owners Co., Ltd. (132,100).—is company was registered on November 11th, with a capital of £50,000 in shares, o carry on the business of producers and suppliers of electrical rgy for ublic private purposes, to acquire from public authorities and others waste heat or gas and surplus high and low-pressure steam or other fuel for generating electrical energy, &c. The subscribers (with one share each) are:—L. Wood, The Hermitage, Chester-le-Street, colliery proprietor; C. S. Hunting, 13, Milburn House, Newcastle-on-Tyne. Private company. The number of directors is not to be less than two or more than twelve, provided that every waste heat owner from whom the company obtained supplies, as aforesaid, may nominate a director, even if the number of directors is thereby increased beyond 12. The first directors are L. Wood and C. S. Hunting; qualification (except first directors or such nominees), £500; remuneration (if any) as fixed by the company. Solicitors, Ingledew & Sons, Cardiff. Registered by Kerr & Lanham, 16, Furnival Street, E.C.

Llanidloes Electric Lighting Co., Ltd. (132,133).—This company was registered on November 12th, with a capital of £3,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—R. Roots, 7, Molesford Road, Parsons Green, S.W., clerk; A. H. Cohen, 115, Burton Road, Brixton, S.W., clerk. Private company. The first directors are not named. Solicitor, W. George, Llanidloes. Registered by Rhys Roberts & Co., 63, Queen Victoria Street, E.C.

Somerby Electric Light Co., Ltd. (132,091).—This company was registered on November 10th, with a capital of £1,000, in £1 shares, to carry on at Somerby, Leicestershire, and elsewhere, the business of an electric light company in all its branches. The subscribers (with one share each) are:—S. C. Hobson, Wycliffe House, Melton Mowbray, spinner; W. J. New, Melton Mowbray, solicitor; J. C. Wigham, Broad Sanctuary Chambers, Westminster, S.W., engineer. Private company. The number of directors is not to be less than three or more than six; the first are S. C. Hobson, W. J. New, J. C. Wigham, C. Glover and C. E. Hay. Registered office, 33, Regent Street, Melton Mowbray.

Chinnerys, Ltd. (132,163).—This company was registered on November 14th, with a capital of £2,500 in 2,350 preferred ordinary shares of £1 each, and 3 000 deferred shares of 1s. each, to carry on the business of advertising contractors and agents, sign and banner writers, manufacturers of, and dealers in, advertising signs, devices and apparatus, facias, electrical fittings and appliances, &c. The subscribers (with one preferred ordinary share each) are:—H. A. Turner, 17, Waterloo Place, Pall Mall, S.W., engineer; R. A. Blackford, 17, Waterloo Place, Pall Mall, S.W., chartered accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration, £25 each per annum (chairman £50). Registered office, 23, Old Street, E.C.

Handley & Robinson, Ltd. (4,064).—This company was registered in Dublin on November 11th, with a capital of £3,000 in £1 shares, to carry on the business of electricians, contractors, motor and general engineers, heating, lighting, &c. The subscribers (with 250 shares each) are:—A. Handley, 27, South King Street, Dublin, electrical engineer; S. T. Robinson, 27, South King Street, Dublin, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are A. Handley and S. T. Robinson. Registered office, 27, South King Street, Dublin.

Edison & Swan Electric Co. (India), Ltd. (132,179).—This company was registered on November 15th, with a capital of £10,000, in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—C. J. Ford, 36, Queen Street, E.C., company director; C. E. Hunter, 36, Queen Street, E.C., company director; G. Gimingham, 36, Queen Street, E.C., company director. Private company. The number of directors is not to be less than two or more than five; the first are C. J. Ford, C. E. Hunter and E. Gimingham; qualification, £100; remuneration as fixed by the company. Registered office, 36-37, Queen Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Honiton and District Electric Supply Co., Ltd.—Particulars of £2,000 debentures, created October 8th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—Capital, £30,000 in £10 shares. Return dated August 12th (filed September 24th, 1913), 2,041 shares taken up, £5 per share called up on 1,195 and £10 per share on 250, £8,475 paid; £5,960 considered as paid on 596 shares. Mortgages and charges: £1,079 14s. 1d.

James Keith & Blackman Co., Ltd.—Issue on November 13th, of £100 debentures, part of a series of which particulars have already been filed.

W. A. Stevens, Ltd.—Trust deed dated November 11th, 1913, to secure £50,000 debenture stock, charged on freehold land and premises in St. Peter's Street, Maidstone, and company's property, including uncalled capital. Trustees: W. Wolsey, jun., Bull Yard, Peckham, S.E., and A. G. Mickleburgh, 50, Cannon Street, E.C.

Electric Law Press, Ltd.—Particulars of £5,000 debentures, created August 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue (on October 28th) being £4,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Memorandum of satisfaction in full on October 28th, 1913, of debentures dated January 31st and February 10th, 1910, securing £2,500, also notified.

CITY NOTES.

Allgemeine Elektrizitats Gesellschaft.

THE report for the financial year ended on June 30th, 1913, which was the thirtieth in the company's history, states that the year yielded the best results hitherto attained, especially in turnover and orders, and that it proved that the industry was able to offer adequate resistance to the continual political unrest in the past 12 months. A moderate slackening of the pace would presumably not damage the working results, but would probably relieve the pressure of the production extending over two and three shifts, and, at the same time, facilitate more comprehensive improvements in the methods of manufacturing. So far, however, a decrease in the company's degree of employment is scarcely to be perceived, because the progressive electrification in Europe, particularly in Russia, as well as outside of Europe, is affording a large turnover.

In Germany the supply of current to distant districts has experienced a fresh incentive through the growing recognition that the production of power must be centralised on the site of calorific and hydraulic energy. Large units, in connection with which machine outputs of over 20,000 KW. are no longer rarities, and conductor networks up to 100,000 volts are leading to an increasing reduction in the price of power. The growth of business necessitated an extension of the financial basis, and an increase of £1,250,000 was made in the share capital, which resulted in the realisation of a premium of £1,365,000, which was added to the ordinary reserve fund, whilst debentures of £1,500,000 were issued in April, 1913. The augmentation renders it possible for the company to participate in the financing of the railway between Gesundbrunnen and Neukolln, for which a capital of £4,500,000 is required. The existing credit at the banks amounts to £3,850,000. The works proposed to be established in the Bitterfeld lignite district is to be on a very large scale. In common with friendly institutions, the company has assured itself of vast deposits of brown coal in order to be able to supply exceptionally cheap energy in the circumference of Berlin. Whether and in what form the supply of the suburbs of Berlin will come into consideration in this connection will depend upon the result of the negotiations pending between the City Council and the Berlin Electricity Works. The invoiced turnover in 1912-13 exceeded that in the previous year by £3,000,000, and in the first two months of the new financial year the volume of business invoiced was £1,150,000 greater than in the corresponding period of 1912, whilst the new orders booked show an increase of £1,500,000, excluding the contracts for the Gesundbrunnen-Neukolln Railway. The constant efforts made to improve the methods of manufacturing and secure a greater output with a relatively smaller number of workmen have been successful, as is shown by the fact that with a considerably increased turnover the number of workers was 68,711, as compared with 70,162 in the previous year, and of these 7,876 and 6,551 respectively were employed in the works at Vienna, Riga and Milan. The accounts indicate the following results for the past two years :—

	1912-13.	1911-12.
Share capital	£7,750,000	£6,500,000
Gross profits	1,690,000	1,405,000
Depreciation	41 000	85,000
Net profits and balance forward	1,445 000	1,219,000
Reserve fund	175 000	150,000
Bonuses	60,000	45,000
Pension fund	50,000	45,000
Dividend	1,085,000	910.000
,, per cent.	14	14

The report proceeds to state that the deliveries of machines and transformers amounted to 122,452 of 1,973,987 KW., these contrasting with 118,205 and 1,861,344 KW. respectively in 1911-12. As new manufactures the company has undertaken the construction of high-frequency machines for a very high periodicity, and of motors for submarine boats. In the turbine department the turnover reached 559,908 KW., as compared with 489,942 KW. in 1911-12, and the largest units delivered comprised one turbo-dynamo of 20,000 K.V.A., three of 15,500 K.V.A., and four of 11,500 K.V.A. The manufacture of arc lamps experienced losses through the improvements made in very economical wire lamps, whilst good progress was made by meters and electrical clocks, especially those for the control of workmen. All the departments in the Oberspree cable works were adequately employed, and a constantly growing demand prevailed for lead cables for high pressures. The perfection of the methods of manufacturing permits of pressures of over 50,000 volts being dealt with. The progressive substitution of cables for overhead telephone wires, induced the company, in conjunction with other firms, to acquire the manufacturing rights for a relay which promises to be of importance in the extension of telephony over great distances. In the glow lamp factory, progress was made by the introduction of lamps of high candle-power, having an efficiency of only ½ watt per candle, and a useful lighting life of 800 hours, and at present lamps of from 600 to 3,000 C.P. are being made. The sale of normal lamps increased by 50 per cent., and a considerable reduction in the cost of production is due not only to this circumstance, but also to the introduction of labour-saving machinery. With the growth in the demand for wire lamps, the sale of carbon-filament lamps declined, and this source of light will soon belong to the past. The decision to dissolve the sales bureau of the United Glow Lamp Works, which had worked well for 10 years, was the result of this development. The company had to refuse the suggestions for the formation of a price convention for wire lamps as apart from the Customs conditions in relation to imports and the fact that the patent question* did not render a combination advisable, the latter would doubtless hamper the technical development of the lamp, which has by no means been concluded. Concerning the electrification of iron and steel works, it is mentioned that this particular work provided abundant activity for the firm. The contest between large gas engines and steam turbines as main producers of power necessitated constantly increasing the outputs of the generators. Generators of 6,000 H.P. and upwards for gas engine driving were continually being made. The electric motor is generally recognised as a practical source of power for driving all kinds of rolling mills, and the total output of the rolling mill drives hitherto carried out amounted to 760,000 H.P., including 23 for reversing mills. An increased turnover took place in mining by the further adoption of rotary compressors, which were partly driven by electricity and partly by steam turbines. Among the abundance of orders received for electric power stations and extensions, reference is made to the impending erection of four further turbo-dynamos aggregating 42,000 KW. and three further steam turbo-compressors, each of 7,500 KW. for the Victoria Falls and Transvaal Power Co. The business in tramways and light railways underwent satisfactory development, whilst large orders were received for the high speed railways in Hamburg and Buenos Ayres, and the equipment of a trial train for the Berlin City railway was in hand. The extension of electrical working on the London, Brighton and South Coast Railway resulted in a very important order for motor coach equipment on the single-phase system. A number of motor coaches has also been ordered for the Lauban-Konigszelt Railway, and 27 locomotives had likewise to be delivered.

* This question, as will be seen from another column, has now been decided in favour of the A.E.G.

Western Telegraph Co., Ltd.

Sir J. Wolfe Barry, K.C.B. presided on November 12th at Electra House, Finsbury Pavement E.C., over the eighteenth ordinary general meeting of this company.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 758) and accounts for the half-year ended June 30th, said he thought they would consider the result satisfactory. There was nothing of importance to which attention should be called. The message revenue for the period was less by £5,000 than that earned during the corresponding six months in 1912, when they were working at a higher tariff. They, however, carried 20 per cent. more traffic for this reduced revenue. The decreased receipts from messages were balanced by increased interest received from reserve fund investments. With regard to the expenses, those in London showed an increase of £630, spread over nearly all the items detailed under Abstract "A," and called for no remarks. The expenditure at the stations was more by £18,268—of this amount £8,000 was on account of salaries and wages due to annual promotions, an increased scale of foreign service allowance, and additional staff engaged to the number of 74, viz., 23 Europeans and 51 South Americans. It was also found necessary to increase the house allowances to the staff at various stations, principally in the River Plate. Foreign and other agencies cost more, as also did the maintenance of landlines, electrical instruments and cable tanks, repairs to buildings and renewal of furniture, stationery and printing. The only item in Abstract "B" which showed any material decrease was that of legal expenses. Under Abstract "C," which comprised the expenses attending the maintenance of cables, there was a decrease of about £4,000. The net result was that the revenue was practically the same as last year, and the expenses were more by £15,000. This was not unreasonable in view of the increased number of messages which were transmitted, and the upward tendency of expenses all over the world. They, like other enterprises, did more business at an increased cost to themselves and at lower charges to the public. After providing £16 373 for debenture stock interest, and £8,892 for income-tax, there remained a balance of £241,363; to this was added £33,817 brought forward from December 31st last, making a total of £275,180. A quarterly interim dividend amounting to £31,180 had been paid. £100,000 transferred to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £45,000 to the provision on account of investment fluctuations. The directors recommended the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together would amount to £51,982, leaving a balance of £37,008 to be carried forward. Since June 30th last there had been, down to the present, a small increase in revenue. The interim meeting, held heretofore by this company in May, would be discontinued, and in future an annual meeting only held in November each year.

Sir John Denison-Pender seconded the motion, and the report was adopted without discussion.

Mr. Ennis moved, and Mr. Newton seconded, a hearty vote of thanks to the directors and staff, and this was carried and briefly acknowledged by the chairman.

Continental.—France.—La Societe Franco-Belge pour l'Equipment des Tramways Electriques is the name of a new company which has lately been formed in Paris (53, Rue de Segur), with a capital of £4,000.

La Société d'Electro-Metallurgique de Dives reports a net profit of £59,390 for the last financial year. A dividend of 5 per cent. is being declared.

The balance-sheet of the Société Industrielle des Téléphones, of Paris, for the last financial year shows a profit of £66,110, as contrasted with only £62,700 in the preceding 12 months.

Bradninch Electric Supply Co.—Presiding at the annual meeting of this company, Dr. Muir said that they had had a successful year, with an increase in consumers and in income. The net revenue account showed a disposable balance of £85; £55 was distributed as dividend, and the balance, less income-tax, carried forward.

Reduction of Capital.—*The British Westinghouse Electric and Manufacturing Co., Ltd.*—A petition for the confirmation of the reduction of capital from £1,875,000 to £1,150,000 has been presented, and will be heard on November 25th.

Amazon Telegraph Co., Ltd.

Mr. George Keith (chairman) presided on Tuesday, at 42, Old Broad Street, E.C., over the nineteenth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 797), he said it was with great regret that he had to announce the death of their secretary, Mr. Petley, on October 27th. In expressing their sympathy with the widow, they had considered it right to make a suitable grant, which he was sure would meet with the approval of the shareholders. He thought they would consider the report and accounts for the year ending June 30th last satisfactorily. Statistics showed that the Amazon rubber crop had again been larger than it was in the preceding year, and their business made excellent progress during the first six months of the year under review, but fell off considerably during the second six months. Their local rates were also twice reduced during the year. The first reduction took place on November 1st in last year, and was more than recouped by the corresponding increase of the traffic passing over their cables. The larger traffic of 1912 automatically brought about another reduction on April 1st, which, unfortunately, owing to the depressed state of business generally, in consequence of the low price of rubber, very adversely affected the year's income. Notwithstanding this reduction the traffic receipts now showed an increase for the whole year of £622. Interest on investments and the year's cash balance were £604 more, and the total revenue, including subsidies and transfer fees amounted to £105,666, or £1,222 more than last year. As regarded the working expenditure, station expenses were £1,181 higher, due partly to the increase in salaries and house allowances in consequence of the rising cost of living in Brazil, and partly to an increase in travelling, office repairs, and other items which fluctuated year by year. Ship expenses had been increased by £2,519, in consequence of the expenses of the light-draught steamer *Ramos* which went out in June last year being charged for the first time for the whole year. The cost of cable used during the year saw an increase in consequence of some 18 miles of cable having been used in relaying and extending the shallow water cable in the large lake on the south side of the river between Santarem and Parintins. The old gutta-percha cable laid in 1897 had become unworkable owing to faults caused by exposure at places where the lake became dry during the low river season. The india-rubber cable now laid was not so liable to those faults, and it had been extended westward for about another 30 miles, which removed the main cable from a dangerous portion of the river, where it had always suffered severely through landslips at the time of the yearly fall of the river. The cost of relaying and extending this cable practically accounted for the increase in the year's total working expenses, which amounted to £59,091, or £7,892 more than last year. As regarded the other charges upon the revenue, the half-yearly redemption of the debentures commenced to take effect from July last year. After placing £22,917 to debenture interest and sinking fund, £10,000 had been added to the general reserve fund, increasing it to £40,000, £2,500 had been added to the reserve fund for the renewal and maintenance of cable steamers, thereby increasing the fund to £14,500, and after meeting these charges and the working expenses, they again recommended the payment of a dividend of 4½ per cent., free of income-tax, carrying forward £5,571. As regarded the current year, their business continued to be very adversely affected by the bad state of the rubber industry, in consequence of the low prices of rubber, and their message receipts up to the present were not what they were at this time last year, but were about the same as they were the year before. This might be attributed to the falling off of official messages and the reduction of rates made during the year not being covered by a corresponding increase of ordinary traffic. The Amazon was the home of fine rubber. The tree might be transplanted, but the soil and climate which produced the quality of the rubber could not, and if the export duties were reduced in Brazil, as they ought to be, it was highly improbable that plantation rubber could compete with fine Para grown in its own climate. He thought the present moment was not unfavourable for higher rubber prices and for better business on the Amazon.

Mr. E B. Ellice Clark seconded the motion.

A Shareholder asked what was the nature of the investments which appeared in the accounts for the first time.

The Chairman said they were partly in the company's own debentures and partly in other securities, and they stood practically at the same price as they were bought at.

Mr. Bailey asked the chairman if there were any other industries on the Amazon besides the rubber industry.

The Chairman said there was the nut industry, and also a certain trade in cattle and wood, but these were comparatively small compared with the rubber industry, on which their company's trade really depended. Notwithstanding all that had been said, he did not think that the rubber industry of Brazil was in a worse position than the plantation industry of the East. Plantation rubber growers seemed to think that they could produce fine rubber by artificial means, but he, personally, was afraid that they would not succeed.

The motion was then carried.

Castner-Kellner Alkali Co., Ltd.—The directors have declared a final dividend of 13½ per cent. for the six months ended September 30th, 1913, and they also recommend the payment out of reserve funds of a bonus of 10s. per share. This will be satisfied by the issue of fully-paid shares at par, one for every two held.

National Electric Construction Co., Ltd.

The report of the directors for the year ended December 31st, 1912, shows a gross profit of £13,370, and after deducting therefrom expenses of administration, debenture interest, &c., there remains a balance of £2,377, plus £4,357 brought forward, making a total of £6,734. From this there has to be deducted £1,550 for the debenture redemption fund, leaving £5,184, which the directors recommend be dealt with as follows:—Depreciation on free-wired installations, £382; rolling stock, &c., Dewsbury and Ossett Tramways, £228; furniture, fittings, plant and tools, £102; carry forward, £4,472. The directors deferred issuing their report and accounts in view of negotiations for an important contract which they expected to secure in October. This contract depends upon finance, and the finance to a great extent, upon certain negotiations with a municipality being brought to a successful conclusion. Steps are being taken by the syndicate controlling the business to complete these negotiations, but it is now unlikely that finality can be reached until the early part of the New Year.

The Rhondda Tramways Construction Syndicate, Ltd. (in liquidation).—The Rhondda Tramways Co., Ltd., was unable to pay its preference dividend owing to the coal strike and the strike of the company's employés referred to in last year's report, and this affected the company's revenue to the extent of about £1,200. The receipts of the Rhondda Tramways Co., Ltd., to October 30th of the current year amounted to £52,321, as compared with £39,340 for the corresponding period of last year, an increase of £12,980.

Torquay Tramways Co., Ltd.—The progress of this company was again very satisfactory, the traffic revenue for 1912 being £28,112, as compared with £22,635 for 1911, the dividend paid on the ordinary shares being 3 per cent., against 1½ per cent. for 1911. The receipts to November 2nd, 1913, show an increase of £3,920 over the corresponding period of last year.

Dewsbury and Ossett Tramways.—The profit, after providing for the sinking fund and interest payments to the local authorities, amounted to £1,167, as compared with £1,147 for 1911. The traffic receipts to November 2nd, 1913, show an increase of £552 over the corresponding period of last year.

Mexborough and Swinton Tramways Co.—A dividend of 2 per cent. was paid on the shares in the Construction Syndicate as against 2½ per cent. for the previous year, the decrease being due to the effect of the coal strike. The receipts, however, to November 2nd, 1913, show an increase of £1,548 over the corresponding period of 1912.

Musselburgh and District Electric Light and Traction Co., Ltd.—Traffic receipts to November 2nd, 1913, show an increase of £722 over the corresponding period of last year.

The boiler troubles referred to in the previous report appear to have been overcome. The local management has been reorganised, with beneficial results to the undertaking.

Town Lighting Installations.—At Bo'ness there was an increase in the gross profit of £135, but in the case of Carnarvon a decrease of £175. In both cases the results were adversely affected by the increased price of coal following the coal strike. The revenue from consumers at Bo'ness for the three quarters ending September, 1913, showed an increase of £764 over the corresponding period of last year.

In the case of Carnarvon the price of current for lighting purposes has been increased from September 29th, 1913.

Folkestone, Sandgate and Hythe Tramways.—The directors have abandoned this scheme as they found it impossible to get the local authorities to agree to a scheme which would enable the finance to arranged. The expenditure has amounted to £39,238, the disposal of which will be dealt with in the accounts for 1913.

The sixteenth annual general meeting was held on Tuesday at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger presiding.

The Chairman, in proposing the adoption of the above report, said that the directors had delayed issuing the accounts as they were hopeful of being in the position of reporting that at least one of the two important contracts they had been negotiating for had been secured for the company. Owing to certain developments one of the contracts in question could not be brought to a successful issue for at least another one or two months. In previous reports reference had been made to a large contract on the Continent, and the fact that so far it had not been secured might lead shareholders to think that the directors had been too sanguine in their expectations, but after hearing what he had to say he thought they would agree that the future prospects of the company were much more hopeful than the report and accounts disclosed. It was about four years ago that the negotiations were first started for the construction of an electric railway on the Continent, and last year he told them that it looked as if the negotiations were likely to be brought to a successful conclusion at an early date, as he was then in a position to inform them that all the local authorities interested, some 30 in number, had come into line and had signed a petition to the Government to authorise the formation of a joint board to carry out the scheme; that the Government, after numerous meetings with the representatives of the local authorities, had drafted a concession, the completion of which was to be delayed until after the holidays. There was, however, again considerable delay after the holidays, and their patience was sorely tried as they felt that the business might ultimately fall through. However, he could now inform them that the concession had been granted, a deposit had been put up by the authorities which, he understood, was forfeitable if the scheme was not carried through, and the joint board had been formed. A Royal Commission

appointed by the Government had been busy fixing the sites of the station, and the latest information which only came to hand a few days ago, was to the effect that all the sites had been fixed with the exception of the terminus at one end of the line, but whatever decision the Commission came to after considering the objections would be final. The president of the Committee came to London about a couple of months ago to discuss matters with Mr. Cownie, their managing director, and it was arranged that directly the joint board was in a position to finally settle the contract, Mr. Cownie would meet the Committee. They had had a very hard fight with numerous competitors for the business during the early days, but the scheme which the Committee had ultimately adopted was their scheme, and negotiations had since only been carried out with the company. He could only give them the facts and leave them to form their own conclusions. The contract, if secured, should be profitable to the company, but what was, perhaps, still more important, it would strengthen the company's position in dealing with other contracts of a similar nature. He also referred at the last meeting to another business in which they were interested, which, if brought to a successful conclusion, would result in a contract to the company running into well over £300,000. From information at their disposal they thought it probable that the financial arrangements on which that contract depended would be completed last October, but, unfortunately, their expectations were not realised, the finance having to be postponed until negotiations concerning certain widenings could be taken in hand and completed. Originally a syndicate of some £15,000 was formed by Mr. Cownie to deal with that business, and the capital was fully subscribed. The capital of the syndicate was being increased by another £30,000, for the purpose of carrying the business a step further. He was glad to say that negotiations to secure that capital were well advanced. He need hardly say that the negotiations in connection with the two contracts he had referred to had involved an enormous amount of work on the part of their managing director and their chief engineer, which was not apparent in the present report; and if they were brought to a successful conclusion, he thought that, notwithstanding any criticism on the present accounts, within a year or two the position would be very different and the company would be able to have a clean balance-sheet and a profit and loss account satisfactory to all. He might add that, in connection with any contracts, the company was financially strong enough to carry them through. Proceeding to deal with the various undertakings in which the company was interested, the chairman said he was glad to be able to say that they were making substantial progress in the right direction, and that in consequence their interest in those companies was always appreciating in value. In the Rhondda Tramways Construction Syndicate (in liquidation) they had just over £50,000, of which they had received back from the liquidators in cash approximately 70 per cent., leaving the cost of their investment at about £15,000. In respect of that interest, they were entitled, on the distribution of the securities, to receive approximately £20,000 in 6 per cent. preference shares and £9,000 in ordinary shares, all fully paid. As far as they could tell at present, the profit earned by the company this year should be sufficient to pay 6 per cent. on the preference, and at least 5 per cent. on the ordinary shares, after making the necessary reserves. Last year, however, the preference dividend had to be passed, and this year's profits would have to meet that charge. There had been a large increase in the traffic receipts, and, compared with last year, the receipts every week were showing an increase of from £100 to £150, and there was no reason why that increase should not be maintained. In the last session of Parliament the company obtained powers to run a railless traction system in connection with the tramways, which should be in operation by the middle of next year, and they had every reason to believe that with a comparatively small capital expenditure both the receipts and the profit would benefit considerably. They had £20,000 in the Torquay Tramways Co., and on the distribution of the securities they were entitled to £8,000 in 5 per cent. debentures and £16,000 in fully-paid ordinary shares. In front of those debentures were £60,000 5 per cent. prior lien debentures. It looked as if the company would this year earn a profit of not less than £15,000, compared with about £11,800 in 1912. Last year 3 per cent. was paid on the ordinary shares, as against 1½ per cent. for 1911, and he thought he might safely say that this year the dividend would again be increased. The Dewsbury and Ossett tramways continued to show satisfactory progress, the profit to date being £300 in excess of the corresponding period in 1912. The increase in the traffic receipts of the Mexborough and Swinton Tramways Co., in which they were interested, was satisfactory, and he was glad to say that the company, despite great opposition, had secured powers to construct a railless traction system to connect with Conisborough, and it was expected that the work would be put in hand within the next month or two. He was advised that the profit from the line would be substantial. Although the company had as yet only been able to pay dividends of from 2 to 2½ per cent. much better results were anticipated when the shares were taken up. In the case of the Musselburgh and District Electric Light and Traction Co., extensive track renewals had been taken in hand which would tend to reduce maintenance charges in the future. Active efforts were being made by the management to increase the lighting and power consumers, which were meeting with considerable success, and therefore they looked forward with considerable hope for the future. Dealing with the Bo'ness and Carnarvon undertakings, the Chairman said that in Bo'ness the business was showing a considerable improvement, and everything pointed to the improvement being continued. At Carnarvon to meet the increased working costs the price of current had been raised from 5d. to 6d. per unit, and that should result in a considerable increase in the revenue. The scheme for the construction of the Folkestone Sandgate and Hythe Tramways had had to be abandoned after every effort had been made to get the local authorities concerned to agree to a workable scheme without success. There was no doubt that if the scheme could have been carried out on the overhead system it would have been a very valuable one, but the Folkestone Corporation required the conduit system throughout, and Sandgate also stood out for that system. The Hythe Corporation was reasonable, and was prepared to agree to the overhead system, but the opposition of Folkestone was too strong. Their loss in the matter—£39,238—was a big one, but they hoped they would be able to clear it out of the account. They were just starting the construction of the Wisbech electric lighting works, and with the experience they had gained with their other undertakings it should turn out a successful venture.

Mr. J. Carr Saunders seconded the motion, which, after a few comments by shareholders, was adopted.

West India and Panama Telegraph Co, Ltd.

Mr. W. B. Kingsford (chairman) presided on November 12th, at Winchester House, E.C., over the meeting of this company.

In moving the adoption of the report (see Elec. Rev., page 797), the Chairman said that, before proceeding to the business, he had to express the regret of the board at the death of their esteemed and venerable colleague, Mr. T. Holmes, in his 95th year, who had been a director for nearly 40 years. Mr. Holmes hardly ever missed a board meeting, and was present at one the day before he was taken ill. He was a shipowner, and was very useful to the company, especially in regard to their repairing vessels. Since the report was issued Mr. H. W. Berks had been invited to join the board, and had done so. The net result of the company's working during the half-year varied very little from that of June of last year. The total revenue amounted to £45,524, which was £1,193 less than during the corresponding period. As against this, the expenses of the half-year were £850 less, and practically the whole of that reduction arose in connection with the cost of maintaining their cables. As he had reminded them at previous meetings, their outlay under Abstract C was always subject to fluctuations. Obviously so much depended upon the time the ship was occupied and the length of cable used in repairs and renewals. Fortunately, in both respects, this time their expenditure had been a little less than usual. After placing £2,000 to reserve, they had approximately the same amount of available balance at their disposal as they had a year ago. Accordingly, they recommended the payment of the dividend proposed in the report (1s. 6d. per share on the ordinary shares), together amounting to £18,394, carrying forward £3,185 to the account of the current half-year. In the report it was mentioned that the Imperial and Canadian Governments, having brought pressure to bear on the company for a general reduction of West India rates, the directors had found it necessary to consent to this in return for subsidies on certain conditions. The deed necessary to give effect to the agreement had yet to be considered and executed, and after execution it would not become valid until it had been submitted to and approved by Parliament. He was sure that in this stage of the negotiations they would understand that that day they hardly felt at liberty to enter at all fully into a discussion on the matter. Much of what might be said about the position and prospects of the company under changed conditions would be in the nature of guesswork, and possibly, therefore, might prove to be erroneous and misleading. For example, should the agreement be carried into effect they feared that at first the earnings of the company might suffer a considerable diminution. On the other hand, they hoped that as time went on the large reduction in the rates might gradually bring about an increase of business sufficient to recoup them, and possibly do more than recoup them for their loss at the beginning. But the fear and the hope were both based not on certainty but on mere conjecture. It should be borne in mind, however, and he ventured to say this was a point which hardly admitted of doubt, that the granting of new subsidies of £16,000 a year, half to be paid by the Imperial Government and half by the Canadian Government, guaranteed for a term of 10 years, coupled with a continuance of their existing subsidies of £10,300, also guaranteed for 10 years, would give the company that important element of stability which hitherto it had not possessed. In West Indian commercial circles it was anticipated that the new tariff recently adopted by the United States would be beneficial to the Colonies. It would at once reduce duties on sugar and other products, and in three years would entirely abolish them, and thus in all probability lead to the increased consumption of these commodities. The preferential arrangements between Canada and the West Indies should also tend to improve the trade of the West Indian Colonies. The traffic receipts for the current half-year down to October 31st showed a small decrease of £508.

Mr. G. Von Chauvin seconded the motion.

Mr. Newton referred to the death of Mr. Holmes, and in regard to the negotiations as to the new rates expressed the hope that the West Indian Government would treat them generously. He pointed out that the experience of the Eastern and the Eastern Extension Telegraph Co. was that each reduction of rates was followed by a large increase in the number of messages.

The report was adopted.

Dorman, Long & Co., Ltd.—A final dividend of 6 per cent. is recommended, making 8½ per cent. for year.

Rushden and District Electric Supply Co.—The first report presented at the annual meeting yesterday, states that immediately the necessary capital was subscribed, steps were taken for the construction of the generating station on the site in Shirley Road, Rushden, and for laying down mains in Rushden and Higham Ferrers. The works include an engine room containing two Diesel oil engines of 240 H.P. each, and auxiliary machinery, battery room, water cooling tower, workshops and offices. The buildings are of solid construction and up-to-date design. The engine room affords a space for a third engine when required, and the capacity of the battery can be doubled without increasing the size of the building. The proximity of the railway enables the oil fuel to be pumped direct from the railway tank wagons into storage tanks. Mains had been laid 2 miles 1,040 yards in length, with full provision for feeder cables, regard being made to a large probable demand within a few years. There was considerable delay in the delivery of some of the machinery, but the public supply was commenced on October 15th. There are about 20 consumers, and the demand is chiefly for power purposes at present.

Fraser & Chalmers, Ltd.—The directors' report for the year ended June 30th (as abstracted in the *Financial News*) shows a net profit of £4,604 (after payment of debenture interest and making the usual provision for depreciation) plus £75,446 brought forward, making £80,050. The directors have paid the full preference dividend for the year of £4,725, and have transferred £60,000 to general reserve account, leaving £15,325 to be carried forward. The directors, in transferring to a reserve account so large a proportion of the balance heretofore carried in profit and loss account, have been guided by the consideration that the requirements of the business necessitated the permanent investment of more capital. The decrease in profits has been due to a continued falling off in the South African business. In England an increased trade has been done, but special expenses have been incurred owing to the changes in character of machinery sold. The directors do not recommend any dividend on the ordinary shares.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Buenos Ayres Lacroze Tramways Co.—Scrip, fully and partly paid, for a further issue of £500,000 5 per cent. consolidated mortgage debentures.

And to allow the following securities to be quoted in the Official List :—

Auckland Electric Tramways Co., Ltd.—350,000 ordinary shares of £1 each fully paid.

Urban Electric Supply Co., Ltd.—Further issue of £131,840 4½ per cent. first mortgage debenture stock.

Norwegian Hydro-Electrical Nitrogen Co.—This company has invited the public to subscribe 83,333 ordinary shares of £10 each at a price of 13 per cent. above par, of which 3 per cent. is the approximate dividend earned since July 1st, 1913, from which date the new issue will be entitled to dividends. The actual price is thus 110 per cent. The issue has been opened for subscription at the company's head offices at Christiania, at Stockholm, in Paris and at Geneva.

Argentina.—The annual general meeting of shareholders of the Compania Anglo-Argentina de Electricidad was held on the 15th ult. Profits for the year amounted to $787,772, plus $32,388 from the previous year. After placing $189,855 to amortisation account, $100,000 to reserve, $47,833 to directors, a dividend of 9 per cent. is declared (8 per cent. last year), and $44,550 carried forward.—*Review of the River Plate.*

Boulton & Paul, Ltd.—For the year ended September 30th, a dividend of 15 per cent. on the ordinary shares is recommended, £23,283 being carried forward.

Provincial Tramways Co.—The directors recommend a final dividend of 1s. per share on the ordinary £1 shares, making a total dividend of 1s. 8d. per share, or 8⅓ per cent. per annum for the year ended September 30th.

West Kootenay Power and Light Co.—The directors have declared a quarterly dividend of 1¼ per cent., increasing the rate from 4 to 5 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

THE swing of the pendulum has brought better news from Mexico, and notwithstanding the fact that money remains very dear, Stock Exchange markets responded smartly to the more cheerful conditions. It cannot be pretended, however, that any settled state has been arrived at, because, only last Monday morning, prices underwent a quick reaction upon unfavourable rumours from the theatre of disturbance. On the whole, though, markets are in a more healthy frame of mind, and one of the principal features of the moment is a robust recovery amongst Home Railway stocks.

The latter is due to the consideration, so often urged, that many stocks now look cheap, in view of the dividend accumulations which they carry in respect of the current half-year. The violent speeches of Mr. Larkin were read gloomily by the Railway market at first, but during the last day or two these utterances have been disregarded, on the assumption that the English railwaymen were not likely to come out at the call of the Irish leader. On the week, prices have improved quite materially in some cases. Amongst the exceptions must be noted East London Ordinary stock, which has dropped back to 6.

Metropolitans and Districts have followed the course of the steam companies' stocks. After being depressed, they both hardened, and at 40½ and 28¾ respectively they show respectable rises on the week. A little attention is being attracted to the stocks of the London Electric Railway Company ; the 4 per cent. Debenture stock, standing at 92, with a dividend due on January 1st, yields nearly 4⅛ per cent. on the money, while the company's 4 per cent. Preference can be bought at 72, and making allowance for the dividend payment on February 1st next, the return is the handsome one of 5⅝ per cent. on the money.

English Electricity Supply shares are firm, with small rises in Charing Cross, City Preference shares of both classes, Westminster Preference and City of London Ordinary. The last-named have risen to 16½, and there are bullish rumours being circulated as to the next dividend which the company is likely to declare—which rumours it may perhaps be well to accept with discretion until they are confirmed. County of London Second Debenture stock improved to nearly par, and a rise of 2 points in Kent Electric Debenture carried the price to 79. St. James's Ordinary eased off to 8⅞, South Londons to 2 1/16. North Metropolitan Electric Power 6 per cent. Preference has been granted quotation in the Stock Exchange Daily List, and the price is 106 to 108.

The Electric Supply Corporation has convened a meeting of debenture stock-holders for Friday in this week, with a view to enabling the Debenture stock already issued to be converted into bearer stock, should the proprietors desire. We have heard that just lately a fair block of the stock has been taken for French investors, who, of course, have a prejudice against anything that is registered. The company has £16,586 Debenture stock left as the balance of the £157,500 authorised by the Trust Deed ; and the directors point out that if the security can be converted into a bearer bond, it will much facilitate the placing from time to time, as needed, of the unissued stock, and will, of course, very much increase its negotiability.

Part of the present slump in the Mexican group has been recovered, there being substantial rallies in the issue of the Mexican Light and Power Company, the Monterey Debentures, and Mexico Trams. The rises range from 2 points to 7, but, of course, they do not by any means wipe out the effects of the previous depression. The news remains of a somewhat mottled character, and during the uncertainty it is only to be expected that prices will go up and down with a considerable amount of irregularity. One of the rumours on Monday said that the rebels—whose identity, by the way, seems to be a matter of general inquisitiveness—were within 80 miles of Vera Cruz, thanks to which report the 5 per cent. Debenture stock of the Vera Cruz Company receded a trifle to 90. That there are a few buyers about is evidenced by the improvement in prices, though to this it must be added that part of the recovery consisted merely of marking up quotations that had been put down earlier, with little stock changing hands in either case.

Brazil Tractions rose 2½. Manaos Trams Debenture, however, lost 2 points at 86 ; considering that the stock was scarcely saleable before, the dropping of the price made little actual difference in the market. Para Electric Railways have risen substantially ; this week the price shot up to 6, showing a gain of 7s. 6d. on balance. United Electric Tramways of Monte Video Preference are ⅛ down, and Calcuttas are rather easier. British Columbia Electric stocks remain a dull market ; the 4½ per cent. Debenture, however, is being absorbed by investors attracted by the excellence of the security, and the price picked up a couple of points.

In the Telegraph market, the Anglo-American Telegraph trio is slightly better, although the only quotable change is a rise of ¼ in the Deferred stock. Indo-Europeans rose 10s., Westerns gained 2s. 6d., and Submarine Cable Trust certificates hardened. Direct United States Cable shares are lower, and the fall in Reuters shares made further progress, the price having now got back to 9 middle. Marconis recovered some of their volatile character. From 3⅛, the price rose to 3½, but suffered a little reaction, which left them 3/16 better on the week, the 7 per cent. Participating Preference shares following in the train of the Ordinary. Canadians are steadier at 8s. 6d., while Americans cling closely to the neighbourhood of 17s. 6d.

The most interesting feature in the manufacturing market is the declaration of a dividend of 22½ per cent. by the Castner-Kellner Company, being an increase of 2½ per cent. as compared with this time last year. In addition, shareholders are given a bonus, which is equal to practically 50 per cent. in the shape of one new share, through capitalisation of reserves, and on the strength of this the price improved to 3 15/16. That there should have been so comparatively small a gain as 1/16 may be due to the fact that the price has been creeping up steadily for some time past. The profits, curiously enough, are a little lower than they were a year ago. Edison & Swan fully-paid shares, after their 10s. fall last week, have recovered 7s. 6d., and there has been an improvement of 10s. in Henleys, taking the price to 13⅛. British Westinghouse Preference hardened a trifle. Willans & Robinson Preference has again risen 4 points. Rubber shares blossomed out into considerable strength, on account of a rise in the price of the product to 2s. 6d. per lb. This provided a ready whip for the chastisement of the "shorts" who have of late found the market so profitable a bear-garden, and whose efforts to get level have resulted in a material rise in most of the leading shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 18th.	Rise + or Fall −	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	93 — 96	..	4 3 4
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ⅛	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	+ ⅛	5 9 1
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16 — 17	+ ¼	5 6 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 8 11
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	97 — 100	+1	4 10 0
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅛	..	3 8 7
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	5	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	7⅞ — 8⅛	..	5 10 9
Kensington & Knightsbridge, Ord.	5	7	7†	7½ — 8	..	5 0 9
Do. 4 % Deb.	Stock	4	4	90 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	+2	5 12 6
London Electric, Ord. ..	3	2	..	1½ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 1 4
Do. 4½ % Cum. Pref. ..	5	4½	4½	4⅜ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 — 102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10½	..	5 11 7
Oxford	5	7	6†	6 — 6⅛	..	5 7 —
St. James' and Pall Mall, Ord. ..	5	10	10†	9⅜ — 9⅝	— ⅛	5 — 1
Do. 7 % Pref	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅝ — 8	— ⅛	7 6 —
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/32 — 1 1/32	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum Pref.	5	3	..	2¼ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8¾ — 9⅛	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4¾ — 5⅛	+ ⅛	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	5†	7⅞ — 7⅝ xd	..	5 11 6
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	106 — 110	+1	6 7 3
Do. 7 % Pref.	$100	7	7	117 — 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	6	..	⅝ — 1 1/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	90½ — 92½	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	+ ½	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ — 104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	66 — 71	+1	7 0 10
Mexican Lt. & Power, Common	$100	4	4	50 — 54	+4½	7 8 2
Do. 7 % Cum. Pref.	$100	7	7	78 — 83	+3	8 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	+7	6 0 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	68 — 73	+3	6 17 0
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	+4½	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	212 — 218	+2	4 11 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 — 104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	131 — 136	..	4 8 3
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 — 107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 100 xd	..	4 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	— ½	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	⅞ — 15/16	+ 1/32	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	123 — 125	..	6 8 0
Do. Collat. Trust	$1000	4	4	89 — 92	..	4 7 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½ — 105½	..	5 13 9
Do. Def.	Do.	30/-	..	23½ — 24	+ ¼	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15¼	..	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 12 0
Direct United States Cable ..	10	4	4†	6¼ — 6¾	— ⅜	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 — 129	..	5 8 6
Do. 8½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12¼ — 12¾	..	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Great Northern Telegraph ..	10	20	5†	30½ — 32½	..	6 2 8
Indo-European Telegraph ..	25	13	5†	57 — 59	+ ½	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph ..	1	20	..	8⅜ — 3⅜	+ 3/16	5 14 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2 9/16 — 2 13/16	+ 3/16	6 0 9
Monte Video Telephone, Ord. ..	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/16	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	96¾ — 97¼	..	4 12 1
Oriental Telep. and Elec. ..	1	10	10†	1⅝ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 1/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	+ ½	4 1 0
Reuter's	10	10	10†	8½ — 9⅛	— ⅛	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ — 125½	+ ½	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6¼ — 6¾	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2 3/16 — 2 7/16 xd	— 1/16	4 17 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10 xd	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½ xd	..	6 6 4
Do. 5 % Debs.	100	5	5	98 — 100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12¾ — 13½	+ ⅛	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 18th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/8 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 23/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	10½ — 12½	— ½	..
Do. Do. Deferred ..	100	..	..	3½ — 5½	— ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	+1	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	3	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	+1	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	75 — 78	..	5 15 5
Central London Railway, Ord...	100	3	1	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	95 — 97	..	5 3 1
Do. 4 % Deb.	100	4	4	90 — 93	..	4 7 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 9/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord. ..	1	..	..	3/16 — 5/16	— 1/16	..
Do. Do. 5 % Cum. Pref.	1	..	5†	½ — 9/16	— 1/16	..
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	74 — 79	—3	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	57 — 61	..	6 11 2
Metropolitan Railway Consol. ..	100	1⅝	1½†	40½ — 40¾	+1½	3 19 9
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	—1	4 11 0
Metropolitan District Ord. ..	100	Nil	..	28½ — 29	+ ⅜	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 83 xd	..	5 8 5
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways ..	10	..	..	3/8 — 3/7	+ ⅛	Nil
Do. "A"	1/-	..	..	1/32 — 1/32	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	+1	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	+1	6 13 4
Yorkshire (West Riding). Ord...	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	3½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89½ — 91½	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97⅛ — 99½	..	4 10 6
Do 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb. ..	100	5	5	101 —103	+1	4 17 1
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	+1	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86½ — 88½	+2½	6 15 6
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	114 —119	—1	6 14 6
Do. Pref. Ord.	100	6	6	102 —107	..	5 12 2
Do. 5 % Pref.	100	5	5	99½ —102½	+ ½	4 17 6
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	+2	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5 7/8 — 6 3/8	— ⅛	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	— 1/16	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	21/32 — 23/32 xd	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5 1/16 — 5 5/16 xd	..	4 14 1
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord. ..	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4⅜d.	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5	6†	1 — 1⅛ xd	..	4 16 1
Do. 6 % Pref.	1	6	6	1 5/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb...	100	5	5	85 — 87	—2	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	78 — 82	+4	8 10 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	80 — 85	+7	5 17 8
Do. 6 % Bonds	100	6	6	81 — 84	+2	7 2 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5⅝ — 6¼	+ ⅜	8 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5⅛ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 5 % Mort. Bonds	100	5	5	88 — 90	..	5 11 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 —102	+1	4 18 0
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅞ — 5¼	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	— ⅛	5 14 3
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	97½ — 99½	—1	4 10 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	2 7/8 — 3	..	5 6 8
Do. Pref.	1	5	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord. ..	1	..	..	1⅛ — 1¼	..	..
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85½ — 87½	..	5 14 3
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5¾ — 6¼	— ½	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref. ..	3	Nil	..	1 — 1 3/16	+ 1/16	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35⅝ — 40½	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	3⅛ — 4	+ 1/16	5 12 6
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	64 — 69	+2	7 5 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	25/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1⅜	+ ⅜	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¾ — 13½	+ ½	5 11 1
Do. Pref.	5	4½	4½	4 1/8 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7 2
Do. Pref.	10	5	5	9¼ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 60	..	6 13 4
Do. B 4 % Cum. Pref. ..	100	..	..	12 — 17	+4	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1913.

The returns of electrical exports and imports for the month of October show an all-round improvement as compared with the preceding month; the exports amounted to £554,769, as against the September total of £445,155, and included telegraphic material valued at £123,679, as compared with, approximately, £70,000 worth in September. The re-exports, at £39,337, reached the highest value we have so far recorded, and were some £9,000 in excess of the previous month's total. Compared with the previous month, nearly every section of the exports showed an improvement in value, the only exception being accumulators; of the total increase in value for the month, about one-half was due to the increased telegraphic exports, which included a single item of submarine cable valued at 53,000.

In the case of the imports—which reached a total of £266,216, as compared with £252,741 in the previous month—the machinery and accumulator sections showed to advantage, cable imports were stationary, while telegraphic and telephonic imports fell away, as compared with September.

In view of its large cable purchase, Denmark was one of our best customers during the month, a distinction which was shared by Argentina, India and New South Wales.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,596	297	294	91	3,960	1,035	13,864	159	...	37	22	53,734	75,089
Germany	5,649	3,887	...	14	583	63	4,122	...	116	22	120	242	14,818
Netherlands, Java and Dutch Indies ...	610	801	450	30	24	171	1,590	923	30	...	52	179	4,860
Belgium	405	366	106	45	184	21	3,892	50	200	323	2,048	89	7,729
France	725	172	4,554	28	2,000	...	5,251	1,048	...	...	158	7	13,943
Portugal	1,338	161	10	42	...	6	707	2,861	471	...	197	445	6,238
Spain, Canary Isles and Spanish N. Africa...	1,534	629	208	...	...	349	4,031	120	11	10	240	20	7,152
Switzerland, Italy and Austria-Hungary ...	221	246	115	...	12	6	4,427	820	...	443	714	1,601	8,605
Greece, Roumania and Turkey	404	1,514	193	...	...	...	440	...	174	...	6,238	1,812	10,775
Channel Isles, Gibraltar, Malta and Cyprus...	58	47	32	20	...	37	251	...	153	...	28	708	1,334
U.S.A., Philippines and Cuba	1,160	356	156	56	20	124	1,999	...	...	...	214	435	4,520
Canada and Newfoundland	2,107	778	569	769	30	1,100	8,541	804	304	67	818	60	15,947
British West Indies and British Guiana ...	1,081	88	45	73	22	...	408	36	48	...	121	...	1,922
Mexico and Central America	22	103	47	33	...	...	614	30	28	...	...	...	877
Peru and Uruguay	296	15	14	...	...	822	1,581	197	10	...	543	40	3,518
Chile	607	128	693	165	...	185	3,388	1,659	230	...	269	777	8,101
Brazil	1,389	1,263	297	675	32	622	7,032	488	199	...	135	18,732	30,864
Argentina	5,401	11,576	553	854	182	692	23,331	3,915	2,386	...	4,792	4,371	58,053
Colombia, Venezuela, Ecuador and Bolivia...	20	...	48	...	...	126	213	...	...	...	15	...	422
Egypt, North Africa and Persia	243	39	455	129	21	...	743	8	256	...	460	8,591	10,945
British West Africa	64	185	33	...	...	492	2,090	122	160	94	457	671	4,368
Rhodesia, O.R.C. and Transvaal	1,127	419	563	723	22	757	3,906	399	145	15	265	77	8,418
Cape of Good Hope	1,156	2,692	736	202	...	611	3,335	1,913	731	11	1,932	4,095	17,414
Natal	1,253	3,654	385	...	...	255	1,867	99	706	...	138	13	8,370
Zanzibar, Brit. E. Africa, Mauritius & Aden	117	133	61	147	10	29	550	...	20	...	66	1,730	2,863
Azores, Madeira and Portuguese Africa ...	661	...	229	105	...	48	621	...	32	...	118	423	2,237
French African Colonies and Madagascar ...	9	...	...	...	...	...	44	...	...	...	20	6,842	6,915
China and Siam	1,741	508	523	349	56	...	1,649	678	1,470	54	385	2,446	9,859
Japan and Korea	656	821	12	139	18	1,464	18,105	938	827	84	5,304	507	28,875
India	4,461	4,140	5,323	1,329	200	1,278	26,038	3,501	2,137	238	2,135	3,508	54,288
Ceylon	354	522	235	56	...	31	201	510	204	15	123	4,584	6,835
Straits Settlements, Fed. Malay States, and Sarawak	1,292	2,164	608	263	...	183	361	949	225	4	2,887	659	9,595
Hong Kong	693	3,122	213	16	...	353	2,133	149	10	39	13	...	6,741
West Australia	205	1,037	136	237	32	...	327	46	196	140	2,377	434	5,167
South Australia	366	4,190	278	432	18	660	1,707	141	504	23	239	44	8,602
Victoria	2,495	4,547	650	945	300	1,018	3,034	292	1,010	...	6,088	1,241	21,620
New South Wales	2,019	11,612	758	2,042	283	1,606	7,915	1,803	827	32	1,063	3,740	33,700
Queensland	826	33	204	329	135	24	2,422	6	304	82	8,934	87	13,386
Tasmania	259	...	13	37	...	...	...	...	...	...	...	24	333
New Zealand and Fiji Islands	1,286	2,738	510	1,174	132	186	9,036	857	515	...	2,326	711	19,471
Total, £	45,906	64,983	20,309	11,549	8,276	14,354	171,766	25,521	14,639	1,733	52,054	123,679	554,769

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	3	...	...	...	29	...	9,330	229	885	...	3,723	14,199
Germany	3,443	31,067	1,968	14,633	8,523	2,762	57,286	62	12,974	8,189	7,502	148,409
Holland	...	...	...	698	873	356	250	...	5	140	...	2,322
Belgium	631	3,045	...	299	30	...	5,835	...	886	198	4,308	15,232
France	212	50	1,580	1,618	459	1,666	754	...	1,480	3,444	9,832	21,095
Switzerland	362	3,486	39	6	4	37	1,009	...	...	387	931	6,596
Italy	...	3,426	...	...	185	50	...	...	...	85	25	3,771
Austria-Hungary	...	934	...	847	18	...	...	...	352	325	72	2,548
United States	9,512	362	1,702	58	563	62	17,261	19,632	645	18	1,427	51,242
Total, £	14,163	42,370	5,289	18,159	10,684	5,268	91,725	19,923	17,227	12,786	27,820	265,414

Additional imports: Spain, carbons £442; New South Wales, meters £25, machinery £110; Canada, electrical goods £105, machinery £120.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	16,599	631	...	2,320	334	...	9,733	...	842	693	8,185	39,337

TOTAL EXPORTS: £554,769. TOTAL RE-EXPORTS: £39,337. TOTAL IMPORTS: £266,216.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE WINDING DIAGRAM IN THE WORKS.

By G. MOORES, B.Sc. Lond.

The object of this article is to show that A.C. winding diagrams might be made much simpler and more useful for works purposes than is at present the case by an extended use of what may be called the "group" type of diagram, of which fig. 1 is an example. Probably the clearest way of showing this will be to explain the diagram, which is already in use to a limited extent, first from the works point of view, and indicate the

Method of Using the Diagram.—Taking for the purpose of this article a particular example, we may assume the case of a four-pole, three-phase induction motor stator with, say, 60 slots, wound with two bars per slot pushed through and bent over at the ends of the slots to form a wave winding of the "barrel" type, all the conductors in each phase being in series, and the phases star connected.

A statement of the pitch of the winding, a standard direction of bending the bars outside the slots, and the dia-

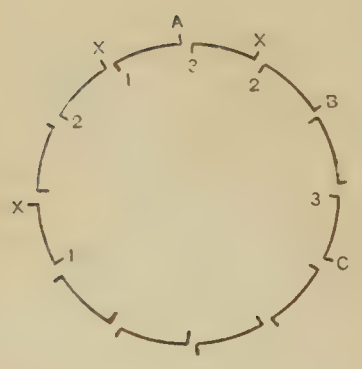


Fig. 1.



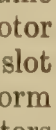
Fig. 2.

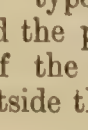
gram shown in fig. 1, are all that is necessary to enable the works to wind and connect the machine correctly. The procedure would be as follows :—

1. The bars would be inserted in the slots and bent in the standard direction to suit the given pitch. A view of either end of the machine would then show the ends of 120 bars arranged in two circles (fig. 2).

2. At the connection (or front) end of the machine, these bar ends would be divided into as many groups as there are lines in the diagram (fig. 1), *i.e.*, in this case 12. The division is shown by the broken lines.

3. The corner bars in each group would be lettered according to the diagram—as shown in fig. 2.

4. All the bars at the rear of the machine, and all the bars in the unlettered groups at the front of the machine would then be connected in pairs, a pair consisting of two bar ends on the same radius, with connectors of the form 

5. In each "lettered" group, the unlettered bars in the bottom row would be connected individually with the unlettered bars in the top row, as shown, either with connectors of the form  or by moving the upper bars radially over the lower bars and using the same kind of connectors as in (4).

After (5) there remains a number (in this case 12) of lettered bar ends, which must be connected by external connectors (cable, wire, or strap) as follows :—

6. The bars lettered from the beginning of the alphabet, viz., A, B, &c., are connected to the machine terminals.

7. All the other bars of the same letter or figure are connected together. Thus the three bars X are connected together to form the star point ; the two bars (1) are connected together ; the two bars (2) are connected together ; and so on.

The winding and connections would then be complete without reference having been made to any diagram except that shown in fig. 1.

In the case of small machines in which the external connections of (6) and (7) are of small wire or cable, fig. 1 is all that is necessary for the works. In the case of larger machines a working drawing may also be necessary to show the mechanical arrangement, method of support, and so on, of the conductors and external connections.

Method of Constructing the Diagram.—The above explanation has been given from the works point of view, and shows the simplicity of the procedure. The method of constructing the diagram is equally simple, being as follows :—

1. Sketch out the usual round type of diagram for one phase only and for two conductors per pole, as in fig. 3.

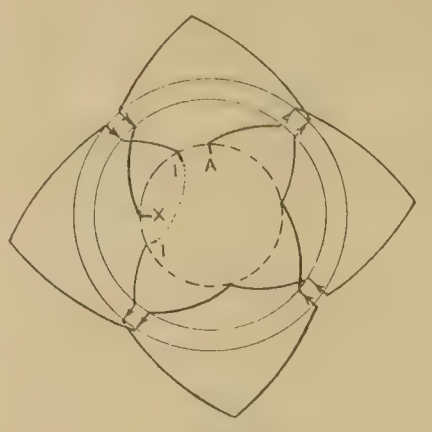


Fig. 3.

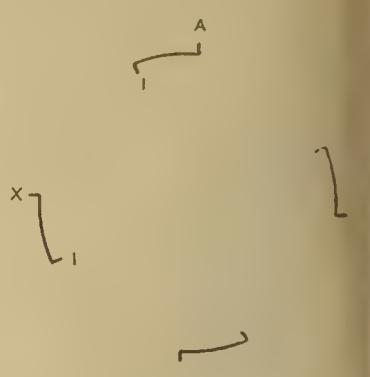


Fig. 4.

2. Letter the beginning of the winding A, the end X, and mark with the same figure (in this case 1) the intermediate points which are joined together by an external connector (1-1 shown dotted).

3. Draw a number of arcs of a circle equal to the number of poles, and letter the arcs to correspond to the letters in fig. 3, thus :—

4. In fig. 3 the marking on the circuit (following the circuit round in the direction of the arrows) is A-1-1-X. Similarly phase 2 may be marked B-2-2-X, and phase 3 C-3-3-X. Then superimpose on fig. 4 two other similar figures for phases 2 and 3, and the result will be the complete diagram, as in fig. 1. It will be noticed from the figure that this must be done in such a way that the three phases begin (at A, B and C respectively) on three alternate groups the phases will then be 120° (electrically) apart.

Principle of the Diagram.—The principle on which this simple diagram is constructed may be understood by reference to fig. 5, which is the complete diagram of one phase of the winding represented by fig. 1, viz. :—Four-pole, three-phase

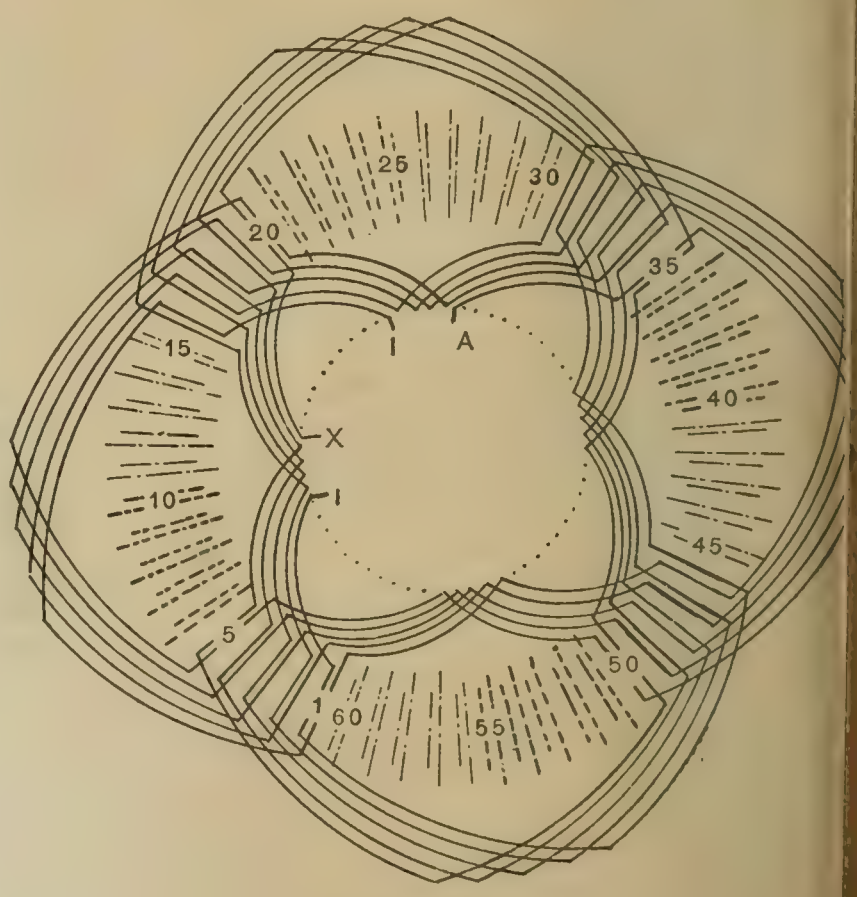


Fig. 5.

60 slots, 2 bars per slot, wave, Y connected, barrel windin
It will be seen that the ends of the bars (touching t
innermost circle) are divided into four groups (= number
poles) which are represented by the four arcs in fig. 4, a
with all three phases in there would be 12 groups, whi
are represented by the 12 arcs of fig. 1. The ends of t

groups to which external connections are made are marked in the diagram as follows :—

The letters A, B and C indicate the terminal connections ; the letter X indicates the star point ; and the figures indicate the bars which are joined together, 1 being joined to 1, 2 to 2, and so on.

The relative position of this marking (which shows the connections) is what the works requires to know, and this relative position is shown by fig. 1. The principle is, therefore, that one line is used to represent one complete group of coils (or conductors) and the lettering and figuring of the lines indicate the connections between the groups.

Hence, if the pitch of the winding is stated, and a standard direction of bending the bars adopted, fig. 1 is sufficient, as far as diagrams are concerned, for the machine to be correctly wound and connected.

Advantages of the Diagram.—Many advantages are at once apparent, and others are seen on examination of the working of the system. In the first place, the group diagram is obviously cheaper to make and less liable to contain error when made than the ordinary diagram of fig. 6, which is the one generally used, or the even worse diagram (to make) of fig. 5. Secondly, one diagram of the group type covers a larger number of cases than the full diagram, for whereas the latter varies with the number of slots per pole and the number of conductors per slot the former does not. In the case of the wave winding a modification of fig. 1, as shown in fig. 7, would cover all cases of three-phase, Y connected

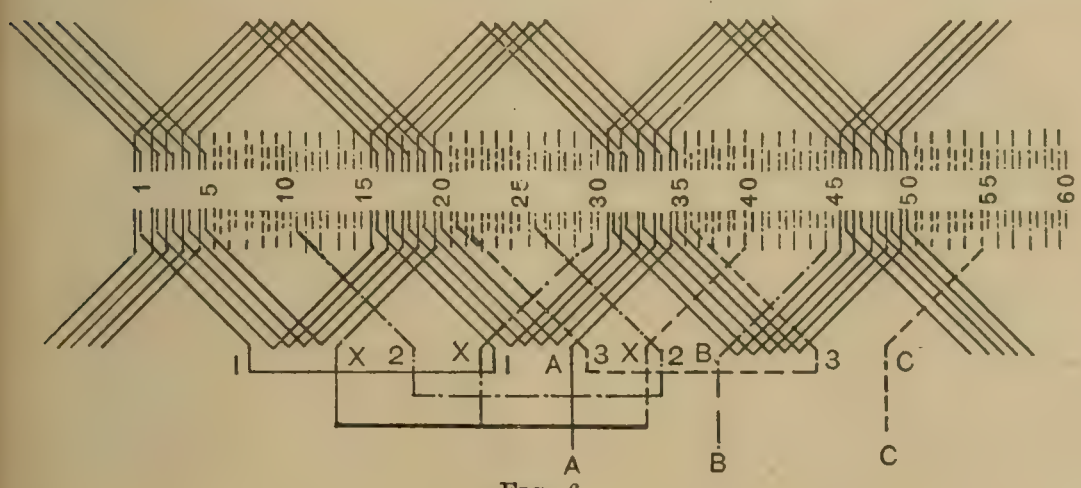


Fig. 6.

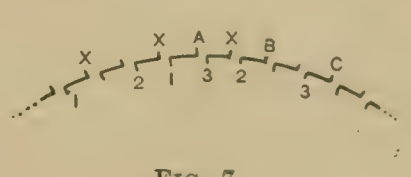


Fig. 7.

windings, in which all the conductors per phase are in series, not varying even with the number of poles.

Although fig. 7 would suffice, from an electrical point of view, for all cases, it would probably be found advisable for mechanical reasons to spread the terminal groups out a little more in the case of machines of, say, 10 poles and over, and to use a second diagram to represent these.

Thus the one diagram of fig. 7, with perhaps another similar one, would suffice for the works in place of scores of the type of figs. 5 or 6, as at present generally used.

Another advantage of the diagram of fig. 1 can be seen by comparing it with fig. 2. The latter may be considered as a drawing to scale of the end connectors of all the bars, therefore in the case of the bar-wound machine *fig. 1 is a drawing to scale, showing the actual relative position of the bar ends which have to be connected by external connectors.* The laying out of a working drawing of these external connections, and the calculation or measurement of their length, are therefore much simpler from fig. 1 than from fig. 6 (which is more often used than fig. 5).

The group diagram also gives less opportunity for error in the shops, for it is easier to read and it has no reference to slot numbers, the tracing of the winding from slot to connector being unnecessary. The practical importance of this advantage is apparent when one calls to mind the number of cases which occur of machines being wrongly connected even when diagrams are correct.

General.—The particular example used to illustrate this article is only one type of winding, but, with modifications, the same type of diagram could be used for all A.C. windings (except a few special cases)—one, two, or three-phase, wire or bars, wave or lap winding, stator or rotor, "barrel," "chain," or "concentric" types. The diagram is already in use for lap windings of the barrel type and of the basket or chain type, and also to a small extent for concentric windings, but it has not been used, as far as the writer is aware, for wave windings, where its use would effect the greatest saving. For that reason the particular case of a wave winding has been chosen for this article.

Group diagrams bear about the same relation to diagrams of the types of figs. 5 or 6 as working drawings to perspective views ; while the latter may be useful for text-book and similar purposes, they are obviously unnecessary for general use in the shop.

ELECTRICITY AS A BY-PRODUCT.

By R. J. Spencer-Phillips.

(*Abstract of paper read before the* Institution of Municipal Engineers, *November 7th*, 1913.)

It is my object to point out shortly the various reasons why electricity can be sold by concerns whose main product has no connection whatever with electricity, and what use might be made of this fact by municipalities.

In the running of a power station, one of the chief objects to be aimed at is to secure a good "load factor." Usually the full output is only maintained for a very short portion of the 24 hours ; at other times the plant is running with a small load, and hence uneconomically as regards steam consumption and maintenance. In the case of a station with a bad load factor, a plant with a capacity double, and sometimes treble, the average output of the station has to be installed in order to be capable of dealing with the maximum demand, involving a correspondingly large capital cost.

The majority of the numerous mills and factories of all sorts scattered throughout the country run night and day, and have a load factor of from 60 per cent. to 80 per cent., which compares with the average supply company's load factor of 20 per cent. In the case of fairly large mills, they find, by putting down their own plant, they can produce electricity at about 0·35d. per unit, including all capital charges—a figure which is far below the average cost of production as given in the technical Press for various supply companies.

Some time ago my firm were called in to advise a certain mill, situated in a country district, as to what they could do to economise their coal consumption. They had at the time three mill engines, driving by means of ropes and countershafts. We put before them the following table, the figures being taken from those supply stations whose average load was comparable, as nearly as possible, with the average load of the mill station :—

	Average cost per unit from existing stations 20 % L.F.	Cost per unit 700-kw. mill station 80 % L.F.
Coal	·3d.	·175d.
Wages	·2d.	·025d.
Oil, waste, stores, &c. ...	·02d.	·006d.
Repairs and maintenance ...	·15d.	·048d.
Rent, rates, taxes	·15d.	·024d.
Total running cost ...	·82d.	·278d.
Management, offices, &c. ...	·3d.	Nil
Int. 4 % on £15,000 ...	·12d.	·038d.
Dep. 5 % on £15,000 ...	·15d.	·048d.
Total cost	1·39d.	·364d.

This table clearly shows that the total running cost of a station with an 80 per cent. load factor is, approximately, one-third the running cost of a station with a 20 per cent. load-factor.

The capital outlay in the above table is taken as being the same in each case, but in the generality of cases the power station would cost considerably more than the mill station, first, because, as previously mentioned, a larger plant would be required, and, secondly, because in the case of a mill very often use can be made of the existing engine room, thus dispensing with the cost of an entire new building.

We eventually put down for the owners of this mill a complete turbine-driven plant, comparable in every way with an electric supply station. As a result, the figures given were closely realised,

and the coal and repair bills were reduced by approximately £4,000, which was equivalent to a saving of just over 45 per cent.

The owners found that they could actually produce current at something like 0·35d. per unit, and that there were other mills not far off willing to pay enough for their supply to ensure the owners of the plant a good profit.

Therefore, being business men, they were not slow in putting two and two together, and now, with a slightly larger plant and larger output, they are able to run even more economically, and to sell their surplus energy as a by-product, and at a profit.

Thus, here we have an instance of an already prosperous concern making an additional profit entirely outside its normal line of business. Clearly, it would have paid the local authority to erect a power station at one of the mills, having these mills as its chief source of revenue, and undertaking the local lighting and power supply as an additional source of revenue. Here, then, is a field open for municipal enterprise. Where steam is required for heating purposes, a reducing turbine can be installed. The reducing turbine has a low-pressure stage enabling the steam either to exhaust to the heating system or to pass through the low-pressure stage to a condenser according to the heating requirements, and at the same time supply a constant electric load. This type is installed where the electrical requirements are in excess of the heating steam requirements.

In a number of mills the heating steam requirements are largely in excess of their power requirements. Supposing a market could be found for electrical energy, the total steam required could be raised to a high pressure and first utilised in back-pressure turbines, where the maximum amount of electricity possible would be generated. By this means the cost of production would be extremely low. A supply of electricity would be available for all the requirements of the mill, and there would be a large surplus of energy on the sale of which a very considerable profit could be made. An example of this kind appeared only a short time ago in the technical Press. I refer to the Salt Union Works at Winsford.* Here it was early realised that the amount of electrical energy available from the steam required for the process would be far in excess of the requirements of the works. Steps were therefore taken to obtain provisional orders for the Urban District Council of Runcorn and the town of Widnes. The total capacity of the plant now installed is two Browett and Westinghouse 725-KW. back-pressure reciprocating sets and two Browett & Westinghouse 1,500-KW. reducing turbines. This example shows very clearly what can be cone in this direction.

It is evident that wherever there are situated any mills or factories, in however small a town or district, such a place possesses great possibilities with regard to the production of electricity at a low cost. In these cases, therefore, it would appear an eminently sound policy for the local authority to undertake the supply of electricity, and, if possible, by entering into some form of agreement with the owners of the mill in question, to put down the necessary plant actually in the mill itself. There is then the course open of either installing an up-to-date boiler plant with back-pressure turbines, and selling both electrical energy and low-pressure heating steam, or if, as may well be the case, the mill already has a suitable boiler plant, an arrangement may be agreed upon by which payment is made for the use of the steam between 150 lb. pressure and 30 lb. pressure, or whatever the required range may be. The electrical energy produced by this steam is then sold, and the steam itself returned to the mill at the required back pressure.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 773.)

BELOW are continued brief particulars of the different electric devices for the starting of the petrol engines and motor cars as displayed at the Motor Show at Olympia, which was brought to a successful conclusion on Saturday last.

The Brolt.—Still another new independent electric starter is that of Messrs. Brolt, Ltd., of Princip Street, Birmingham, the makers of the lighting set which bears their name. Interest in the system, which was exhibited by Messrs. Brown Bros., Ltd., the sole selling agents, lies in the means adopted of sliding the driving pinion into and out of mesh with a toothed ring on the engine fly-wheel. This is a problem on which much thought has had to be centred, and which has resulted in the evolution of a number of methods, some more or less complicated. The Brolt certainly strikes one as being one of the simplest and most effective that has so far been produced. The spindle of the armature is extended, and has cut on it a spiral thread; the driving pinion, which has a similar internal thread, is loose on the spindle. The arrangement may be compared with that of the familiar small Archimedian-screw hand-drill. Thus, when it is desired to start the engine, the current from the battery is switched on by pressing down a pedal; the instant the motor-spindle begins to revolve it automatically draws up the pinion into mesh with the toothed ring, the pinion, owing to its own inertia, not being revolved—and consequently not acting as a driver—until it is completely wound-up and in full engagement with the ring. As soon as the engine starts and attains a speed in excess of that which the motor can impart to it, the driving pinion is thrown automatically out of gear. Some fear has been expressed that the vibration resulting from the car travelling over bumpy roads may cause the driving pinion to have a slight movement along its spindle, and so bring it into touch with the toothed ring on the fly-wheel, to the detriment of its teeth; but this is a possibility—one will not say a probability—that can readily be overcome, while the fact that no levers or other mechanism are necessary to bring the pinion into engagement is a decided advantage. The motor, which works with a 12-volt current, is stated to be capable of starting four-cylinder engines up to 100 mm. bore, it being capable of developing 0·8 H.P., and of revolving the crankshaft of such an engine at 100-120 R.P.M. Another pattern is also made, in which an epicyclic reducing gear is incorporated with the motor; in this case the drive to the engine is by means of a V-shaped fibre wheel, which engages with a corresponding groove formed on the fly-wheel.

The Rushmore.—As it is proposed to fully describe the Rushmore electric starter, introduced by Rushmore Lamps, Ltd., London, in an early issue, it need only now be mentioned that it is essentially a series-wound motor, arranged to deliver for brief intervals only a maximum output of power; it is of the ironclad type, with four poles and an equal number of brushes. Interest in the system lies in the means adopted of bringing the driving pinion into and out of engagement with the toothed ring formed on the periphery of the engine fly-wheel.

The Rotax-Leitner.—The Siddeley-Deasy Motor Co., Ltd., Coventry, are adopting an electric starter on their 1914 cars; the arrangement, while acting on a toothed ring on the engine fly-wheel, differs in several ways from those that have already been dealt with. The motor, a Leitner, is located to the left, and rear of, the engine; its spindle is prolonged through the medium of a leather flexible joint, there being mounted on the end, a slidable sleeve carrying a small gear pinion which can be moved in and out of engagement with the fly-wheel. It is in the control gear that the novelty of the arrangement mainly lies; this is done by the usual clutch pedal, so that a separate pedal is not required. Normally, the clutch pedal is out of engagement with the starter, but by releasing a trigger on the dashboard, the pedal is, by a catch device operated through Bowden wire, brought into connection with the system of levers, by which the motor pinion is laterally moved. A further lever, linking up to the switch, is also provided in conjunction with the system, so that to start the engine, it is only necessary to move the dashboard trigger and press the clutch pedal down, the two operations of meshing the driving pinion and switching on the current following in quick succession. As soon as the engine starts, the motor pinion is moved out of mesh by simply releasing the clutch pedal for an instant.

The Disco.—Another example of the separate unit system is seen in the Disco, which was made by the company of that name, of Detroit, U.S.A., and which was shown on an Arrol-Johnston car. The drive is of the fly-wheel variety, the motor being a 12-volt machine of the two-pole, series-wound type, with the fields and pole-pieces in one casting. The makers state that the machine has no peculiar features, simply following good electrical practice, departing only in the matter of an extremely large factor of safety in the design of the bearings, brushes and commutator. A spur reduction gear is incorporated with the motor; the switch is so arranged that simultaneously with the sliding into mesh with the fly-wheel toothed ring, the motor is slowly rotated, the full power not being switched on until the wheels are in full engagement, a resistance coil being employed to give the slow motion. It is claimed that the motor can turn an engine at from 110 to 150 R.P.M., it being capable of developing a maximum of 2·2 H.P.; its weight is given as 37 lb., and its maximum efficiency as 77 per cent. The usual roller clutch is provided in conjunction with the driving pinion, so that the engine can overrun the motor after it has started up, until the pinion is disengaged from the fly-wheel.

The Bijur.—The Bijur electric starter, found on one of the Arrol-Johnston cars, is made by the Bijur Motor Lighting Co., of New York. It is very similar to the Disco and other types already alluded to, being connected to a toothed ring on the fly-wheel through a reduction gear, roller clutch, and sliding pinion.

Starting is accomplished by pressing a pedal which is connected by a lever to the motor-starting switch, and to a trunnion on the roller clutch shaft. Normally a spring holds the motor switch open and the pinion out of mesh with the fly-wheel. Depressing the pedal operates the switch and connects the battery to the motor through a resistance; the motor, therefore, rotates at moderate speed, ensuring a proper mesh between the pinion and the fly-wheel teeth, after which the resistance in series with the motor is cut out of circuit, leaving the motor connected directly across the terminals of the battery. The motor then spins the fly-wheel and after the engine starts a spring returns the pinion and switch to their original positions. This system is made to work with either 6 or 12-volt batteries.

The Westinghouse.—Although the Westinghouse Co. are making various equipments for motor cars—combination lighting and ignition, and combined lighting and starting—they are also manufacturing sets of the separate unit type, and it is the latter only that one found at the Show, this being on the Hupmobile (American) cars. Confining attention to the starting motor, this is of the "four-pole consequent pole" six-volt type, with only two field coils, the commutator and brushes being enclosed in detachable

* ELEC. REV., September 5th, 1913.

covers. The motor is located at the left side and drives a toothed ring on the fly-wheel by means of a double reduction gear. The short intermediate spindle carries two pinions, one of which is fixed, while the other can, by a system of levers, be slid into engagement with the fly-wheel. The sliding pinion is controlled by a pedal, with which the starting switch is connected, one motion of the pedal being thus all that is necessary. The switch is provided with preliminary contacts, which are engaged before the sliding gear is moved, so that by the time the gears begin to mesh the motor has commenced to run slowly, this greatly facilitating the meshing operation. The full current is only admitted to the motor when the gears are in full engagement, thus preventing damage to the teeth. The wiring is of the earthed return type, with the exception that a full copper return to the battery is used to minimise the drop in the voltage when the

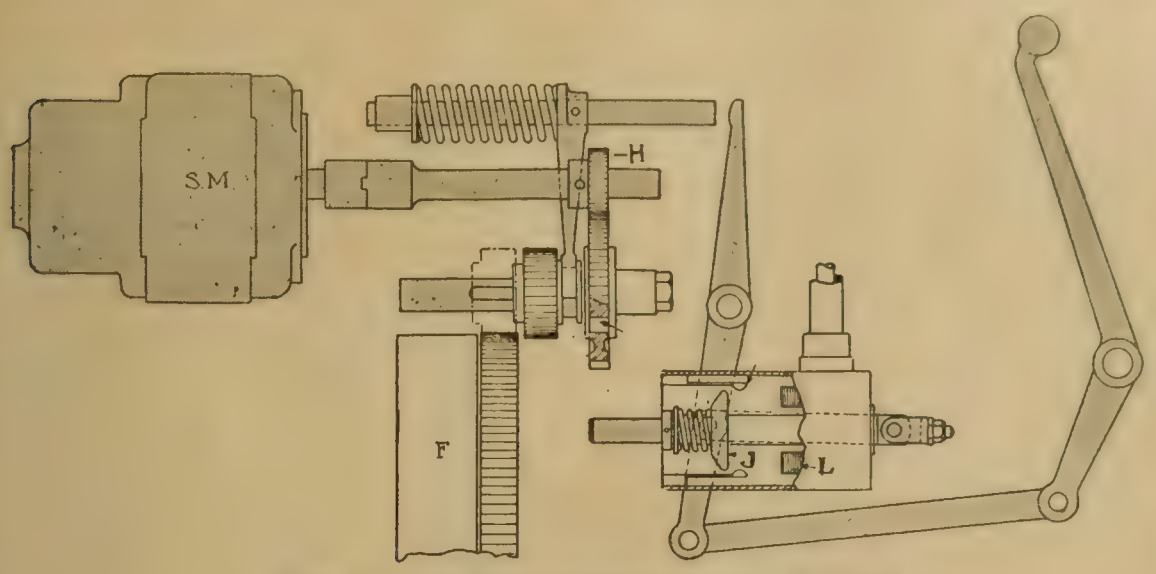


Fig. 4.—The Westinghouse Engine Starter.

starting motor is in operation. A roller free-wheel clutch on the intermediate shaft, allows the engine to over-run the motor, as soon as the former commences to run under its own power, the current to the motor having then to be switched off.

The Remy.—Still another example of the separate unit installation was found on the Mitchell cars, built at Racine, Wis., U.S.A., which are fitted with ignition magneto, lighting dynamo and starting motor, all made by the Remy Electric Co., of Anderson, Indiana. The series-wound motor, which takes current at 6 volts, has a pinion which can be brought into and out of engagement with a large pinion, formed not as usual on the fly-wheel periphery, but separately mounted on the shaft between the clutch and the gear box. The controlling pedal has two movements, the first of which brings the gears into mesh and the second switches on the current, a roller clutch enabling the engine to over-run the motor as soon as the former commences to run under its own power.

The Gray & Davis.—Another American separate unit starter is the Gray & Davis, made by the company of that name, of Boston, U.S.A., and shown on the Overland cars. It works at a pressure of 6 volts, and is connected to the engine either by a direct chain drive to the crankshaft, or through the medium of a pinion which can be brought into mesh with a toothed ring on the fly-wheel, the first movement of the controlling pedal being to mesh the gears—a small current is allowed to pass to the motor to assist the operation—and next, the switching on of the full current. Two sizes of this machine are made, both being designed for a working speed of 1,500 R.P.M., the ratio of the pinion and the fly-wheel ring varying from 15 to 1 to 20 to 1. It is stated that on the average from 80 to 120 amperes are used in starting up an engine. The motor is protected against being driven by the engine, when it commences to fire, by an over-running clutch which is applied to the gear train between the motor and the fly-wheel.

The S.E.V.—A French electrical starter, known as the S.E.V., was shown fitted on a 40-H.P. Berliet car. So far I have not been able to secure any particulars of the machine, but, as exhibited, the principal feature is the fact that its location on the chassis has been carefully studied—a remark which also applies to the lighting dynamo by the same makers. The motor is constructed in conjunction with the gear box, one of the pinions of which it drives through worm gearing. As distinct from all other systems, there is, in this case practically nothing to see, everything being enclosed. The machines are being manufactured by the Société d'Eclairage des Voitures, of Suresnes, Paris, which has, I understand, been formed by a syndicate of leading French motor-car manufacturers to acquire certain rights held by the Thomson-Houston Co.

The Magician.—Two other electric starters, one being a separate unit and the other combined with a lighting dynamo, are being introduced by the United Motor Industries, Ltd. They are of French design and known as the "Magician." As, however, at the time of writing, I have not been able to obtain full particulars of the machines, a description must, for the moment, be deferred.

Combination Lighting Dynamos and Starting Motors.

The Delco.—A leading place in the list of combination machines must be given to the Delco, made by the Dayton Engineering Laboratories Co., of Dayton, O., U.S.A., by reason of the fact that it may be termed the pioneer appliance of the kind, this being the second year that it has been shown as a standard part of the equipment of the Cadillac (American) and Lanchester (British) cars, while it is also now being employed on the Hudson (American) vehicles. Interest in the arrangement is also increased by the fact that it is the only one that serves the triple purpose of car lighting, engine starting and ignition. The machine is of the compound-wound type, with fields in two sections, multiple-wound for charging the battery, and series-wound for use as a starting motor, the same armature being used for both purposes. There are two sets of gearing to the motor, one of which is direct from the timing gears as a generator drive, and the other a reduction gear to the toothed fly-wheel of the engine, for use as a motor in starting. A controller forms an important part of the outfit, this consisting of a number of switches, so arranged that at one position the battery is wired to the series winding of the generator, converting it into a motor, and in the other in multiple to the four sets of cells of which the battery is composed to the multiple winding of the generator, for charging. A differentially-wound automatic cut-out breaks the charging circuit when the speed of the engine, and consequently of the generator, falls too low to overcome the voltage of the battery, thus preventing the latter from discharging itself. The battery consists of 12 cells, arranged in groups of three, of 6 volts each; they are normally wired in multiple to the generator, which charges them at 6 volts, and to the ignition and lighting system, to which the battery discharges at the same pressure. For engine starting, however, the battery current is taken in series at 24 volts. The first function, that of ignition, is accomplished by taking the current from the controller as a primary current, and inducing a high-tension current with it in a single-unit induction coil, which high-tension current is distributed to the sparking-plugs of the engine by a gear-driven distributor, included in the generator group. The second function—lighting—is accomplished by taking current from the controller at 6 volts, and conducting it through a lighting switch to the individual set of lamps, in parallel. The engine starting function is accomplished by switching the current from the battery back through the generator, in a series winding, distinct from the multiple winding employed for charging. For engine

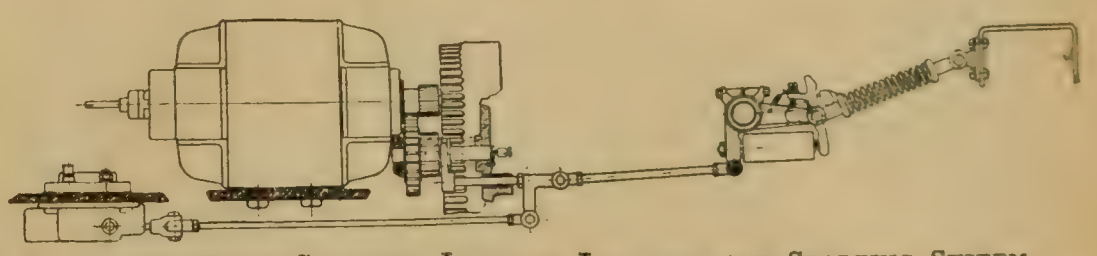


Fig. 5.—The Delco Combined Ignition, Lighting and Starting System.

starting, the clutch-pedal is pushed out, with the ignition retarded. This operation meshes the reduction gears of the generator-motor with the toothed fly-wheel, and moves the controller to the position wherein all the cells of the battery are in series to the series-winding of the dynamo, at the same time operating the starting clutch, which locks the starting mechanism fast to the clutch-pedal. When the engine responds, the ignition is advanced, and the pedal released, whereupon the controller is again shifted to its normal position. The latter operation is, on the latest pattern, effected by one of the motor brushes, which is so arranged that when the clutch pedal is pushed forward in the act of operating the starter the brush is brought in contact with the motor commutator. As soon as the engine starts, and the clutch pedal is allowed to come backward, the brush is lifted from the commutator to a position where another contact is made, thereby bringing the generator into operation. Another modification in the latest arrangement is the adoption of an earthed return for the wiring system, thus reducing the amount of wire by about one-half. There are many interesting features in the Delco system which it is impossible to deal with on this occasion. At first glance, the system may appear complicated, but that this is more imaginary than real is indicated by the fact that the only trouble experienced by the Cadillac Co. was in connection, not with the electrical machine, but with the accumulators, and this trouble having now been overcome, no further difficulty has arisen.

The T.A.T.—Another example of the double-purpose machine is seen in the T.A.T., which is the result of two years' experiment by Messrs. Tattersall & Tattersall, consulting engineers, who have made over the sale of the sets to the Imperial Motor Industries, Ltd., London, by whom it was exhibited. The machine is a compound-wound combined dynamo and motor. When working in the former capacity, it has an output of 250 watts at 12 volts, and, by means of a special arrangement of the field windings, the output is claimed to remain absolutely constant, irrespective of engine speed, *i.e.*, when the minimum speed necessary for charging the cells has been attained. The armature case is of the slotted type, while the field coils are former wound. There being no electrical circuit-breaker, a free-wheel clutch is employed; this being incorporated in the driving mechanism, its purpose being to allow the armature of the dynamo to be free-wheeled by the reversal of current from the battery in the event of the circuit not being broken when the engine stops, or when its speed falls below the

rate necessary for balancing the voltage of the battery. Enclosed in the driving end of the casing is an epicyclic gear which is automatically brought into action when the machine is to be used for starting purposes. The closing of the circuit by means of a push-button on the switchboard first excites a solenoid, which locks the drum carrying the planetary pinions of the gear, by means of a pawl and toothed rack cut upon its periphery. The motor then drives the engine through the epicyclic reduction gear, this continuing until the engine starts, when the motor being relieved of load, the current passed is insufficient to hold the pawl in position. The latter is, therefore, automatically released, even should the starting-button be kept depressed, and the motor is then run as a dynamo, and commences to again deliver current to the battery. The two end covers of the

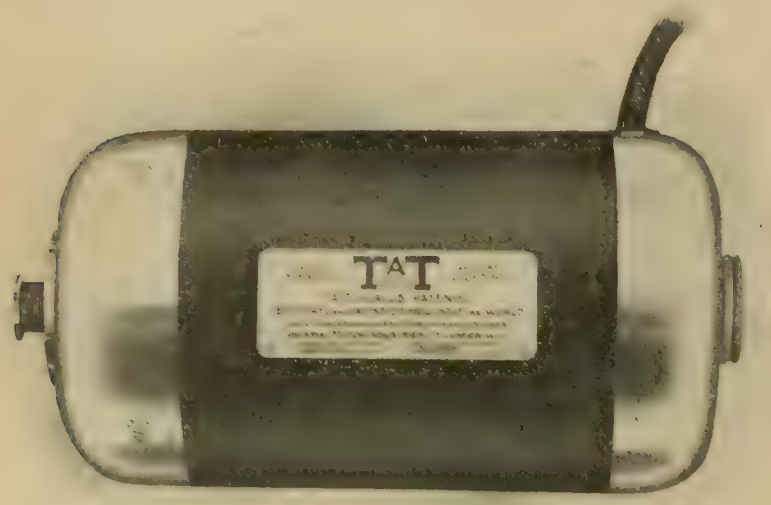


Fig. 6.—T.A.T. Combined Lighting Dynamo and Engine Starter.

machine are detachable, the removal of one exposing the brushes, and of the other the epicyclic gear, which gives a large gear reduction and high torque for starting, and a small reduction for driving as a dynamo. The gear ratio is adjusted according to the size of the engine to which the appliance is to be fitted, the example displayed having a 14 to 1 gear for starting, and 2 to 1 for charging. The only connection with the engine is a silent chain connecting the crankshaft with the spindle of the dynamo-motor. The charging switch has three positions, namely, "Off," "Half Charge," and "Full Charge." The intermediate position cuts out part of the field windings of the dynamo and the generator then delivers only a small "soaking" current to the batteries. "Full charge" only requires to be used when all the lamps are alight. With the charging switch in the "Off" position the armature runs



Fig. 7.—T.A.T. Machine with End Covers Removed.

idly without absorbing any power, as the winding circuits are all open and no current is generated. Furthermore, it is claimed that, should the engine be stopped with the charging switch on, no harm would take place, as it would take about 50 hours to run the batteries down under these conditions, while the slight noise of the machine running would warn the driver before he left the car. It is stated as a testimony to the reliability and efficiency of the apparatus as a starter that it can give not less than 200 starts without reducing the battery current below the critical mean. It is also claimed that this machine is capable of starting the largest engines, both four and six cylinder, from cold against full compression, and with magneto ignition alone. It weighs complete about 120 lb., inclusive of the battery, switch box and lamps, while its lighting capacity is described as being much beyond normal requirements, even for an interiorly-lighted car.

(*To be continued.*)

Morocco.—Since May, 1911, a detachment of telegraphists has connected all the military stations with either wireless telegraphy or landlines, the latter exceeding 2,000 km. in the aggregate.

INSTITUTION OF ELECTRICAL ENGINEERS.

Scottish Local Section.

At the opening meeting for the session, held in Glasgow on Tuesday, 11th inst., the new Chairman, Mr. J. A. Robertson, chief electrical engineer to Greenock Corporation, gave an address on the subject of "Recent Progress and Limitations in Electrical Development." The author pointed out that they were passing through a period of extremely rapid development in the multifarious applications of electricity, and questions which appeared but a few years ago to be in the domain of pure speculation were now claiming attention as practical problems waiting for solution in the near future. The efficient utilisation of the natural fuel resources of the country by concentrating the generating plant in large central stations and transmitting energy over areas extending to hundreds of square miles, the abolition of the smoke clouds which disfigured and polluted our cities and towns, the electrification of our railway systems the possibility of replacing existing systems of motor traction on our streets by cheaper, cleaner and safer methods, the application of electricity on a large scale to chemical processes, and its employment in the production of steel and iron, these were some of the questions which would claim attention from the electrical engineer within the next few years. The possibility of concentrating power generation in large central stations was primarily due to two causes—first, the improvements made in the steam turbine during recent years; and, second, the development of high-pressure polyphase systems of transmission. In his opinion a modern power station equipped with water-tube boilers and steam turbines represented practically the limit of economy, so far as present knowledge went. A 5,000-KW. turbo-generator would deliver a unit of electricity at its terminals for about 13¼ lb. of steam at 550° F., with a 28-in. vacuum at the condenser, while a 10,000-KW. set might bring the figure down to 12½ lb. This appeared to be the limit of economy in the existing state of progress, and it was possible to supply energy from central stations under these conditions at rates cheaper than any private user could generate it for himself. But this only meant an overall thermal efficiency in the station of about 15 per cent., 30 per cent. being lost in the boiler house, 5 per cent. through friction and radiation, and 4 per cent. in generating losses, while the remaining 46 per cent. was rejected in the form of heat to the condenser. To improve the efficiency of the turbine, they required to increase its range of temperature by additional superheating of the steam, and the difficulties in the way of doing this would, in his opinion, be overcome. The advantages of the Diesel engine were next enumerated, but Mr. Robertson voiced the view that engineers would do wisely in confining themselves to a type of plant for central-station work which could be operated with coal—Britain's natural fuel—of which they had, and were likely to have, an abundant supply for many years; 4,000 H.P. appeared to be the present limit for single-stage gas-producer engines, and if they could combine the mechanical and operating advantages of the steam turbine with the thermal efficiency of the gas engine, they should have a much improved combination and might manage to raise their station efficiency from the present figure of 15 per cent. to something like 25 per cent. Turning to transmission, Mr. Robertson pointed out that transmission of energy by high-pressure polyphase current had become standard practice, and in view of the adaptability and efficiency of this system for all conditions it was hardly likely to be superseded. The use of polyphase low-pressure current for power purposes was also on the increase, and in the light of present experience it might be questioned whether central station engineers had acted wisely in adopting wholesale a three-wire transmission system which temporarily increased the economical radius of supply, but had since proved to be only a stop-gap between the low-pressure two-wire direct or single-phase current and the present system of high-pressure transmission. Reliability of supply and absence of breakdown either to the mains or to the wiring on consumers' premises were of primary importance, and from this point of view the simplest and most reliable system was undoubtedly a two-wire system of distribution with high-pressure transmission to sub-stations. The undertaking with which he was connected employed three-wire distribution partly from the generating station and partly from sub-stations, but on an extension to a neighbouring burgh now being carried out they proposed to use a two-wire distribution system throughout for power and lighting. In this case they had to deal with a number of consumers with demands ranging from 200 KW. up to 800 KW., some of them having private installations running at pressures from 200 to 250 volts. The position of these consumers enabled them to be grouped together on two sub-stations with short lengths of feeders, and on going into the matter he decided to adopt the pressure of 250 volts on a two-wire system for both kinds of supply. The additional expense involved as compared with a three-wire system for the same area was not more than 25 per cent. in this particular case, and he was of opinion that the saving effected in balancers and switchgear and the benefit of interchangeability between the power and lighting systems, combined with simplicity and safety, would fully compensate for the extra cost. Recent developments in the manufacture and use of storage batteries were claiming considerable attention, and in one large municipal station a battery capable of discharging 3,000 KW. on a one-hour rating had been installed. This was still a long way behind the sizes of batteries employed in lighting stations in America, where it was not unusual to keep a battery capacity sufficient to take the whole of the station load for short periods. The New York Edison Co. kept a battery of 11,000 KW.-hour capacity on a one-hour rating, which was capable of dis-

charging at 25,000 KW. for short periods. The use of such batteries was two-fold. They could be employed to deal with sudden demands and also the peak loads, and for this purpose might be compared with an equal capacity of generating plant. Their more important function was, however, to take up the load automatically in the event of a breakdown to any unit of the generating plant. From that point of view he thought that a large battery was justified. As to storage batteries, the chief limitation there was the use of lead for electrodes and acid for the electrolyte. Much had been done to improve the lead battery both mechanically and chemically, but many of the original defects still remained. In America much attention had been given to the storage battery for automobile purposes, and many of the defects of the lead battery appeared to have been successfully overcome. The greatest advance was undoubtedly the battery invented and perfected by Mr. Edison, after eight years' experiment. In this battery the lead plates were replaced by electrodes of steel and nickel, and an alkaline electrolyte was employed instead of acid. It combined comparative lightness with great capacity, and mechanical strength was attained without any reduction in efficiency. It could be discharged at almost any rate up to short-circuiting rate without apparent injury, and although it was advisable to charge at normal rates, it was possible to give the cells short "boosting" charges of half an hour's duration at five times the normal charging rate. The use of an alkaline electrolyte overcame many minor troubles such as corrosion of terminals experienced with acid batteries, and the mechanical arrangement of the electrodes and terminals was a great advance on former practice. At present it was somewhat expensive compared with the lead battery, and its use at first would be chiefly for automobile purposes. The makers claimed that when used on a taxi-cab service doing an average duty of 50 miles per day, the battery would propel the car 150,000 miles—practically a 10 years' life—without requiring renewals or mechanical repairs, and they were prepared to enter into a guarantee that after four years' use under all possible conditions of automobile service, the car would retain its original capacity. If these claims were substantiated, it appeared that they were at the beginning of a new development of automobile work which was bound to have a far-reaching effect on the electrical industry. They had had practically no experience of electric automobiles in this country beyond one or two half-hearted attempts which were made some years ago to run electric 'bus and cab services in London. On the other hand, there were in the United States over 20,000 electric automobiles in daily use, and over 40 firms engaged in their manufacture. The capital invested in the industry was £12,000,000, and the energy used for charging was estimated at 65 million units per annum. What opportunity was there for the electric automobile in this country? Compared with the petrol car, the advantages of the electric were simplicity of construction, freedom from repair, easy and noiseless running and better control. With electricity at 1d. per unit it compared very favourably for economy with petrol cars under present conditions. As the batteries could be charged at times convenient for the station, the load was one which most station engineers would be glad to supply at ¾d. or even ½d. per unit. The limitation of the electric car was, of course, its restricted radius of travel on a single charge. Even although charging stations were established over the country, this would still constitute a disadvantage to those who desired quick travelling over long distances. There was still an enormous field, however, for the electric car in cities and towns, where its advantages over the petrol car would be specially appreciated. The commercial electric car offered still greater possibilities for the use of secondary batteries. In this case the disadvantage of limited radius and moderate speed did not apply, and as an instance of what was being done with commercial electric cars, he stated that when he was in Paris on the occasion of the visit of this Institution last May, he took occasion to pay a visit to the municipal department, which was responsible for the collection of the city's refuse and its transmission to the destructors. He had an opportunity of examining and testing some 5-ton electrically-propelled refuse wagons, one or two of which had been in experimental use for nearly two years. One could not help being impressed with the superiority of the electric car for this class of traffic, and an order had been placed by the Paris municipality for 100 electric wagons, the idea being to replace gradually the whole of the horse-drawn vehicles used by the department, while several other Continental towns had decided to adopt the electric car for municipal purposes. There was a big field here awaiting electrical engineers in this country, and it was hoped that when this new branch of business was introduced they would go in for a complete system of standardisation from the beginning. Generally speaking, the outlook for the electrical industry was never more hopeful than it was at present. Electric lighting had passed out of the region of controversy, while the electric motor was rapidly superseding all other forms of power application. Another branch which had developed rapidly of late was electric heating and cooking. The convenience and cleanliness of electric heating constituted its unique advantages, and its limitation at present was purely a financial one. With regard to electric cooking, the position was still more favourable. The only exception at present was the difficulty of furnishing an adequate supply of hot water for all household purposes. In the meantime the best arrangement seemed to be a combination of electric cooking with a water heater fired by anthracite or coke. It was at least a debatable proposition whether their local authorities would not be justified, from the public health point of view alone, in selling electricity for domestic purposes even at a loss, in view of the tremendous benefits to be attained by abolishing the smoke cloud over their cities and towns.

Dublin Local Section.

AT the opening meeting at the ROYAL COLLEGE OF SURGEONS, Dublin, on November 14th, MR. J. MARSHALL HARRIS, M.I.C.E.I., the new chairman, read an address of which an abstract is given below :—

We have experienced nearly three months of the effects of labour unrest in our own city, brought about, not in the ordinary way by Trade Unionism as we heretofore understood it, but by Labour Unionism gone mad. Never, perhaps, was a more wanton strike called ; never was labour so badly advised and led, and never was a cause more grossly misrepresented.

Labour leaders should remember these common-sense laws of strikes :—

1. No strike can be ultimately successful in which the manner of its initiation or conduct alienates public sympathy. The public is stronger than any local strike, and will be found to be stronger than any general strike.

2. No strike for wages larger than the industry attacked can afford to pay, can be ultimately successful. You may succeed in the immediate object, but you ruin the industry and decrease employment.

3. Industries which can be transferred—will be transferred if labour conditions reduce profit unduly, or hamper the free action of employers, and so decrease local employment.

I believe that not a single person interested in the commercial prosperity of this city has escaped injury. The tramway company was early marked down by the labour agitators for violent attack, but, of all the concerns so marked, it is the one that has suffered the least.

If the industrial prospects are now brighter, unfortunately there will remain great losses to be recovered, and great suffering amongst those who have been out of employment, and still remain so, and quite uselessly ; but it is the earnest wish of this Institution that all outstanding differences may be settled in a permanent manner, and the old friendly feelings restored between the workmen and employers.

Apart from these troubles, the prospects for our profession are highly satisfactory. No doubt the Board of Trade regulations prohibiting the use of bare overhead wires carrying high potentials, have been largely responsible for keeping back the progress of electricity supply from large central stations over wide and thinly populated areas. These regulations are being steadily relaxed, and now municipal undertakings stand most in the way of expansion. They themselves are unable to go far afield, and their trading instincts prompt them to prevent anyone else from undertaking this work. But the great central power stations must come sooner or later, and the sooner the better for the country at large, and incidentally for the electrical engineer.

In traction work great progress has been made in the ever-increasing number of passengers carried. According to the last Board of Trade returns, there were 220 million more passengers carried than in the previous year. On the railways there has been a great falling off.

All the large undertakings, especially the older ones, are busily engaged in their workshops, redesigning their rolling stock to better meet the increasing demands ; the tendency being for larger cars, covered-in tops and faster running, which calls for more powerful equipments. Where new track is being laid, or old work renewed, the tendency is in the direction of heavier rails and more costly work all round, with the object of making the work as permanent as possible. In the overhead equipment and in the methods of distribution of electrical energy, very few changes have been made or called for in recent years. Phosphor bronze and other alloys are finding favour when replacing the trolley wires, originally of hard-drawn copper. A most important matter to both tramway undertakings and the public is the recent agreement of the Postmaster-General to use covered wires instead of bare wires in all cases where the Post Office wires cross the tramway overhead, so doing away with the necessity for guarding the trolley wire in such places with the cumbersome and dangerous network of steel stranded wires. In the generating station the increasing cost of coal calls for the engineer's more careful attention every day. The reciprocating steam engine is giving way to the steam turbine, but it still is doing excellent service in conjunction with turbines of the exhaust or mixed-pressure type. Engines of the internal-combustion type are no nearer finding a place in the large power stations than they were some years ago. Higher steam pressure and superheating to a degree far in excess of anything we have heretofore been accustomed to, are coming in ; the consequences cannot be viewed without apprehension, for the necessity for better material, higher class workmanship, more costly maintenance charges, and more careful attention will increase with the pressure and temperature.

In the boiler house there is more room for improvement than in any other part of the power house. The Bonecourt boiler, which is designed for gas firing, promises almost to revolutionise methods of steam raising ; it opens the door to all fuels, such as peat and sewage sludge, and while an efficiency of 92 per cent. is claimed for the boiler, valuable by-products can be recovered from the gas producer.

With cheap fuel, whether at the pit mouth, or in this country at the bog side, and with improvements in boilers or gas engines, and with a satisfactory single-phase A.C. motor, perhaps we may yet see electricity largely used in the cultivation of the land, and so become the means of solving a great economic difficulty in that direction.

In one very important direction we are working very much in the dark ; I refer to the money we are spending on the upkeep of

machinery, and the absence of records to enable us to judge better of the value we are getting for the expenditure. We usually class money spent in this way under the heads "Maintenance," "Repairs," and "Renewals." These terms explain themselves, but the difference between them is not generally understood. The object I have in view is to suggest a simple way of keeping records which will enable us to ascertain the value of each particular machine at any time as affected by the work it has done, and the money that has been spent on keeping it in order. If we can get this far, we shall also have a means for finding from our records when any machine has reached the end of its economical life. The system I propose involves the opening of an account for each separate unit or piece of machinery, and in these accounts the money spent on that unit is assessed as follows :—

Under maintenance put the cost of any minor parts that regularly wear out more rapidly than the whole, being common more or less to all machines of the same kind, such as re-lining bearings with white metal, new brushes for a motor or generator, &c.

Under renewals charge any part that is put in complete and which part puts the unit as a whole (making allowance for wear and tear) into the condition it would be in when the whole was new. It is not necessary that a renewal be always made with an absolutely new part. Credit would be allowed for a part taken out of a machine when that part either has a scrap value or is available for use again after repair. Under repairs must be put everything that is done other than maintenance or renewals. When a part that has been repaired is renewed, the cost of such repair no longer stands against the unit, and it is left out of consideration in arriving at its value.

In the accounts kept in the above form a very accurate analysis of the expenditure would exist. They would contain a record as to the amount of money spent on each unit and the direction in which it went.

A ready means for arriving at the actual value at any time would be provided by deducting the depreciation from the original cost and adding the scrap value, depreciation being arrived at in the following way :—

$$\text{Depreciation} = \frac{\text{Original cost of machine} \times \text{time working}}{\text{Life time}} + \left\{ \begin{array}{l} \text{Depreciation due to the nature of the repairs standing} \end{array} \right.$$

The original cost and the time working are figures available.

The life time if not settled would be arrived at in whatever way experience showed to be the best.

As to the Institution, I do not know what are the actual results of the recent changes in our constitution. The creation of the "graduate" class no doubt has already brought in, and will continue to bring in, many desirable men who otherwise would not have been reached, but I know that last year a number of men who sought admission and were offered the graduate class, refused it on the ground that the qualification lowered rather than raised their status and they were better without it.

We have followed the lead of the Institute of Civil Engineers in instituting entrance examinations; this is good, but we should go further, engineering is not legally a learned profession, it is a trade. The solicitor's clerk is not a solicitor; the apothecary's assistant is not an apothecary; the apothecary is not a doctor; the sexton is not in holy orders, and the mechanic who makes up sets of false teeth is not a dentist. They cannot call themselves such, they cannot act as such by law; but the plumber, the wireman, the engine driver, the commercial agent of a manufacturer, are all "engineers," and can, and do, act as engineers, and can, and do, recover fees as such, independent of qualifications. How can this be mended? There appears to be no use in relying upon the Institute of Civil Engineers, which appears to be an autocracy run from Westminster. Our Institution with its Local Sections and its more democratic organisation is more fortunately situated, and we had better rely upon ourselves. If there were no precedent it might seem hopeless to evolve order and create a profession out of the present chaos.

Fortunately we have in the Medical Act of 1858—barely 50 years ago—an example of how the thing not only can be, but has been, done. In that year the medical profession was in much the same state as the engineering profession is now—with no standard of qualification and no legal rights. In that Act no injustice was done to anyone then earning his living as a *bonâ fide* medical practitioner, and if we follow suit any Act sought by us must fulfil the same condition.

On August 2nd, in the year 1858, an Act of Parliament was obtained for the medical practitioners, so that "Persons requiring medical aid should be enabled to distinguish qualified from unqualified practioners," the effect of which was to raise the status of the profession of medicine and surgery, making it illegal for anyone to practise unless registered as the possessor of *bonâ fide* qualifications. The Act, after providing for the formation of a Medical Council and branches and the appointment of a Registrar, enacts (Sec. 15) that every person then possessed of certain qualifications described in the Schedule (*a*) shall upon payment of a fee be entitled to registration.

Sec. 18 provides that any person who was actually practising medicine in England before August 1st, 1815, or some 33 years before the passing of the Act, was entitled to registration upon making a declaration to that effect, while the Schedule (*a*) referred to, provided for the taking-in of everybody who had any reasonable qualifications for recognition.

Sec. 31 gives power to every registered person to practice medicine or surgery, or both, as the case may be, according to qualifications, and confers certain rights as to recovery of fees by law, but legalises such by-laws as may be made by any College of Physicians preventing its Fellows or Members from suing for fees.

The next section provides that only registered persons can recover fees by law.

Sec. 36 sets out the appointments that an unregistered person cannot hold. These include every public appointment that is of standing, such as physician or medical officer to the Military or the Navy or any public institution, friendly society, &c., while Sec. 37 enacts that no medical certificate will be valid unless signed by a person registered.

Sec. 40 enacts that any person who shall wilfully and falsely represent himself as registered when he is not, shall, upon conviction, pay a sum not exceeding £20.

Sec. 46 provides for persons practising abroad.

This early Act was amended twice in 1858 and once in 1862, 1868, 1873, twice in 1875, once in 1876, 1883, but this Act was repeated three years later. The last amendment Act is, I think, that of 1905, giving power to extend portions of the Medical Act of 1886 to the Colonies.

None of the subsequent Acts departed from the original purpose of the Medical Act of 1858; on the contrary, except that the powers were made to reach further, and ladies were allowed to qualify for registration (the Medical Act, Royal College of Surgeons of England, 1875), the subsequent Acts strengthened and further raised the status of the medical practitioner.

The Perjury Act of 1911 (1 & 2 Geo. V, Cap. VI), Sections 6, 7, and 17, gives power to punish persons, aiders or abetters, &c., for making false declarations, by imprisonment or fine or both, in respect to attempts to procure false registration.

Before the year 1888 the dentists, like the early physicians, seeing that their profession was being encroached upon by unqualified persons, and those qualified were without any protection or distinction, got together, and as a result an "Act to amend the law relating to dental practitioners" was passed in that year. This Act is not so useful to the dentists as the Medical Act of 1858 to the doctors; it is, I understand, shortly to be amended, but to do this successfully now, and secure a useful instrument, no injury must be done to those already established.

The way to raise the status of the engineer is to make engineering a profession recognised by law. The way to do this has been shown us.

THE BRITISH STANDARD SPECIFICATION FOR CONSUMERS' ELECTRIC SUPPLY METERS.

In the discussion on Mr. Holden's paper (read before the Institution of Electrical Engineers in Birmingham on November 12th, 1913—for abstract see Electrical Review, page 810), Mr. R. A. Chattock said he thought that it was quite time that the specification should be revised and brought up to date, but he did not agree that frequent revision of the specification should be necessary, once every five years being quite sufficient. The only feasible way of ensuring that the best materials and workmanship were used was to require a long period of guarantee. The specification required one year's guarantee only for accuracy, and three years for defective material and workmanship. Five years should be the period required under all these heads, and if this was insisted upon it would ensure that the makers put the best materials and workmanship into their goods. Defects in meters very often showed up two or three years after they had been put to work. The consumption in the pressure circuit should not exceed 2 watts per 100 volts of pressure for both A.C. and D.C. meters. He agreed that the stipulation as to accuracy was too clumsy for ordinary use. An accuracy of within 2 per cent. up or down from full load to one-twentieth load for meters of 10 amperes capacity and upwards, and from full load to one-tenth load for meters below 10 amperes capacity, should meet the case satisfactorily. Meters should be accurate within 2 per cent. up or down for any power factor between unity and 0·25, and this should be the total allowable inaccuracy from whatever cause.

Mr. Fawssett agreed that the size specified for labels was too small; 3 in. by $\frac{7}{8}$ was a much better size, the holes being $\frac{1}{8}$ in. diameter and $2\frac{3}{4}$ in. apart. Clauses 12 and 13, if taken together, would, in a large power meter, require eight separate indices besides testing ones. Such a number was unnecessary, and tended to wrong readings. The author's emendations to Clause 16 were excellent. The 15 watts of the specification did not apply to large meters; more than that was necessary, and, moreover, was absolutely insignificant. The lower limit in Clause 20 might be less, and should be made to read as follows :—"The error of a meter shall not exceed 2 per cent. between full and twentieth loads, except that meters below 5 amperes capacity shall not be required to conform to this below ·25 ampere." Temperature errors were the most serious errors in many types of meter, and the least often tested for. All A.C. meters examined by the speaker were fairly good on this score, but most D.C. meters were truly terrible. A reasonably close guarantee for temperature would debar from compliance nine-tenths of the D.C. meters in use to-day, but yet something ought to be done. He suggested that Clause 28 should read: "A variation of 10° F. above or below the standard temperature shall not cause an error in respect of such variation of more than 1 per cent." To include polyphase meters and provide against some of their special sources of error, some new clauses were necessary. He suggested something on these

lines: "A meter intended to measure true power in a polyphase circuit shall be constructed on the 'two-wattmeter' principle and shall not show a greater divergence than 1 per cent. on reversing the direction of both current and pressure in either or both elements, and no more than 3 per cent. change between ·5 polyphase power factor current leading and current lagging." Pressure transformers for use with such meters must when supplied within 10 per cent. of their rated voltage and at the correct frequency give a ratio when loaded with the meters not more than ½ per cent. from the correct ratio. Under such conditions the phase angle must not exceed one-tenth of a degree. Current transformers for use with such meters must when loaded with the meters, and at the correct frequency, maintain their correct ratio to $\frac{1}{10}$ full load within 1 per cent. and to $\frac{1}{20}$ full load within 2 per cent., and the phase angle should not *exceed* 1° from full load to $\frac{1}{10}$ load, nor *vary* more than 1° between full load and $\frac{1}{20}$ load.

Dr. C. C. Garrard said he had found the specification of the greatest use, and Mr. Holden's suggestion that copies of the specification should be sent out with tenders was excellent, but the price of 5s. per copy was prohibitive. As regarded Clause 2, he would prefer a 2½-ampere size instead of a three-ampere size for both D.C. and A.C., as it was exactly half the size of the next larger, and it was very convenient to have this exact relationship. The 75-ampere size might well be deleted, and he did not consider it necessary to have both a 250-ampere and a 300-ampere size. An iron case had the great advantage that it magnetically shielded the interior, but it would be bad to exclude all other cases, for example, aluminium ones; these had the advantage of lightness, which was of great importance in the export trade. He thought the word "unit" was more easily understood by the general public than the words "kilowatt-hour." He strongly disagreed with the suggestion that manufacturers should be called upon to guarantee meters for five years. A motor or clock meter which would work well for one year would certainly, with proper attention, last 10 years or longer. A five years' guarantee might mean a very large expense to the manufacturer or a very small one, depending upon the care taken with the meter and the reasonableness of the user or supply authority, and in the long run the manufacturer would have to cover himself by considerably increasing the prices. With regard to current transformers, the maximum phase error allowed should not exceed ½°. The most serious blemish of the present specification was Clause 18, which fixed the insulation test. The clause as altered to his suggestion would be: "The insulation resistance between all the electric circuits . . . . and the case should be tested by the application of 2,000 volts (R.M.S) alternating-current pressure, having a sine-wave shape, for a period of 15 minutes without any sign of breakdown." The corresponding test pressure between the main circuit and the pressure circuit to be 500 volts A.C.

Dr. G. Kapp pointed out that there was a difference in the working conditions between a meter tested in the laboratory and the same meter in regular service at a customer's premises. This difference was recognised by the German rules, which allowed a greater error in the latter case. In the standard specification it was not stated whether the permissible error referred to laboratory tests or to the commercial use of meters. The important point was the performance of the meter in actual service; for this reason meters should be tested *in situ*, and in view of the disturbing influences, such as temperature variation, vibration, moisture, &c., to which meters might be subjected when in commercial use, it would be right to have two scales of permissible percentage error.

Mr. Taylor said that in the case of generator meters the points to be guarded against were errors introduced by the loads on the three-phase not being equally in balance, also those due to the varying power factors of the load. In the case of instruments on the feeders, there was the error introduced by the insertion of relays, ammeters, power-factor indicators and occasionally "trip" coils in the secondary circuit of the current transformers. This changed the ratio of the transformer, and thereby introduced errors. He offered clauses covering these points.

Mr. A. E. Jepson said with regard to Clause 2 that if the 2½-ampere size was made standard for single-phase meters, it should be made standard for D.C. meters also. The 75-ampere size should stand, for on a 200-volt D.C. circuit this equalled 15 KW., which was a very handy size, and on a three-phase circuit, with a line voltage of about 400 volts it was approximately equal to 50 K.V.A., which was also a convenient size. The author's statement that cases of soft metal or sheet jointed together were not used on the highest class of meters would be hard to uphold. Aluminium cases had been found to withstand all sorts of climates and conditions of humidity, and, when pressed in one piece, were quite strong enough for the ordinary usage which meters were subjected to. A cast-iron cover was likely to give a false sense of security. Clause 10 might very well be entirely deleted, for customers required various particulars to be contained on their labels. Riveting the labels on the covers was not quite satisfactory, as many Corporations were averse to breaking seals on meters until the guarantee period was past. The ordinary slow-moving roller type of cyclometer dial was in considerable demand, particularly by the smaller Corporations. The expression "unit" was better than "kilowatt-hour." In the case of very large meters, the last dial often read in tens, or even hundreds, of units, and the alteration to the clause might have included sizes above 200 units per hour.

Clause 16 was not very applicable to large meters, particularly of the shunted type, for the loss considerably exceeded 15 watts. Meters of the commutator type required at least 1 volt drop, and if a maximum of 0·75 of a volt were specified, radical alterations would have to be made to the design of meters of this type. In the case of shunted clock-type meters, at least 0·2 of a volt was required. With regard to the consumption of energy allowed, a distinction should be made between A.C. and D.C. meters, and it would probably be better to state the watts lost per 100 volts instead of taking the figure of 7 watts for a maximum of 65 volts.

Mr. S. James said there was a decided advantage in having a small number of standard sizes from every point of view. American standards differed from German, and both differed from the British standard specification. All were to be obtained in this country, and there were at least 20 so-called standards to be obtained below 100 amperes. A 2½-ampere meter was to be preferred to a 3-ampere, at any rate for A.C. meters, because a standard set of gears to fit 2½, 5 and 10-ampere meters all running at standard speed, would also fit 25, 50 and 100-ampere meters with no alteration but a change of dial. A 75-ampere meter was quite unnecessary, and so were the 150-ampere and 250-ampere meters. The three-terminal connection was out of date. The second part of Clause 6 should be altered to read: "Watt-hour meters, or meters having a pressure-circuit, shall have the terminals adapted for both the mains to pass through the meter." This would prevent the meter being tampered with, and render a joint on to the main unnecessary. A uniform method of connection would be an advantage. A label marked with the number of revolutions of the rotor in registering one unit was to be preferred. Clause 23 specified a test difficult to carry out satisfactorily, and the following was more practical: "The meter shall not be injured, and its accuracy shall not be permanently impaired by direct connection across the mains through a fuse of double the rated capacity to the meter." This test approached more nearly to service conditions than the specification test.

Mr. C. M. Shaw said that having had the benefit of investigating many of the finest organisations in America, he was particularly impressed with their superior methods of maintaining meters after purchase, which was more important than quibling about refinement of design. All seemed to work on common lines without duplication, and this was due in a large measure to their adopting a meter code. The development of the code was placed in the hands of the Electrical Testing Laboratories of New York, and many associations joined hands for the further development of the code. An active and representative Committee of operating engineers, and representatives of makers and testing institutions had the duty of considering developments in all branches of meter practice, and a report was presented by a chairman to the various bodies each year. Any improvements, after general approval, were incorporated in the code, thus bringing it up to date each year.

Mr. J. W. Melsom said that in view of the importance of large meters he hoped that any revision would not limit the size to 500 amperes, but would include all "Consumers' Electric Supply Meters." While cast-iron or pressed-steel cases were apparently quite satisfactory for small meters, he did not think they would do for large ones. With a short-circuit current such a case would be liable to become permanently magnetised and to make large errors in the subsequent meter readings. Mr. Holden's proposal to connect cables for currents up to 500 amperes by means of two screws clamping the cable into a hole was somewhat revolutionary. The suitability of such a type of connection for large cables should be very carefully considered. The I.E.E. Wiring Rules provided that all cables larger than 7/18 must be soldered to proper lugs for connection. Meter makers, almost without exception, provided for 500-ampere meters, either soldering sockets or flat surfaces to which copper strip could be bolted. The question of connections was of the greatest importance, and the meter specification in this respect should be considered in conjunction with the Wiring Rules Committee, and with reference to any existing specification such as for ammeters and voltmeters, so that substantially the same type of connections might be allowed for all classes of apparatus used in a permanent installation.

New Electrical Ironworks.—It is reported that the owner of the Ulefas Ironworks in Norway, Chamberlain S. W. Cappelen, has been granted a concession for the erection of a large electrical ironworks for the smelting of iron ore. The new establishment will be erected on the same property as the present ironworks. In the concession is also included permission for the transmission of the necessary electrical energy, which is to be derived from some waterfalls in the neighbourhood, which are now being harnessed. The Ulefas Ironworks is one of the ancient Norwegian works of the eighteenth century, which were all laid down about 1870, with one exception. The works has now, however, been in operation for some years, and an experimental electrical plant has been installed, which turned out 300 tons of electrical pig-iron in 1912. The results have been so satisfactory, that the owner has now decided on starting electrical smelting of iron ore on a large scale. The process employed is a Norwegian process, which is also used at the Tinfos Electrical Ironworks.

Radium Therapeutics.—Excellent progress is being made at the Cancer Hospital, London, in the application of radium to the alleviation, if not the cure, of cancer and allied diseases. In some cases complete cures appear to have been effected, while in others the morbid growths have been so greatly reduced that successful surgical operations have been rendered possible. A special department, in the charge of an expert physicist, has been equipped with the most delicate apparatus for research in connection with radium and the Röntgen rays; in this laboratory it is possible to measure one-millionth of a milligram of radium, and to detect the presence of $1/10^{14}$ milligram in water.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

New American Tariff.

The Board of Trade have now issued in Blue Book form a complete copy of the new tariff as signed by the President of the United States on October 3rd. The rates on electrical and similar goods under the new tariff are given below; for further information and for details of the rates under the existing tariff, which, by reason of extensive re-casting, cannot be tabulated satisfactorily, readers should see the Blue Book itself, which may be obtained from Messrs. Wyman & Sons, Fetter Lane, E.C., at a cost of 1s. 1d. The rates previously proposed were considerably modified immediately prior to the passing of the Act.

Mica, unmanufactured:	
Valued at not more than 15 cents per lb. ...	4 cts per lb.
Valued at more than 15 cents per lb.	25 % ad. val.
Mica cut, splittings, built-up mica, and manufactures of mica or of which mica is chief value	30 % ,,
Mica, ground	15 % ,,
Electrodes for electric furnaces, electrolytic and battery purposes, brushes, plates and disks ...	25 % ,,
Carbon manufactures not specially mentioned ...	20 % ,,
Carbons for electric lighting, wholly or partly finished:	
Made entirely from petroleum coke	15 c. per 100 ft
If composed chiefly of lamp-black or retort carbon	40 % ,,
Carbons for flaming arc lamps not provided for ...	30 % ad val
Carbon pots, porous, for electric batteries	15 % ,,
Structural iron or steel	10 % ,,
Ball bearings, &c.	35 % ,,
Iron or steel wire	15 % ,,
Telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials...	15 % ,,
Galvanised iron wire	15 % ,,
Castings of iron or steel not made up	10 % ,,
Wheels for railway purposes...	20 % ,,
Steam engines	15 % ,,
Other machinery and other metal manufactures not elsewhere specified in the tariff	20 % ,,
Telegraph, &c., posts, trolley poles, &c., if wood ...	10 % ,,
Asbestos manufactures	10 % ,,
India-rubber manufactures (except druggists' sundries)	10 % ,,
India-rubber manufactures, vulcanised	25 % ,,
Earthenware and crockery ware:	
Plain	35 % ,,
Painted, decorated, &c.	40 % ,,
China and porcelain ware:	
Plain	50 % ,,
Painted, decorated, &c.	55 % ,,
Incandescent electric light bulbs and lamps with or without filaments	30 % ,,
Glass manufactures not specially mentioned ...	30 % ,,
Marble manufactured	45 % ,,

The following are free of duty: Unmanufactured asbestos; crude rubber; asphalte; scientific instruments; plumbago; railway bars, T rails and punched iron or steel flat rails.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co, Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,955. "Electric target." P. Elphick. November 3rd.

24,963 "Electric-bell signalling for railway purposes." F. Raybould. November 3rd.

24,966. "Electric alarm to audibly indicate the movement of marine engines in a direction contrary to that shown upon the telegraph dial." F. S. Dubash. November 3rd. (Complete.)

25,018. "Electric railway-signalling and means therefor." Siemens Bros. & Co., Ltd., and J. Boot. November 3rd. (Complete.)

25,023. "Portable electric lamps." M. E. Feilmann, A. E. Turnham, C. R. Noble, and S. H. G. Stuart. November 3rd.

25,046. "Electrical regulating devices." A. G. Bloxam. November 3rd. (Firm of Robert Boschm, Germany.) (Complete.)

25,062. "Signalling-apparatus." E. C. R. Marks. November 3rd. (Mead Electric Signal Co., United States.) (Complete.)

25,072. "Arrangement and connections of switch-gear and switches therefor." Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koltgen, and R. A. R. Bolton. November 3rd.

25,073. "Arrangements for connecting two electrical sources in parallel." Siemens-Schuckertwerke G.m.b.H. November 3rd. (Convention date, June 7th, 1913, Germany.) (Complete.)

25,077. "Type line-casting machines." H. Wade. November 3rd. (Electric Compositor Co., United States.) (Complete.)

25,085. "Telescopic radio-telegraphic masts." T. D. Smith. November 3rd. (Complete.)

25,093. "Electric lamps." H. J. Williams. November 4th.

25,107. "Meter applicable to the measurement of electrical energy and also to the measurement of electrical power." P. C. Fernando. November 4th.

25,129. "Electrically-operated system of and apparatus for automatic track signalling on railways." E. W. Bottle. November 4th.

25,140. "Electric circuit controller." Westinghouse Brake Co., Ltd., and B. H. Peter. November 4th.

25,141. "Electrical connectors for electro-medical apparatus." Siemens Bros. & Co., Ltd. November 4th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

25,144. "Production of alkali metal alloys by the electrolysis of alkali hydroxide in the molten state and the obtainment therefrom of alkali metals and alkali metal compounds." E. A. Ashcroft. November 4th. (Complete.)

25,163. "Automatic regulating-devices for electric distributing systems." British Thomson-Houston Co., Ltd., and C. M. Jones. November 4th. (Divided Application on 25,286/12. May 3rd.) (Complete.)

25,164. "Systems of and apparatus for control of electric motors on traction systems, trains, and the like." R. F. Baerlocher. November 4th.

25,171. "Electric furnaces." F. T. Snyder. November 4th. (Complete.)

25,179. "Process of welding rails or the like, and apparatus to be used therein." Th. Goldschmidt Akt. Ges. November 4th. (Convention date, December 19th, 1912, Germany.) (Complete.)

25,180. "Welding rails and other fixed constructional parts." Th. Goldschmidt Akt. Ges. November 4th. (Convention date, March 28th, 1913, Germany.) (Complete.)

25,184. "Electric clocks." Nu-lines Manufacturing Co., Ltd., and C. C. Chapman. November 4th.

25,208. "Incandescent electric lamp-holders of the bayonet socket type." S. Morris and W. T. Critcher. November 5th. (Complete.)

25,210. "Miner's electric safety lamps." J. G. Patterson. November 5th.

25,236. "Pneumatic electric current limiting apparatus." T. de Olazabal y Eulate. November 5th. (Convention date, January 25th, 1913, France.) (Complete.)

25,247. "Telephones." C. F. Killar. November 5th.

25,257. "Means for suspending secondary battery plates." H. Leitner. November 5th.

25,274. "Electrical protective systems." E. G. Waters. November 5th. (Addition to 26,961/12.)

25,283. "Telephone systems." J. Savin. November 5th.

25,292. "Transmission of power to the driving axles of motor-vehicles and the like." J. G. P. Thomas. November 5th.

25,316. "Securing-devices for incandescent electric lamps." B. Griffiths. November 6th.

25,327. "Mutiplex telegraphy." E. D. Cather. November 6th.

25,335. "Earthing and bonding clip." J. H. Powell. November 6th.

25,362. "Tubing for conduction and insulation purposes and method and machine for making the same." P. Menzel. November 6th. (Complete.)

25,363. "Electrical conduit systems." M. Railing and T. Taylor. November 6th.

25,385. "Electric storage batteries." G. Inrig and G. J. Mills. November 6th.

25,415. "Electrolytic cells." H. C. Jenkins, H. F. Pattinson and R. Wellesley. November 6th.

25,434. "Wave-detectors for radio-telegraphy and telephony." F. P. W. Allen. November 7th.

25,437. "Device for recording or counting telephone calls." A. R. Denbigh. November 7th.

25,464. "Collector brush-holders for electrical apparatus." W. Christie. November 7th. (Galvanische Metall-Papier Fabrik Akt. Ges., Germany.) (Complete.)

25,465. "Collector brushes for electrical apparatus." W. Christie. November 7th. (Galvanische Metall-Papier Fabrik Akt. Ges., Germany.) (Complete.)

25,473. "Generation and control of electricity, for lighting trains and other vehicles." Gavan Inrig, Ltd., and G. Inrig. November 7th.

25,477. "Electrical switches or circuit-breakers." F. B. Holt and H. Smith. November 7th.

25,479. "Cooling arrangements for electric locomotives." Siemens-Schuckertwerke G.m.b.H. November 7th. (Convention date, May 26th, 1913, Germany.) (Complete.)

25,484. "X-ray apparatus." R. S. Wright and E. E. Burnside. November 7th.

25,503. "Apparatus for effecting the sterilization of water or other liquid by ozonation." E. L. Joseph. November 7th.

25,506. "Mariner's compass." E. Farkas, V. R. von Klarwill, G. R. von Klarwill, and S. Scheer. November 7th. (Convention date, November 7th, 1912, Austria.) (Complete.)

25,531. "Sparking-plugs construction for internal-combustion engines." E. A. H. de Poorter. November 7th. (Complete.)

25,544. "Fittings for electrical conduit systems." D. L. J. Broadbent. November 8th.

25,569. "Safety electric ceiling rose." H. G. Foster. November 8th.

25,586. "Electrical candle-lamps." A. E. Watson and Veritys, Ltd., November 8th. (Complete.)

25,591. "Duplex and like telegraphy." Eastern Telegraph Co., Ltd., and F. Ryan. November 8th. (Complete.)

25,598. "Leakage protective devices for alternating-current distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. November 8th.

25,599. "Manufacture of electric contacts." British Thomson-Houston Co., Ltd., November 8th. (General Electric Co., United States.) (Complete.)

25,601. "Electrical wiring circuits for motor cars." H. Salsbury. November 8th.

25,607. "Plates or electrodes for secondary batteries." E. H. Naylor. November 8th.

25,612. "Wireless telegraphy." I. S. Winby and R. Garrett. November 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free. 9d. (in stamps).

1912.

Process for Preparing Metals and Metal Oxids in a Minutely Divided State. Dr. H. Kast. 19,006. August 19th.

Direct Current Dynamos and Motors. E. R. Freeman. 21,415. September 20th.

Glow Lamps Radiator for Cooking or other Heating Purposes. G. E. Dutertre and C. Jacquel. 23,748. October 17th.

Pocket Electrical Lamp Signalling Apparatus. H. Neuburger. 23,887. October 19th.

Means for Indicating when the Flow of Current in an Electric Circuit is Interrupted or Varied. A. F. Berry. 23,940. October 19th. (Cognate Application 27,534/12.)

Machines Suitable for Coating Wires, Threads, Strips, or the Like with Lubricating or other Substance in Liquid Form. British Thomson-Houston Co. (General Electric Co.) 24,058. October 21st.

THE

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1914 EDITION.

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.

IN the paper read by Mr. J. W. Jackson before the Newcastle Local Section of the Institution of Electrical Engineers, we find much of interest, if not of novelty; but even though Mr. Jackson's paper is belated, there is still very good reason for it to have been written. We refer more especially to what he has to say on the combustion of bituminous fuels, a subject to which we have allotted very considerable space in these columns for at least 20 years, for a casual reference to our back numbers shows, among many other references, that the subject was dealt with on September 15th, 1893, September 19th, 1895, August 5th, 19th and 26th of 1898, August 30th, 1901, January 2nd, 1903, February 3rd and 17th, 1905, January 19th, 1906, and February 23rd, 1906. In these and many other articles and paragraphs, much of what is now advanced by Mr. Jackson has been dealt with thoroughly and in detail. We have contended that in order to ensure good combustion of bituminous coal, not only must there be air admission to the gases direct, but such furnace forms as shall secure that the air is thoroughly mixed with those gases, and that such admixture must obtain before the gases are cooled seriously by contact with boiler surfaces. The necessity of temperature conservation has been insisted upon, and the use of protective guards, linings, arches, &c., of refractory material to prevent heat loss and to store and give out heat, so as to minimise temperature fluctuation and provide a heat store to meet sudden outpourings of gas from freshly stoked coal.

The action of the mechanical stoker has been explained, and the faults of the once too common form of furnace of the water-tube boiler, as well as the possibilities of the water-tube boiler in the way of its applicability to sound forms of furnace, have been pointed out. The use of violet-blue glass has been explained in respect of flame intensity determination. Thus for over 20 years we have pursued this subject. What we said so long ago, Mr. Jackson is saying to-day, and he states that the principles all along advocated by us are now being more and more appreciated. This is well, so far as it goes, but is it not a pity that in so important a matter as fuel combustion it should require so very many years for "trained" engineers to awaken to the elementary principles of combustion and the means by which such principles should be carried out in practice?

Fifty years ago Roscoe and other lecturers on chemistry were showing how a spiral of platinum wire could be placed about the flame of a hydrocarbon candle so as to cause its rapid extinction. Yet this simple demonstration of the need for high temperature in burning hydrocarbon gases appears only to have been regarded as a curious phenomenon without practical value, for who wants to buy costly

platinum spirals when a tin cone will put out any candle more promptly? And so the tin cone, in the shape of water-cooled plates, has been used to extinguish bituminous coal flames, and is still so used, and the recognition of proper methods is still so rare that it is referred to by Mr. Jackson, who, at the foot of our page 780, uses words which are somewhere to be found in our columns since the year 1903. Search would doubtless discover them.

Even Mr. Jackson is apparently somewhat vague as to furnace forms to-day, for he speaks of the space between the grate and the tubes of the water-tube boiler having been too little 15 years ago. The trouble with the common setting that he is referring to was not so much the height as the fact that the gases rose vertically from the grate and ascended directly between the cold tubes—the platinum spiral of the lecture room. How, in such a furnace, could the gases be mixed with air?

Perfect combustion of bituminous coal gas may easily be secured by the use of a very long brick-lined furnace tube. Given an initially correct air admission, it is only a matter of sufficient length for every molecule of gas to meet its atoms of oxygen. In practice, abnormally long tubes of this order are not used. Practice adds a surplus of oxygen, and so far introduces the evil of a lower temperature, but it also ensures that each molecule of gas shall have a chance of meeting some atom of oxygen within a shorter path of travel. But practice has employed cold pathways, and these have been the most grievous error in boiler practice. Mechanical engineers who have studied the question have been unable to make their voices heard, for steam production has for 25 years been largely in the hands of men who were neither steam engineers nor furnace experts.

Of all the stations in London 10 years ago, we can call to mind only one in which bituminous coal combustion received any attention. We hardly need say that we refer to Kensington.

Finally, we may refer to the suggested reduction to 200° F. of the furnace gas in order to allow of the latent heat of the steam, formed by the hydrogen, being recovered. When platinum is as cheap as copper, this may be done, but Mr. Jackson is suggesting a sulphuric acid bath for, presumably, steel boiler tubes. Has not Mr. Jackson ever seen an economiser fed with cold water, the lower ends of the pipes for about 18 in. being eaten away by this acid as the result of too cold a feed? Until sulphur can be otherwise eliminated, it will not be practicable to recover the said latent heat.

The Prestige of the Press.

From our list of Stock Exchange quotations, it may have been observed that the price of Reuter's shares has not wholly recovered the fall which followed the issue, and withdrawal, of the Agency's unfortunate circulars to the Press a month or so ago. Certain of the daily papers adopted an attitude of outraged virtue, and rather pompously paraded their zeal for the purity, the prestige of the Press. The sonority of the demonstration seemed sufficiently swelling to arouse mild surprise in the non-expert in these matters, who probably wondered what it all meant. The cynic perhaps had some excuse for his mistaken impression that the incident resembled the drum-banging which drowned the howls of the victims at the quack dentist's public performances. Others who are engaged in journalism, and who are equally concerned for its prestige—even if they prate about it less lustily—trusted that the incident might be provocative of needed reforms in certain departments of the newspaper world. Up to the present the reforms, if they have been made, have received much less advertisement than might have been expected after the righteous outbursts mentioned above.

Most of the financial papers frankly admit making a charge for the quotation of securities in which there is no official quotation and no free market. On the face of it, this candour might appear to disarm criticism. Most shareholders like to see some regular quotations for their stocks and shares. They might themselves demand that the board should pay, say, 100 guineas per annum, to this end, if the papers considered that the shares were of insufficient general interest to justify daily lineage being devoted to their gratuitous quotation. And if the Press were to indicate which were the quotations recorded as a matter of course, and which were paid for as a matter of expediency or advertisement, little could be said against the practice. A list of Stock Exchange prices, however, may be fairly regarded as on a par with Editorial news, and the inclusion amongst it of a number of paid-for quotations is patently undesirable. When it is further inquired whence the prices will in all likelihood be obtained—and if there is no free market, they must necessarily come from interested sources—the importance of separating the two classes of quotations becomes apparent. One of the financial papers puts a special mark against quotations that are charged for, and the system ought to be adopted by all journals accepting such advertisements.

The question whether meetings of shareholders should be reported in the Press without payment by the companies holding them, is unfortunately no longer a vexed one. Those who take the attitude that only by refusal of payment can the newspapers be expected to publish independent, free reports of meetings are in the small minority. Even the *Times* confesses that "reports of proceedings under the heading 'Company Meetings' are inserted as advertisements, *but* care is taken to ensure that they be trustworthy." The mere acknowledgment of the fact that care is taken to ensure trustworthiness carries the inference that the practice might otherwise be conceived to conceal at least the possibility of paid-for suppression of unpleasant details. Much food for reflection resides in the conjunction which we have taken the liberty of italicising in the above quotation.

These are but two of the ways in which it may occur to some that the vaunted prestige of the Press can sink at times to something far removed from the stars. The coincidence of favourable editorial comment upon something which "happens" to fill a full page of advertisement is no novelty. The demand for free calls of shares, the well-known device of the two editorial articles, one of which will appear, the unabashed offer of publicity masquerading as honest editorialism, the sale of unbiased opinion in order that by "obliging" some fount of information, a scoop may be effected when the chance offers—these and others of the same bastard brood of corruption are very much alive in the City to-day. It ought to be impossible to have a disguised puff inserted as a piece of news or comment, at a price. It ought to be impossible for any sort of editor to demand gold only—notes, cheques and calls declined—for inserting guileless-looking paragraphs that gild a flagrant advertisement. But these things are all too usual, and in a large section of the Press. The outsider may stumble against them by accident, and profess his disgust, his alarm, that such things can be. He will be met by the initiated by polite astonishment at his elementary ignorance. Cynicism and casuistry pat him patronisingly on the back as they defend to their complete satisfaction the degradation of a profession which will certainly never lack (newspaper) champions of its cherished honour and prestige.

The Parsons Turbine for Chicago.

We illustrate in our pages this week the 25,000-kw. turbo-alternator recently constructed and supplied by Messrs. C. A. Parsons & Co. for the Fisk Street station extension of the Chicago Commonwealth Edison Co. At the moment it is the biggest single-power unit ever constructed, and although this may be a fleeting honour, in view of the fact that the Commonwealth Co. also has a 30,000-kw. unit on order, yet it represents an achievement in turbine construction of which British engineers in general, and the makers in particular, have every reason to be proud. While Messrs. Parsons have had more and larger experience in turbine building than any other firm, it will be recognised

that so far the opportunities of English firms for building very large land turbines have been very few indeed, and it is therefore all the more a matter for congratulation that Messrs. Parsons have been able to show their ability to construct a turbo-alternator which is, in fact, the largest so far built.

Naturally the construction of such a machine introduced somewhat new problems, which, however, have been successfully overcome by the constructors, whose experience in large marine turbine work, as well as land turbines, is well-known. It is a matter for regret that the conditions of electricity supply in this country have not, in the view of those most interested, favoured the adoption of really large turbine units; the schemes which are maturing for railway and municipal power stations contemplate generating sets of only modest outputs, and, indeed, the 18,000-kw. turbine set which Messrs. Parsons are constructing for the London Underground Railways, and the 15,000-kw. set which is being installed by the Manchester Corporation, will apparently be the largest turbo-electric plants in use here for some time to come.

Lead.

The market has hardly kept up the degree of buoyancy which has been for so long associated with it, and the feeling is beginning to gain ground that the trade reaction in progress is bound before long to make itself apparent upon the situation of lead. It cannot be overlooked that the deficiency in supplies from Mexico which arises directly from the revolutionary disturbances in that unfortunate country, has now been felt in full force, and that the world has been able to get along without Mexican lead. The price has, of course, shown the stringency arising from the lack of Mexican metal, but even this stringency is much less than might have been expected, when it is remembered how great stress has been laid upon the importance of the supplies coming from that quarter. The fact seems to be that other countries have given a little more freely, and that with trade receding the world can get along with rather less than seemed likely to be required. There is, at all events, no further talk of a scarcity akin to famine conditions, and it may be admitted freely that lead at considerably below to-day's figures would still stand at a good price. The general situation of the metal is, however, less favourable, and one rather significant thing is that important Missouri producers have recently been making close inquiries in the London market with the object of getting in touch with London conditions, for the purpose of selling lead here when the time seemed to be ripe. So far they do not appear to have done any actual business, but quite a considerable deal was proposed to leading interests here, and it may even yet mature. Much, of course, depends upon the tendency of affairs as regards Mexico and the United States, but the intention to sell American lead in Europe should not be dismissed as a matter of slight importance. Mexican lead has come recently into this country in small quantities, nothing of any consequence, however, and all appearances indicate that there will not be any serious renewal of shipments for a long time. The position of the mines and smelters is not thoroughly known here, owing to the difficulty of establishing communications, but as regards copper, it is perfectly clear that the mines in many cases are not working, and that owing to this the smelters are at a standstill. It is fair to presume that a somewhat similar state of things prevails as regards the lead industry. Recently the arrivals of lead here from abroad have been on a more liberal scale, but the position of the market has not been seriously prejudiced, though it would be well to take a rather more moderate view of the possibilities. The export demand has lessened latterly, which is only what is to be expected now that the shipping season to the Baltic and Canada has closed, and that in consequence the demand for lead for prompt dispatch has subsided, but at the same time quite a fair demand exists for near deliveries, for English consumers are but ill provided with material, and there is a continual succession of small demands which are required for immediate despatch, and for which buyers have to pay pretty high premiums. At the same time, the premium recently commanded by spot and near deliveries has been too high for complete satisfaction to be felt with the position, and an abatement of this is to be desired as a means of imparting a more sound appearance to the market. The outlook has certainly lost some of the recent strength, and unless there is to be a fresh curtailment of supplies in some at present unexpected direction, the probability is that things will gradually ease down. The market at present has a sloppy appearance, and it seems that confidence has been shaken pretty severely. Any materially advanced level of prices is unlikely now unless there should be fresh developments of an unfavourable nature as regards production, for consumption has managed to override the Mexican shortage, and all conditions now are of an easier character.

"Lest we Forget."

The report of Major Pringle to the Board of Trade on the Aisgill disaster was issued on Tuesday, and bears out the views which we expressed at the time as to the lessons to be derived from the accident. The blame is laid principally upon Driver Candle, whose excuses are brushed aside as insufficient reasons "for his neglect of the far more important duties of observation and caution."

The Inspector considers that there were two sources of fire—burning gas, and live cinders from the ash-pan—the first of which was successfully coped with. He again strongly urges upon railway companies the desirability of employing electricity as their standard illuminant, and while he admits that the cost of immediate conversion of the gas-lighted vehicles would be too great, he advises that all new stock shall be constructed with electric lighting, and all gas-lighted stock on main line and express services shall be replaced as early as possible, this policy being "in consonance with the trend of general practice all over the world, and one which is not impracticable from the point of expense." Perhaps Sir Guy Granet will now take steps to inform himself correctly as to what is being done abroad.

The Inspector is not yet prepared to recommend any of the cab-signalling systems that have been experimented with, and merely mentions the wireless control of trains; he is, of course, aware of the successful working of the system developed by Mr. H. von Kramer, which, in fact, is being installed on a section of the Midland Railway, and has been adopted on some German State railways, and perhaps when further experience has been gained he will be able to take up a more progressive attitude in this connection.

In the meantime Major Pringle suggests that the train stop in use on the London Electric Railways shall be tried, and if found reliable at high speeds, should be adopted.

There is no doubt that gas escaped from the cylinders under two of the wrecked coaches and ignited, and the Inspector points out that electric lighting, which is considered to-day the most desirable illuminant for high-class express trains, will in future be demanded as the standard system of train lighting, thus corroborating the views which we have put forward for many years. The lesson has been a bitter one; we trust that its teachings will not be forgotten.

Insulation Resistance.

Mr. Sydney Evershed is to be congratulated upon the admirable paper which he has contributed to the proceedings of the Institution of Electrical Engineers, and of which an abstract is commenced elsewhere in this issue. It is in many ways a model of what a technical paper should be, and contains a great deal of information, much of which, no doubt, has been familiar in a general way to those engaged in the manufacture and use of electrical apparatus, but which is now for the first time subjected to the scientific method, and elevated to the status of "disciplined knowledge" by the application of accurate measurement and trained observation.

The author takes a modest view of the results which he has obtained, but it is clear that he has shed new light on the phenomena of leakage through insulators, and his work will undoubtedly be of immense benefit not only to those who employ the materials at present available, but also to those who are endeavouring to develop new and improved methods of insulating electrical conductors.

AMERICAN METHODS: AN INDICTMENT.

By F. W. D.

It is probable that many who read the recent interesting article entitled "American Methods are not Suitable for British Conditions" did so without deriving from it any clear idea of what American methods are. The writer of that article, who evidently realises that hardly any electrical men on this side of the water agree with him, claims that British gas engineers have accepted American methods whole-heartedly. Their enthusiasm is, no doubt, commendable; but this quality is not peculiarly American, though the form it sometimes takes may be.

A man's methods are the outcome of his philosophy—or the lack of it. The average American's philosophy is frankly materialistic, and he refers everything in life to the dollar standard. Self-assertive, boastful, and overbearing in his manner, he has, rightly or wrongly, come to be regarded as a type that must not be taken at face value. He conceives of no higher good than to control the wills of others. As a worker, his one ambition, if he has one, is to become a "boss"—the only one, if possible. True co-operation he does not believe in, and as a workman he cannot be relied upon to work his hardest, except under pressure. As a "boss" he will tackle no proposition that he cannot control; or, if he does, it will be with the idea of ultimately getting the control into his own hands. Of course, one knows full well that America has produced others, but the loud-voiced opinionated American is so predominant and advertises himself so persistently that by many he has been accepted as representative. American methods have a bearing upon the electrical industry in three aspects: financial, which affects the investor; industrial, as it concerns the employés; and commercial, as it relates to the consumer or customer.

American finance with its widely advertised prospectus—plausible, confident, and inviting—is usually noticeable by the attractive colours in which prospects are painted. Dividends—which are assumed to start from the very inception of the company—are usually estimated on a scale that will satisfy the most greedy investor. American finance is nothing if not monopolistic; and once a company is started an effort is usually made to eliminate competing concerns by means of a competitive warfare, which is good for neither companies nor the public. This usually impoverishes the company, and sometimes more capital is required. Often enough the market in the shares then goes to pieces, and the unfortunate shareholder parts with his shares at a nominal price. The majority of the shares are thus easily acquired by the promoters, who are then in a position to force a reconstruction, or a debenture issue at a high rate of interest, or other like financial operation, which, being outside the scope of this article, need not be further discussed. This cycle of events has happened so often to American investments—industrial concerns and mining ventures—and capital has so often been frittered away without materially benefiting any one save the "bosses" who controlled the market in the shares, that the British investor has become chary of them. It must, however, be admitted that it is on the financial side that British methods most nearly approach the American.

American methods in their application to industrial concerns usually involve some highly specialised system which practically eliminates all personal interest in the work for all except "the boss." No matter if the system costs more to carry out—and it usually does—than the problematical saving it effects, it accomplishes one thing, centralised control; but however attractive and scientific such systems may appear to be, they usually fail to justify themselves by financial results. Indeed, the cost of running the system is often no inconsiderable item. Such systems, having been tried, are usually discarded after a short run; otherwise those responsible for their introduction have had to fall back upon some modification of them. System, of course, there must be in every kind of industrial establishment; but the distinctively American systems are so unnecessarily elaborated that in some cases a special staff is required for their carrying out.

Mr. Seabrook, in his article, speaks of the "welfare work, contentment of, and improved conditions for workpeople, their proper feeding, housing, and so on," as though—forsooth—the workpeople were merely so many horses—or machines. A true man who is treated on such lines will not, and cannot, do the best work of which he is capable. His nature demands liberty; and, given a fair wage, he would infinitely prefer to look after his "proper feeding, housing and so on," himself. Rob him of the consciousness of liberty by needless restrictions on his conduct in the works and by fussy interference with his life outside, planning his dwelling as though it were part of a barracks, and his spirit will be stifled; he will lose his self-respect, and his whole being will suffer in consequence, as surely as his body would suffer were he denied fresh air. This ignorance of, and disregard for, human nature accounts to some extent for the discontent that exists among workpeople in works that pay attent[illegible]"welfare work" on American lines. Obviously it cannot be [illegible] to men to decide what hours they will work, nor how much work they will do in a given time. When, however, the time in which he must complete each job is narrowly computed and specified to the workman, when any suggestions from him relating to the work are—if not actually forbidden—strongly discouraged, when he is watched at every turn by "inspectors," and when he is treated by the management with indifference or contempt, he will certainly not prove to be the efficient unit that the management with their so-called scientific organisation expect him to be. It may be freely acknowledged that no hard and fast rule can be enunciated as to what point the organisation should be carried to in any particular works; every case has to be settled with reference to its own particular circumstances. The relationships existing in British industrial concerns before American methods were introduced resulted in better work, and more of it, from staff and workpeople alike. Whatever economy has resulted from later methods is due to more economical designs and labour-saving machines—some of the latter admittedly of American origin; and not at all to American methods of dealing with the workpeople.

Coming now to the commercial end of a business, we see as its most salient feature that greater relative importance is attached to salesmanship than used to be the case. In the palmy days of electrical engineering, to make a good dynamo was more difficult than to sell it; and to maintain a continuous supply of electricity more difficult than to get a new consumer: now all that is changed; and to-day, owing to increased competition and other causes, the harder task is to sell your goods. The statement that "the man who can sell is worth more than the man who merely makes" is, however, one of those catch phrases that sometimes floor an unwary opponent in an argument without his knowing from whence the knock has come. A dogmatic statement such as this carries no conviction with it. One might transpose the words thus: "The man who can make is worth more than the man who merely sells." This looks as well in print, anyhow, and is just as convincing. The fact is, the Americans have exaggerated the present-day importance of salesmanship as they do everything else. The respective salaries drawn by the man who makes and the man who sells are determined by economic conditions which are not necessarily permanent, but may some day change again so as to give the advantage to the man who makes. Their respective salaries are no more an indication of their respective intrinsic values than the Stock Exchange quotations of any particular classes of shares are necessarily an indication of anything beyond the public demand for them for the time being. The methods of salesmanship presumably advocated by your contributor aim at influencing the good judgment of the public, the object of American advertisements being to impress upon the potential purchaser or consumer the desired idea by persistent and blatant reiteration. Leaflets, newspaper advertisements, sky signs, and other methods are all brought to bear upon a man's judgment, not by reasonable argument, but by sheer force of hypnotic suggestion. Such methods are a slur upon the intelligence of the people, and the better educated class resent it. It may be possible, by constant reiteration, and by constantly presenting the same suggestion in different forms, to fatigue—so to speak—the critical faculties, this being a form of hypnotism; and custom may

sometimes be secured in this way. These methods are out of line with the best traditions of British trading, and—apart altogether from the dignity of the thing—are not to be recommended, for it is only the novelty of the method that has ensured its success in the few instances where it has been tried. People will sooner or later take such methods at their true value.

There is, too, such a thing as self-hypnotism; and the apparently whole-hearted belief in themselves and their goods on the part of Americans—and, according to Mr. Seabrook, the British gas engineers also—should not be taken too seriously. The propect of an Americanised "boss" "leading to success the British electrical supply industry" is not altogether an inspiring one, nor is it likely to appeal to many readers of the ELECTRICAL REVIEW. The renunciation of one's own judgment in technical matters and one's individuality, is repugnant to thinking men—and there are many in the electrical profession. In fact, it may be said that American methods generally are not likely to be permanently successful in this country, for its geography, its industrial conditions, and, above all, the temperament of its people, are not favourable to them.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Travelling Representatives.

Apropos the controversy under this heading, surely it is regrettable that even the slightest doubt should exist as to the necessity for the personal element in the development of sales.

Most certain it is that a travelling representative, as a sentient being, must know thoroughly the wares he wishes to flaunt before he can pretend to render the slightest assistance to his trade friends, for assuredly it is the salesman's mission to help the customer to buy rather than anything else he may strive to effect.

The ever-increasing variety of electrical material at the disposal of prospective purchasers, coupled with the indecision consequent thereupon, is in itself a stupendous justification for the travelling salesman.

The right kind of "ambassador" is of immense educative value to both those upon whom he calls and those whom he represents, and in spite of his present activity, his, it seems, is an object never completely accomplished.

That engineering is an exact science is agreed, and yet how unnecessarily large is the number of buyers of engineering material who omit the desirable degree of exactitude in their inquiries.

Apart from quite a large proportion of contracting engineers are numerous consulting experts, who seem habitually to neglect the necessity for even the slightest care with which solicitations for prices of material should be written or dictated. Consider the extensive variety of, say, switch and fuse gear, and yet who concerned with this important section of the trade will deny that it is commonplace to receive inquiries for switchgear without any indication of the type, finish, purpose, capacity, voltage, &c.? Here, then, is the necessity for the salesman who can "educate" his customers.

Even the perplexity which so often obtains at present as a result of vagueness in this connection would be tenfold or more, were it not for the fact that a representative in many cases is summoned by the customer to make recommendations, in order that the requirements may be intelligently conveyed to his principals.

This is by no means the whole case for the commercial traveller, nor would it be reasonable to try adequately to treat it in a communication of this length, but sufficient it is to say that in these remarks is embodied at least one important purpose of the salesman as a representative of the manufacturer whose aim it is to satisfy the demands of industrial progress.

P. O. Wittey.

Birmingham, *November 19th*, 1913.

Electrical Accidents in Mines.

The reports of mining accidents published in the last two numbers of this paper show that there is still room for improvement in the electrical equipment of some coal mines, and in the observance of rules and regulations in others. We shall always have the fool-hardy person among us who needlessly risks his own safety and often that of others. Such people will get into trouble, in spite of fool-proof apparatus and the most stringent and comprehensive rules.

Beyond those accidents due to men's carelessness, several others seem to be caused by damaged cables. It would be rather interesting to know the exact type of cable in use where these accidents happened. It is quite clear that damaged cables, whether main or trailing cables, are not unavoidable.

On page 732 the Inspector is quoted as saying that "trailing cables do not always receive the care they require." Again, on the same page, it is stated: "This is another instance where armoured cables would in all probability have prevented an accident." We do not suppose that many will dispute either of these statements. Whether a cable is slung in the roof of a working or laid on the floor as a trailing cable, if there is any chance of its being crushed that cable will most certainly be seriously damaged unless it is protected by some form of armour. The toughest covering short of an armouring, namely, lead, may not suffer greatly, but those types of cable which are generally used in mines, *i.e.*, V.I.R. and bitumen cables, are very easily damaged. A jute or leather braid is not sufficient protection for a trailing cable which is subject to constant abrasion on rough floors, to being trodden upon, and even wheeled over. Faults may easily occur inside a trailing cable without the outside giving any indication of it until someone touches it, as in the case reported in paragraph 8, page 733.

Trailing cables are now made with three or four types of protection; the cores are generally V.I.R. insulated (an earth wire simply braided sometimes accompanying them) and laid up, and wormed circular with jute, or vulcanised bitumen. The use of the latter material makes the cable waterproof, even if the outer coverings become porous. The cable is then finished with tapes and braided with jute or leather. As an alternative the outer braid is replaced by a spiral lapping of galvanised iron wires or strip.

On another type the cores are simply twisted, and wormed and sheathed with vulcanised rubber of a very tough quality. The first type (braided) is undoubtedly more liable to damage than either of the others. For the solid rubber-sheathed cable the makers claim immunity from abrasion and chemical action, but this is perhaps the most expensive form of protection. Personally, we favour the spiral-armoured cable as the most suitable for this class of work. If armouring is necessary to protect cables hung in the roof, how much more so is it for those which are pulled about, turned and twisted, and generally roughly handled on the floor!

Referring to the Inspector's statement that trailing cables do not always receive the care they require, we can readily believe this, but we would point out that after making full allowance for the natural difficulties under which these cables are used, it is not a difficult matter to ensure that they are properly looked after. For instance, if the coiling and uncoiling of the cable is carried out carelessly, the conductors are apt to kink, and in time burst the insulation. When not in use they should be coiled up carefully and put aside.

We note that in one case a machine man was left to repair a concentric cable, and we quite agree that such a repair should only be carried out by a competent electrician. Repairs of this kind, whether to concentrics or multi-core trailing cables, are quite difficult enough for anyone outside a cable factory to tackle. Further, such cases support the argument that mining cables should be armoured, because however skilfully a repair of this nature may be performed, the cable is not the same afterwards, the outer coverings are disturbed and the locality of the repair may quite possibly afford an opportunity for the occurrence of another breakdown.

In short, so long as mining conditions are such that cables are liable to concussion, it seems to be the truest

economy, as well as the safest plan, to armour all cables underground, irrespective of the question as to this being compulsory or not.

We do not know how much the question is affected by the class of cable used, but it may be more than a coincidence that the best trailing cables are used in the Scottish coal mines, the district which had in 1912 the greatest freedom from electrical mining accidents.

Armour.

Remarkable Motor Records.

I am pleased to see the test-sheet and curves in your issue of Nov. 14th. All along, in accordance with your original article, which clearly states "120 B.H.P. with a range of speed of 230 to 650 R.P.M.," I have considered these machines as 120 B.H.P. at 230 to 650 R.P.M., whereas the tests are for 650 R.P.M. only. This alters the whole outlook, as my criticisms are based on the lower speed, as any variable-speed (shunt control) motor is understood to be capable of doing its full load throughout the range of speed, for a specified time. On the lower speed basis, I think all my contentions hold good. At the motor's lowest speed, on 120 B H.P., the efficiency will be decreased to a figure, the nature of which I have stated: the field and other losses being greater, the heating will be vastly increased, the peripheral speed, and hence radiating capacity, being decreased. The time required to reach final temperature will also obviously be increased.

I now gather the designer waives the question of performance at lower speed. Taken at the higher speed, the figure he cited for losses in his letter of 28th ult. is about 1 per cent. higher than ordinary commercial machines—probably test bed errors will account for this. The original article states as one of the departures from normal design that "flux densities are pressed up to very high values." The saturation curve contradicts this statement, as only at 80 per cent. full field are normal densities reached. I should advise a very careful study and analysis of the test sheet from various points of view. For instance, the field-speed curve shows that at 650 R.P.M. the field is low, and therefore unstable or sensitive, a difference of 10 per cent. excitation showing an increase of 30 revolutions in the speed. Yet, mark, the test sheet shows constant speed with first period, 10 per cent. decrease in excitation. Probably there are test bed errors, as witness column headed "Res. in." Regarding the last letter, I disagree with the remarks on time of final temperature, and referring back to my letter, repeat, that this time depends on energy radiated per time and energy storing capacity of machine. The latter surely depends on volume, disposition of, and specific heat of materials used, and though I quite agree that "a copper machine" "if" badly designed, would be expensive, I do say that to get minimum time constant, it is as Martin Harvey saith "the only way." I agree with the remarks on cost per unit, providing labour is not increased, but observe that no tangible figure is given. I have now got sufficient information to satisfy me as to my contentions, and to show my belief in the following maxims: "Hide not thy light under a bushel," and "If thou hast the light of knowledge, let others light their candles at it." I give below details of a design, contemporary with the designer's, to show that similar results have been, and can be, obtained, without deviating much from the road on which designers have, in my opinion, to travel :—

Output, 80 B.H.P, volts 300, revolutions 600.
Armature diameter 18·5 in., gross length 7¾ in.
Turns in series between brushes, 99½.
Winding, two circuit single.
Commutator segments, 199.
Weight armature strip, 128 lb.
Number of poles, four; air gap, $\frac{3}{32}$ in.
Diameter pole cores, 7¾.
Shunt A.T. per pole, 4,550.
Shunt weight copper per pole, 11 lb.
Series A.T. per pole, 1,000.
Series A.T. per pole, 3 lb.
Four interpoles 2¼ dia., tips 1¾ × 7¾, with ⅛ gap.
Weight interpole copper = 11 lb. per pole.
Commutator 11 in. dia. × 5 in. face = 80 lb. copper.
Total weight of machine = 3,000 lb.

Dimensions were well within your figures, and the temperature rise in 10 hours did not reach 75° F. in any part. Commutation was perfect in either direction with brushes neutral. I considered this machine a departure from contemporary practice, but nothing to write home about, although, on second thoughts, I think it would compare very favourably with the efforts of some of our present-day eminent designers. I think if your correspondent will go into this design, he will come to the conclusion that the last paragraph of my first letter is still true. Now, Sir, if we can see the figures for the full-load run on lowest speed, with no-load speed and full-load speed on constant field, figures, I notice, as I anticipated, left out, no doubt thoughtlessly, from published sheet, I shall then be in the position to finally reply, and no longer trespass on your valuable space. By the way, I am keenly disappointed that none of our foremost designers have had any remarks to make on this subject, which should be of interest to them. I can promise your correspondent that when next in London I shall not fail to avail myself of his kind offer.

W. Rae Joss.

Harrogate, *November 17th*, 1913.

Drastic Procedure.

The formation of an Association for obtaining better conditions for assistant engineers is showing up some of our chiefs in their true colours, one of whom has issued orders "that anyone of his staff joining the Association will be dismissed."

This is a case of interfering with the personal liberty of the assistants, and this chief thinks that because he pays his shift engineers about 37s. 6d. a week for 56 hours' work, he is entitled to tell them what they shall do the remaining 112 hours of the week, when they are free to act as they choose.

Now, then, assistant engineers, you know how you stand; your chiefs have bought you body and soul, and you must not even go to a picture show without first getting permission.

'Tis strange, but 'tis true, that the men who control and operate the most useful supply of energy known, have not the energy and pluck to resist the imposition of conditions so bad and unfair that the average casual labourer would refuse to put up with them for one day.

"Fiat justitia, ruat Cœlum."

November 24th, 1913.

Canadian Electrical Trade.

I am glad to avail myself of your invitation to express my views upon this subject, in which I have taken the greatest interest since my first visit to Canada some three and a half years ago. Since that time I must have travelled over 20,000 miles in the country, having crossed from coast to coast five times. I have also lived for several months at a time in some of the principal cities. My experience has been that which one invariably meets with in studying any new subject, the more deeply one goes into it the more impressed one becomes with the knowledge of how little one knows. Certainly our lack of knowledge, on this side, of the existing conditions and future possibilities of Canadian trade is appalling.

I read with the greatest interest the communicated article in your issue of the 31st ult., and Mr. Berry's criticism of it in your issue of the 14th inst. I am bound to say that my own experience endorses that of the writer of the original communication, every word of which I entirely agree with.

We have heard a great deal during the past few months about the iniquities, or supposed iniquities, of the National Board of Fire Underwriters, but so far as I can gather, the criticisms are chiefly based upon the supposition that inasmuch as it is an American organisation, and the various bodies who constitute the Committee are American societies, it stands to reason that their prejudices must be pro-American and anti-British, and that their rules and regulations will be drafted accordingly.

I am not prepared to say whether or not there is any justification for this supposition, but I do suggest that if

any British manufacturers are able to quote concrete cases where they have received unfair treatment at the hands of the National Board of Underwriters, they should publish their experiences. From my own experience, I find it difficult to believe that such strong prejudices do actually exist. I have had the pleasure of visiting the National Underwriters' Laboratory at Chicago, where I was received with the greatest courtesy. I have also submitted for their approval British-made electrical appliances, and have obtained their consent to their use, subject to the modification of certain minor details of construction. The modifications called for were, moreover, perfectly reasonable and entirely consistent with the restrictions enforced in connection with American-made appliances.

I quite agree with Mr. Berry that the N.E. Code is "built up around the specialities of American manufacturers," but—quite apart from any question of prejudice—it would surely be surprising if it were otherwise. Until quite recently, British engineering manufacturers have ignored the Canadian market, whereas U.S.A. manufacturers have for many years nursed and developed that market, with the result that engineering practice in Canada has naturally followed American lines. My own opinion is that the interests of British investors—who, according to Mr. Berry, have provided considerably more than half the funds for Canadian fire insurance—have been far better protected by rules and regulations drafted to cover the actual apparatus in general use than if they had been broadened to include apparatus manufactured in accordance with British practice, which is at present almost unknown in that country.

Mr. Berry is a specialist who, for many years, has devoted his attentions to the perfecting of a particular piece of apparatus. We all know that his efforts have been crowned with success—but, like many successful men, he is inclined to be hypercritical. Upon visiting a new country he naturally devotes his chief attentions to the subject in which he is principally interested. He finds this particular subject has not received the attention at other hands that he has himself devoted to it—that, in fact, the devices generally used have the same defects as similar devices used in this country before he and others showed how they might be improved—and he at once jumps to the conclusion that the electrical practice of the country is bad.

I think, however, that Mr. Berry will confirm my own experience that Canadian engineers are always ready, and eager, to investigate any new principle or piece of apparatus put before them; in fact, I venture to express the opinion that he found them far more willing to give favourable consideration to his proposals than English engineers were inclined to do when he first commenced his campaign in this country.

I cannot agree with him that the life hazard question is neglected in Canada to the extent he would have us believe. I could quote a number of, to my mind, very necessary rules and regulations for the protection of life in Canada that appear never to have been thought of in this country.

Mr. Berry refers to the inconsistency of a code which insists upon an insulating lining for the metal cover of a three-ampere tumbler switch, "and at the same time allows in the factory a switch 100 times larger without any protective cover whatever." True, but the 300-ampere switch in the factory is known to be dangerous and is not handled by "the man in the street," who, as Mr. Berry remarks, should be protected. There are, however, many thousands of innocent looking three-ampere tumbler switches installed in this country in bathrooms or otherwise in close proximity to earthed fittings, the metal covers of which are uninsulated and no precautions are enforced to ensure that a strand of one of the conductors cannot make accidental contact with the metal cover. It only needs the unsuspecting "man in the street" to attempt to use one of these switches in which accidental contact with the cover has been made—when, say, in his bath—for him to receive a most unpleasant, if not actually dangerous, shock.

The danger of the combination of circumstances referred to may be remote—but it undoubtedly exists, and to guard against this danger, or life hazard, the N.E. Code insists that these switches must be constructed in such a way that accidental contact between the live conductor and the metal cover is impossible.

I have no wish to defend the use of the unprotected switch in Canadian factories, but am merely suggesting that our own regulations may not be as perfect as Mr. Berry would have our friends across the water believe them to be.

I entirely endorse the opinion expressed by Messrs. Chiswell & Co., in your issue of the 14th inst., that British manufacturers are making a great mistake in neglecting the opportunities of Western Canada and in being satisfied, apparently, to leave this district to be handled by agents in, say, Montreal. They overlook—or perhaps do not realise—that the distance between Montreal and Winnipeg is about the same as between London and St. Petersburg, and that there are many hundreds of miles of practically unpopulated country between the two districts.

Western Canada, particularly the Middle West or Prairie Provinces, undoubtedly offers in many respects far greater scope for British manufacturers than Eastern Canada, for the reasons Messrs. Chiswell explain.

Engineering developments in Western Canada have received a temporary check during the past few months, owing to the difficulties Western cities are at present experiencing in procuring the capital for carrying out the many very necessary developments that are contemplated.

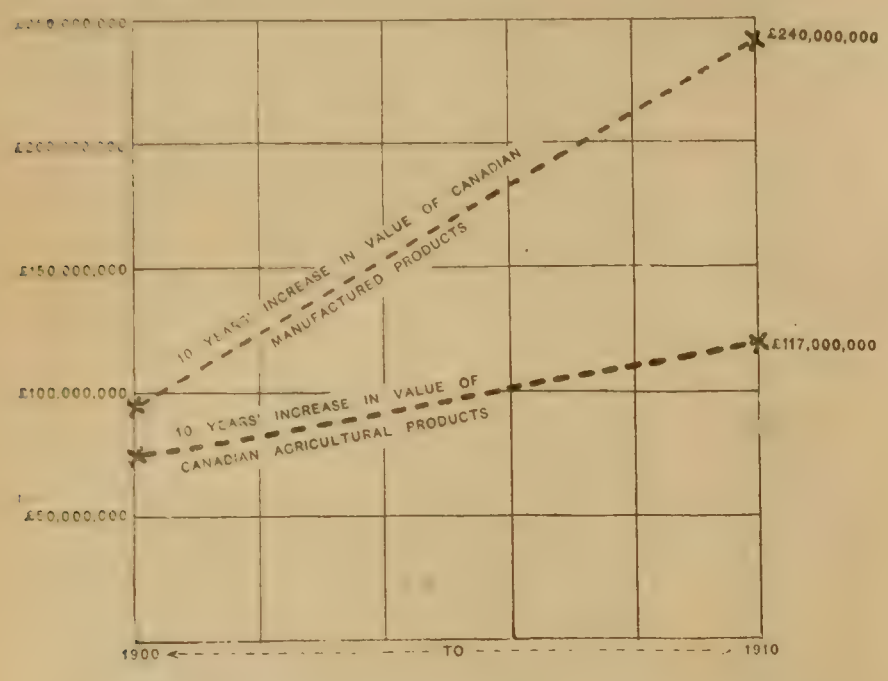
Our City financiers, who guide the British investor—and, in fact, the investor in all parts of the world—tell us that these Western cities have been over-borrowing relatively to their present rateable value, and that they must curtail their expenditure. The position at the moment is a peculiar and difficult one for those who have to contend with it. The average immigration into Canada during the past four years, has been over 1,000 persons per day, and is steadily increasing the whole time. The majority of these new-comers go West, and the flow in that direction is supplemented by numbers of Canadians from the Eastern Provinces. All these people on arriving at the respective cities they are bound for expect to find modern buildings to live in and to work in, an adequate city water supply, modern and efficient sanitary arrangements, electric light and power plants, well-paved and effectively-lighted streets, main line and street railway facilities, &c. For the provision of all these large sums of money are required. It is true that the influx of population brings with it a corresponding influx of capital, but provision for the newcomer must be made considerably in advance of his arrival. The result of the present difficulty in borrowing money to cater for the rapidly-increasing population is bound to mean the temporary adoption of a hand-to-mouth policy of making the best possible provision for the most pressing immediate requirements. This policy must of necessity be economically unsound in the long run, but what alternative has the unfortunate local engineer got but to give the maximum service possible with the funds at his disposal—leaving refinements for the future? He knows that his work will be criticised by engineers from this country—who, when inspecting his work, will doubtless exclaim "how appallingly crude, such practice would not have been permissible under the regulations obtaining in the old country"—but he usually takes all such criticism in good part, probably being an Englishman himself and remembering that when he first arrived, and before he appreciated the difficulties, he was himself inclined to be equally critical.

I have already referred to the misconceptions that exist in the minds of the majority of people in this country respecting the industrial position in Canada at the present time. An example of this is, I think, the idea generally held that Canada is almost a purely agricultural country. I find that if one asks an average Englishman which he supposes to be the greater—the agricultural production or manufactured production of Canada, he invariably replies that the value of the former must be many times the latter. According to Prof. Henry Laureys,* however, the value of the manufactured products of Canada is considerably greater than twice the value of the agricultural production for the same period. What is perhaps even more surprising is the fact that, though the increase in Canada's agricultural production year by year has in itself been phenomenal, the rate of increase

* Pamphlet entitled "Les Industries Manufacturières du Canada," published by Beauchemin, Ltd., 79, St. James Street, Montreal.

in the manufactured production of the country has been even more marked.

The following curves, showing the respective increase in the values of manufactured and agricultural products between the census of 1900 and that of 1910, should convey some idea of the remarkable industrial expansion that is taking place.



The period of industrial development in Canada has been coincident with that of the development of electrical supply, with the natural result that practically every factory in Canada is fully equipped with electric power. In many of the new cities that are springing up all over the prairie provinces, public gas supply is practically non-existent, and new houses are therefore wired for electric supply as a matter of course. It goes without saying, therefore, that there is no other country in the world that offers such attractions for the electrical engineer as Canada — and particularly Western Canada—at the present time.

From my own experiences I am convinced that our many fellow-countrymen and all other British subjects in Canada will cordially welcome any co-operation we on this side are prepared to give them in developing the immense potentialities of this wonderful country—co-operation in dealing with their many new engineering problems, and co-operation in dealing with their financial and commercial problems. They will also accept in good part any criticisms we may have to offer respecting their present methods, so long as the critidisms are combined with co-operation. It is not unnatural, however, that they should resent any tendency to give too much of the former and little or none of the latter.

Leonard Andrews,
Managing Director,
The Canadian British Engineering Co., Ltd.

London, E.C., *November 24th*, 1913.

Mr. Leonard Andrews has, with characteristic courtesy, sent me a proof of a letter which he is addressing to you, in order that I may, if I desire it, meet his criticisms in the same issue of your journal.

I have tried to find where Mr. Andrews differs from my point of view, but I find myself unable to trace it so far, except in matters of detail. On the contrary, I have read his letter most carefully, and I find myself in agreement with him in regard to the broad principle involved.

Like Mr. Andrews, I, myself, visited the Underwriters' Laboratories in Chicago and New York, and I was quite overwhelmed with kindness and consideration. Moreover, the argument in my letter was freely discussed with Mr. Dana Pearce in New York.

I found Mr. Dana Pearce and his colleagues in Chicago most anxious to redress any just grievances of the British electrical manufacturer, and to assist in removing certain obvious anomalies which he admitted existed in the Code.

I wish most emphatically to repeat, and I think my previous letters make it clear, that the honest intentions of the National Board of Fire Underwriters are absolutely above suspicion, but at the same time I am bound to say that I think it will be accepted by British electrical manufacturers as a very graceful act on their part if they will consent to widen the Committee responsible for Rules and Regulations, so that it may include the representatives of accredited British interests.

In making this suggestion, I desire to emphasise the fact that I cast no slur upon the honest purpose of the parties responsible for the existing Code. It is only fair to say that I found that the Underwriters' engineers were not aware, in some instances, of the electrical practice obtaining in Great Britain, but it was a subject which they found full of interest. Is it then surprising that British methods have been overlooked? As I stated in my previous letter, it would be strange were it otherwise.

All I ask on behalf of the British electrical manufacturer, in order that he may build his works and open branches throughout Canada, is that he and his brother Canadian may be given a fair field and no favour.

Mr. Andrews raises the point that I approached this question from the view-point of a specialist in one particular direction. I admit it freely.

My object in starting this discussion is that the views of of all sides may be obtained.

In conclusion, Sir, I would like to add that my remarks in connection with the National Electric Code are directed solely to the application of the rules in the British Dominion of Canada. I have accepted a challenge that under certain conditions I shall erect works inside the Dominion, and I write this letter feeling that on this subject I am already a Canadian.

I again agree with Mr. Andrews. I found the Canadian engineer more hospitable, more friendly and more willing to extend the hand of good fellowship than I have ever experienced before. I look forward with great pleasure to the time when I shall be working with him, side by side.

As the point has been raised, I should like it to be known that my visit to Canada and the United States was in a purely personal capacity. I did not represent any committee, association, or other organisation of which I may be a member.

Herbert H. Berry.

London, E.C., *November 25th*, 1913.

Capping Wood Casing.

We should be pleased to have the opinion of your readers as to whether it is advisable to screw the capping on casings in the centre or at the edges of the capping. In manufacturing these casings and cappings it is our desire to manufacture them to suit the wishes of the electrical trade generally.

When the cappings are nailed or screwed on the outside edges the capping is less likely to gape open and allow dust to get inside the casing; in this case the thicker timber will have to be left on the outside of the grooves, reducing the centre portion somewhat.

On $1\frac{1}{2}$-in. casing what is the best shape, therefore, which will suit the trade?

Any replies from your readers on this point would be appreciated, whether given by sketches or figures.

C. Jennings & Co.

Bristol, *November 22nd*, 1913.

Lead-Tin Alloys.

I am writing to ask if a reader of the Review could tell me the specific resistance of lead-tin alloy—cable sheath material—consisting of 97 per cent. lead and 3 per cent. tin, as usually prescribed for telephone cable sheaths, and the formula for calculating the specific resistance of same alloy with different percentages of lead and tin?

C. A. Smith.

London, W., *November 23rd*, 1913.

[A number of values for this quantity are given in *Tables Annuelles Internationales de Constantes et Données Numériques*, Vol. I.—Eds. Elec. Rev.]

Pressure Regulation.

In my article on this, writing from memory of a description of a Brown-Boveri turbo-generator set, I somewhat hastily wrote that in case of the turbine losing its steam, the field would be wiped out if the current came back through the compound series turns from other sets in parallel. This is not quite correct, as the field would be maintained by other sets in parallel, but at the same time I think it would be so weakened by current in the series turns that the set might run away. The best way to settle the discussion would be for Messrs. Brown, Boveri to explain why they use exciters on c.c. turbo-generators. Perhaps the Editor could get their opinion on the matter.

C. Turnbull.

Tynemouth Electricity Works,
November 18*th*, 1913.

NEW EL CTRICAL DEVICES, FITTINGS AND PLANT.

2,000-Ampere Armoured Switchgear.

An example of the extent to which the complete armouring of switchgear, designed on the draw-out principle, can be carried is shown in figs. 1 and 2. The views represent one of the sub-station equipments of the Newcastle Electric Supply Co.'s system. There are two panels controlling the 440-volt side of three-phase static transformers, each switch having a current-carrying capacity of 3,000 amperes per phase. The switches are of a strong mechanical design, suitable for use in a situation which is close up to the power station.

Fig. 1 shows the switch withdrawn, with the connections to the bus-bars and current transformers padlocked off, and the oil tank lowered as for the inspection of contacts.

The gear was made by Messrs. Reyrolle, of Hebburn-on-Tyne.

New Cord Grip.

An ingenious and novel type of cord grip was recently brought to our notice by Mr. B. Deakin, M.I.E.E., which ensures the complete separation of the wires as they enter the lampholder, and perfect insulation from the case of the fitting, so that shocks and short-circuits are prevented. The grip can be used with most of the standard holders at present on the market. As shown in fig. 3, it consists of a wooden block A_1 fitting inside the dome of the holder; the flexible leads are threaded through holes at right angles, pass partly round the block in a groove, and again enter holes which guide them into the terminals of the holder. The grip thus obtained is so strong that it is impossible to pull the wires out without breaking them; there is no difficulty in threading them in, or in adjusting the length, and there is no strain on the terminals. The same grip can be used in ceiling roses with advantage, as shown at A in fig. 3.

A useful device to be employed in conjunction with the cord grip is the "Anti-Vibra" earthing shield, which consists of a braided steel sheath enclosing the flexible. The end of the sheath is easily splayed out, and is securely held between the holder and the cord grip; the sheath then takes the whole weight of the lamp and fitting, and protects the flexible from mechanical injury and short circuits. The shield is especially useful in hot climates, where flies do great damage to the flexible, and its resilience renders it an effective protection to metal-filaments against vibration; but its most important function, perhaps, is that of providing an efficient means of earthing the holder and fitting.



Fig. 3.—Pendant Holder and Ceiling Rose with Deakin Cord-Grips.

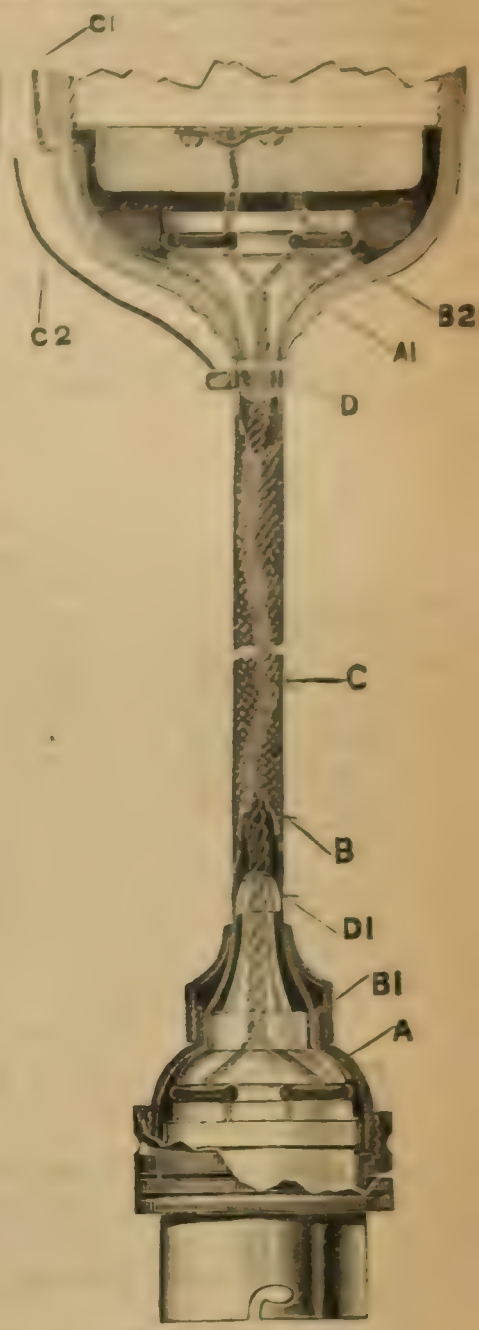


Fig. 4.—Pendant fitted with Anti-Vibra Earth Shield.

Fig. 4 shows a complete combination of cord grip in holder and ceiling rose, and anti-vibration shield used for earthing the holder. The separated leads are shown at A and A_1, the shield at B, the cord grips at B_1 B_2, the earthing clip at D, and the earth wire, which is attached after the ceiling rose is closed, at C_2. An alternative method of bringing out the earthing wire through a hole in the cover of the ceiling rose is shown at C_1. Fig. 5 shows a simple plug formed in one piece with the cord grip, and an

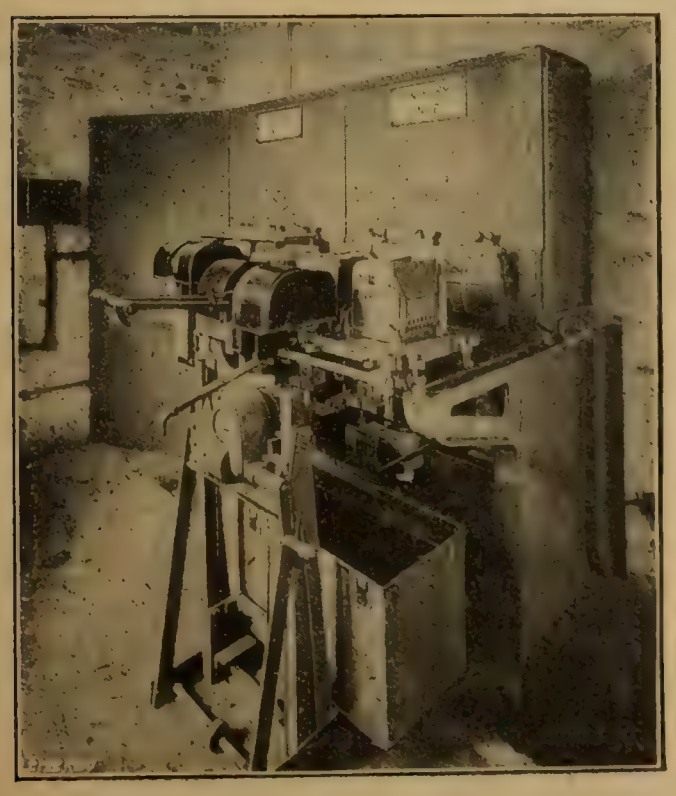


Fig. 1.



Fig. 2.

Reyrolle Armoured Switchgear.



Fig. 5.—Plug with Cord Grip.

adapter of similar design is made. A wall and earthing plug is also to be had, using the cord grip and shield in conjunction with a three-prong plug. A special feature of the devices is the fact that they are applicable to the standard fittings now in use without modification, and thus existing installations can be equipped with them at small cost. They are manufactured by the Leopold Turners & Workers, 124-127, Leopold Street, Birmingham.

Some Special Motors.

Messrs. Higgs Bros., of Balsall Heath, Birmingham, who are specialising in "fractional" H.P. motors and dynamos, and others in sizes up to about 8 H.P., show in their recent list a neat little hanging motor, fig. 6, which gives ¼ H.P. at 1,750 R.P.M., and is fitted with gun-metal journal and ball-thrust bearings.

The shaft is tapped and can be readily connected to flexible shafting for driving emery wheels, or for other use.

Another compact apparatus is the direct-coupled forge fan,



Fig. 6.—Small Hanging Motor.

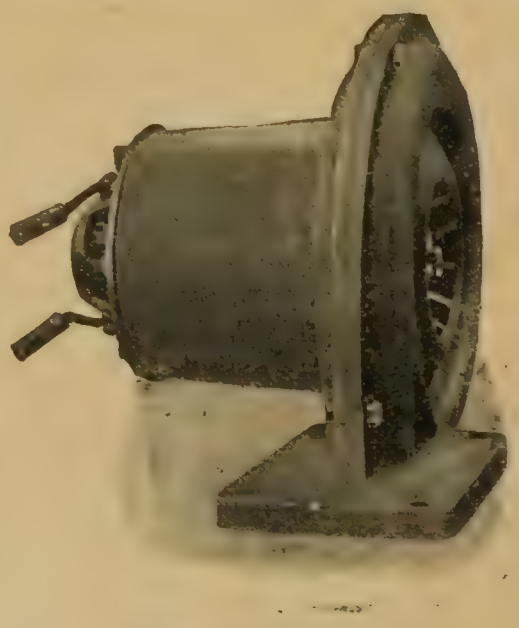


Fig. 7.—Electrical Forge Fan.

shown in fig. 7. This is suitable for 1½ in. tuyers, and 8 in. W.G. draught; the speed is 6,000 R.P.M., and the driving energy required is about 250 watts. The complete device weighs 45 lb. We understand that Messrs Higgs are building motors at the rate of 150 per month, every part being standardised and readily renewable if required.

A Large Contact Suspension Gear.

We illustrate in fig. 8 an eight-ring contact suspension gear, constructed by the London Electric Firm, of Croydon, for suspending an electrolier suitable for seven circuits, from the dome of a church in Edinburgh. It may be noted that the gear is

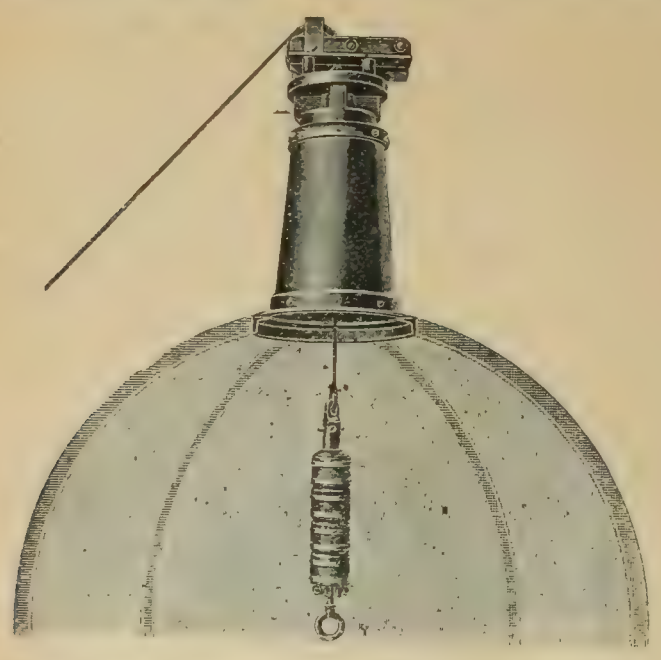


Fig. 8.—Contact Suspension Gear for Electrolier.

supported from beneath, being located between the inner and outer structures of the dome.

A number of four-contact gears have been supplied for picture theatres, giving two separate circuits for red and white lights respectively; also some five-ring gears.

In all cases the weight of the fitting, sometimes amounting to a ton, is only on the winding rope during the actual raising and lowering operations, and, even then, is carried by the firm's self-sustaining winches, which are used in connection with the above gear.

A Telephone Attachment.

A telephone designed by Mr. W. C. Ude, of West Haven, Conn., U.S.A., enables one to call up a person or receive a call without putting his hand to the instrument. This saves much time and confusion in the use of office telephones, where information is often required over the wire and has to be obtained from books, when both hands are needed to handle them; or notes have to be jotted



Fig. 9.—Handy Telephone Attachment.

down, and it is more convenient to have both hands free. The arm carrying the receiver can be turned to either side.

An Electric Boot Warmer.

A novel device for warming and drying boots electrically has recently been placed on the market. This, as shown in fig. 10, consists of two small radiator lamps arranged to be attached inside the fronts of aluminium boot trees and to be coupled up to an

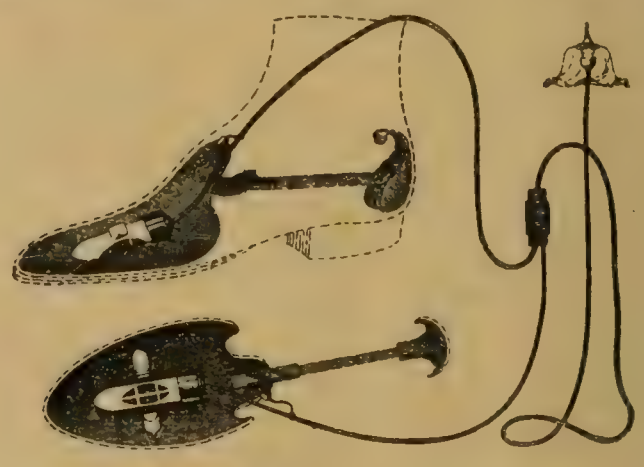


Fig. 10.—Electric Boot Warmer.

ordinary lamp socket. The warming and drying is done more expeditiously from the inside of the boot. One pattern only is supplied, suitable for all voltages.

We understand that the General Electric Co., of Queen Victoria Street, are handling this device.

The Telethermo Heater.

The illustration shows a novel type of electric heater introduced by Messrs. Lester B. Betts & Co., Ltd., of 9, London

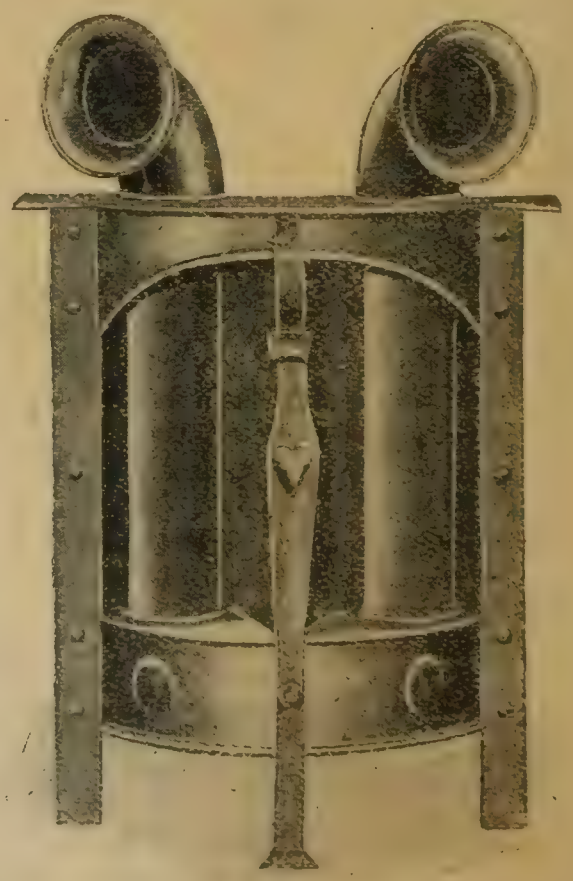


Fig. 11.—"Comfy Corner" Telethermo Heater.

Street, E.C. Its purpose, as the name implies, is to convey heat to a distance, and the method adopted is to direct a current of hot

air in the desired direction by means of two flues with cowls, which deflect the current of air horizontally. The heating elements are fixed inside the perpendicular cylinders of ruby glass which form the main parts of the flues, and are of 250 or 500 watts capacity. The cowls are movable. An 8-C.P. carbon-filament lamp in each ruby glass gives a cheerful red glow to the device.

LEGAL.

Patent Rights of the National Telewriter Co

In the Chancery Division on Wednesday, November 19th, Mr. Justice Warrington had before him a petition by the National Telewriter Co., Ltd., in the matter of the letters patent granted to Foster Ritchie, No. 24,048, of 1899, for the prolongation of the company's patent rights in an electrical device for transmitting exact facsimiles of handwriting at the moment of writing over long and short distances,

Mr. Walter, K.C., with Mr. Gray, appeared for the petitioners, and the Solicitor-General (Mr. Buckmaster, K.C., M.P.), with Mr. Austen Cartmell, appeared on behalf of the Crown.

Mr. Walter, K.C., in opening the petition, said there was no opposition. The patent did not expire until December 1st next. The Privy Council practice, continued counsel, upon which the extension of patents was based, held that in order to obtain an extension, the invention must be one of considerable merit from the public point of view, and further, that for reasons for which the patentee was not responsible, the remuneration during the period for which the licence was originally granted was not adequate in the opinion of the Court. The invention before his Lordship related to the electric transmission from point to point of writing, drawings, or anything that could be put with a pencil on paper. It was an instrument which could transmit a signature to a bank sufficiently accurately for it to be honoured, along many miles of electric wire. The history of inventors' efforts in this direction showed that in 1858 William Thomson, afterwards Lord Kelvin, made a suggestion along the lines of an apparatus to effect this telewriting, but it did not get any further. He would mention here that Lord Kelvin was a shareholder in the present company, and shares were held by Lady Kelvin at the present time. Lord Kelvin got no further in the direction of telewriting beyond the transmission of certain signals which could be interpreted by light thrown upon a wall, and possibly on photographic material, which afterwards could be developed. Next came Cowper's series of patents beginning in 1878. Cowper had the idea of an electrical device controlling an apparatus at the end remote from where the operator was signalling, and the way in which he accomplished this was by an apparatus which responded, unfortunately, to no particular law. but which undoubtedly did give, within small limits, fairly accurate results. The writing pencils, however, both at the transmitting and receiving end could only move over a limited range, and another drawback was that the paper on which the operator was writing was constantly moving. Nothing came of that invention. Then there appeared the patents of Elisha Gray, whose instrument formed a great advance. Anything that could be written or drawn could be resolved into two movements—a vertical movement and a horizontal movement. The type of receiver which Gray proposed to attach to his machine was capable of doing this. The operator's pen was connected with levers which moved in two directions at right angles to one another, and the movements of these levers caused electrical pulsations to follow one another along to the receiving instrument, reproducing the step-by-step mechanical movement; thus the pen at the receiving end moved in sympathy with the operator's pen. It was found, however, that Gray's patent was defective, inasmuch as when the operator wrote quickly the mechanical part of the instrument failed to correspond with the electrical part, and confusion resulted, this making the instrument practically useless from a commercial point of view. Ritchie's patent, which was the one before his Lordship, also had the device of two rods working at right angles, but no longer controlled by step-by-step impulses but by variations of electric current. To make certain of the chronometer movement, it was also necessary to have resistance acting upon the same law. By working this combination it became possible to write rapidly and to go back to any particular point in the writing for the purpose of erasing errors, crossing "t's" or dotting "i's," &c. Then by a very beautifully worked-out electrical problem, an exact correspondence was obtained between the pen of the operator and the pen of the recording instrument.

The Solicitor-General intervening, said that one of the objections sent in was that there was not sufficient general novelty and merit in the invention to justify an extension of the patent. The Crown, however, did not feel bound to take notice of any objection, and would leave the point entirely in his Lordship's hands.

Mr. Walter, with regard to the financial side of the application, contended that it was through no fault of the patentee that the remuneration he had received was inadequate. As far back as April, 1895, a company called the Telautograph Co., Ltd., was registered with the object of introducing Gray's instrument upon the market. A number of Gray's instruments were made, but they had eventually to be withdrawn, as they proved to be commercially unworkable. By September, 1898, the company had come to the end of its resources, and another company, called the Facsimile Syndicate, Ltd., was registered, of which Sir J. Craggs and members of his family were practically the sole financiers. Mr Ritchie, who had come over from America to work the Gray instrument, had devoted himself to remodying its defects and the present invention was the result of his energies. Throughout he had been employed continuously by the various companies which had been formed in connection with the device, and he had received, almost entirely from Sir J. Craggs and his family, a salary of from £100 to £500 a year as manager, making up to date a sum paid to him of about £7,000. The patent was taken over by the Facsimile Co., and further licences arose which led eventually to the development of the National Telewriter Co., Ltd., the present petitioners. Passing on to the actual uses of the telewriter, counsel explained that it was of great use in transmitting coded cables to post offices, and was used by financial houses which would not accept telegrams at all. It was also used in connection with the Liverpool Cotton Exchange for sending out the current prices. A telewriter exchange had been established in Liverpool for this purpose. The instrument had also been established in the Press Gallery of the House of Commons for transmitting news from the Gallery to newspaper offices, and it was used for many other purposes. The need of entering into some arrangement with the Post Office and the National Telephone Co., who were the controllers of wires for sending messages from place to place, was early recognised. Accordingly in 1896 the Telautograph Co., Ltd., entered into an agreement with the National Telephone Co. for the use of their wires, and under it the Telephone Co. charged the Telautograph Co. 27½ per cent. of its gross receipts for the transmission of messages over certain distances, and 22½ per cent. of the gross receipts in respect of others. In April of 1899 the company eventually managed to obtain a licence from the Post Office. It was for one year certain, with six months' notice after that. The charges made by the Postmaster-General were 27½ per cent. of the gross receipts made by telewriters in respect of the use of wires where the rights of the Post Office were non-exclusive; and in cases where the Postmaster-General's rights were exclusive, the charge was 37¾ per cent. of the gross receipts. They were the only terms upon which the Telautograph Co. could do business. It meant that the company had to pay out in respect of these agreements 50 and 60 per cent. of the gross receipts, and it became impossible to carry on the business under such terms. Eventually, better terms were secured, and in November, 1904, a new agreement was entered into with the N.T. Co. which provided that where the rental charged by the Telautograph Co. for their instruments exceeded £10, 15 per cent. of the gross receipts should go to the National Telephone Co., and in cases where the rental was under £10, it was to be 10 per cent. of the gross receipts. In consideration, however, of reducing their terms, the National Telephone Co. insisted upon 15 per cent. of the gross rentals from private installations, viz., where the instrument was used from one department to another in big business houses, &c. After long negotiations with the Post Office, in March, 1906, new licences were obtained from the Postmaster-General for a term of five years certain, terminating on six months' notice, at an all-round charge of 10 per cent. on the gross receipts, but no right was granted to use the telephone exchanges, or even to set up exchanges of their own. In 1906 a further agreement was secured with the Post Office on much better terms. A licence for 21 years certain was obtained at 10 per cent. of the gross rentals after deducting any sums paid for telephone line rental. The now well-known clause of the Postmaster-General giving him a right to purchase was also inserted. There was a further clause permitting the use of the telephone as supplemental to the telewriter, and also permission was given to establish special telewriter exchanges, but the company was still forbidden to use them at the telephone exchanges. It lived in hopes, however, of getting that concession eventually. Of course, with such a licence the company, now the National Telewriter Co., were able to do more business, and they had already established two exchanges in London, and a third, which he had already referred to, in Liverpool. The return of the company's receipts had shown an increase from £801 rentals in 1909 to £5,453 during the present year.

Expert evidence was given by Prof. C. V. Boys, who described minutely the mechanism of the patent. He praised in the highest terms the cleverly worked out electrical problem involved in the instrument, and said the precision and accuracy with which it worked were little short of superhuman.

Sir John Craggs gave evidence as to the growth of the various companies concerned and the financial aspect of the matter.

Mr. Foster Ritchie, the patentee, in evidence, said he was an electrical engineer, and chief engineer to the petitioning company. From 1882 to 1896 he was electrical superintendent to the Electrical Manufacturing Co., of Chicago, and as such became associated with Elisha Gray. For several years he worked with him in connection with the telewriter machine. Eventually witness came over to England to work the Gray patents for the Telautograph Co., and he had been employed by that and the subsequent companies ever since. After the failure of the telautograph as a commercial machine, witness set himself to work to perfect the instrument, with the result that the present machine was patented. The power to establish exchanges, witness said, marked a great development in the petitioning company's business. In his opinion, the real business of the company lay in that direction.

In giving judgment, his Lordship said it was obvious that the instrument could be used for a certain quasi-public purpose, as was shown by its use in the Liverpool Cotton Exchange. He held that the want of sufficient remuneration to the patentee up to the present time was not due to anything within the patentee's control, but was largely due to the fact of being unable to get the use of telephone lines. He thought the petitioners should be granted some further time in order to exploit their patent on a profitable

basis. It was not, however, a case where the outside limit of extension should be granted, but he proposed to grant an extension of the patent for five years, and he would make an order to that effect.

Greenwood *v.* Salford Corporation.

On the 21st inst. an action to recover damages for the loss of her husband was brought by Mrs. E. D. Greenwood, of Whit Lane, Pendleton, before Mr. Justice Bailhache and a common jury, at the Manchester Assizes, against the Salford Corporation.

According to Counsel's statement, Greenwood was a hairdresser, aged 37. He had alighted from a tramcar in Frederick Road, Pendleton, about 11 p.m. on June 17th, and was walking towards the footpath, when he was knocked down, run over, and killed, by a motor-tower wagon belonging to the tramways department of the Salford Corporation, which came up at a very fast speed, and without any warning.

The jury awarded the plaintiff £500 damages.

British Westinghouse Electric and Manufacturing Co., Ltd.

In the Chancery Division on Tuesday (25th inst.), Mr. Justice Astbury had before him a petition of the British Westinghouse Electric and Manufacturing Co., Ltd., to confirm a reduction of capital from £1,875,000 to £1,150,000.

Mr. Clauson, K.C., for the company, said it was proposed to write off £725,000, the amount of capital lost or unrepresented by available assets.

His Lordship said he had been through all the facts, and counsel need not trouble with them.

Mr. Clauson stated that the loss was on patents, goodwill, and on account of a very heavy arbitration between the company and the Underground Electric Companies, and other causes.

His Lordship sanctioned the reduction.

Hankow Light and Power Co., Ltd.

Mr. Justice Joyce, in the Chancery Division, on 21st inst., heard a motion by Mr. H. C. Frank, a shareholder, to restrain the company from declaring a dividend on its ordinary shares on a cumulative basis. Plaintiff contended that the ordinary shares only carried a non-cumulative dividend according to the regulations of the company. Later it was stated that the case depended on the construction of the memorandum of association and the effect of a resolution, and whether the shares were in fact issued with the preferential rate.

His Lordship decided to hear the motion on Tuesday.

Workman's Compensation Claim.

At Rotherham County Court last Friday, George W. Howard, electric welder, applied for compensation, the respondents being Messrs. Edgar Allen & Co., Ltd. Applicant alleged that he had lost the sight of his right eye in the course of his employment. Dr. Walker, of Leeds, sat as medical assessor.

According to the report in the *Sheffield Daily Telegraph*, Mr. Howe stated that Howard was doing his work as an electric welder, on May 19th, 1913, when there was a flash in his face. The sight of the right eye was practically lost, but the left eye was about normal. The applicant's wages at the time were over £2, and £1 a week compensation was paid up to July 1st. The respondents denied total incapacity. The real point seemed to be whether the present condition of the right eye was in any way attributable to the flash, or whether it was entirely due to previous disease, or some other cause.

His Honour (Judge Benson) acting on the opinion of the medical referee, gave judgment for the respondents.

Giant Finance Co., Ltd., *v.* Victoria Falls and Transvaal Power Co., Ltd.

Before Mr. Justice Pickford in the King's Bench Division on 20th inst., plaintiffs asked for a declaration that, as assignees of Mr. M. F. Armstrong, they were entitled to a commission on the gross actual receipts in respect of electric power supplied to the Eckstein group of mines on the Witwatersrand and other undertakings. The defendants denied that Mr. Armstrong obtained any contract for the supply of electric power to the Eckstein group, or that they supplied the group. They said that a contract to supply the group was obtained by a Mr. Harper, that a subsidiary company—the Rand Mines Power Co.—was formed to take over the business, and that Mr. Harper was paid £70,000 for his rights. The hearing of the case was continued on 20th inst., when his Lordship deferred judgment.

Factory Acts Prosecution.

At the Birmingham Police Court, on 20th inst., Messrs. William Bayliss, Ltd., tube manufacturers, Wiggin Street, were summoned under the Factories and Workshops Act with neglecting efficiently to earth metal work and a portable lamp, in consequence of which neglect a workman named George Farraday suffered bodily injury. The defendants were also summoned for neglecting to provide efficient means suitably located and capable of cutting off and controlling electrical pressure.

According to the report of the case in the *Birmingham Mail*, Mr. J. E. Harston, Inspector of Factories, appeared in support of the summons.

William Lee, a workman employed by the defendants, said that on October 8th last Farraday was found in an unconscious condition. The witness attempted to raise him from the ground where he lay, and received a shock. Lee had to release his hold of him. Another employé named Dolby declared that the voltage was 110. When he saw Faraday lying prostrate on the floor he cut off the current. A copy of the Electrical Regulations was fixed up in the premises, and if they had been infringed they had been infringed through being misconstrued. Mr. Evans, a representative of the defendant firm, questioned the witness with regard to the electrical installation. The witness said that electrical experts had seen the apparatus, and only 14 days before the accident it was tested by them. Dr. Sampson, of the General Hospital, said that when the man Faraday was admitted to the institution he was in a very critical condition. The witness had never seen such a severe case of electric shock before.

The defendants pleaded guilty. Mr. Evans declared that they had been "let down" by the electrical experts. They were deeply grieved at the accident.

The Bench considered the case a very serious one. The defendants were fined £50, with £3 19s. 6d. costs on the first summons, and £5 and 10s. 6d. costs in the second case.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Pamphlet No. 91 containing illustrations and brief particulars of "Universal" electric light fittings; also a pamphlet relating to their electric controlling apparatus for printers, a lengthy list of printing offices equipped by the firm being given.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—Pamphlet describing the Westinghouse steam heating apparatus for steamships.

The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—12-page pamphlet, entitled "That Blue Light," concerning the application of mercury vapour lamps to box advertising signs and the illumination of buildings. Pictures are included of buildings lighted by this means, and of the different types of lamps and fittings used.

The Sterling Telephone and Electric Co., Ltd., 210 and 212, Tottenham Court Road, London, W.—Several publications. No. 173 (8 pages) gives illustrations, with revised prices, &c., of "Primax" automatic interphones; No. 179 deals with electric bells; No. 210 gives prices of receivers for wireless telegraphy; and another contains illustrations and prices of condensers for telegraph, telephone, ignition, and other service.

Messrs. C. Jennings & Co., Pennywell Road, Bristol.—266-page bound catalogue containing fully illustrated information and prices of their numerous manufactures in woodwork, ranging alphabetically from arches to woodwork mantelpieces. Particulars are included relating to their electric light casings and cappings, also creosoted troughing for underground cables. The makers of this troughing claim that whether it is creosoted by dipping or by pressure the material used is free from acids injurious to the lead or other coverings on the cables. Sharp flexion and fatigue are avoided owing to the longer lengths and elasticity obtainable with a wood trough system. A large stock of teak for the electrical trade is listed. We have also received one of the firm's fourfold brass jointed rules.

Messrs. Higgs Bros., Dynamo Works, Sherbourne Road, Balsall Heath, Birmingham.—Ten-page illustrated pamphlet in binding cover, containing specification of small motors for propeller fans, forge fans, and electric drills. Shunt and series motors, enclosed ventilated, from ⅛ to 7½ h.p., and shunt generators from ·2 to 4 kw., are particularised as to speeds, prices and dimensions, and information is given of controlling gear.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—The *Mazda House News* for November contains in its 20 pages a good deal of chatty and interesting information relating to "Mazda" lamps, fittings and lighting, and publicity literature concerning same.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—The firm's 1914 catalogue is a very bulky one. It consists of 13 sections separated by a thumb index, and with a complete alphabetical index for the whole of the contents. As usual the book is profusely illustrated, and prices are clearly indicated. The manufactures of which particulars are given include all makes of metal-filament and other incandescent lamps, arc lamps for various purposes, cables and flexibles, switchboards, switchgear, measuring and testing instruments, electric lighting accessories, electric radiators, fires, heaters, cooking and heating appliances, telephones for different classes of service, motors, starters, fans, vacuum cleaners, prepayment devices, Holophane and other glassware. The last and largest section is that dealing with electric light fittings, indirect and semi-indirect lighting, fittings, Striplite, watertight fittings, &c.

The A.E.G. Electrical Co. of South Africa, Ltd., Caxton House, Westminster.—Pamphlets describing the A.E.G.-Nitra lamps, of 600-3,000 c.p., taking ½-watt per candle, with fittings and accessories.

Patent Notices.—An order has been made restoring letters patent No. 25,736 of 1908, granted to Edward Temple, for "Improvements in and relating to washing or purifying apparatus for use in gas generating plants."

An application has been made by H. Hartley and V. Canova for restoration of patent No. 13,359 of 1908, for "Improvements in taximeters or the like indicating and recording instruments."

Glasgow Exhibition Electric Kitchen.—The accompanying photograph illustrates a series of Carron cooking appliances which were used in the restaurant kitchen at the Glasgow Electrical Exhibition by Mr. James Craig, of Glasgow, the caterer for the Exhibition. The appliances consist chiefly of



Carron Electric Kitchen at Glasgow Exhibition.

an 18 in. × 15 in. grill and hot-plate; a breakfast cooker set, consisting of a 10-in. grill with an 8-in. boiling plate; a 24 in. × 18 in. baking plate; a 4 ft. × 2 ft. 6 in. hot closet and carving table; three-gallon water boiler, and one of the company's standard electric cookers, No. 860. These appliances were found sufficient to provide luncheons, teas and other refreshments for a daily average of 500 people, and were worked at high pressure throughout the run of the Exhibition. The results obtained were highly appreciated by the public, as well as by the caterer, Mr. Craig, and the Exhibition management generally.

Private Arrangements.—Accessories Manufacturing Co., Ltd., 11, Dean Street, Oxford Street, London, W., electric accessories manufacturers.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Friday, November 14th, at the offices of Messrs. Roberts, Wright, McCann & Co., chartered accountants, Pancras Lane, E.C. It was reported that the shareholders had passed resolutions in favour of voluntary liquidation, and had appointed Mr. H. A. McCann to act as liquidator. A statement of affairs was presented showing the position as at October 29th last, and this disclosed liabilities of £1,386, all of which were due to unsecured creditors. The assets were estimated to realise £1,368, less £141 for preferential claims, leaving net assets of £1,228, and a small deficiency was thus disclosed. The assets consisted of cash in hand and at bank, £20; sundry debtors £466, expected to produce £350; stock-in-trade at or under cost prices, £899; and fixtures and fittings valued at £100. It was reported that the company was registered on November 7th, 1910, with a nominal capital of £5,000 in £1 shares. There were 4,900 preference shares, and 100 ordinary shares, all of the face value of £1 each. The company was formed to take over the assets of a previous company. The purchase price payable for the assets was agreed at £1,670, and that amount was discharged by a payment in cash. During the first 12 months that the company was in existence it carried on business at a loss of £200, while in the succeeding year there was a further loss of £400. After discussing the position the creditors decided to confirm the voluntary liquidation of the company, and approved the appointment of Mr. McCann as liquidator. A committee of three of the principal creditors was also appointed to act with the liquidator.

Electrical Co., Ltd.	£202	Ickelheimer, Max.	£46
Gilson & Co., Ltd.	194	Macintyre & Co., Ltd.	47
Goossens, Pope & Co., Ltd. ..	20	Outram & Co.	42
Heath & Co., Ltd.	284	Zimmerman & Co.	32
Hawkins Bros...	27		

Telephone Rents.—On Tuesday an action was brought by the Postmaster-General, in the Manchester County Court, to recover one year's rent of a telephone, due in advance on May 9th, 1912, from J. Solberg, partner in the late firm of Kirby & Solberg, of Harpurhey. Notice of dissolution of partnership was published in the *London Gazette*, but Judge Mellor held that this was not sufficient, and the defendant was liable. At the same time, he expressed astonishment that the Government should press the claim, as the defendant had only had nine months' use of the telephone, and was being made to pay for two years' use.

Book Notices.—*Applied Mechanics.* By A. Jamieson. Vol. V. London: Chas. Griffin & Co. Price 7s. 6d.—This, the eighth edition, incorporates the author's last additions and alterations; it treats of the theory of machines and practical mechanisms, and follows the syllabus of the final B.Sc. examination in engineering for external students of the University of London, covering also that of the Institution of Civil Engineers for the Associate Membership examination. The work is so well known that we need only commend it to new readers as one of the most lucid and instructive text-books extant on this subject, written in the author's inimitable style, and fully illustrated. Numerous examples and examination questions are included.

We have received a copy of the first number of the *International Review of Commerce and Industry*, a monthly magazine edited by Mr. T. [illegible]. The price is 2s. net, and the intentions of the publishers (Messrs. L. Upcott Gill & Son, Ltd.) are to produce a high-class review dealing with international commerce and industry in the same way that the well-known monthly reviews cover politics, literature, social and religious questions. The opening pages contain, under the heading "Markets of the World," a collection of useful notes on commercial conditions, which are well informed, and cannot fail to be of service to all who wish to follow the course of matters bearing upon trade and commerce in different parts of the world. These comments are followed by a number of articles from the pens of authorities, on a variety of matters coming within the scope of such a publication. Among the articles in the present issue (December) are the following:—Commerce and the Universities, Trade Routes as they will be Affected by the Panama Canal, Oil Fuel and its Use for Steam Raising, The Incidence and Effects of the New American Tariff, The Commercial Outlook in China, The Merchant System and Oversea Trade, A Retrospect and Prospect, by the editor, Siberia of To-day, extracts from official reports and from the world's commercial Press. We extend to our new contemporary the hand of welcome, and wish the editor every success in his efforts to maintain that high standard which is his aim, and to which he fully attains in his first issue.

"Insulation and Design of Electrical Windings." By A. P. M. Fleming and R. Johnson. 1913. London: Longmans, Green and Co. Price 7s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 1. November, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"The Influence of Inert Gases on Inflammable Gaseous Mixtures," by A. Clement. "Monthly Statement of Coal-Mine Fatalities in the United States, July, 1913," by A. H. Fay. "A Laboratory Study of the Inflammability of Coal Dust," by J. C. W. Fraser, E. J. Hoffman and L. A. Scholl; and other mining pamphlets. Washington: Government Printing Office.

"*Journal* of the American Institute of Architects." October, 1913. Washington: The Institute.

"The Physical Review." Vol. II, No. 5. November, 1913. Lancaster, Pa. The American Physical Society.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 7. September, 1913. Chicago: The Society. Price 50 cents.

"Memoirs of the College of Science and Engineering, Kyoto Imperial University. Vol. 5, Nos. 6 and 7. May and August 1913. Kyoto: The College.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 5. November, 1913. Philadelphia: The Institute. Price 50 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 21. November 15th, 1913. Milan: Stucchi Ceretti & C. Price Lire 1.50.

"*Boletin* de la Sociedad de Fomento Fabril. Vol. XXX, No. 10. October, 1913. Santiago de Chile: The Society.

Condensing Plant Contracts.—Orders for condensing plant have recently been received by the Mirrlees, Watson Co., Ltd., for:—The City and Guilds (Engineering) College; the Carron Co.; De Beers Consolidated Mines, Ltd. (Kimberley); New Jagersfontein Mining and Exploration Co., Ltd.; Fife Power Co.; Bournemouth and Poole Electric Supply Co.; Oldham Corporation; and a number of collieries.

For Sale.—Reading Corporation has for disposal a steam engine and fan, also a fan suitable for direct electric drive. Particulars are given in our advertisement pages.

The Norwich Electric Tramways Co. is offering a 200-kw. Westinghouse dynamo and Browett-Lindley engine for sale.

Bankruptcy Proceedings.—William Henry Davis (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, 75, Ralph Road, Saltley, Birmingham.—The first meeting of creditors herein was held last week at 191, Corporation Street, Birmingham, when the statement of affairs showed liabilities amounting to £227, and assets estimated at £44 odd, the estate disclosing a deficiency of £182. The debtor started trading in 1898 as a dealer in gas and electric light accessories, having at the time no capital. He had had no experience of the trade, but was fairly successful until 1909. Debtor had for several years had the regular custom of a brewery company for the supply

of accessories to their licensed houses, but owing to the loss of that business and to illness, he became financially embarrassed, and on September 9th accepted a situation which was offered by one of his creditors. The debtor was indebted to his daughter to the extent of £60 for arrears of wages on June 22nd last, and he paid her £20 on account, which sum was immediately repaid to the debtor in purchase of household furniture. The books of account kept consisted of a sales ledger and a day book, and debtor had not at any time endeavoured to ascertain his financial position. The matter was left with the Official Receiver.

J. G. M. Hilton, electrical engineer, Birmingham.—The application to approve the scheme of arrangement was refused, and the debtor adjudged bankrupt, at Birmingham, on November 19th.

Wakelin Bros, 9, Tottenham Street, W.C.—December 10th is the last day for the receipt of proofs for dividend by the liquidator, Mr. W. A. Henderson, 3, Fenchurch Street, London, E.C.

Dissolutions and Liquidations.—Safety Light, Ltd., 118, Queen Victoria Street, London, E.C.—Messrs. P. J. Goodchild & Williams have been appointed joint receivers for the debenture-holders. Pending the preparation of accounts of the position of affairs they are continuing the business as a going concern.

Clampett & Duckworth, electric light and power engineers, 5, Cathedral Yard, Manchester.—Messrs. R. H. Clampett & J. Duckworth have dissolved partnership from November 15th. Mr. Clampett attends to debts, &c., and he will continue the business as Robert H. Clampett & Co.

Lund Bros. & Co., electrical and mechanical engineers, 78-80, Queen Victoria Street, London, E.C.—Messrs. R. Lund & F. C. Polden dissolved partnership as from June 30th, 1911. Mr. Lund will attend to debts and continue the business under the same style at the same address, and Mr. Polden will carry on business under the style of F. Polden & Co., at 56, Cannon Street, E.C.

Trade Announcement.—Mr. S. Ferguson has resigned his position as chief draughtsman to Messrs. Ferranti, Ltd., and is joining Mr. G. Pailin for the purpose of carrying on the business of switchboard building. The new firm is entitled Messrs. Ferguson, Pailin & Co., Edward Street, Higher Openshaw, Manchester, and it is not connected with Messrs. Ferranti, Ltd.

Lamp Works Extensions.—We understand that extensions are now in progress at the works of Pope's Electric Lamp Co., Ltd., at Willesden, which, when completed, will enable them to cope successfully with their largely increased business in "Pope Elasta" wire lamps.

Germany.—A company has recently been formed in Stettin, with the title Die Pommersche Gluhlampenerneuerung Gesellschaft, to exploit a process for the renewal of burnt-out lamps.

France.—A company has lately been formed at Lyons, with a capital of £40,000, and the title La Société pour l'Electro-Métallurgie du Zinc, to exploit a new process, known as the Côte and Pierron, for the electrical production of zinc, which was described in our issue of September 12th, 1913.

LIGHTING and POWER NOTES.

Abercarn (Mon.).—Prov. Order.—Powers for E.L. within the area of the U.D.C. are being applied for by the South Wales E.P.D. Co.

Accrington.—Another extension of the Corporation electricity works, involving a large capital outlay, is in contemplation in order to meet the ever-increasing demands for current from both inside and outside the borough. Alderman Higham, the chairman of the department, is a most enthusiastic advocate of electrical methods, and his ambition is to place Accrington amongst the leading municipal electricity undertakings of the country in the matter of cheapness and efficiency. The neighbouring district, Great Harwood, is at the present time negotiating with Accrington for supplies of current. Blackburn is also being asked to quote terms to Great Harwood, and it is stated that before long Rishton will seek an electrical supply from either Accrington or Blackburn.

Argentina.—The Municipality of San Justo (Santa Fé) has accepted the tender of Mr. Carlos Droz for the erection of an electric light station. The contract has been forwarded to the Government for approval.

Sr. P. Ferreira, concessionaire for electric light works at La Plata, has informed the authorities that he has obtained the necessary capital and is prepared to carry out the contract. He, therefore, desires to withdraw his previous petition in which he relinquished the concession.—*Review of the River Plate.*

Aylesbury.—Loan Application.—The U.D.C. has decided to apply to the L.G.B., for sanction to a loan of £20,800 to carry out the E.L. scheme, the sum including £5,425 for plant, £9,852 for cables, and £1,471 for public lighting by the conversion of 265 gas lamps to electric lighting.

Beeston.—Prov. Order.—The U.D.C. has decided not to proceed with the application for a prov. order for electric supply The Notts. and Derbyshire Electrical Co. has already given notic of application for an order to supply electricity in the town

Bingley.—In connection with the supply of electricity which will be commenced in January, 1914, the following scale of charges for lighting has been compiled by the D.C.: 4½d. per unit up to 250 units, 4d. per unit from 250 to 1,000 units, and 3½d. per unit from 1,000 to 5,000 units, with a minimum of £2 per annum. It is proposed to have a separate scale for power consumers.

Canada.—The Department of Agriculture has issued a 50-year permit to the Skagit Power Co. (Bellingham, Ont.), which is a subsidiary of the Stone and Webster Co. The company will construct a power plant in the Upper Skagit River country, to cost $5,000,000, and to develop 27,610 H.P.

Among eight by-laws to be brought before the ratepayers of Winnipeg is one to provide $1,000,000 for power distribution.—*Canadian Engineer.*

Chiswick.—Proposed E.L. Purchase.—The U.D.C. on the 19th inst., discussed the proposal to promote a Bill for taking over the undertaking of the Chiswick Electricity Supply Corporation. Councillor C. E. Bovill said that the prov. order was now vested in the electricity undertaking, but under the terms of the agreement the Council had an opportunity in January next of acquiring that undertaking at a figure that fairly represented the actual money expended, and as represented the works, without any price for goodwill. The Council had taken the advice of Mr. Snell. After making allowance for depreciation and replacement of engine power, he believed the Council would in the future make a very considerable profit. Ald. Helmsley severely criticised the proposal, the report, to his mind, being in the nature of the prospectus of a limited company inviting ratepayers to become shareholders, and he considered it would be a calamity for the district to buy it. Councillor Stone, after eliciting from the chairman that a town's meeting would be necessary before the Council could promote the Bill, said that certain representatives of the Council had had an interview with the Brentford Gas Co., and some sort of an arrangement had been made for the latter to take over the undertaking on certain conditions. After other members had opposed the motion on the ground that they objected to municipal trading, the debate was adjourned, but we understand that at the subsequent meeting a resolution to proceed with the Bill was carried.

Continental Notes.—France.—The French State Railway authorities have decided on the establishment of a large electric generating station at Rouen for the electric lighting of the various railway stations in that city and for lighting power puposes at the extensive railway works at Sotteville, just outside Rouen.

The much-discussed scheme to harness the Rhone at Pougny-Chancy, which is of much importance industrially to the future of the Gex country, has advanced a stage with the announcement of the Minister for Foreign Affairs that a Franco-Swiss convention was signed on October 1st, regulating the division of the water-powers of the Rhone. The scheme, at the head of which is M. Crépel, Deputy for Gex, may now be expected to be realised at no distant date.

The Société des Forces Matrices de la Cère, says the *Revue Pratique de l'Electricité*, has under consideration a scheme for the establishment of a big hydroelectric generating station and factory for the manufacture of nitrate of soda. The plans propose the construction of a dam across the bed of the Cère, and the conveyance of the collected water a distance of 30 km. in tunnel, giving a head of 160 metres. The cost of the undertaking is estimated at £800,000. The land has already been acquired, and operations will be begun forthwith.

Switzerland.—The Swiss Government has lately granted a concession for the establishment of a large plant to utilise the water-power of the Rhine at Eglisiau, in the generation of electrical energy. The full capacity of the plant will be 24,000 H.P., but this, it is estimated, will only be available on 80 days per year, the capacity, owing to the fall of the level of the river dropping at low water to 12,500 H.P. Four turbines and generators of from 3,400 to 4,000 H.P. are to be installed, the total cost of the installation being estimated at £528,000.

Germany.—The Westfalen Elektricitäts Gesellschaft, which has a large electricity supply station at Hattingen, proposes to establish two additional plants—one at Hamm and one at Haltern, with the view of supplying current for lighting and power purposes in the eastern and northern districts of Westphalia. It is expected that by the end of next year the company will be supplying current to no less than 100 towns and villages.

Norway.—A company with a capital of about £35,600 has recently been formed with the object of generating electric power from the numerous waterfalls in the neighbourhood of Sandefjord, about 65 miles south of Bergen. According to the local Press, the total power produced will be from 70,000 H.P. to 80,000 H.P. Two power stations will be erected and very extensive damming operations are to be carried out. A water-tunnel 8·5 km. (about 5¼ miles) long is also to be constructed.—*Board of Trade Journal.*

The town of Horten has recently installed electric light. Energy is supplied from a plant at the Skolbenberg Waterfalls, from which H.T. current is transmitted to a transformer station in the town.

Cowbridge and Penybont.—Prov. Order.—The South Wales E.P.D. Co. is applying for a prov. order for E.L. within the borough of Cowbridge, the six parishes in the area of the Penybont R.D.C., 26 parishes in the area of the Cowbridge D.C., and in a portion of the parish of Llantrisant.

Deal and Walmer.—Prov. Order.—The Gas Co. is applying for powers to supply electricity in the boroughs of Sandwich and Deal, the urban area of Walmer, and the rural parishes of Ripple, Sholden, Great Mongeham, Ringwould and Word, and the transfer to the company of the undertaking authorised by the order obtained by the Sandwich, Deal and Walmer Electricity Supply Co., Ltd.

Dundee.—New Plant, &c.—On November 18th the Electricity Committee adopted a proposal by the engineer that additional plant to generate 5,000 kw. be ordered for the Carolina Port station

The borough electrical engineer has reported that the standardisation of the electricity supply systems of Dundee and Broughty Ferry—recently annexed to the city—is highly desirable. The lighting pressure in Broughty Ferry is 230 volts, and in Dundee 200 volts. The change has been approved of by the Electricity Committee, and consumers will be provided with new apparatus, where necessary to effect the change. The cost will be between £800 and £1,000.

Earlestown and Newton.—Prov. Order. — The U.D.C. has decided to apply to the B. of T. for a prov. order authorising it to supply electricity.

Easington.—Workhouse Lighting.—The B. of G. has decided to ascertain at what cost electricity can be obtained for lighting the workhouse premises, with a view to the E.L. being installed at an early date.

Edinburgh.—Prov. Order.—The T.C. has had under consideration a letter from the Colinton Tramway Co. intimating that it intended making application for a prov. order to enable it to supply electricity within the parish of Colinton and part of the parish of Corstorphine. The T.C. has now adopted the recommendation of the Electric Lighting Committee, mentioned in our last issue, to make immediate application for a prov. order to extend its own area of supply, so as to include therein the following parishes in the county of Midlothian, viz.: Cramond, Corstorphine, Colinton, Liberton and Newton.

East Ham.—Electricity Assessments.—The borough treasurer reports having interviewed the valuer to the Assessment Committee of the West Ham Guardians with reference to the Corporation's objection against the valuation list in respect of the revised assessments of the electricity and tramways undertakings, which show a net increase in the gross estimated rental of the electricity undertaking of £3,730; of £4,150 as regards the tramways department and increases in rateable value of £2,758 and £3,150 respectively. The revised assessment was £9,450, £15,150, £5,010 and £6,650 respectively. The borough treasurer's suggested revised figures are: Gross estimated rental, electricity undertaking, £8,982; tramways undertaking, £15,899; rateable value, £4,061 and £3,660. At the interview it was pointed out that there were several differences between the valuer and the borough treasurer as to the method of calculating various items prior to arriving at the rateable value, and these are to be the subject of a further interview. The Committee has decided to continue the negotiations.

Haslingden. — The Electric Loom. — During an address to a number of cotton manufacturers, managers and workers, Mr. J. W. Crowley, a well-known expert on electrical power in its application to the textile trades, was asked what chances there might be of an electrical loom in the future.—Mr. R. Cotton, who put the question, said there were jacquards in which the thread was selected electrically. An electrical loom might tend to less complications in fancy weaving.—Mr. Crowley, in replying, said he was afraid that development in this direction was some distance off. There was, however, a big opening for anyone who could devise a better machine than the present loom, which was anything but good mechanism.

Hawarden.—Prov. Order.—The R.D.C. intends to apply for a prov. order to supply electricity within the parishes of Hawarden and West Saltney.

Hereford.—Loan Sanction.—The T.C. has received sanction from the L.G.B. to a loan for £1,000 for services, and for £33, the excess expenditure on mechanical stokers at the electricity works.

Hertford.—E.L. Agreement.—The T.C., after much negotiation, and after a B. of T. inquiry on the appeal of the North Metropolitan Electric Power Supply Co., which contended that the Council had unreasonably withheld consent for it to supply current for power within the borough, has sealed an agreement between the company and the North Metropolitan Electrical Power Distribution Co., which holds the Council's E.L. order under transfer. The Power Co. has laid a trunk main through the borough for the purpose of affording a supply of alternating current at high voltage beyond the area of supply of the Corporation, and under the agreement the company will be enabled to supply current off the main to the Distribution Co. for use in the borough, and the latter company will supply all the necessary sub-stations, machinery, plant, switchgear, distributing mains and other apparatus, which will become purchaseable by the Council should it at any time desire to execute its power of purchase, in which instance the Council would take current from the Power Co. for not less than seven years on terms to be agreed upon.

Higham Ferrers.—The B. of T. has informed the T.C. that the undertakers of the Rushden and District E.L. order, who had deposited £400, had applied for £300 to be returned, and as work to that amount had been carried out, it was proposed to grant the request.

Hove.—The Corporation has now almost agreed on the amount of the purchase money to be paid to the Hove Electric Lighting Co., Ltd., for taking over its undertaking, which will probably be about £200,000. We understand that the Corporation is accordingly now prepared to receive propositions from responsible persons for leasing the undertaking, together with the undertaking in Aldrington, which has from the first been run by the Council itself. The company has for some years past paid large dividends and built up a large reserve fund, and it is believed that the undertaking would, in the hands of the right parties, form an attractive investment. Particulars can be obtained from the Town Clerk, Hove Town Hall.

Llandiloes. — Prov. Order. — The T.C. has been informed that the Llandiloes Electric Lighting Co., which is now being formed, intends to apply for a prov. order to supply electricity within the borough, and a Committee has been formed to consider the question of supporting the company.

Llanfairfechan. — E.L. Scheme. — The U.D.C. has appointed a Committee to open negotiations with the North Wales Electric Power Co., for a supply of electricity. The engineer engaged by the Council estimated the capital cost at £3,250, whereas a local water-power scheme would cost £5,250. The Power Co.'s terms, on the basis of 24,000 units, were a lease of seven years and a charge of £120 per annum for the first two years and £150 per annum for the remaining five years—equal to a charge of 5½d. to 6d. per unit to consumers.

London.—St. Pancras.—The Electricity Committee has received a letter from the Comptroller of the L.C.C. in connection with the Council's application for sanction to the borrowing of £15,000 for the 5,000-kw. Ljungstrom turbine set for the King's Road station, asking to be advised more fully in respect to the contemplated extension, as it was desired to consider more closely the possibility of the B.C. obtaining a bulk supply as an alternative to the proposed extension of the undertaking, and in order that the financial aspect of the matter may be more clearly understood, he was requested to ask for full particulars received by the B.C. as to a supply in bulk, and for detailed figures showing how the opinion that it would be more economical for it to extend its own plant was arrived at, and what was the amount of saving anticipated by the new plant contemplated. The chief electrical engineer reports that the capital expenditure required would amount to £66,018. This amount included £15,000 for the turbine under discussion, and made provision in the boiler house for further extensions of boiler plant at a later date. The saving anticipated by the installation of the proposed new plant, on the assumption that electricity could be purchased in bulk at £4 per kw. and ·33d. per unit (which was the offer obtained for supply in June, 1912), and after allowing for the L.C.C.'s shortened periods for repayment of loans, is estimated at £21,417. Since the offer for supplying in bulk referred to above was received, a lower price of £3 per kw. and ·25d. per unit has been offered to a neighbouring borough, and on the assumption that electricity could be purchased at this lower price, the installation of the anticipated new plant would, it is estimated, still show a saving of £9,584. These facts, and the point that if a bulk supply was obtained it would not offer the reliability and certainty of service which is obtained by the Council with the control of its own generating plant, are to be forwarded to the L.C.C.

The L.C.C. has sanctioned the following loans by the St. Marylebone B.C.:—£10,825 for electricity purposes, £4,300 for mains, £1,325 for auxiliary plant, and £5,200 for house services; also a loan of £5,000 for the purposes of the Fulham electricity undertaking.

The Finance Committee has recommended the L.C.C. to sanction the borrowing by the Stepney B.C. of £7,180 for the purchase of property in connection with the electricity undertaking.

At the Tuesday's meeting of the L.C.C., the chairman of the London Electricity Supply Committee was asked whether he could give any information regarding the proposal of the County of London E.S. Co. to apply for powers to postpone the date of purchase of the London Companies by the Council, and in reply, he said that nothing could be usefully done until the Bill was produced. He had heard, however, that the idea was to form a "super-company" to acquire all the present companies and to offer local authorities bulk supplies from large power stations.

Motherwell.—Under the direction of the Corporation electricity department an electrical exhibition was opened last Friday by Provost Wilson. All the latest appliances were on view and attracted considerable attention.

Neath.—L.G.B. Inquiry.—An inquiry was held on November 20th into the application of the R.D.C. for a loan of £9,636 for electric supply in the parish of Blainhonddan, and the hamlets of Coedfranc, Duffryn, Clydach, Rulais Lower, and Llantwit Lower. There was some opposition on the ground that the scheme would entail heavy rates, but the inspector, Mr. R. H. Hooper, pointed out, on it being suggested that the parish concerned had had no opportunity of discussing the matter, that the question was dealt with by the R.D.C. in May last, that notices were issued, and that the application was in order. In the end, the inspector adjourned the inquiry *sine die* for the supply of a statement showing the difference between loans already sanctioned and the amount actually expended on capital account.

Newcastle-under-Lyme.—We are informed that the new scale of charges mentioned on page 784 ("Lighting and Power Notes"), as having been adopted by the T.C., is for outside arc lamps only.

Northampton.—Municipal Lighting Inquiry.—The T.C. has directed an inquiry to be held into the question of municipal lighting, both by gas and electricity.

Reading.—Bulk Supply to Gas Co.—Notice is given by the Reading Electric Supply Co. of its intention to apply for a prov. order to empower it to supply electricity to the York Town and Blackwater Gas Co. for use within the electrical area of supply of that company.

Rickmansworth.—Prov. Order.—The Colne Valley Electric Supply Co., Ltd., of London, is seeking powers to supply electricity within the area of the Rickmansworth and Chorley Wood Urban Councils, and in the parish of Rickmansworth Rural.

Scottish Prov. Orders.—Notices have appeared of applications for prov. orders for E.L. at Ellon, Ballater, Aboyne and district, and for an extension of the Ayr electric lighting area.

Sedbergh.—The U.D.C. has appointed a Committee to consider terms for a draft agreement relating to the proposed formation of an E.L. company for the district.

Skelton and Brotton.—The Cleveland and Durham County Electric Power Co. has applied for consent to supply current at 11,500 volts to Kilton Mines, in the area of the U.D.C.

South Africa.—According to the local Press, the Municipality of Graaff Reinet, Cape Province, is taking steps to raise a loan of £40,200 for, among other things, installing an electric light system.—*Board of Trade Journal.*

The Parys (O.F.S.) Municipality proposes to expend £3,500 on a turbine, piping, &c., and £1,000 on extensions to the overhead electrical system.—*African World.*

Southend-on-Sea.—Supply to Leigh.—Leigh-on-Sea has now become incorporated in the borough, and at a meeting of the T.C. last week, a Leigh member inquired when the electric light would be extended to Leigh. Alderman Martin replied that as soon as the Council had a sub-station, it would give a supply.

The T.C. proposes to light the area of the town east of the White Horse, by 13 electric lamps.

Stone (Staffs.).—Prov. Order.—The Stone Gas Light and Coke Co. is applying for powers to supply electricity within the areas of the Urban and Rural Councils.

Surrey.—Prov. Order.—Mr. Gilbert Allom, electrical engineer, of London, is applying for a prov. order to enable him to supply electricity in the parishes of Banstead, Walton-on-the-Hill, and Kingswood.

Thornton (near Fleetwood).—Prov. Order.—The U.D.C. has decided to apply for a prov. order authorising it to generate and supply electricity.

Tynemouth.—Quay Lighting.—The Trade and Commerce Committee of the T.C. has adopted the report of the electrical engineer with regard to the electric lighting of the Fish Quay, in which he recommends that Messrs. Robson & Coleman's alternative tender be accepted for wiring the new installation; that the lamps run for street lighting hours be charged at ordinary street lighting rates for 100-watt lamps, and that the intermittent lamps which will be of larger candle-power, and which will be run for short periods only, be charged at the street lighting rate, but that the lamp bulbs be kept up by the Fish Quay department.

Last week a series of "Tricity" cooking lectures and demonstrations was given in Gregg's Café, on behalf of the Corporation electricity department (Mr. C. Turnbull, engineer), the lecturer, as usual, being the inimitable Mr. F. S. Grogan.

Walthamstow.—The oil lamps in Higham Hill Road to Friar's Watch, Billet Lane, are to be converted for electric lighting. At a meeting of the U.D.C., the Joint Committee recommended that the price charged for the current supplied to the tramways be 1⅜d. per unit for the first million and a half units and 1d. per unit in excess of that amount; the current supplied for lighting the car depôts and offices to be assessed at power rates. The Light Railways Committee, in its report, states that it does not agree with the decision of the Joint Committee, and recommends that 1½d. per unit for the first million and a half units and 1d. per unit thereafter should be the charge, and that such recommendation be submitted to the Finance Committee. The Finance Committee, having considered the reference, made no recommendation thereon.

Wigan.—The T.C. has reduced the price of electricity for heating and cooking purposes from 2d. to 1d. per unit.

Yeovil.—Prov. Order.—Messrs. Petters, Ltd., a local firm of engineers, are applying to the B. of T. for a prov. order for E.L. in the borough.

York.—Powers for Extended Supply.—The T.C. has applied for powers to extend its area of supply of electricity so as to include 46 parishes in the North and West Riding, and situate in the Rural Districts of Easingwold, Flaxton, Great Ouseburn, Tadcaster, Bishopthorpe, and Eserick.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Extensions.—The Corporation intends to apply to the Secretary for Scotland for a prov. order for the extension of the existing tramway lines along Mid-Stocket Road as far as Glenmore Road; from Holburn Street along Union Grove to Queen's Cross; and from Victoria Road, Torry, along Menzies Road to Craiginches. Power is sought to establish railless traction from Castle Street, by way of Justice Street, Commerce Street, and St. Clement's Street, to Footdee and from Schoolhill, by way of Skene Square, to Westburn Road, as far as Foresterhill Road. The Corporation is asking for power to borrow £60,000, and to apply one-third of the profits from the tramway undertaking to such purposes as it may think fit.

Argentina.—The first underground electric railway in Buenos Ayres, between the Plaza Once and the Plaza Mayo, is now completed and is expected to be opened for traffic early next month. Work is also well in hand on a 2¼-mile extension of the line to Caballito.

The work of electrifying the tramway line from Asuncion to the suburb of Villa Maria will probably be completed by the end of the year.

During the current year several proposals were received by the Buenos Ayres Municipality for the establishment of motor-'buses in the city. As the Mayor was not in favour of this service and the petitioners would not accept his ruling, the matter was referred to the City Council. The Public Works Committee of the Council unanimously opposed the establishment of a motor-'bus service. It considers that the electric tramway service has given excellent results. The report of the Committee was approved by the City Council, so that motor-'buses are not likely to be seen on the streets of Buenos Ayres for many years to come.—*Review of the River Plate.*

Baildon.—The U.D.C. has decided to complete the agreement with the Bradford Corporation for the extension of the tramways from Bradford to Baildon.

Blackpool.—Four additional transparent illuminated maps showing the Corporation tramway system are to be obtained, and next summer it is proposed to distribute 100,000 small leaflet maps of the tramway system.

Bournemouth.—Tramway Extension Refused.—The Corporation has refused to extend the tramways to Charminster Road, and as a result, a meeting of the residents has resolved to support an application for powers to inaugurate a railless traction scheme.

Continental Notes.—Spain.—The *Electron* learns that Dr. Pearson, in pursuit of his object of monopolising electric operations, has offered to the Northern Spain railway companies, and also those of Madrid, Zaragoza and Alicante, to take over the traction on their lines and work them by energy from the hydro-electric stations at the Falls of Noguero, Palleresa and the River Ebro, with a view to quadrupling the speed of transit on those lines. The question is now being considered at Paris, with, our contemporary asserts, great promise of a favourable issue to the plans of the proposer of the scheme.

A company has lately been formed at Ferrol to construct an electric tramway between that town and Jubia y Nadi.

Russia.—Work is well in hand on the construction of an electric railway between St. Petersburg, Peterhof and Oranienbaum, a distance of about 36 miles. The line is being built by the Société du Chemin de Fer Electrique d'Oranienbaum, under a 50 years' concession. The power generating station, which will be located near St. Petersburg, will have a capacity of 6,000 kw.

Germany.—An electric ferry boat, which can carry vehicles as well as passengers, has lately been put into service on the Rhine between Godesberg and Niederdollendorf.

Coventry.—New Cars Required.—The Tramways Committee has recommended that ten new cars with covered tops be obtained at an estimated cost of £10,000, and that application be made to the B. of T. for sanction to borrow this sum.

Dover.—The T.C. has under consideration the doubling of the tramway track in London Road between Beaconsfield Road and Lorne Road. A portion of the work is to be carried out at once.

East Ham.—In reply to a letter from the Barking U.D.C., the Electric Lighting and Tramways Committee states that it is not averse to the suggestion that "the existing arrangement between the L.C.C., the West Ham Corporation, the East Ham Corporation, and the Barking Council for the inter-running between Loxford Bridge and Aldgate should be terminated, and that, in lieu thereof, the cars of the three former authorities should have their terminus at Barking Broadway," provided the Barking authority submits terms acceptable to the East Ham Council. The Barking authority thinks that this arrangement will leave it at liberty to arrange with the Ilford Council for inter-running between Barking and Ilford.

Glasgow.—The Tramways Future.—Following upon the annual inspection of the tramway works, &c., on November 20th, interesting points as to the future policy of the department

and the disposal of the yearly increasing financial surplus were given in the speeches at the luncheon in the City Chambers. Lord Provost Stevenson, who acknowledged the civic toast, said that in his opinion the tramways ought to be run at the minimum cost, and the citizens ought to be carried the maximum distance for their money. Ex-Bailie Kirkland, the tramways convener, replying to the toast of the Tramways Committee, proposed by Mr. H. J. Mackinder, M.P., said they had every reason to be satisfied with the progress made up to the present. Not since 1901 had such an important Bill for extensions been presented as the one now in hand, which asked permission to lay not less than 21 miles of double track. They also meant to seek powers for the construction of a new bridge over the Clyde from Oswald Street to Commerce Street. That, in his opinion, would materially lessen the great and growing congestion of traffic which existed in the centre of the city. He wished to state in that connection, however, that he hoped the Corporation in their next provisional order would apply for power to build a second bridge from Dixon Street to Portland Street. To cope with the increasing traffic, which had gone up phenomenally since the doubling of the halfpenny stages, the department had decided to increase the stock of 850 cars to 1,000, and so far as revenue was concerned, they were confidently looking forward to having £50,000 more than last year, when the income for the first time totalled over £1,000,000. They had now, however, reached a very important question, which the Corporation would have to settle once for all—the question of what was to be done with the profits. Some of the members of the Council were of opinion that the tramway surplus should be devoted to the reduction of assessments, and other members thought that the surplus should be utilised for some municipal scheme, such as the building of cottages for the working classes. He, personally, was of opinion that the surplus should be devoted to the reduction of fares and the improvement of the system.

During a visit of the T.C.'s Committee to the tramway works, a demonstration of the new lifting jacks, with which it is intended to equip each car in the service, was given. Already 30 of the new jacks have been issued, and the numbers are being added to by 10 per week.

Huddersfield.—The extensions of the Corporation tramway from Birchencliffe to West Vale, *via* Elland, are again likely to be delayed through disagreement between the Elland Council and the Corporation. In order to make the roadway and track at Long Wall as safe as possible some Elland people are advocating the extension of the wall for another 80 yards, but both authorities think they ought not to be called upon to carry out the work.

India.—Petrol Tramcar Results.—The report of the year's working of the East India Tramways Co., which operates 8½ miles of route and 30 Simplex motor tramcars, is of some interest in these days of rival traction systems.

The average working expenses amounted to 4·93d. per car-mile, inclusive of ·82d. for depreciation. The total expenses were 57 per cent. of the gross receipts, and the fares averaged less than 1d. each. The car-miles run were 566,685, and passengers carried 5,583,291.

London.—Stepney.—In order to relieve the congestion of traffic in East India Dock Road, the L.C.C. proposes to construct a tramway lay-by in West India Dock Road at its junction with East India Dock Road.

Owing to a mishap at the Baker Street sub-station, the trains on the Bakerloo Tube were delayed from 5 o'clock to 5.30 p.m. on Monday.

The Bakerloo extension to Paddington will be opened on Monday next. An escalator will be provided at the new station, there being no lifts.

Northwich.—It has been decided at a town's meeting to form a local motor-'bus company in preference to seeking powers to run a municipal scheme. Twelve members of the U.D.C. have undertaken to invest £1,200 in the company, and a capital of £10,000 is suggested.

Norwich.—Proposed New Tramways.—The Tramway Co. is seeking powers to construct 10 additional lines of electric tramways in the city, with a branch to the village of Thorpe.

Preston.—Tramway Extensions.—By 20 votes to 10 the T.C. has decided to apply for powers for the construction of new tramways, and for the running of motor-'buses within the borough and in the urban district of Fulwood.

Shipley.—The extension of the Bradford Corporation tramways from Nab Wood to Bingley will probably have the effect of making considerable alterations to Shipley residents, as they may be left without a service between Shipley and Nab Wood. The Shipley Council has, therefore, approached the Bradford authorities, and a conference is to take place between the Shipley Highways Committee and Mr. C. J. Spencer, the Bradford tramways manager

South Lancashire.—Last week the new turbine, which has been installed in the South Lancashire Tramways generating station at Howe Bridge, was started up. The chief contractors for the work were Messrs. Brown, Boveri, who supplied the generator; Messrs. Howden, who supplied the turbine; and the Rees Roturbo Co., who put down the condensing plant

Stanley.—A proposal has been made by the local electric tramways company to the U.D.C. with regard to the running of motor-buses in the district in place of a tramway scheme which has been abandoned, and the matter has been referred to the Highways Committee.

Swansea—Mumbles. It has recently been announced that the question of electrifying the line between Swansea and Mumbles is under consideration. The Mumbles tramroad is the oldest in the kingdom, having been authorised by an Act dated June 29th, 1804.

Walsall.—Tramway Extensions.—The Corporation is promoting a Bill, the main object of which is to obtain powers to extend the tramways to the outlying districts. The intention is to run railless cars. Four new railless routes are contemplated:—(1) From Rushall, through Pelsall, to Brownhills, and from there back to the present terminus at Walsall Wood; (2) a continuation of the Bloxwich line through Great Wyrley to Cannock; (3) from the existing terminus at the Great Barr boundary on the Birmingham Road to Scott Arms, Great Barr; and (4) along Corporation Street and West Bromwich Road to the Wednesbury boundary at Tame Bridge. In addition, power is asked for authority to continue the last-mentioned service by running motor-omnibuses to West Bromwich, which would be a very great convenience to the public.

Walthamstow.—The general manager of the tramways department is negotiating with the G.E. Railway Co., with a view to the construction of a tramway siding into the north side of the yard at Hoe Street Station, so that the cars may wait for passengers from the trains. The Commissioner of Police is being asked to put a stop to the practice of motor-'buses stopping to pick up and put down passengers on the tramway track in Hoe Street.

TELEGRAPH and TELEPHONE NOTES.

Anglo-Swiss Telephony.—Experiments that have been carried out show that telephonic communication between London and Switzerland can be carried on successfully, and the service, *via* Paris, will shortly be opened to the public. The charges at first will be 7s. for three minutes in the daytime and 4s. at night.

Austria.—A new telephone cable has lately been completed between Vienna and Dalmatia; the line includes not only a land section, but also several submarine sections, linking up a number of islands in the Adriatic Sea. Ordinary bronze wire is used for the landline, and continuously-loaded cable for the underwater portion of the system. Tests recently made between Vienna and Sarajevo, a distance of about 875 miles, were completely successful.

The Government is reported to be preparing a vast telephone programme, which will take four to five years to realise, and involve an expenditure of £3,750,000. In order to avoid raising a public loan, the Government will invite the Austrian contractors—cable and telephone instrument companies, copper works, &c.—to finance the scheme by loans, which the latter will contract with local banks on the security of annual Government repayments, spread over a period of 20 to 25 years.—*Telegraphen und Fernsprech Technik.*

Telephonic communication has been opened up between Vienna and Bucharest. The fee for a three-minute conversation is 6·50 kronen.

Canada.—Owing to a fire of very brief duration in the Bell Telephone Building, Montreal, 13,000 subscribers to the exchange, mainly in the business area of the town, were recently deprived of the service. The fire broke out in the main distributing frame and extended to the intermediate frame, and the former was almost entirely destroyed. Like a previous fire, on July 29th, it was due to a contact with a power circuit outside the exchange. The interruption may last for weeks, as there is not room for a large number of men to work on the cables.

Germany.—Until lately the German Telegraph Administration has made use of several kinds of telegraph instruments, according to the country communicated with. A great improvement has now been achieved by the adoption of a new instrument devised by the firm of Siemens. The instrument belongs to the class which transmit the signals by an automatic sending device, and is thus free from the failings attendant on the human telegraphist. It is able to send 600 signals one way and 1,200 both ways at the same time, or, at the rate of 6 signals per word, 200 words per minute; as against 720 signals and 120 words with the older system. In practice, no saving of staff is achieved by its use, but there is a possibility of a greatly increased utilisation of the existing transmission lines.

It is announced that a wireless service between Nauen and Togoland and German South-West Africa will be opened next year, and will be continued to German East Africa, probably in 1915. Wireless telegrams were exchanged overland between Nauen and Togoland, a distance of about 3,235 miles, early in the present year. Communication is already established between Nauen and Yap, one of the Caroline Islands, which are about 2,100 miles apart, and the extension to Samoa and New Guinea is expected to be completed in April next year.

Holland.—The Second Chamber of the States General has voted the credit for the construction of a telephone cable between the Netherlands and Great Britain.

Hull.—The Corporation Telephones Committee has agreed to purchase from the Government the plant of the late National Telephone Co. in the Hull area at £192,423, the price paid for it by the Government.

Japan.—Preparations are being made to carry out some experiments in wireless telegraphy between the Japanese shore stations at Choshi and Ochüshi and San Francisco, with a relay at Honolulu. Last year the same experiment was not a success, but since then various improvements have been made.

So great is the demand for the installation of the telephone in Japan, that the Government is not able to supply sufficient funds to meet all the requirements promptly. With the view of relieving the pressure, the authorities have now decided to install telephones immediately for such applicants as will agree to bear the cost themselves.

Mexico.—A contract has been entered into between the Mexican Ministry of Communications and Public Works and Senor Isidore Sternefeld, for the installation and working of 20 wireless telegraph stations, each with a radius of 1,500 km., at Mexico City, Tampico, Progreso, and other places.

Russia.—Four wireless stations, built to the order of the Russian Post and Telegraph Administration in the North Polar Sea, have been brought into operation. The stations are intended for the assistance of shipping frequenting the Siberian coast, and to give warning as to the state of the ice and the existence of fogs.

Telegraph-Telephone Combine.—It is reported from the United States that a year and a-half ago the Morgan interests, acting through the American Telephone and Telegraph Co., attempted to absorb all the independent companies, whose appraised value totals something like 400 million dollars, with a view to forming one great combine, but the negotiations broke down.

Wireless on Trains.—Successful experiments with wireless telegraphy on trains have been conducted on the Lackawanna Railroad. The apparatus is installed in the forward part of the train, and an aerial, consisting of four wire rectangles, supported by stanchions 2 ft. high, is placed on the top of each of the carriages. The operator's room is in the rear of the second carriage from the front, under the centre of the aerial. It is reported that the experiments will shortly justify an installation of wireless on all long-distance passenger trains.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" October 31st.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" to-day.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

The Finance Committee has recommended the Municipal Council to invite tenders for switchboards to control auxiliary motors at the refrigerating plant at the markets.

Victorian Railways Department.—January 28th. One three-phase alternator, &c.—*Tenders.*

Belgium.—Antwerp.—January 27th. Supply and erection of six electric cranes for the harbour at Antwerp. Deposit, 20,000 fr. Particulars (0·30 fr.), Hotel de Ville, Antwerp.

Brussels.—January 2nd. Construction of the metallic superstructure with the mechanical and electric equipment of the Pont des Hospices. Guarantee deposit, 10,000 fr. Cahier des charges (80 centimes) and other particulars from Bureaux du Service spécial d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Régent, Brussels.

Bingley.—Wiring of electric light installation at Bingley Town Hall. H. Bottomley, Engineer and Surveyor, Town Hall, Bingley.

Birkenhead.—December 2nd. Corporation. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P. See "Official Notices" November 21st.

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 kw.; storage batteries, boosters and switch and regulating gear; two 1,500-kw. rotary converters, transformers and switchgear. See "Official Notices" to-day.

Bulgaria.—December 9th. The municipal authorities of the town of Varna are inviting tenders for the supply of 1,000 electricity meters, and for the establishment of an electric cable testing establishment.

Canada.—Yorkton (Sask.).—December 22nd. Tenders marked "Tenders for Diesel Electric Machinery" to be addressed to T. F. Acheson, Secretary-Treasurer, Town of Yorkton, for one 500 B.H.P. combined unit. Specifications, &c., from M. M. Inglis, electrical engineer, Yorkton.—*Canadian Engineer.*

Coventry.—The City Council proposes to obtain ten additional covered-top tramcars, at an estimated cost of £10,000.

France.—December 12th. The French State Railway authorities (Bureaux du Service Electrique), in Paris (43, Rue de Rome), are inviting tenders for the supply and installation of two batteries of accumulators at the Argenteuil-Triage sub-station.

Germany.—Bremen.—December 10th. Tenders are required for the supply of 10 electric capstans and 19 guide pulleys for Haven II at Bremen. Particulars and conditions of tender (2 marks; stamps not received) from the Hafenbauamt in Bremen.

Glasgow.—December 1st. Electric light installation at Langside Library, for the Corporation. Apply, Office of Public Works, City Chambers. Deposit, one guinea.

London.—L.C.C.—December 3rd. Installation, 225 lighting points, at Chester Road Elementary School, St. Pancras, N.W. See "Official Notices" November 21st.

L.C.C.—December 10th. Installation, 265 lighting points, at Ocean Street Elementary School, Mile End, E. See "Official Notices" to-day.

It being necessary to provide 150 tramcars with trolley equipment, &c., for operating certain through services, tenders are to be invited from selected firms for the supply of trolleys, switches, additional wiring, plough collector gear, &c., for the purpose.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—November 28th. Corporation. Two water-tube boilers and superheaters, economisers, coal chutes, ash conveyor, pipe connections, additional stoker shafting and clutches, and pneumatic ash-handling plant at boiler house No. 2, Stuart Street generating station. See "Official Notices" November 7th.

New Zealand.—January 5th, 1914. The Christchurch City Council invites tenders for series street-lighting plant (1,950 metallic-filament lamps) and accessories. A specification can be seen at the B. of T. C.I. Department in London.

Nottingham.—December 1st. Corporation. 750 tons of steel tramway rails, tie bars, steel tramway poles and fittings. Mr. A. Brown, City Engineer, Guildhall. (Deposit one guinea.)

Plymouth.—December 1st. Corporation. Contract No. 31. Ironclad high-tension switch panels. See "Official Notices" November 14th.

Salford.—December 4th. Corporation. Maintenance, repairs and renewals to intercommunication telephone system. See "Official Notices" to-day.

South Africa.—The Tramway Committee of the Johannesburg Town Council recommends that tenders be invited for 15 new tramcars. The general manager of the tramway service also recommends the purchase of four more motor-buses of the Tilling-Stevens type.—*African World.*

Municipality of Ermelo, Transvaal Province.—December 23rd. Steel pipes and accessories, generating and pumping plant and overhead distribution system, in connection with the domestic water supply and electric lighting systems about to be installed. Specifications from the consulting engineer, Mr. H. Hancock, P.O. Box 62, Klerksdorp; deposit, £1 1s. Tenders to Town Clerk, Ermelo.—*African World.*

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" to-day.

Stockton.—December 22nd. Construction of Stockton to Billingham Beck Branch Railway (about three miles in length), for the N.E. Railway Co. C. F. Bengough, Company's Engineer, York.

Sweden.—Stockholm.—Five sluice gates for tube inlet, also accessories; weight of gates, about 85 tons. For Porjus power station.

(*Continued on page* 879.)

A 25,000-kw. PARSONS TURBO-ALTERNATOR.

As a good many of our readers are no doubt aware, the large turbo-alternator set which Messrs. C. A. Parsons & Co. have recently constructed for the Commonwealth Edison Co.'s Fisk Street generating station, in Chicago, has now arrived at its destination.

At the moment it is the largest turbo-generating unit in existence, being designed to develop 25,000 kw. continuously when running on steam at 200 lb. pressure, superheated 200° F., and with a vacuum of 29 in.

The turbine, as will be seen from the views reproduced herewith, is of the tandem type, and similar to, though very much larger than, the turbines installed at the Lots Road power station.

On the one shaft there are mounted a high-pressure single-flow turbine with governor gear at the extreme end, a double-flow low-pressure turbine, an alternator, and—beyond the end bearing—an overhung exciter, the arrangement being shown in our views.

The total length of this power unit is 76 ft. 2 in., the

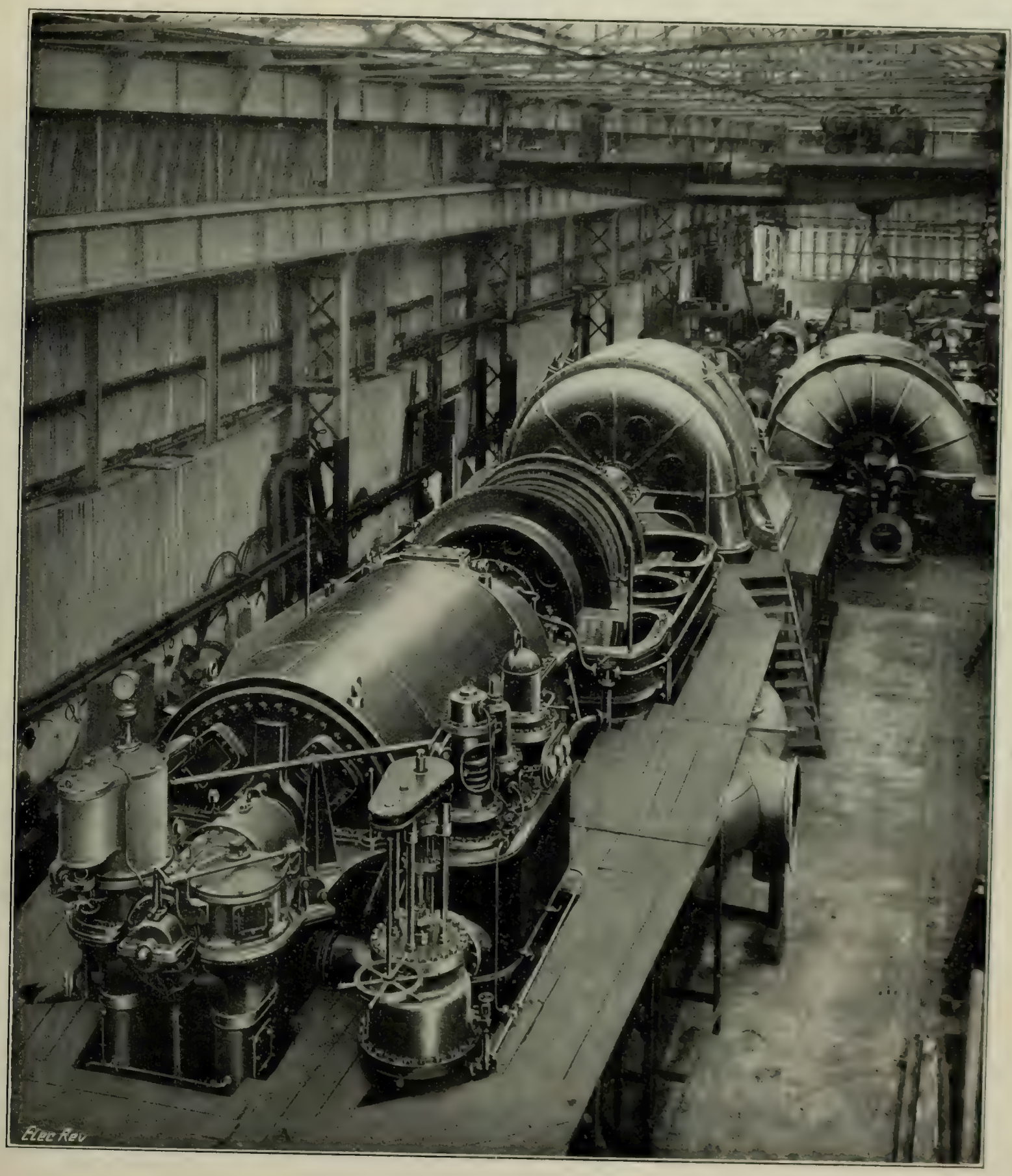


Fig. 1.—25,000-kw. Parsons Turbo-Alternator in the Erecting Shop, showing the Steam End.

Under these conditions the guaranteed steam consumptions at various loadings are :—

10,000 kw.	...	...	...	12·50 lb. per kw.-hour.
15,000 kw.	...	...	...	11·65 lb. "
20,000 kw.	...	...	...	11·25 lb. "
25,000 kw.	...	...	...	11·65 lb. "

These figures show that this turbine plant will be remarkably economical over the ordinary loadings likely to be met with in practice ; the plant will, moreover, carry momentary fluctuations in load up to 10 per cent. in excess of 25,000 kw.

greatest width is 18 ft., and the height above engine room floor level 11 ft. ; allowing for the condenser which is suspended beneath the low-pressure turbine, the depth of the complete plant, shown in fig. 13, is about 30 ft.

The high-pressure turbine casing, shown in fig. 6, is constructed in four sections, of cast-steel where subjected to high superheat temperatures, and of cast-iron elsewhere.

The rotor blading in contact with superheated steam is of copper, but for ordinary steam temperatures brass blading is used ; the high-pressure turbine contains 64 rows of blad-

ing providing six expansion stages, each blade being caulked in separately with its distance piece. The high-pressure rotor, fig. 7, is a hollow forged-steel drum which is in one piece with the shaft extension at the governor end of the turbine, and is shrunk on and bolted to a big flange on the next section of the main shaft at the other end. The end pressure is balanced by three dummy pistons at the governor end of the rotor.

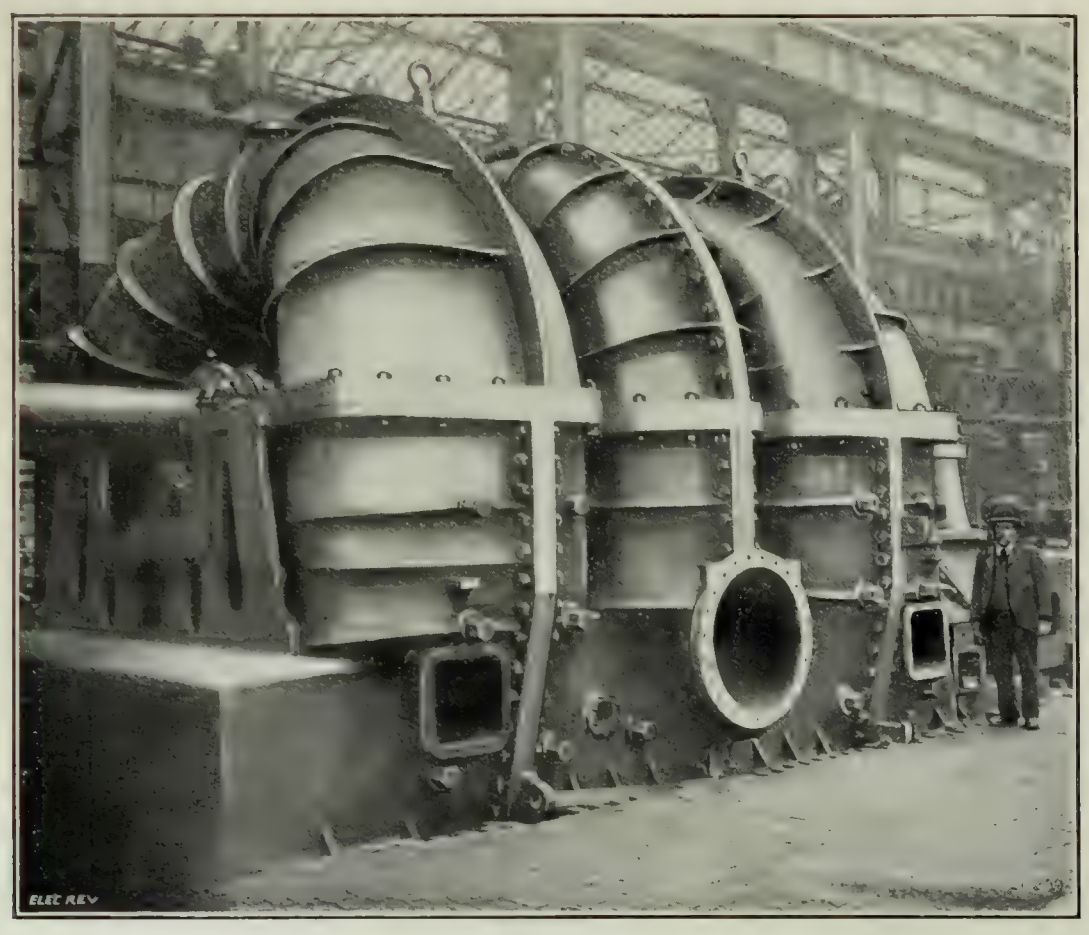


Fig. 2.—The Low-Pressure Turbine Casing.

The low-pressure turbine, the construction of which is shown in figs. 2 and 3, is of the double-flow type originally introduced by Messrs. Parsons, and is connected to the high-pressure casing by 30-in. dia. pipes, delivering steam to a central chamber, from which it passes through six expansion stages on each side to exhaust chambers at each side of the casing, the arrangement being clearly shown in fig. 3.

The exhaust chambers unite on the under side of the turbine, forming a rectangular opening 21 ft. × 12 ft. direct to the condenser, shown in figs. 10 and 13.

Forty-eight rows of blades are fitted, with blades up to 19 in. in length; the blading is stiffened by means of circumferential binding strips and the blade tips are thinned.

The low-pressure turbine casing is of cast-iron, built up in sections, and weighs about 150 tons; the rotor blading is built upon a hollow steel drum rigidly attached to the main shaft at the centre, and also supported at the ends by mild steel diaphragms, which are sufficiently flexible to allow for differences of expansion between the drum and shaft.

Steam packed glands are provided at either end of the low-pressure turbine; the high and low-pressure steam rotors are rigidly coupled together, but provision has been made for the axial expansion of the high-pressure turbine.

Fig. 1 shows the arrangement of valves at the high pressure end of the turbine; a worm on the main shaft operates a worm wheel on either side, on the spindles of the main and emergency governors respectively, the former being coupled to a main double-beat stop valve, and the latter to an emergency valve, in series with the main valve, which automatically closes with a speed increase of 12 per cent. The main governor can be adjusted either from the switchboard, electrically, or on the spot, by hand.

The electric regulating gear consists of a small reversible motor, which raises or lowers the governor sleeve, and so varies the steam admission to the turbine.

Adjacent to the main valve is an overload by-pass valve which automatically admits high-pressure steam direct to the second expansion, when the load exceeds 20,000 KW.

The main governor is specified to maintain the steady speed variation within 3 per cent. between no-load and 25,000-KW. load, and to limit momentary variations to 5 per cent.

As our readers are aware, the Parsons governing arrangement employs an intermittent steam admission, the main valve being attached through its spindle to a spring controlled piston, which continually oscillates in its cylinder according to the variation of the steam pressure beneath it, the latter depending on the to-and-fro movement of a controlling relay valve, which is coupled through a lever to a moving cam on the revolving governor spindle. Some 320 steam admission occur per minute.

The spindle of the by-pass valve is attached to a similar piston, the position of which is controlled by the steam pressure on the underside derived from the first stage of the turbine; when the turbine load increases, this pressure also rises, and lifts both piston and valve, thus automatically admitting steam to the second stage.

A further independent mechanical governor is provided on the main shaft, which can be tripped by hand.

As previously mentioned, the two sections of the turbine are solidly coupled together; the alternator, however, is driven through a flexible claw coupling of the Parsons type.

The alternator is an enclosed machine, which will be ventilated by means of an external motor-driven fan, and is designed for a continuous output of 25,000 KW. at 4,500 volts pressure, 25 cycles, when running at 750 R.P.M.

The stator consists of top and bottom halves, each of which consists of two sections rigidly bolted together; it

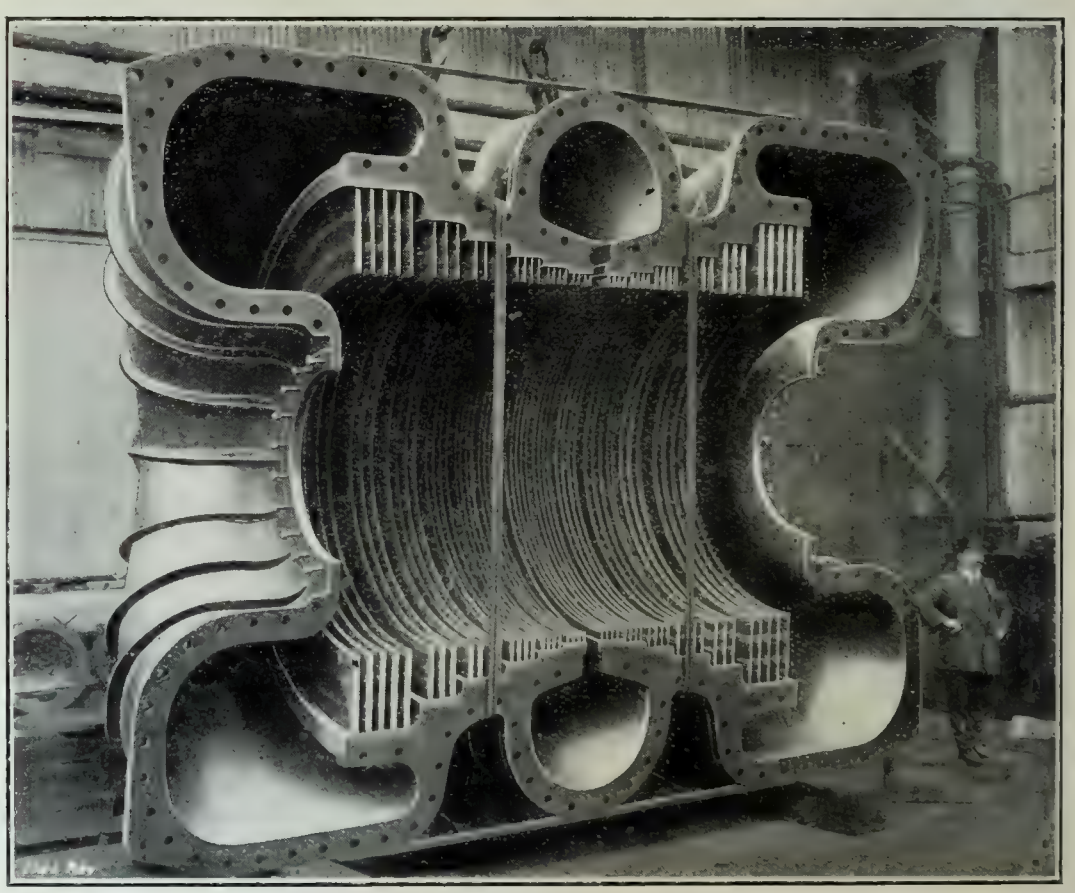


Fig. 3.—Top Half of L.P. Casing Lifted, showing Blading.

carries 42 groups of core plates, which support 84 stator bars, 10 ft. long, in completely closed slots, $4\frac{1}{2}$ in. deep by $1\frac{3}{4}$ in. wide, there being one bar per slot.

The slot insulation is moulded to shape ; the winding is three-phase, star-connected, and to allow of the lifting of the top half of the stator, the conductors coupling the top and bottom windings are provided with bolted joints.

The rotor, of the cylindrical type, is built up of 32 forged steel disks, with the field winding embedded in peripheral slots ; it is supported on a forged steel shaft, running in two 18-in. diameter bearings, each 48 in. long, and carrying at its extreme end the armature of a 250-volt exciter.

The rotor coils are former wound, embedded in leatheroid troughs which were forced into the core slots by hydraulic pressure, and are rigidly held in position by brass keys.

The coil ends are carried in bronze end-bells, and the complete rotor, shown in fig. 5, is 6 ft. 2 in. diameter and 10 ft. 10 in. long, weighing 50 tons.

nests of tubes is discharged through a 18-in. diameter outlet.

The condenser shell was constructed for Messrs. Parsons by Messrs. Hawthorn, Leslie & Co. ; the circulating and other pumps were supplied by the firm of Henry R. Worthington, while Messrs. Richardsons, Westgarth and Co. supplied the kinetic ejector equipment, the use of which is somewhat of a novelty in American practice, displacing the usual dry vacuum pump.

The functions of this ejector apparatus were fully described in our issue of July 4th last, in connection with a plant installed at the Stuart Street generating station, Manchester. The only mechanism consists of two centrifugal water pumps, one of which draws condensate from the condenser and discharges it to a tank, while the other supplies water (*i.e.*, the condensate) from this tank to the ejector, which, by the combined action of water and steam jets, withdraws the air from the condenser, discharging back into the same

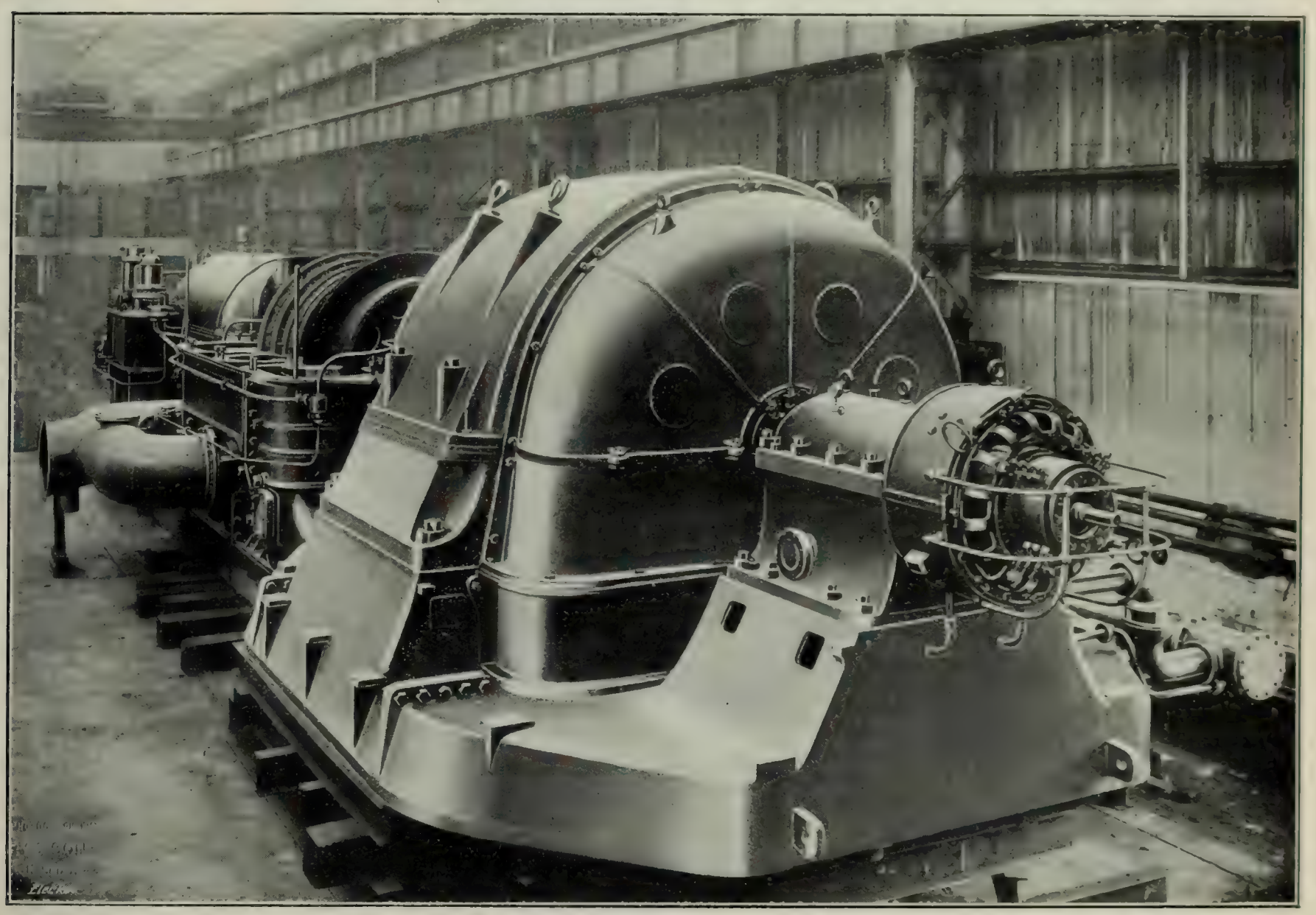


Fig. 4.—General View of the 25,000-kw. Turbine Set, showing the Alternator and Exciter.

The exciter is a shunt-wound four-pole self-excited overhung machine attached to the end bearing casting.

The lower half of the stator casing packed for shipment weighed some 60 tons ; the machine is designed to allow the circulation of 80,000 cb. ft. of air per min., and to have a temperature limit, when running fully loaded, of 70° F.

The condenser, as previously mentioned, is suspended from the underside of the low-pressure turbine ; it consists of a roughly semi-circular shell, with sagging plates and water ends of cast-iron and tube plates of naval brass, which are drilled for two nests of 1-in. diam. tubes. The shell is provided externally with stiffening flanges and four brackets are provided at each side, which rest on springs, and through them transmit a large proportion of the weight of the condenser to the foundations.

The condenser has a cooling area of 39,300 sq. ft., and normal and maximum ratings of 230,000 and 300,000 lb. of steam per hour respectively,

A feed-water heater, of 470 sq. ft. surface, is to be built into the steam entrance to the condenser ; the circulating water for the latter enters at the bottom of the shell, and after passing through the lower and upper tank. A diagrammatic view of the kinetic apparatus is shown in fig. 11, in which A represents the tank, and B the centrifugal pump operating the water jet.

The tank is always full, the overflow being equal to the steam condensed in the condenser. Fig. 13 shows the arrangement of the turbine and condensing plant, in which can be seen the steam jet fitted under the condenser shell and the kinetic ejector, pump and tank installed in the basement. The ejector in this case consists of two units, shown in section in fig. 9, either or both of which can be used ; the steam jet is exhaust steam from auxiliaries, and under air-tight conditions will raise the temperature of the feed water about 3° at full load and 8° at half load. The exhaust steam, in addition to withdrawing the air by its kinetic energy, also heats the feed water, the total heat in the steam and in the vapour withdrawn from the air being absorbed by the condensate.

Careful tests, the results of which are shown in fig. 8, were made with the air pump, the requisite conditions being obtained by blanking off the air suction pipe, and maintaining the desired vacuum with a pre-arranged amount of free air admitted to the suction system, and the

normal quantity of water at a temperature corresponding to actual working conditions. With an air admission of 160 cb. ft. per minute, equal to a $\frac{7}{8}$-in. diameter hole, a 28·6 in. vacuum was maintained, with water at 85° passing through the jets.

The tests show that the Chicago equipment should have an air margin of $2\frac{1}{2}$ times at 29·4-in. vacuum, and jet water with a temperature of 80°, which is much higher than will occur in practice, thus giving a reserve which will ensure economical working, even should air leaks develop.

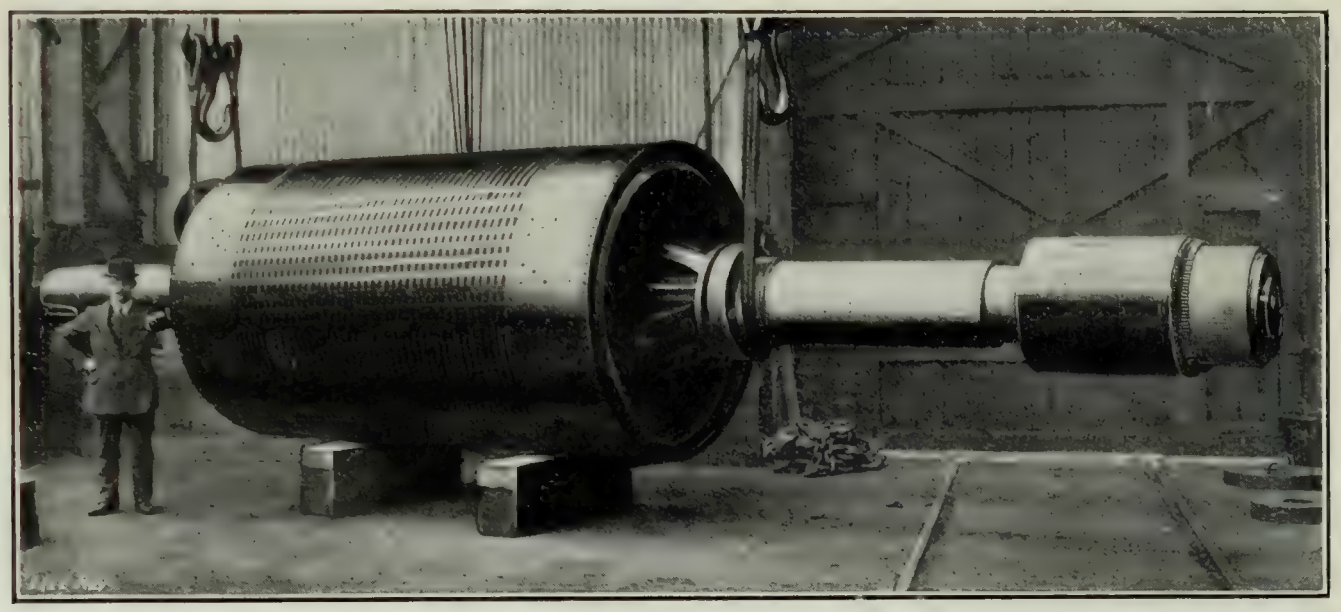


Fig. 5.—Alternator Rotor and Exciter Armature on Shaft.

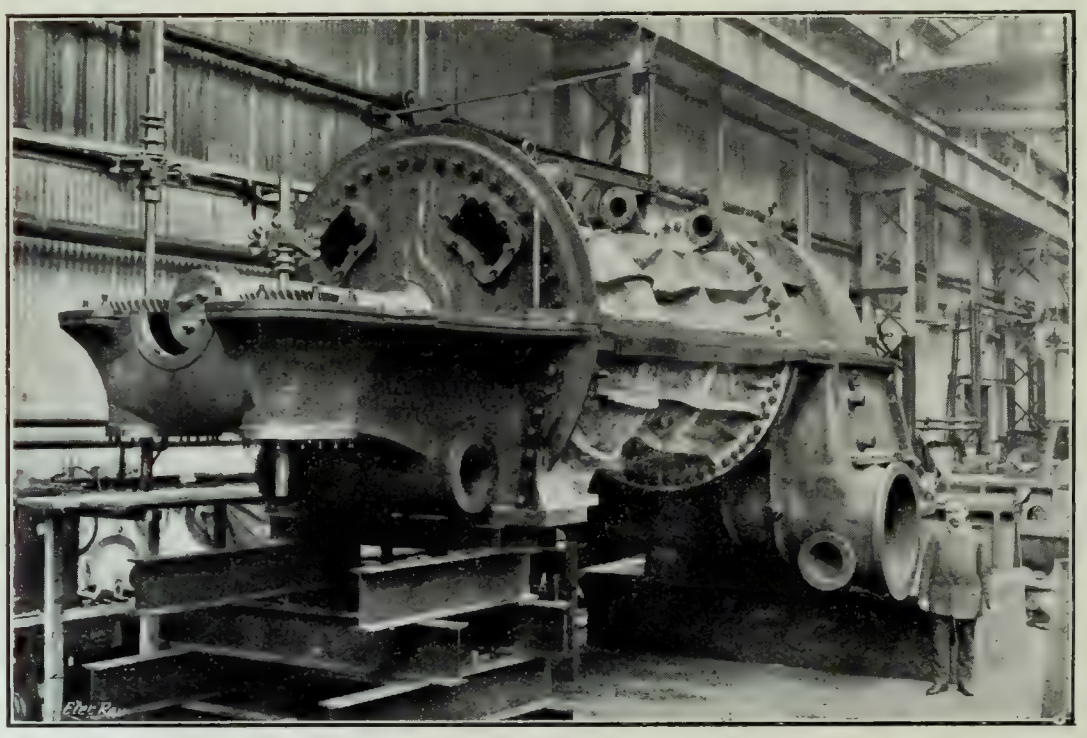


Fig. 6.—High-Pressure Turbine Casing; Governor Gear being Erected

The Worthington pumps in connection with the condenser auxiliaries are nearly all driven by 220-volt, 25-cycle squirrel-cage motors, and comprise a horizontal centrifugal pump for the circulating water with an output of 42,000 gallons per minute; a horizontal two-stage centrifugal hot-well pump, with a capacity of 750 gallons per minute; and a horizontal centrifugal pump for the ejector rated at 4,000 gallons per minute; service and centrifugal boiler feed pumps are also provided in connection with this section of the plant.

In view of the imposing size of this generating unit, it is of some interest to refer briefly to the extension now being carried out at the Commonwealth Edison Co.'s Fisk Street Station, Chicago, of which it constitutes such a notable feature. The present equipment of this station comprises 10 12,000-kw. vertical Curtis turbo-alternators, and it will be noted that the new 25,000-kw. Parsons unit marks a change to the horizontal type of machine, a 20,000-kw. horizontal Curtis turbine set being also on order at the present time, while the necessary space will be available beside these machines for two additional horizontal turbine sets.

The arrangement of the new extension follows generally the usual plan where large units are concerned; it consists of an engine house, with the turbines placed axially, boiler houses running at right angles on one side, and terminating in a "train shed" or fuel reception building which runs across their ends, parallel with the engine house.

Each of the new generating units will be supplied with steam from four marine type Babcock boilers, the two groups occupying one boiler house, and being served by one steel chimney 250 ft. high and 19 ft. inside diameter.

Fuel entering the train shed in railway cars may be dumped or emptied by grabs into receiving hoppers below, from which it passes through two sets of crushers, being reduced in size to ·75 in., and is then carried by bucket conveyors to bunkers over the boilers. The coal storage for the Parsons unit is 225 tons per boiler; the "train shed" contains additional bunker capacity amounting to 3,360 tons, while the receiving hoppers will also hold 1,320 tons. Ash storage is also provided for 1,180 tons. The four boilers for the first turbine are each to evaporate 80,000 lb. of water per hour, and each contains 12,200 sq. ft. heating surface with about 20 per cent. of superheating surface.

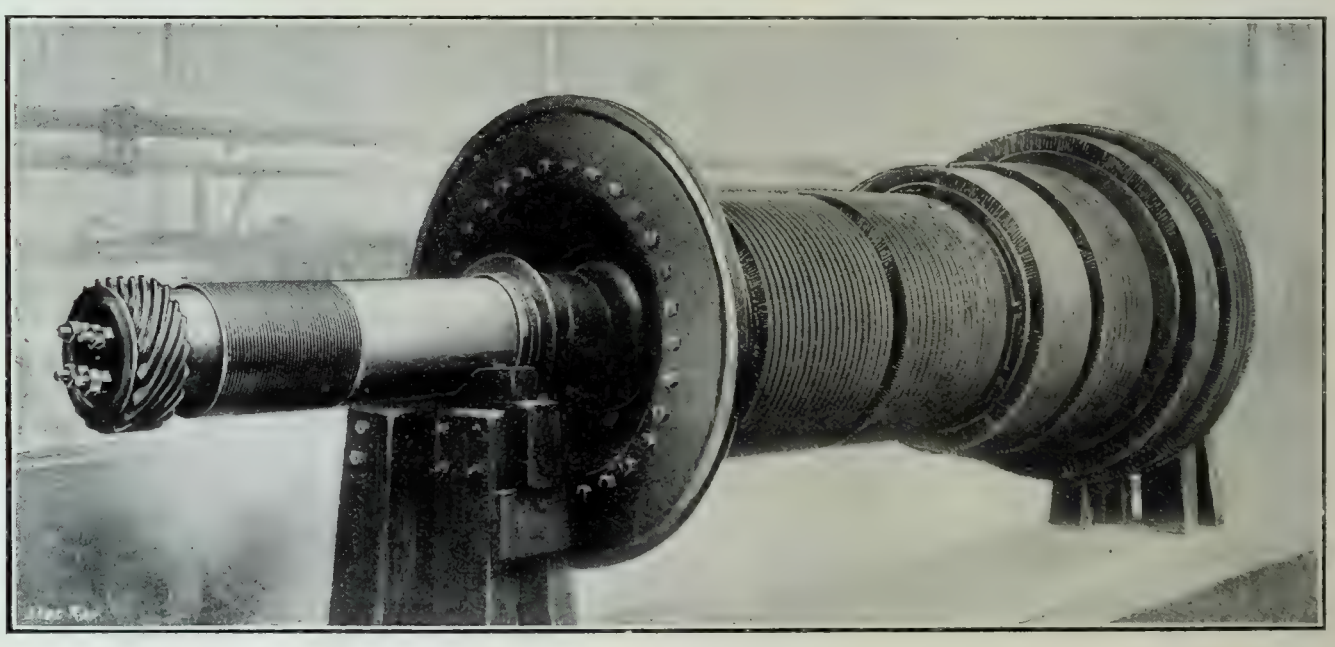


Fig. 7.—Rotor for H.P. Turbine, showing Blading.

Two chain-grate stokers are provided to each boiler, each 10 ft. 6 in. wide and 13 ft. long; the maximum boiler working pressure is 225 lb. per sq. in., with a superheat of some 225° F.

Economisers are provided over the boilers, and induced draught fans to maintain 1·5 in. of draught in the boiler

uptakes. As the station main bus-bars work at a pressure of 9,000 volts, compensating 4,500/9,000-volt transformers are placed between the Parsons generator and bus-bars.

The ventilating plant for this unit includes an air-washing equipment and a fan, driven by a 150-H.P. motor, with a capacity of 80,000 cb. ft. of air per min.

The horizontal Curtis unit which is on order, is of the single-flow type, to run at 1,200 R.P.M.; it is self-ventilated and will generate at 12,000 volts pressure, and 60 cycles, giving its best economy at 15,000 KW. load.

The Commonwealth Edison Co. has also ordered a horizontal 30,000-KW. turbine unit for its North-west station at Chicago, which will follow the arrangement of the Parsons machine in having separate high and low-pressure turbines, and the latter arranged on the double-flow plan.

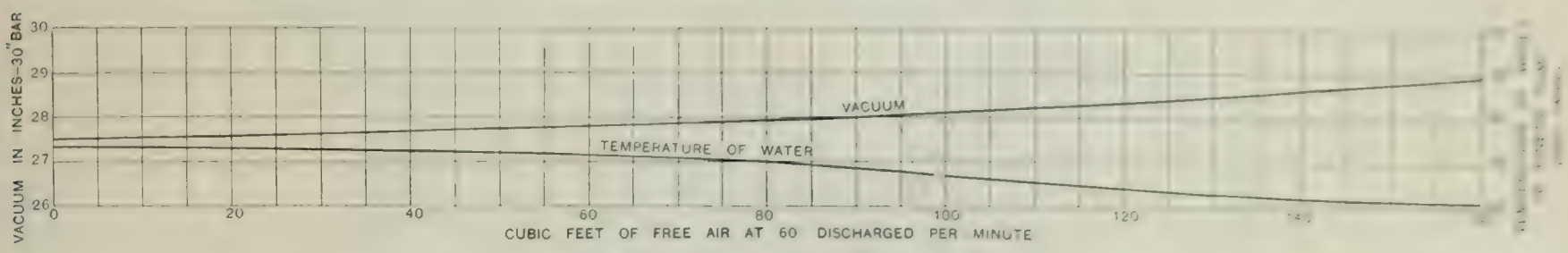


Fig. 8.—Test Results of Kinetic Plant.

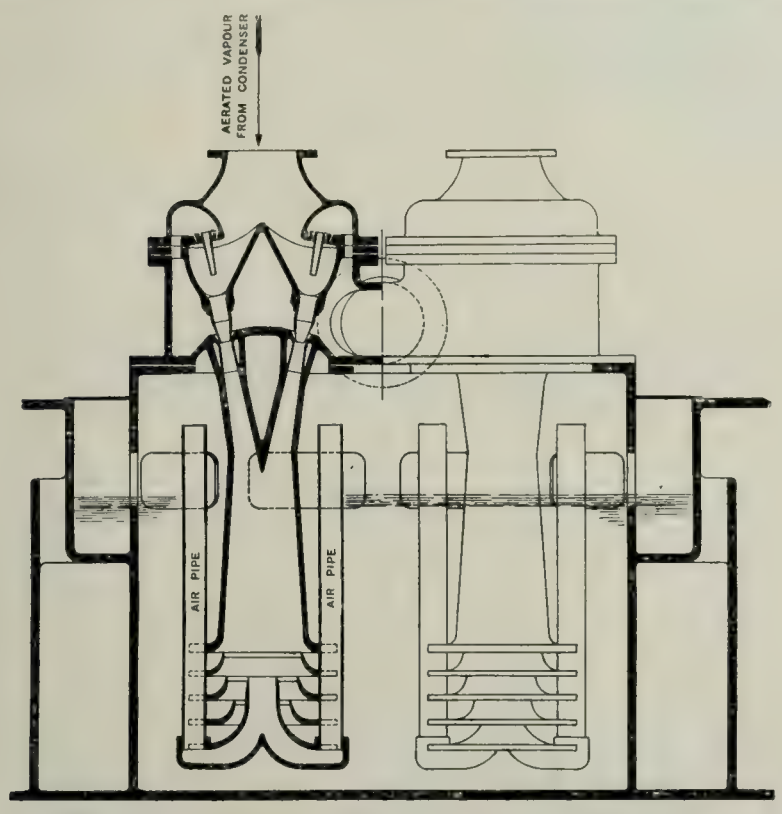


Fig. 9.—Sectional View of Kinetic Ejector.

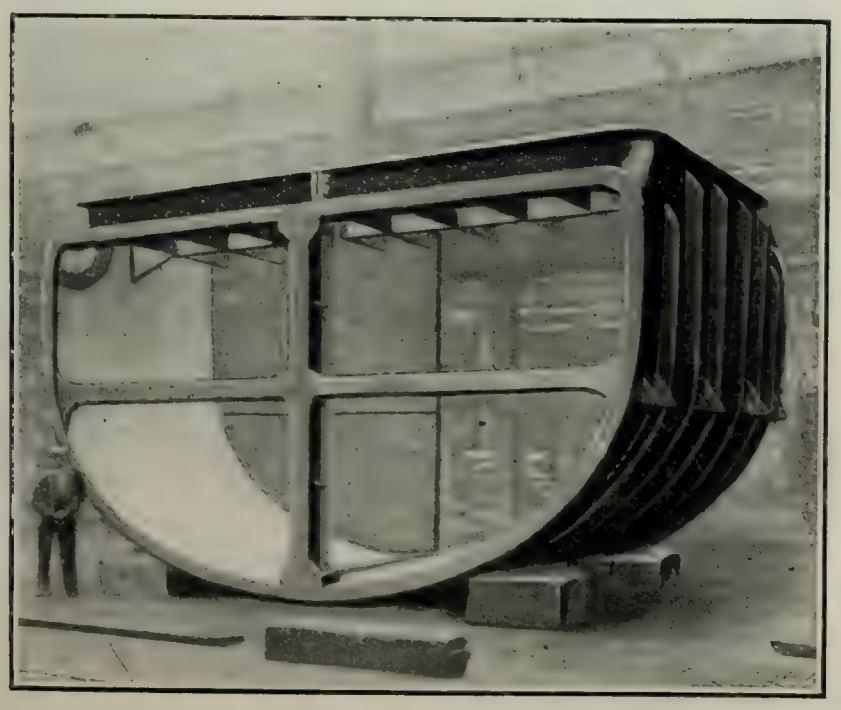


Fig. 10.—Condenser Shell for 25,000-kw. Turbine.

This machine is to run at 1,500 R.P.M., and generate energy at 9,000 volts pressure and 25 cycles.

The complete extension scheme of the Commonwealth Co., which is to be carried out during the next few years, will increase its effective generating plant capacity to some 480,000 KW., this including 210,000 KW. at the Fisk Street station, 84,000 KW. at Quarry Street station, and 160,000 KW. at the North-west station.

These figures give some indication of the enormous scope of electricity supply in the Chicago area, which in 1912 absorbed some 799 million KW.-hours, for lighting, power and traction purposes, supplied by the above company. It is only fair to add that the phenomenal progress made is due in no small degree to the skilful management of its president, Mr. Samuel Insull, who, it may be remembered, as a guest at the last I.E.E. dinner in London, emphasised his views on the future of the electricity supply industry.

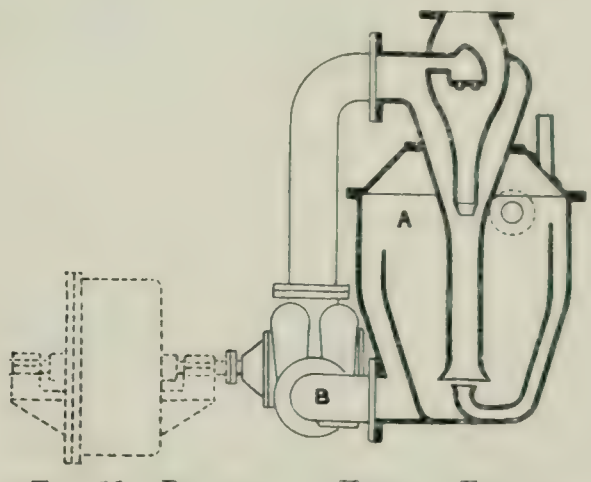


Fig. 11.—Diagram of Kinetic Ejector.

In conclusion, we are indebted to Messrs. Parsons and to Messrs. Richardsons, Westgarth for their assistance in the preparation of this article; we have also drawn on the *Electrical World* for the sectional view showing the complete Parsons turbine unit.

The Commonwealth Edison Co.'s consulting engineers, Messrs. Sargent & Lundy, of Chicago, were responsible for the design of the extensions to the company's plant, and were associated with Messrs. Merz & McLellan, London, in connection with the construction of the Parsons turbine set and condensing plant.

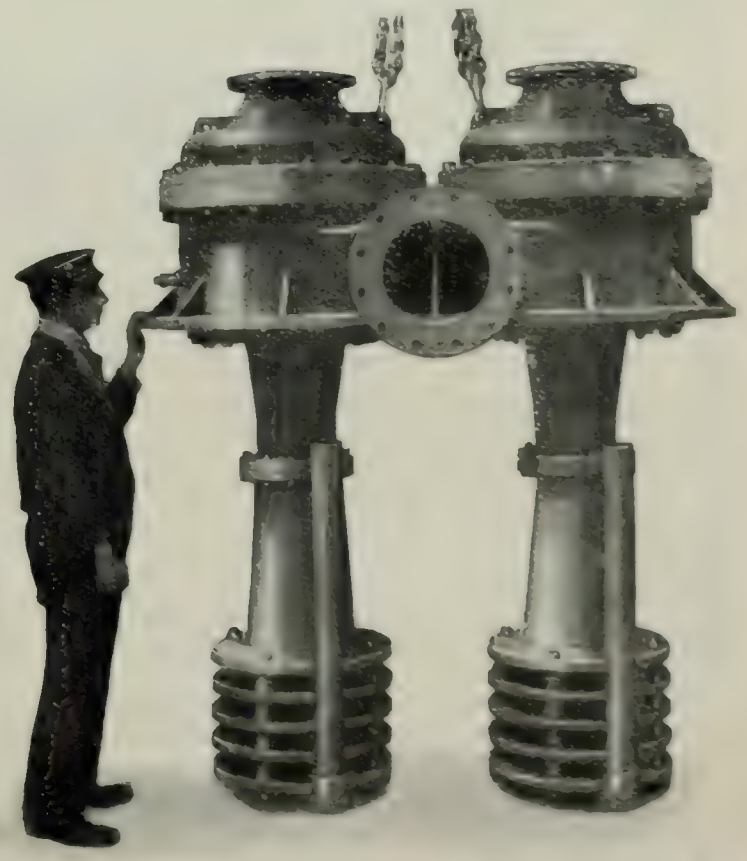


Fig. 12.—View of Kinetic Ejector for 25,000-kw. Turbine.

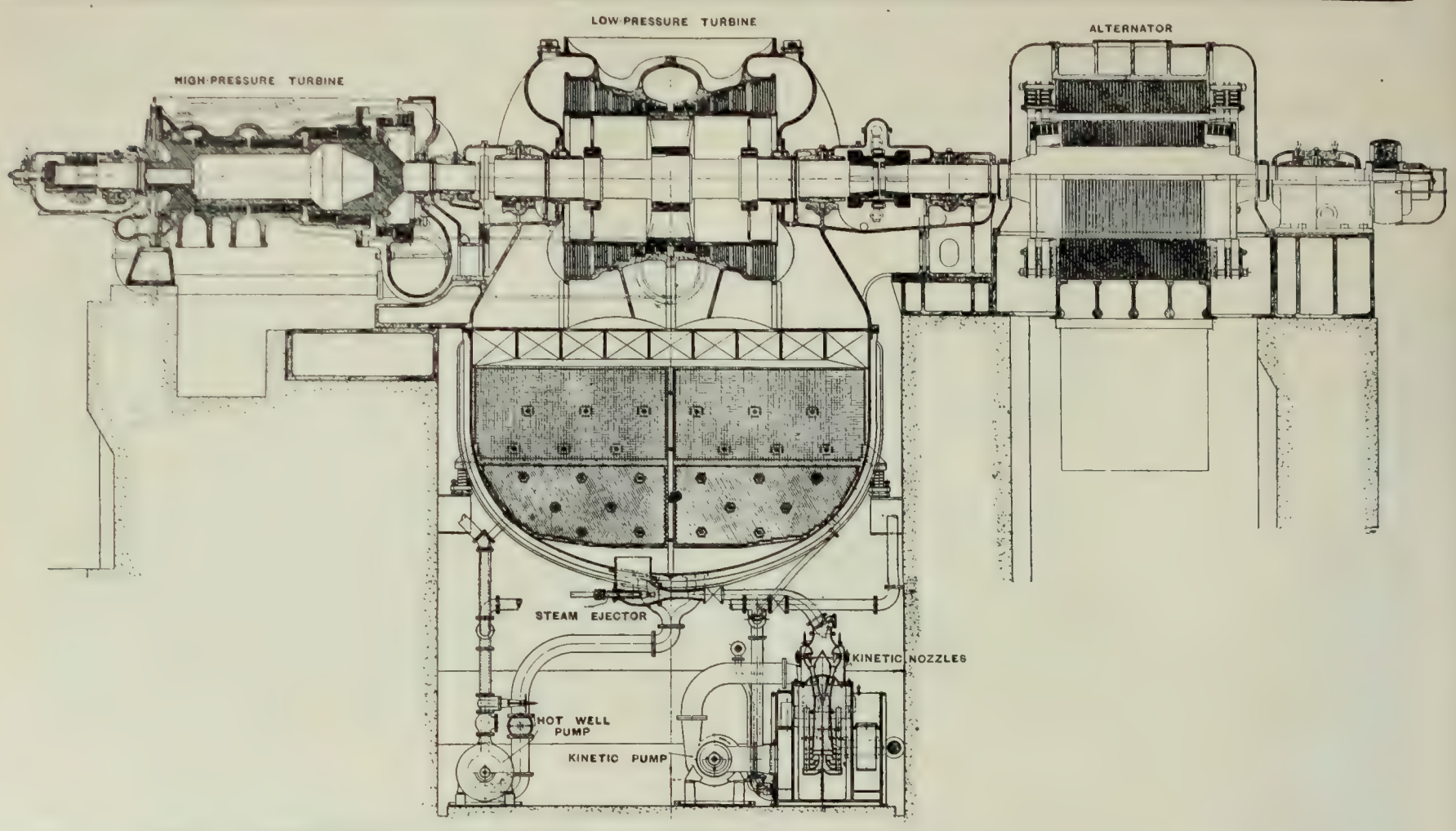


Fig. 13.—Sectional Elevation of 25,000-kw. Parsons Turbine Set, showing Arrangement of Condenser Auxiliaries.
(See pages 871-5.)

THE BRITISH ELECTRIC TRANSFORMER CO.'S WORKS.

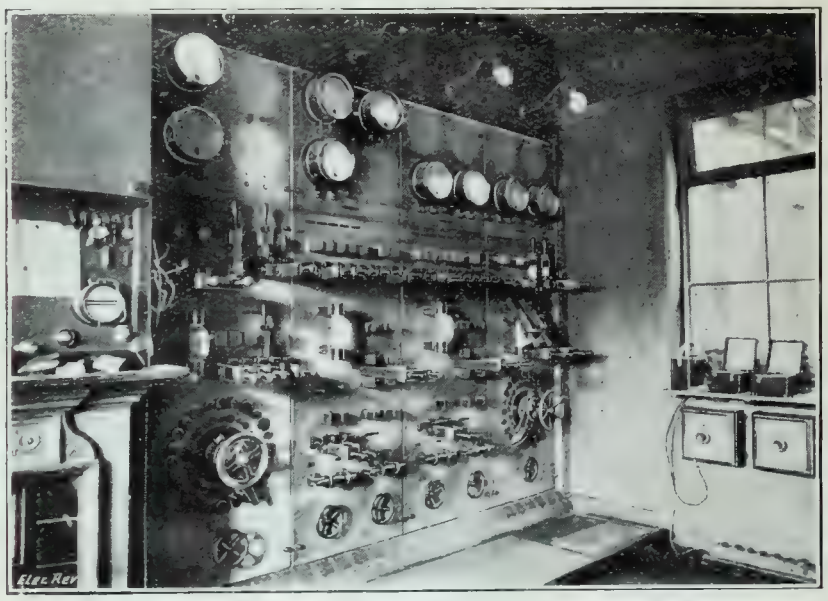
A good many years have elapsed since we illustrated the works of the British Electric Transformer Co., at Hayes.

In the interval electrical engineering and electricity supply has developed enormously and with it the business of the company in connection with the well-known Berry type of transformer.

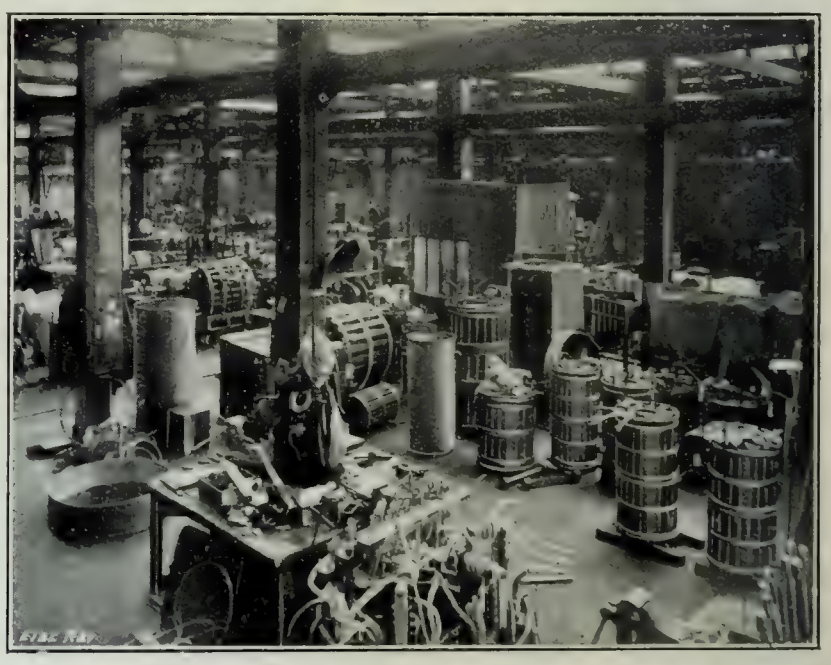
Originally started in 1901—the Berry transformer having been on the market since 1896—the Hayes works have been enlarged from time to time, the most recent addition being a new bay equipped with crane accommodation, to deal with transformers up to 25 tons in weight. The company has also added the manufacture of the well-known "Tricity" cooking and heating apparatus to its other business, and in this direction also considerable progress is being made. The shops are now electrically driven throughout, power being taken from the mains of the Uxbridge and District Electric Supply Co.; hot-air apparatus has also been installed to maintain the shops at uniform temperature, day and night, in order to prevent condensation.

In the course of a recent visit which we paid to these works the methods adopted by the company were briefly explained to us.

Transformer building being largely a matter of expert assembling of manufactured and semi-manufactured material, the stores play an important part in the works, as large stocks of standard core plates, copper strip and wire, insulating troughs, tubes, Berrite fabric, &c., are held in readiness for the construction of the transformers, of every class, and with a view to facilitating quick delivery.



Switchboard in the Test Room.



General View in the Shops.

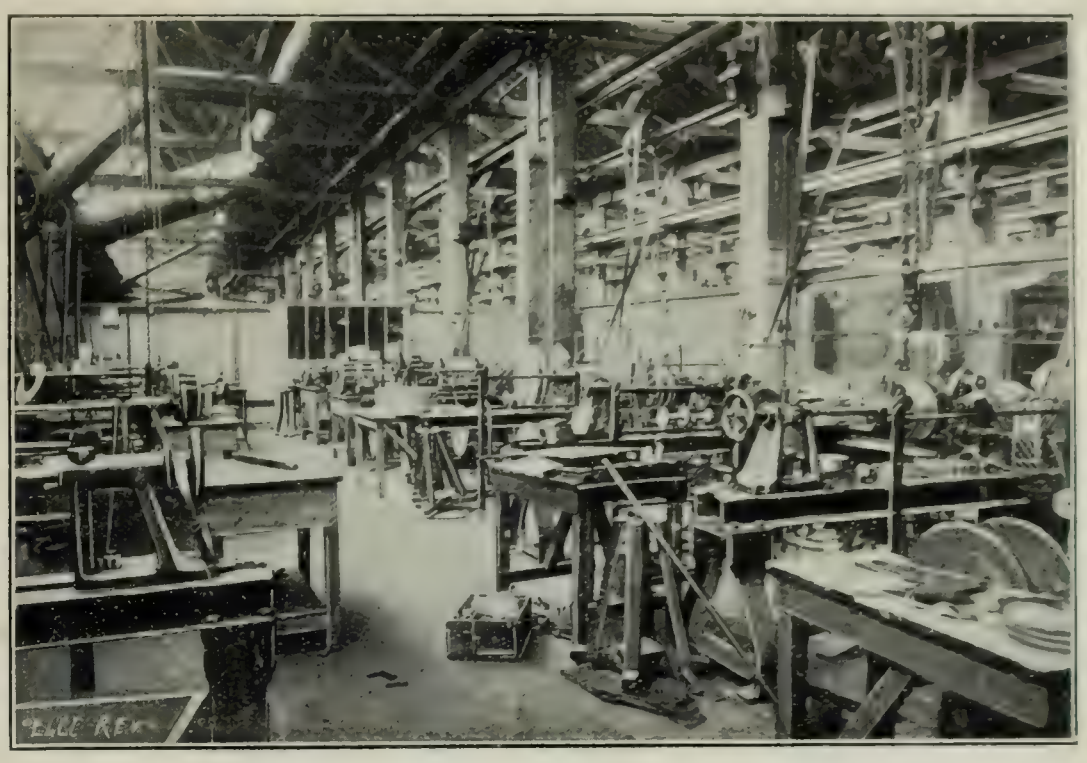
The British Electric Transformer Co.'s Works, Hayes, Middlesex.

The constructional features of the Berry transformer are so well known that we do not propose to describe them at length, but in the main shop with the material drawn from the stores, the procedure is, roughly, as follows:—A specially-constructed mandrel is built up with the inner core irons and insulated; the inner secondary winding is then wound on; after that the primary coils are placed in position, the winding process being completed by the outside secondary; after that the iron circuit is completed by the outer core

plates, which are rigidly held in position by means of wire bands.

From the construction it will be noted that the primary winding is totally enclosed by the secondary winding, and that the secondary winding again is protected from external damage by the core plates, which totally enclose the whole of the primary and secondary windings.

A feature of the Berry transformer is the hand insulation of all the windings, the material employed, Berrite sheet, being a product of the firm, which has special qualities in the way of insulation and mechanical strength, which allow exceedingly rigid constructional methods to be employed.



Small Coil Winding Shop.

A special department is given up to small coil winding, and all cotton-covered wire employed is impregnated with Berrite; indeed, this product, in one way or another, is in general use for insulation purposes in the works.

The increase in the use of rotary converter plant throughout the country has created a big demand for transformers having a high reactance—in some cases up to 25 per cent.

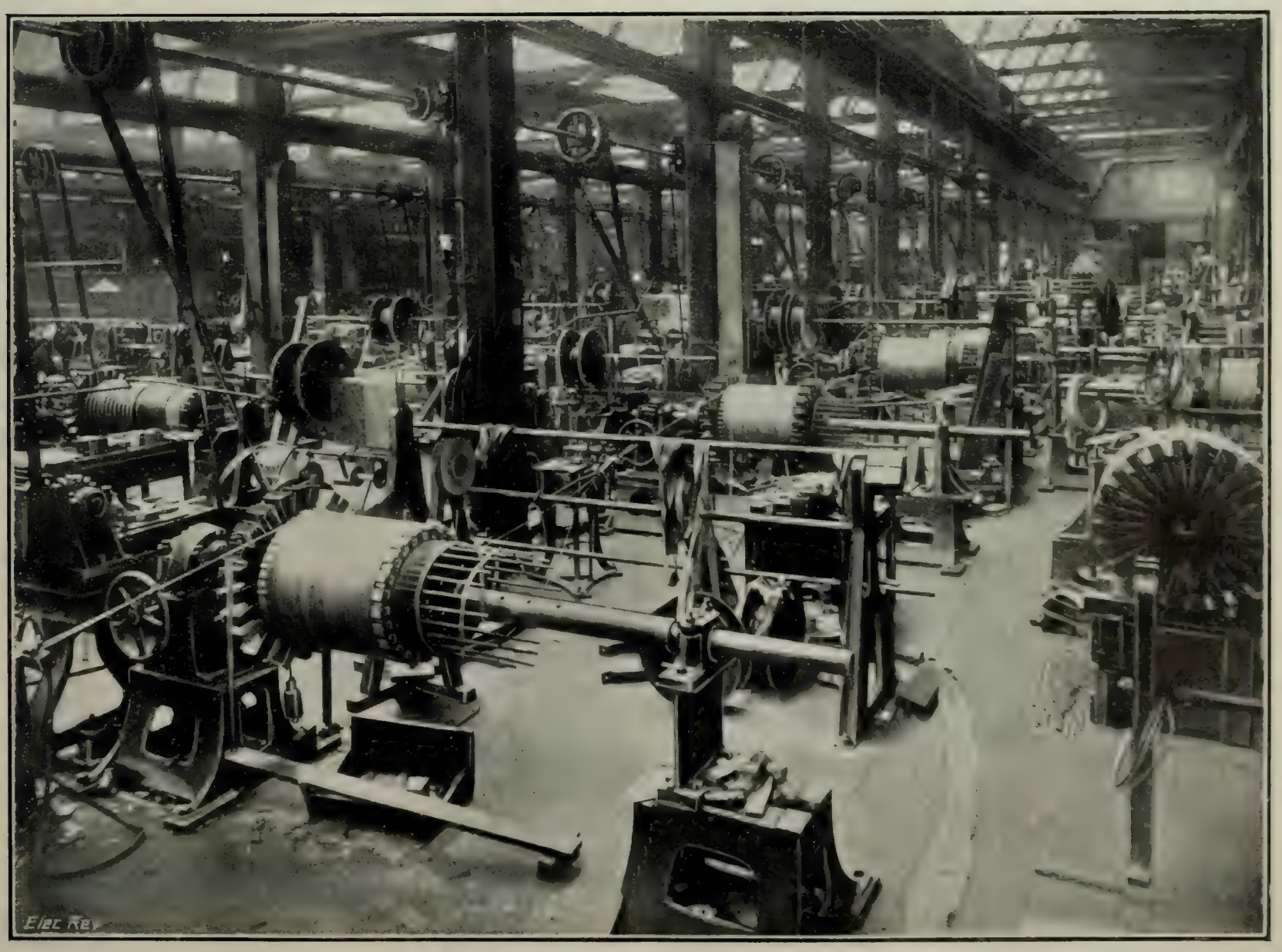
The Berry type of transformer is admirably adapted for giving this reactance, without unduly increasing the losses in the transformer itself.

At the present moment, in addition to ordinary transformer work, we are given to understand that the firm have in hand upwards of 100,000 h.p. of transformers of the high-reactance type for use in connection with various railway electrification schemes.

In addition to transformers, air, oil or water-cooled, the company specialises in transformer kiosks and distributing pillars of various types; the Berry patent series gear for reducing the light-load losses and increasing the overload capacities of transformer substations, and the Berry patent booster transformer for pressure regulation are also well known specialities. In connection with their business in cooking and heating apparatus, a special shop has been set aside, where the modern "Tricity" cooker has been developed. All the apparatus manufactured is iron-clad throughout, so that it is impossible for the user, however unfamiliar with electrical apparatus, to get a shock.

A special test room is provided in the "Tricity" shop for output tests, &c., and complete apparatus is passed to a "finished" store situated in the new bay.

It is almost needless to add that the messrooms for both men and women operators are electrically equipped throughout, no other method of cooking being available.



View showing Transformer Building at the British Electric Transformer Co.'s Works

REVIEWS.

Electricity for Everybody. Second edition. By R. Borlase Matthews, Wh.Ex. London: The Electrical Press, Ltd. Price 5s.

Although this work of reference contains much of interest and value to the general public, the chief object of its author has been to produce a manual for the guidance of those who are called upon to advise upon the applications of electricity, either as selling representatives, or indirectly in their capacity as officials of electricity supply undertakings. Work undertaken with so important an object to some extent disarms criticism which, in any case, can be little more than a divergence of opinion on detail, and the expression of a hope that the demand for this useful publication may render it necessary to issue further editions and give opportunity for those frequent revisions which are so essential when dealing with a business of such vitality, that each recurring season offers new appliances and fresh possibilities.

At the present time a most urgent demand exists for men with a fair foundation of mechanical and theoretical training who are willing to specialise on the selling side of the electricity supply business. That such men are not forthcoming in sufficient quantity, or generally satisfactory in regard to ability and business enthusiasm, is largely due to the fact that many supply authorities expect such duties to be carried out for a wage which a greaser would not accept, without the incentive of payment by results, or reasonable allowance for those expenses which are a recognised part of the selling costs of any other commodity.

In the hand-book under review many detailed comparisons are drawn between electricity and gas, both for lighting and heating. These are useful, as assisting a beginner in the business to look for points of difference, and to state concisely the advantages of electricity; but, as a whole, they are certainly in need of some revision and excision.

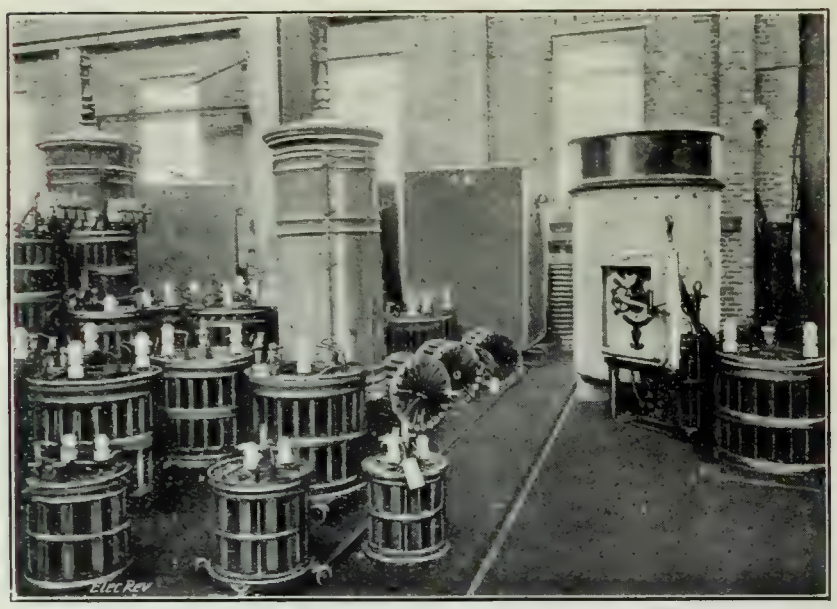
They do not take into consideration the great advances which have been made in the use of gas and gas appliances; this should certainly be done. In no direction need any electricity supply, which is in capable hands, fear the competition of gas for any purpose to which electricity may be applied. It is, therefore, most essential that selling agents should have accurate information with regard to the best that gas can do. The fact will still remain that the average gas appliance in the hands of the average consumer gives results far below those which can be, and are, obtained with good gas appliances carefully attended to.

This is not true to anything like the same degree with electrical apparatus, the deterioration of service being far less than in the case of gas;



The Works and Canal.

VIEWS OF THE BRITISH ELECTRIC TRANSFORMER CO.'S WORKS, referred to on pages 876 and 877.



Typical Products in the Works



Interior of the New Bay.



General View, showing Transformer Building, &c.

a constant and permanent advantage in favour of the former.

Throughout the book statements are generally made in terms of the carbon lamp, while the superior efficiency of the metallic lamp is insisted upon. This method of treatment should be looked upon as out of date. The metallic lamp is now practically universal, and statements should be made in terms of it, the carbon lamp being merely mentioned as having a certain limited sphere of usefulness under particular conditions.

The recommendations with regard to the amount of light required for different purposes must be taken with some reserve; so widely is the question affected by position, reflectors, colour and character of surroundings that it is doubtful whether general rules are of much use unless informed by some experience on the part of the reader.

To recommend 8-c.p. carbon lamps for the less important rooms of a house is scarcely wise. In any position bad lighting is an annoyance, and is very apt to form a ground for a general complaint about electric lighting; whilst at the present time the life of metallic-filament lamps is so long that the whole argument that they should only be used where considerable burning hours can be realised loses most of its point, at ordinary tariffs at least.

The data given for power and such domestic uses as heating and cooking form a valuable foundation for the work of the canvasser or constructional engineer; they should be supplemented by his own records of actual experience and comparative cost, which in relation to cooking, at least, will be found even more favourable than the figures given by the author. The expansion of the cooking business is being hampered to-day by the lack of selling agents who have a sound knowledge of simple cooking and domestic economics, which is for this work more important than technical information. With regard to the apparatus, a sufficient familiarity with the electrical principles is readily obtainable from the author's book, and this part of it, at least, may be commended to the attention of ladies who by choice or necessity seek a useful outlet for their knowledge of household management.

So far, the number of lady demonstrators or canvassers employed in connection with electrical work is not great, but there is an immediate field for them in connection with cooking, and in the better-class residential districts a knowledge of decorative principles in relation to lighting might greatly increase their usefulness to the suppliers and their own prospects.

The author's recommendations with regard to expert advice command sympathy; but his observation, that it is not the business of the wiring contractor to design installations, can hardly be admitted with regard to the general run of house and shop work. It is one of the difficulties of the industry that so many wiring contractors do not take the trouble to keep themselves fully familiar with the latest developments of electrical work, and make a study of the design as distinct from the practice of electric lighting. The average consumer is not called upon to ask for any special advice with regard to gas lighting, and he has the right to expect that a tradesman displaying electrical apparatus in his window in the public streets should take the trouble to obtain information and keep himself up to date with regard to the best methods of installing and using the same, putting aside as a secondary consideration those questions of immediate profit and shop-keeping expediency which unfortunately, to-day, too often guide him in advising his clients.

Engineering as a Profession. By A. P. M. Fleming and R. W. Bailey. London: John Long. Price 2s. 6d. net.

The authors explain in a preface to this work that a considerable experience in supervising the training of young engineers has forced upon them the opinion that a large number of failures are due to a lack of knowledge of what constitutes a suitable course of training, and ignorance of the conditions governing engineering employment. In this book very complete information is given as to the best means of obtaining engineering training both of a technical and of a practical character. The curricula obtaining at most of the colleges which have an engineering department, together with the fees, are given in great detail, and the conditions upon which apprentices are received by a large number of engineering firms in the country are explained. Some useful information is also given as to the scope and remuneration of engineering appointments at home and abroad. The book will well repay perusal by all who are contemplating entering the engineering profession.

The Ideal Code Condenser. Second edition. By Alfred Kolkenbeck. London: The Central Translations Institute. Price £1 1s. net.

A perusal of the advance copy of this book reveals how much progress has been made in the art of coding and the cutting-down of the cost of telegraphing. In fact, so many codes and condensers have been put on the market in recent years, that the telegraph bill of the ordinary merchant must have decreased by leaps and bounds, and gentlemen like Mr. Kolkenbeck must be regarded as public benefactors. Increased facilities increase the use of the cables to such an extent that, notwithstanding the amount of revenue code makers deprive them of, the companies still prosper and advance. In fact, they themselves have fathered cheap rates and have brought them down to so low a level that very many people neglect codes with the view of saving time—a matter of great moment.

Mr. Kolkenbeck enables the public to use two or more codes at the same time, which is certainly a novelty and an advantage; particularly, as it is stated, because certain expressions and phrases necessary to make a telegram explicit may be found in one code and not in another.

Mr. Kolkenbeck further states that the Telegraph Administrations of the United Kingdom, France and Germany have, on behalf of the International Telegraph Union, examined the condenser and have issued a certificate in virtue of which the words compiled therefrom cannot be queried or rejected.

CONTRACTS OPEN.

(*Continued from page 870.*)

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

West Hartlepool.—December 3rd. Corporation. Car bodies and trucks; electrical equipments for cars; points and crossings. See "Official Notices" November 21st.

Weymouth.—December 1st. Electric light and power installation at new bakery and stables, for the Co-operative Society (44 lighting points, with fittings, lamps and connecting-up of three motors). Clerk of the works, Cromwell Road

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CLOSED.

Australia.—The following tenders have been accepted by the Commonwealth:—

Victoria.—P.M.G.'s Department.—

50 miles of wire, two twisted conductors, £4 9s. 6d. per mile; 5 miles ditto, three conductors, £6 9s. per mile.—John C. Fuller & Son (J. Paton and Co.).

2½ miles paper-insulated lead-covered cable, 104 pairs 12½-lb. conductors, not served, £363 per mile; 2½ miles ditto, served, £378 per mile; 5 miles ditto 39 pairs, served, £211 per mile.—Callender's Cable and Construction Co., Ltd. (Noyes Bros.).

10 tons twisted-pair outside-distributing wire, £145 per ton; 9 tons tinned-copper rubber-insulated and braided wire, £168 6s 8d. per ton; 15 miles paper-insulated lead-covered cable, 52 pairs, 12½-lb. conductors, served, £246 per mile; 15 miles ditto, 26 pairs served, £166 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

20 miles paper-insulated lead-covered cable, 260 pairs, 12½ lb. conductors, not served, £732 per mile.—Western Electric Co. (Australia), Ltd.

—*Tenders.*

Defence Department.—Stores for the Small Arms Factory, Lithgow; Messrs. Noyes Bros. (Sydney), Ltd., for electric motors.

N.S.W.—Public Works Department.—

Transformers for workshops, Walsh Island, £1,234.—British G.E. Co.

Sydney.—The Electric Lighting Committee has recommended the Municipal Council to accept the following tenders:—

Testing transformer, £27 10s.—Australian General Electric Co.
Copper for bus-bars, £78.—B. I. & Helsby Cables, Ltd.

—*Tenders.*

And that the stock of switchgear be replenished as follows :—

Four 5,000 volt feeder panels, £87 each; two 10,000-volt ditto, £87 each; six 5,000-volt, 200-kw. transformer panels, £71 each; two 10,000-volt ditto, £71 each; 10 415-volt, 200 kw. ditto, £48 each; four 415-volt summation panels, £80 each; seven 415-volt, 200-kw. distributor panels, £47 each; six 200 k.v.a. 5,000/415-volt, three-phase transformers, £246 each.—Australian General Electric Co.

One 10,000-volt, 200-kw. transformer panel, £81 10s.—Ferranti, Ltd.

Two 10,000-volt feeder panels, £102 7s. each; one 10,000-volt transformer panel, £94 11s.; one 415-volt, 200-kw. ditto, £46 10s.; five 100-k.v.a. two-phase transformers, 10,000/415 volts, £700.—Noyes Bros.—*Tenders.*

The N.S.W. Public Works Department Tender Board has opened the following tenders :—

Two 3-ton electric jib cranes for State Brickworks, Homebush Bay.

W. A. Hodkinson	£692
Muir & Neil	1,064
Gordon Marr & Sons	1,120
Babcock & Wilcox, Ltd.	1,296

—*Tenders.*

Blackpool.—The Corporation has accepted the tender of Messrs. James Eaves & Co., of £355 for a new underground transformer chamber opposite the Hippodrome.

Delabole (N. Cornwall).—Contracts for the generating plant, battery, overhead mains, street lighting and private wiring have been secured by Messrs. W. G. Heath & Co., of Plymouth.

East Ham.—The tenders of T. Moy, Ltd., and E. and A. Shadrack have been accepted by the T.C. for the supply to the electricity department of 100 tons of Kirkley nutty slack, at 15s. 6d. per ton, and 100 tons of Cadley Hill nutty slack, at 15s. 3d. per ton respectively.

Faversham.—The T.C. has accepted the tender of Mrs. Davis, of Faversham, for Gillyceidrim washed anthracite coal for the Electricity Works, at £1 14s. per ton.

France.—The French Post and Telegraph Authorities, in Paris, have just placed a contract with Messrs. Geoffroy & Delore, of Clichy (Seine) for the supply of 300 km. of rubber and fire-proof cotton-covered copper wire, and with La Société Industrielle des Telephones, of Paris, for 200 kilometres ditto.; the price ranging from £3 16s. to £4 8s. per kilometre.

Glasgow.—The T.C.'s Sub-Committee on Tramways, Works and Stores has recommended acceptance of the following tenders :—

Cast-steel pipe connections.—Babcock & Wilcox, Ltd.
Cast-iron pipe connections.—Macfarlane, Strang & Co., Ltd.
Slide valves.—Dewrance & Co.
Trolley feed cable.—St. Helen's Cable Co.
Rail anchors.—Carey Patent Anchor Chair Co.
Insulated bolts.—W. C. Yuille & Co., Ltd.; J. Hally Craig.
Traction lamps.—General Electric Co., Ltd.
Double cotton-covered copper wire.—B.I. and Helsby Cables, Ltd.
Overhead crane.—Alex. Jack & Co.
Tower-wagon chassis.—Halley's Industrial Motors, Ltd.
Steel work, &c., Dalhousie depôt.—Redpath, Brown & Co., Ltd.
Trolley wire.—F. Espir.

Gravesend.—The T.C. has accepted the tender of Messrs. Cory & Co., for coal for the electric light works for a period of four years and nine months as follows :—Nixon's Navigation Screenings, 17s. 6d. per ton delivered, subject to market fluctuations, the quantity in any one year not to exceed 4,000 tons.

Hereford.—The T.C. has accepted the tender of Messrs. Cory & Sons, Ltd., for the supply of 2,500 tons of best Cannock rough small coal for the electricity works.

Leicester.—The T.C., on November 21st, accepted the following tenders in connection with the tramway undertaking :—

United Electric Car Co., Ltd.—12 top covers for cars, £101 each.
Walter Scott, Ltd.—Steel rails (180 tons) and fishplates (6 tons), £1,273.
T. Wragg & Sons, Ltd.—Single-way stoneware conduits, 4 in. diameter (2,800 yd.), £136.
Bayliss, Jones & Bayliss, Ltd.—1,000 steel tie bars in three lengths, £79.
Ibbotson Bros. & Co., Ltd.—Bolts, nuts and washers (6 tons), £141.

London.—L.C.C.—The Stores and Contracts Committee has placed a contract for steel conduits and fittings for electric wiring, for the year 1914, with Brotherton Tubes and Conduits, Ltd. Thirteen firms were invited to tender. Contracts for engine packing and asbestos goods have been placed with the following:—R. Beldam, J. W. Roberts, Ltd., A. Terry & Co., Thermofelt, Ltd., and Ward & Davidson, Woods, Sons & Co., J. Wotherspoon & Sons.

The Highways Committee has accepted the tender of Messrs. Hardy & Padmore, at £240, for 36 each cast-iron feeder pillar bases and cases, and that of Mr. J. Billingham, at £199, for 12 tons of standard flanged treadplate.

HAMMERSMITH.—In response to its invitation of tenders for arc lamps for hiring out, the Electricity Committee received 14 tenders, which will be reported upon later.

STOKE NEWINGTON.—The B.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for meters of assorted sizes for two years.

L. & S. Western Railway.—Messrs. Scholey & Co., Ltd., have received from the British Westinghouse Co. an order for their special tool-steel gears and pinions for the whole of the equipments required in the electrification of the suburban lines of this railway. We are informed that this constitutes the largest single order ever placed in this country for gears and pinions.

Rotherham.—The Corporation E.L. and Tramways Department has placed a repeat order with Messrs. E. Bennis & Co., Ltd., for two of their machine-stokers and self-cleaning compressed-air furnaces for a Lancashire boiler.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 28th. At 39, Victoria Street. Paper on "Patent Protection," by Mr. A. Abbey.

Greenock Electrical Society.—Friday, November 28th. At 7.45 p.m. At Temperance Institute, West Stewart Street. "Steam Turbines," by Mr. J. H. Parker; "The Entz Reversible Booster," by Mr. P. Kerr.

North-East Coast Institution of Engineers and Shipbuilders (Graduates' Section).—Friday, November 28th. At 7.30 p.m. At Westgate Assembly Rooms, Newcastle-upon-Tyne. Conversazione.

Physical Society of London.—Friday, November 28th. At 5 p.m. At Imperial College of Science. Papers by Prof. H. L. Callendar, Mr. F. J. Harlow and Prof. J. A. Fleming. Also an exhibition of a double-fibre string galvanometer, by Mr. W. Apthorpe.

Manchester Association of Engineers.—Saturday, November 29th. At Grand Hotel, Aytoun Street. Paper on "Pattern-making Department in an Engineering Works," by Mr. T. Roberts.

Institution of Electrical Engineers (Western Section).—Monday, December 1st. At 4.30 p.m. At South Wales Institute of Engineers, Cardiff. Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

Society of Engineers.—Monday, December 1st. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Corrosion and Rusting of Iron," by Mr. E. K. Rideal.

North of England Institute of Mining and Mechanical Engineers.—Monday, December 1st. At 8 p.m. At Chemical Theatre, Armstrong College. Fourth Lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Royal Society of Arts.—Monday, December 1st. At 8 p.m. At John Street, Adelphi. Cantor Lecture on "The Measurement of Stresses in Materials and Structures," by Prof. E. G. Coker.

Rontgen Society.—Tuesday, December 2nd. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Papers on "Sterilisation of Milk by Electrified Gas," by Dr. Hampson, Prof. W. G. Duffield and Mr. T. Murray. On "Some New Radium-emanation Applicators," by Mr. C. E. S. Phillips.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, December 2nd. At 7.30 p.m. At the University (Physical Lab.). Paper on "The Characteristics of Insulation Resistance," by Mr. S. Evershed.

Institution of Civil Engineers.—Tuesday, December 2nd. At 8 p.m. At Great George Street, S.W. Ordinary meeting.
Friday, December 5th. At 8 p.m. Students' meeting. Paper on "The Liverpool St. Extension of the Central London Railway," by Mr. H. V. Hutt.

Institution of Civil Engineers of Ireland.—Wednesday, December 3rd. At 8 p.m. At Dublin. Ordinary meeting.

Dynamicables.—Wednesday, December 3rd. At the Trocadero. Dinner.

Institution of Electrical Engineers.—Thursday, December 4th. At 8 p.m. At Victoria Embankment, W.C. Address on "Electricity Supply in Large Cities," by Dr. G. Klingenberg.

Chemical Society.—Thursday, December 4th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Faraday House Old Students' Association.—Friday, December 5th. At 7.30 p.m. At Holborn Restaurant. Annual smoking concert.

Institution of Mechanical Engineers.—Friday, December 5th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Junior Institution of Engineers.—Friday, December 5th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address, by Sir Boverton Redwood, Bart.

Manchester Association of Engineers.—Friday, December 5th. At Whitworth Institute, Whitworth Park. Conversazione.

Salford Technical and Engineering Association.—Saturday, December 6th. Visit to Salford Electricity Works. At 7 p.m. At Royal Technical Institute. Annual Meeting.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, December 1st.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, December 2nd.—"B" Company. Ditto.

Wednesday, December 3rd.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, December 4th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, December 5th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 p.m.

Saturday, December 6th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) R. HOLT WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Australian Electricians' Wages.—Many of our readers will be interested in the rates which two recent awards by Mr. Newbery have made compulsory in the State of New South Wales. One award deals with the employés of the Sydney City Council, the other affects the general public. The awards are to remain binding for a term of three years, and have many identical clauses.

For Council employés the minimum rates are to be :—

Electrical fitters and instrument makers, 12s. per day.

Electrical mechanics, consumers' attendants, electrical mechanics on overhead work, and meter fixers, 10s. 8d. per day.

Cable jointers, 12s. 6d. per day.

Arc lamp trimmers, 9s. 6d. per day.

Motor inspectors, 11s. 2d. per day.

Mechanics employed on motor breakdown staff, 11s. 8d. per day.

Meter testers and repairers and arc lamp testers, 11s. 8d. per day.

Shift electricians at sub-stations, 13s. 2d. per day ; assistant shift electricians, 9s. 8d. per day ; senior shift electricians, 14s. per day.

Switchboard attendant at power house, 9s. per day for first 12 months ; 10s. per day afterwards if over 21 years.

Principal battery fitter at Town Hall, 13s. 8d. per day.

For employment outside the City Council the minimum rates of wages are :—

Shift electricians, 1s. 6d. per hour.

Installation electricians, 1s. 6d. per hour.

Electrical fitters, 1s. 6d. per hour.

Instrument makers and fitters, 1s. 5d. per hour.

Battery fitters, 1s. 6d. per hour.

Electrical mechanics, 1s. 4d. per hour.

Linemen, 1s. 2d. per hour.

Cable jointers, 1s. 6d. per hour.

Arc lamp trimmers, 1s. 1d. per hour.

Leading hands are to be paid 1s. 6d. per day over the above rates.

Electricians in charge of installations are to be paid not less than 13s. per day when the capacity of the plant is less than 75 KW., and not less than 15s. per day when it is over that amount.

The minimum weekly rates for apprentices, both for Council and general work, are to be :—First year 7s. 6d., second year 12s. 6d., third year 17s. 6d., fourth year 25s., fifth year 35s. The standard hours to be 48 per week. Overtime, time and a half till midnight, double time after that period.

Living allowances at the rate of 6s. per day to be paid on the first two days, and 5s. per day for the following days, after that at the rate of 25s. per week.

Preference of employment, other things being equal, is to be given to members of the Electrical Trades Employés' Union.

The awards contain a number of definitions as to the duties of the various grades, and a number of other regulations as to suburban and emergency work, employment on Sundays and holidays.

The rates are in all cases an advance on those at present paid, and are such that workers in this country cannot but regard them with interest. It must, however, be remembered that the cost of living is much higher in Sydney than in this country, and that when the margin between the week's wages and the necessary expenses of the home is considered in the two cases, the balance in favour of Australia is not so great as might be inferred at first sight.

Power Conditions in North-West U.S.A.—Up to 1910, the rapidly increasing demand for power in the Pacific North-West districts taxed the resources of electric supply companies in that region to the utmost, but recently the demand has slackened, so that all the operating companies have an excess capacity ranging from a few thousand kilowatts to a considerably greater amount. Unless industrial developments absorb this excess, it will be some years before the construction of new power plants will be warranted. Supply rates all over the country have decreased constantly, in many cases to 35 per cent. or 50 per cent. of their value a few years ago. At present the rates in the North-West compare favourably with those in any part of the States.

Streams on the west side of the Cascade Mountains in Washington and Oregon have a rapid fall and abundant and comparatively well regulated water. Storage capacity is, however, needed to maintain operation during February and September or October. The prevailing public opinion is that these streams could easily be harnessed and made to yield enormous revenues. In the *Electrical Review and Western Electrician*, Mr. W. E. Herring points out the constructional difficulties and costs involved. Transport difficulties are great, transmission lines must be very long, and steel tower lines involve constructional difficulties. Local timber is rarely useful for poles, but a wide belt of trees, averaging 150 ft. in height and often attaining 250 ft., must be felled. The average cost of a H.T. line in heavily timbered country is £800 or more per mile according as wooden poles or steel towers are used. A city distributing scheme costs from £1,500 per mile where wooden poles are used to £8,000 per mile using underground ducts. Auxiliary plant and equipment designed to enhance security of supply absorbs much capital. Natural causes of interruption are many, and the repair of damage (apart from incidental losses) is costly. The Seattle supply company has £54,000 invested in storage cells which will carry full load for 25 minutes only. Only about 50 per cent. of the horse-power available at the stream or 70 per cent. of the power generated reaches the consumer. The initial cost of a complete hydro-electric development is from two to four times that of a steam plant of equal capacity.

The Puget Sound Co. supplies from Tacoma North to the British Columbia line from four water and six steam plants totalling 105,140 rated H.P. (76,000 H.P. in one water plant). Supply in the remainder of the western portion of Washington and Oregon is by the following undertakings :—Oregon-Washington Corporation : one water, two steam stations, total 3,000 H.P. (567 H.P. hydraulic). Portland Co : Three water, seven steam stations : total, 81,270 H.P. (55,410 H.P. hydraulic). Oregon Co. One water, two steam stations ; total, 5,620 H.P. (666 H.P. hydraulic). California-Oregon Co. : Two water stations ; total 3,500 H.P. The new N.W. Electric Co. has a 16,000 H.P. hydro-electric plant at Washington and a 5,000-H.P. steam station under construction in Portland. A number of developments, admirable in every other respect, have not been carefully investigated, because no market exists for the output of which they are capable. Under present conditions, it will be years before these developments can be exploited. One company, at least, has instituted an aggressive campaign to increase industrial activity in its district. As an inducement, rates less than £4 3s. per H.P.-year have been quoted to large power users for 24-hour supply. The power cost of manufacturing per month, assuming use of 100 H.P., 10 hours per day at 75 per cent. load factor is, in :—Boston, £194 ; Philadelphia, £173 ; New York, £144 ; Chicago, £130 ; Cleveland, £115 ; Pittsburg, £86 ; Buffalo, £38 ; Seattle and vicinity, £31 to £77 ; Niagara, £29.

There are unlimited power possibilities on streams in Washington and Oregon, but until the country is more densely populated and until industrial activity is greater, there will be no such development of these streams as has occurred in other parts of the States. Low-head developments, the rule rather than the exception in the Eastern States, are non-existent in the North-West.

The Largest Aerial Cableway in the World.—The *Electrical Review and Western Electrician* states that plans are being completed for an electrically operated 75-mile cableway to give access to the Vale of Kashmir from the plains of the Punjab in Northern India. The longest cableway at present working is in Argentina and is 22 miles long.

The ruggedness of the mountainous district, the treacherous character of the frequent landslides after heavy rains, and the falling of heavy boulders, make the construction of an ordinary railway impracticable.

Two separate ways will be set up, side by side, about 9 ft. apart, and will permit of uninterrupted transport of freight on incoming and outgoing lines. The cable will be about 1·5 in. in diameter, and arranged in 5-mile sections. A system of springs, thoroughly anchored and with heavy counterweights will be employed to take up expansion and contraction due to heat and cold. The spans will be about 2,400 ft. each, with a fixed cable upheld by iron pillars and lattice work towers, some of which will be 100 ft. high. In some cases the spans are across canyons 1,200 ft. deep. The cars will be of steel, and each capable of holding from 335 to 450 lb. of freight. The transfer of the cars from one section to another will be automatically done by revolving drums, which will affect release of the cars and renewal gripping to the hauling ropes of the next section. The system will be electrically operated from a hydro-electric station near the town of Rampore.

The estimated cost will be about £300,000, and the inception of the scheme is due to a Canadian military engineer temporarily in the service of the Kashmir Government.

"The Voysey Inheritance."—Once again the Electrical Trades Benevolent Institution is indebted to the Garrick Dramatic Society for an excellent entertainment and for financial benefit to its funds, the exact extent of which we hope to announce in due course. So far as the Dramatic Society is concerned, the performance at the Court Theatre was all that could be desired, but as might be anticipated from what we said in our last issue, the electrical support was not so good as last year. Mr. Duddell, president of the I.E.E., was present, and among others from the manufacturing and other sections of the industry who put in an appearance were Mr. H. Hirst, Mr. E. L. Byng, Mr. H. H. Berry, Mr. F. H. Nalder, Mr. Rawlings and Mr. F. J. Walker. An electrical man might have expected in looking round the building to see many more familiar faces, and so he would have done but for the fact that a number of prominent men who had purchased tickets with the object of assisting to ensure the success of the evening were unable to occupy their seats. There is nothing so inspiring to actors, and especially to a society of amateurs, as a full house ; on another such occasion no doubt purchasers will be able to think of this in advance and suitably dispose of tickets that they cannot personally use.

Electrochemical Works in Sweden.—A big factory has just been completed near Johannesburg, in Sweden, for the manufacture of carbide of calcium and nitrate of calcium by the carbon improved process. The novelty of this method consists in the addition of a little carbide spar to improve the quality of the product. Four 400-KW. A.C. furnaces are installed for the manufacture of carbide of calcium, and six 2,666-KW. three-phase furnaces for the nitrate. The power house has a capacity of 15,600 KW. The entire hydro-electric installation has cost £250,000, of which the electric equipment stands for £42,000, the transmission lines £108,000, and the canals and dams £50,400.—*Journal du Four Electrique.*

Football.—On Saturday last the teams of Cunningham, Ltd., and Electrical Installations, Ltd., second eleven, met on the former's ground, the game resulting in the defeat of the visitors by six to nil.

London Electric Supply Companies and the Purchase Date.—With reference to our note of last week concerning the application to Parliament by the County of London Electric Supply Co., Ltd, for powers to postpone the date of purchase, the notice of the company appeared in the *London Gazette* for November 25th. The application is intended to be made by, or on behalf of, the County Council either alone or in conjunction with any one or more of the other London electric supply companies for leave to bring in a Bill for the following purposes:—

To enable the County Co. and any other or others of the London Electric Supply Companies respectively, and any one or more of such companies on the one hand and the London County Council on the other hand to enter into and carry into effect agreements for the postponement of the date at which the Council may proceed to purchase the undertakings or parts of the undertakings of the London Electric Supply Companies or any of them, and for a variation of the terms and conditions under which such undertakings or any of them are purchaseable, and making new provisions with regard thereto, including any extension of powers of purchase in reference to generating stations or portions of undertakings outside the county of London, and to provide for the validity of any such agreement, notwithstanding that the same may restrict the right of the Council under or may be inconsistent with or contrary to the provisions of Sec. 23 of the London Electric Supply Act, 1908, or any other provisions of that Act or any other Act, and whether affecting the company or companies parties to such agreement or any other or others of the London Electric Supply Companies not parties to such agreement.

To sanction and confirm and make binding any agreement or agreements already made, or which may hereafter be made, between the County Co. and any other or others of the London electric supply companies, or any one or more of them, on the one hand, and the Council on the other hand, for any of the purposes referred to in this notice.

The Bill may make provision for the postponement of the date at which the Council may proceed to purchase the undertaking of the County Co. and the undertakings of the other London electric supply companies respectively, and for the alteration or amendment of the terms and conditions under which such undertakings or parts of undertakings respectively, or any one or more of them, may be purchased, and make new and extended provisions in reference thereto, including any extension of powers in regard to purchase by the Council of generating stations and portions of undertakings outside the county of London.

There was some discussion on the matter at Tuesday's meeting of the Council. Major Levita asked for information, and in reply Mr. G. H. Hume, speaking for the London Electricity Supply Committee, said that they could do nothing until the Bill was deposited in December. Their officers would then report. The Committee was not aware of what lay behind the notice.

Late Legal.—The Osram Lamp Works, Ltd. Judgment against Oro Light Co.—In the Chancery Division, before Mr. Justice Astbury, on Wednesday, November 26th, Mr. J. H. Gray, on behalf of the plaintiffs, in the action of the Osram Lamp Works, Ltd., *v.* the Oro Light and General Supply Co., Ltd., moved for judgment in default of defence. He said a defence was delivered, but was afterwards withdrawn. The action was for infringement of two patents.

His Lordship: Are these old friends?

Mr. Gray: Yes. Counsel pointed out that the minutes of judgment were in the usual form. They provided for an injunction, delivering up or destruction, and for an inquiry as to damages.

His Lordship: Under what circumstances did they withdraw their defence?

Mr. Gray said he did not know; he only knew there was an application to withdraw it. The defendants asked for leave on November 10th, they got leave on the 12th, and the defence was withdrawn on the 15th.

His Lordship gave judgment in the usual form.

Attack on a Sub-Station.—During the meeting of Trade Unionists at the Albert Hall, London, on Wednesday last week, a large number of students made an attack on the sub-station of the Kensington and Knightsbridge Electric Light Co., which is situated at the rear of the Hall, with a view to extinguishing the lights in the Hall, and throwing the meeting into confusion. Telephones, electric lamps, switchgear, &c., were broken by the mob, which broke down the gates and rushed into the station, but the lights were not affected. Two of the marauders—Angus McCallum and G. W. Elkington—were captured, and were charged next day; they were remanded on bail.

Appointments Vacant.—Senior and junior draughtsmen for Birmingham electric supply department (senior £130 to £160, junior £80 to £130). Switchboard attendant, for Portsmouth Corporation (30s.). Particulars are given in our advertisement pages.

Engineering Trade Conference.—The *Financial Times* states that a conference was held last week at Caxton Hall, between the Engineering Employers' Federation and representatives of unions concerned in the trade, when a demand was put forward by representatives of the unions for a 48-hour week. The matter was considered and the employers promised to communicate the matter to the companies connected with the Federation.

L.G.B. and Electrical Publicity Expenditure.—The Associated Municipal Electrical Engineers (Greater London) have been in communication with the L.G.B. regarding the legality of expenditure on publicity and advertising matters in connection with municipal electrical undertakings. The letter to the President of the L.G.B., amongst other things, pointed out that "According to the reports in the Press, he was good enough to state when he recently received a deputation from the British Commercial Gas Association, that he was in full sympathy with the objects of the Association, and considered money spent in support of its work would be money wisely spent by gas undertakings, and that if the money so spent were described as payment for 'goods supplied and services rendered'—the goods supplied being the 'Bulletin,' the advertisements inserted by the Association in papers having a national circulation, and the samples of literature sent by the Association to its subscribers—such payments would not be made the subject of a surcharge by the Local Government Board." The letter, in conclusion, asked whether his opinion applied equally in the case of municipal electrical undertakings.

In reply, the L.G.B. draws attention to a paragraph in its letter to the President of the British Commercial Gas Association, mentioning that the views there expressed as to the purchase of literature, is applicable to municipal electrical undertakings.

The paragraph referred to runs as follows:—"I am to add, however, that the Board have been advised by the Law Officers of the Crown that publications containing information so immediately connected with the discharge by a local authority of their duties, as to be likely to enable them to discharge those duties more efficiently, might legally be purchased by the local authority. The question of the legality and reasonableness of expenditure incurred in the purchase of the publications would, in the case of a local authority whose accounts are subject to audit by a district auditor, be one for consideration in the first instance by the auditor at the audit."

Meeting of Creditors.—A meeting of the creditors of John Samuel Richardson, electrician, 29, Frodsham Street, Marfleet, Hull, was held at the office of the Hull Official Receiver on Tuesday. Debtor's liabilities amounted to £95, and his deficiency was estimated at £81. He attributed his failure to the law costs in an unsuccessful action brought by him for damages for personal injuries received. His affairs were left in the hands of the Official Receiver.

A Manchester Staff Dinner.—The first staff dinner of the electrical department of the Calico Printers' Association, Manchester, was held in the Albion Hotel, on Saturday, the 22nd inst. 110 covers were laid, and amongst those present were representatives of the Manchester and Rawtenstall electricity departments and leading electrical manufacturers in the city. The chief electrical engineer of the company, Mr. W. Cotsworth, presided, and he was supported by Mr. C. Roberts, director. Apologies for non-attendance were read from Messrs. S. L. Pearce (Manchester Corporation), C. D. Taite (Lancashire Electric Power Co.), R. Blackmore (Stalybridge Corporation), and others. After dinner an enjoyable vocal and instrumental concert followed. Madame Ethel Nicholson gave excellent renderings on the violin, Mr. J. Ridgway on the flute and piccolo, and there were many humorous songs by members of the staff, together with some amusing lightning sketches. The chairman, Mr. W. Cotsworth, proposed "Success and Prosperity to the Calico Printers' Association," to which Mr. Roberts responded. Mr. F. H. Whysall, Manchester Corporation electricity department, as representing the guests, proposed "The Chairman." Not the least interesting of the speeches during the evening was an account of how electric lighting was first introduced into one of the company's works 34 years ago. The dynamo was driven by an engine nearly 90 years old. A pleasant evening ended by the singing of "Auld Lang Syne" and the National Anthem.

Institution Notes.—The Post Office Telegraph and Telephone Society of London.—At the second meeting of the session an address was given by Mr. John Newlands, C.I.E., Controller of the Central Telegraph Office, on "The Telegraph System, Methods and Results."

The Wireless Society of London.—Nearly 100 members attended a most successful general meeting of the above society, held in the Westminster City School on Tuesday evening last. The minutes of the inaugural meeting having been approved, the president (Mr. Campbell Swinton) commented on the rapid growth of the society, the membership of which had risen from seven on July 5th, to 60 on September 23rd, and to 160 at present; many country applications were still pouring in. They had a list of vice-presidents of which any society might be proud. The club rooms at 107, Hatton Garden, E.C., were now available for use though not completed. Ultimately a fine "wireless" library would be established, classes and demonstrations of new systems and apparatus would be arranged, and an elaborate set of apparatus was being installed such as would enable members to calibrate their own instruments and perform other work, generally beyond their reach, owing to lack of suitable apparatus. Discussing the question of licensing amateurs' stations, the president said that the Post Office was now experiencing great difficulty in allocating ranges and wave lengths in such manner as to avoid confusion. Coastal and shipping traffic must be protected against interference, and any amateur might be sure that if the range-circle of his proposed station included a State or commercial station or a shipping route, his application would be questioned very closely. Control over senders was imperative and secrecy must be respected, hence only responsible persons should be granted even receiving licences. The proposed tax on wireless licences was, however, indefensible if not actually contrary to the Act of 1904. Such an imposition would lead to evasion, for time signals could be received by apparatus which a search warrant would fail to reveal! The authorities ved help of *bona-*

fide amateurs, and members must see that present concessions were not abused; cases of "wireless hooliganism" (*e.g.*, false S.O.S. signals) must be dealt with severely. The Admiralty and Messrs. Marconi trained large numbers of operators using sending and receiving stations closely adjacent; there were no advantages but many objections to having instructional stations miles apart. Full membership of the society was now restricted to persons who had been engaged in wireless research or experimental work for at least two years *and/or* who satisfied the Committee that they possessed the necessary qualifications or training. The authorities were prepared to accept the endorsement of the society on applications for licences. Maps would be prepared for metropolitan and country areas, showing the location of members' stations; the work of the society would thus be facilitated.

Mr. Russell Clarke said it was proposed to have first-class standardised apparatus in the Society's laboratory, and about £70 worth of apparatus had already been promised by members, but, to avoid the ignominy and risk of living on charity, to realise the full possibilities of the Society and to make it self-supporting and flourishing, the original subscription must be raised to £1 1s. for metropolitan members and Associate members; 10s. 6d. for country and foreign members; and 10s. 6d. entrance fee. Those members who had already "got in on the cheap" might well bring their subscriptions, in effect, up to the new level by donations to the instrument fund.

The rules of the Society, including the increased subscription rates, having been approved, the president called upon Dr. W. H. Eccles to outline the research work initiated by the Radio-Telegraphic Committee of the British Association, and to indicate how members of the Society could help in this work.

Dr. Eccles said that the Committee recognised its duty to be the undertaking of work which could not be performed by individual experimenters. Discharges from the atmosphere in the immediate neighbourhood of a station (causing sparking in the aerial, or permitting a vacuum tube to be lighted, were called "statics" or "atmospherics." Disturbances arriving from a long distance were termed "strays," and the British Association had decided to investigate these natural electric waves, which travelled over a large part of the earth. About 70 per cent. of strays received at stations in the North and South of England could be traced and identified, but to trace them to their source—perhaps thousands of miles away—required a world-wide network of observers. Already the British Association was prepared to start work with 200 or 300 observers in British and foreign colonies, the United States, and ships in various seas. By the examination of records received, it was hoped to determine the laws and nature of "strays," and also (since the same set of observers would serve), to determine the influence of meteorological conditions on long-distance transmission. The Committee was preparing official forms, so that all information might be collected on a uniform plan; specimen copies of this form would soon be available to members, but, for the present, the Committee could only accept official assistance from, say, a dozen members of the Society scattered up and down the country. There were, however, many unofficials ways in which members could be of immense assistance to the Committee. For example, any member possessing a directional aerial should observe the direction from which disturbance proceeds during X-storms. There was much to be done, too, in the way of recording sunset and sunrise variations in the strength of signals received from, say, Coltano. Hitherto the difficulty had been to measure strengths of signals, but accuracy could be gained by practice, and the calibrating laboratory of the Society would doubtless prove invaluable. Two members working simultaneously on long and short aerials, or on two differently-tuned receiving sets in the same aerial, should record the frequency and strength of strays received; these would not be the same in each case. If members would work along these and similar lines, and if a sub-committee of the Society would sift reports before transmitting them to the B.A. Committee, the latter would be helped enormously, and this country would become the centre of such research.

Following the announcement of various gifts, a further appeal was made for money and apparatus, and the President announced that he would deliver an address at the next general meeting, in January, 1914.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Hereford T.C. has appointed Mr. R. J. Wright as charge engineer at the electricity works, vice Mr. W. Haines, who has received an appointment on the Margerita Tea Plantation at Makum, Assam.

Mr. J. J. McGregor, at present assistant engineer at the Deptford generating station of the London Electric Supply Corporation, is recommended for the position of charge shift engineer at the Greenwich generating station of the L.C.C., recently advertised. The advertisement stipulated for candidates to be "not more than 40 years of age," and there were 104 applicants. The salary is £250, rising to £300.

Mr. C. Furness, the electrical engineer and tramways manager at Blackpool, has been elected president of the Blackpool and District Municipal Officers' Guild. The Blackpool Tramways and Electricity Committee has recommended that his salary be increased by £200 per annum. If the recommendation is adopted, Mr. Furness's salary will be £[illegible] per year, the amount being divided proportionately between the electricity, the tramway, and the street lighting departments.

Mr. J. S. Gibson, charge engineer at the Dewsbury Corporation electricity works, has resigned his position.

Mr. C. F. Anderson has resigned his position at the West Bromwich Corporation electricity works, having obtained an appointment with the Barnes (London) Urban District Council. The West Bromwich staff presented him with a gold matchbox.

Tramway Officials.—Mr. Walter T. Young, who for two years has been traffic superintendent of the Oldham Corporation Tramways, has just been appointed to a similar position under the West Ham Corporation. Before going to Oldham, Mr. Young served under the Aberdeen Corporation for 14 years.

General.—We are informed that Mr. J. H. Collings, who for many years has been connected with the electrical fittings department of the General Electric Co., Ltd., at their head office, 67, Queen Victoria Street, London, E.C., has been appointed by the board of directors to the important position of manager of sales counters and showrooms at the Queen Victoria Street premises. During Mr. Collings's lengthy service with the company in the fittings department, we have had many opportunities of meeting with him, and from experience we can say that callers at the G.E. head office will always find him ready and willing to devote personal attention to their requirements.

An interesting presentation of a gold watch and chain has been made to Mr. N. W. Prangnell, of the Metropolitan Electric Supply Co., by the Electric Supply Publicity Committee, as a token of their appreciation of his management on their behalf of La Maison Electrique, at the Ideal Home Exhibition, Olympia.

The marriage took place at the Parish Church, Waenfawr, on November 19th, of Mr. Harold B. F. Childs, chief engineer of the Cefndu Marconi station, and Miss Enid Mary Williams, only daughter of the Rev. R. A. Williams. The presents included one from Mr. Marconi, and another from the engineering staff and workmen at the Cefndu wireless station.

Mr. G. H. Anger, managing director of the Anger Manufacturing and Supply Co., Ltd., Preston, has just returned from attending the Convention of the American Electric Railway Manufacturers' Association held at Atlantic City, and from a visit to the United States and Canada in the interest of his brake adjuster.

Mr. S. M. Johnstone having been appointed chief engineer and designer to a large crude rubber-treating machinery manufacturing firm, has resigned his position as engineer-in-charge with the St. Pancras Borough Council electricity department.

Mr. Stevenson has been re-elected Convener of the Edinburgh Corporation Electricity Committee.

Councillor Gibb has been unanimously re-elected Convener of the Aberdeen Corporation Electricity Committee, while Councillor Smith has been appointed Convener of the Tramways Committee.

At the first meeting of the Sheffield Electric Light Committee, Alderman C. F. Bennett was elected chairman, in succession to Councillor J. W. Crowther.

Obituary.—Mr. J. E. Lickfold.—It is with profound regret, we might say with the feelings of a personal loss, that we learn that Mr. J. E. Lickfold, the well-known solicitor, passed away on Monday morning last at the age of 73 years. He had been in ill-health for some time, but, as he showed some signs of improvement he was brought home from Ramsgate to his house at Muswell Hill ten days ago. Unfortunately, he became worse, and on Friday last the case was seen to be hopeless. The deceased gentleman stood quite in the front rank among City solicitors, for he had an experience of so varied and lengthy a nature as to be described as almost unique. Our own earliest association with him as proprietors and editors of the Electrical Review, dates back now 21 years ago when, as representing the famous firm of Lewis and Lewis, of Ely Place, he devoted himself with all his heart and mind to the series of legal proceedings in which we were engaged consequent upon our exposures of the electric belt frauds. Thanks to his skill in handling matters, and to the justice of our cause, we were able to emerge from those proceedings satisfactorily. Some 16 years ago Mr. Lickfold left his old firm and commenced business on his own account, and two of his sons joined him later under the firm title of J. E. Lickfold & Sons. To these gentlemen and the other members of the family we tender our condolences in their bereavement.

Sir W. H. Bailey.—The engineering world has lost one of its leading engineers, and Manchester one of its foremost public men, by the death, which we regret to announce, of Sir Wm. Henry Bailey. To engineers everywhere the name of his firm—W. H. Bailey & Co., Ltd., of Albion Works, Salford—is a household word. Present-day Manchester owes him much, among the valued services which marked his connection with that city being his interest in the Manchester Ship Canal, which brought such strength and activity into the industrial life of the borough and the surrounding district. Of this undertaking he was one of the original promoters, and it was when he was Mayor of Salford, in 1894, that Queen Victoria conferred upon him the honour of knighthood, the ceremony taking place on board the first vessel to pass through the Canal. He began inventing engineering apparatus when he was a very young man, and in the course of his career produced many inventions in connection with pumping, blast furnaces, mining, pyrometry, testing, and other machinery and instruments. One of the latest movements in which he displayed interest was the formation of the Engineers' Club at Manchester, the opening of which took place a week or two ago. Sir William passed away suddenly at a London hotel last Saturday morning. He was 75 years of age.

Mr. James Howden.—We regret to learn of the death, which occurred on November 21st, of Mr. James Howden, J.P., M.Inst.C.E., chairman of the well-known Glasgow engineering firm of James Howden & Co., Ltd. The deceased gentleman was 82 years of age.

Will.—According to a financial paper, the late Dr. Hermann Aron left estate in the United Kingdom valued at £7,755, the net personalty being £7,722.

NEW COMPANIES REGISTERED.

Musolaphone Syndicate, Ltd. (132,255).—This company was registered on November 19th, with a capital of £5,000 in £1 shares, to establish systems by means of which performances entertainments, lectures, sermons, legal proceedings, orations, descriptions of athletic and sporting events, recitals of news, &c., may be transmitted to and received at distant places, by aid of telephones and telegraphic apparatus, to enter into contracts with the Government of this or any other country, &c. The subscribers (with one share each) are:—J. A. Nicholson, 34, Barrington Road, Egremont, Cheshire, clerk; A. E. Birch, 14, Elstree Road, Fairfield, Liverpool, clerk. Private company. Table "A" mainly applies. Registeed by C. H. Wright, 34, Clement's Lane, E.C.

Indian Railless Traction Co., Ltd. (132 231).—This company was registered on November 18th, with a capital of £5,250 in 5,000 preferred shares of £1 each, and 5,000 ordinary shares of 1s. each, to carry on in India or elsewhere the business of engineers, electricians, suppliers of electricity for light, heat, power and traction, manufacturers of carriages, wagons, carts and other vehicles, &c. The subscribers (with one share each) are:—Sir Alick D. Gibbons, Bart., West Cliff, Isle of Wight; H. H. Bathurst, Finsbury Pavement House, E.C., secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Solicitor, L. M. Parkin, 114A, Chancery Lane, W.C. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Di kinson Electrical Manufacturing Co., Ltd. (132,225).—This company was registered on November 18th, with a capital of £2,000 in £1 shares, to carry on the business of engineers, manufacturers and patentees of electrical and other appliances, &c, and to adopt an agreement with W. Dickinson. The subscribers (with one share each) are: G. North, Oaklands Road, Bexley Heath, Kent, electrical engineer; W. Dickinson, Highfield, Bexley Heath, Kent, electrical engineer; J. L. Orchard, Belvedere Road, Bexley Heath, Kent, electrical engineer. Private company. The number of directors is not to be less than two or more than five, the first are G. North (managing director), W. Dickinson and J. L. Orchard; qualification, £100; remuneration (except managing director) as fixed by the company. Registered office, 85, Broadway, Bexley Heath.

Wescoscope, Ltd. (132,240).—This company was registered on November 18th, with a capital of £7,500, in £1 shares (5,000 6 per cent. cumulative preference), to take over the business of electrical engineers and dealers in electrical appliances carried on by the Wright Electrical Sales Co., Ltd., at 5, Upper Mill Hill, and 94, Albion Street, Leeds, to carry on the same and the business of manufacturers of and dealers in photographic, magnetic, cinematographic, railway, motor and other appliances, &c., and to adopt two agreements—(1) with the said old company, and (2) with A. B. Hudson. The subscribers (with one share each) are:—W. W. Newbold, Street Lane, Roundhay, Leeds, merchant; A. B. Hudson, Hazelgrove, Thorner, near Leeds, engineer; A. M. Hudson, Hazelgrove, Thorner, near Leeds, engineer; A. Colby, 1, Noster Place, Leeds, tailor's assistant; G. R Ellis, 14, Strathmore Drive, Leeds, tailor's cutter; W. C. Ellis, 14, Strathmore Drive, Leeds, tailor's assistant; W. Marchant, 39, Victoria Street, Chapel Allerton, Leeds, clerk. Minimum cash subscription 50 preference shares. The number of directors is not to be less than two or more than seven; the first are W. W. Newbould, A. B. Hudson and A. Hudson; qualification (except first directors), £250; remuneration of ordinary directors, £50 per annum. Solicitor, A. Pettitt, Leeds. Registered office, 94, Albion Street, Leeds.

Plates, Ltd. (132,280).—This company was registered on November 20th, with a capital of £6,000 in £1 shares (3,000 "A" and 3,000 "B"), to take over certain inventions, patents and rights relating to the processes or apparatus for the coating of plates and sheets, such as are used on the tinplate industry, to carry on the business of tinplate substitutes, smelters, refiners, rollers, assayers, &c., and to adopt an agreement with Metal Plates, Ltd., Sherard Osborn Cowper-Coles, and Peek, Frean & Co;, Ltd. The subscribers (with one "A" share each) are:—A. Carr, 158, Drummond Road, S.E., director; G. Roberts, 158, Drummond Road, S.E., director; G. H. Davis, 158, Drummond Road, S.E., director; P. Carr, 158, Drummond Road, S.E., director; J. Carr, 158, Drummond Road, S.E., director. Private company. The number of directors is not to be less than two or more than four; the first are A. Carr, G. Roberts, S. O. Cowper-Coles, and J. Gordon Gordon. The two last named may remain directors for five years; qualification (except first directors), £100; remuneration as fixed by the company. Registered office, 158, Drummond Road, Bermondsey, S.E.

Electricals, Ltd. (132,317).—This company was registered on November 22nd with a capital of £10,000 in £1 shares, to carry on the business of electrical and mechanical engineers and contractors, electricians, suppliers of light, heat, sound and power, brassfounders, metal workers, boiler makers, manufacturers of and dealers in electrical and other machinery and plant, &c. The subscribers (with one share each) are:—J. G. Smith, Belmont, Bentinck Road, Newcastle-on-Tyne, accountant; W R. Curry, 1, Curtis Road, Fenham, Newcastle-on-Tyne, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, 25 ordinary shares; remuneration as fixed by the company. Registered office, Cathedral Buildings, Dean Street, Newcastle-on-Tyne.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pernambuco Tramways and Power Co., Ltd.—Amended particulars of £1,250,000 debentures, created July 24th, and secured by trust deed dated August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200,000. The original particulars gave the whole amount as issued.

Issue on November 14th, 1913, of £50,000 debentures, part of a series of which particulars have already been filed.

Aero Fire Alarm, Ltd.—Issue on November 13th, 1913, of £600 debs., part of a series of which particulars have already been filed.

Atlas Electrical Co., Ltd.—Particulars of £5,000 debentures, created August 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £350. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Greystones Electric Light and Power Co., Ltd.—Particulars of £1,200 debs., created by resolutions passed April 22nd, August 5th and October 28th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking, goodwill and all property, present and future. No trustees.

Rangoon Electric Tramway and Supply Co., Ltd.—Trust deed dated November 5th, 1913 (supplemental to trust deeds dated February 1st, 1906, and December 22nd, 1908, securing £250,000 debenture stock), charged on certain freehold and leasehold heredi aments and premises. Trustees: Sir John Gray Hill, Kt., 10, Water Street, Liverpool; and R. Henderson, St. Vincent Place, Glasgow.

Brilliant Arc Lamp and Engineering Co., Ltd.—Particulars of £300 debentures, created November 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Pirelli, Ltd. (103,068).—Capital, £8,000 in £5 shares; return dated October 2nd, 1913; all shares taken up; £8,000 paid; mortgages and charges: Nil.

Newton's, Ltd. (48,936).—Capital, £40,000 in £10 shares; return dated September 30th, 1913: 3,265 shares taken up; £18,650 paid; £14,000 considered as paid; mortgages and charges: £14,000.

Sheerness and District Electric Power and Traction Co., Ltd.—Particulars of £12,500 debs., created November 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,965. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Consolidated Diesel Engine Manufacturers, Ltd.

The directors have issued their report to March last (which will appear in our next issue). It shows that for the 19 months from March, 1912, to October, 1913, the general expenses exceeded the revenue by £9,600, and it is accompanied by a circular stating that the company is without sufficient funds to meet an expenditure of between £70,000 and £80,000 which is necessary for the purpose of running the Ipswich works until they can pay their way. A scheme is put forward for reconstructing the company with a view to putting it on a sound basis. A new company with £600,000 capital would take over the present company's undertakings, assets and liabilities, issuing 600,000 shares, each credited with 15s. paid up, the remaining 5s. liability being paid partly on application, partly on allotment, and the rest later. Shareholders would receive one share in the new company in exchange for each share held in the present company. A financial paper states that at the instance of shareholders representing over 200,000 shares, Sir W. B. Peat is making an independent investigation of the company's affairs.

Electrolytic Alkali Co.—At a meeting held on Monday, according to the *Financial Times*, shareholders approved of the scheme of reconstruction, involving the issue of 124,000 £1 7 per cent. participating preference shares. Existing preference shareholders will accept one new ordinary share for every five shares now held, and ordinary shareholders one for every 10. The total share capital will then amount to £164,000, compared with £300,000. It is proposed to extinguish the existing debentures, and to issue 60,000 new ones. £46,000 will be spent on the new power plant.

Adelaide Electric Supply Co, Ltd.—The directors have declared a final dividend of 5 per cent., making 10 per cent. for the year, together with a bonus of 2 per cent. on the ordinary shares for the year ended August 31st.

Japan.—An amalgamation has been arranged between the Kyushu Electric Light and Railway Co., the Sasebo Electric Co., the Karatsu Railway Co., the Nanyama Hydro-Electric Co., the Oiso Electric Co. and the Itoshima Electric Light Co. The amalgamated concern will be known as the Kyushu Electric Light and Railway Co.

Richard Hornsby & Sons, Ltd.—The directors recommend a dividend of 6¼ per cent. on the ordinary shares for the year ended September 30th. £15,000 is placed to reserve, and £4,570 is carried forward.

Melbourne Electric Supply Co., Ltd.—The directors announce a final dividend of 6 per cent., making 10 per cent. for the year, on the ordinary stock for the year ended August 31st.

Provincial Cinematograph Theatres, Ltd.—The directors have declared a second interim dividend of 7½ per cent. on the ordinary shares for the period ending October 31st.

Ruston, Proctor & Co., Ltd.—The directors announce an interim dividend at the rate of 5 per cent. on the ordinary shares for the half-year ended September 30th.

British Electric Traction Co., Ltd.—The directors have declared a dividend on the 6 per cent. cumulative preference stock for the half-year ended September 30th.

Provincial Tramways Co., Ltd.

The directors' report for the financial year ended September 30th, 1913, shows that the net revenue received from the local companies was £41,683, against £36,062 last year. The amount of net revenue from local companies was £41,683, plus £3,187 brought forward, transfer fees £35, interest £289, income-tax deducted from dividend warrants £1,405, making £46,600. From this there are deducted: Administration expenses, £1,511; income-tax, £1,467; Western Trust, Ltd. (trustee fee), £52; interest to the debenture-holders for the year, £8,750; preference dividend for the year, £6,000; interim dividend on ordinary shares, £4,152 = £21,932, leaving £24,668. The directors have set aside to credit of reserve and depreciation account £12,000, and for third party insurance or other purposes £2,000, leaving a balance of £10,668. The directors recommend a dividend upon the £1 ordinary shares of 1s. per share, making, with 8d. per share paid in June last, 1s. 8d. per share, a dividend of 8⅓ per cent. per annum for the financial year ending September 30th, 1913. The balance dividend upon the ordinary shares will absorb £6,228, and leave £4,440 to be carried forward.

The annual meeting was held on Friday last at the offices, Moorgate Station Chambers, E.C., Mr. Andrew Beattie, D.L., J.P., presiding.

The Chairman said that the accounts showed a prosperous state of affairs, the net profit being £41,683, against £36,062 in 1912, an increase of £5,631. That was highly satisfactory, as it was the largest net profit since the formation of the company. The results of the past year's working proved the forecast expressed at the last meeting to have been well founded. They had had extremely fine weather during the year, which had helped the receipts very considerably. The price of coal remained high during the year, and the cost of oil fuel used in their Diesel engines had been practically double. They had hoped that more favourable prices would have obtained towards the close of the year, but those hopes were not realised. In addition, in common with many other companies, increases in wages were demanded by their staffs in districts where wages had been generally increased, and the directors having carefully considered all the circumstances and the merits of the demands, conceded what they considered just and equitable. Those increases were found to be satisfactory to the employés. Speaking generally, there had been increases in nearly every department of the expenditure. Every year seemed to bring fresh demands, so that the strictest economy must be exercised in all these matters which the directors could control if they were to present a satisfactory balance-sheet. He would like to make it clear that efficiency in all departments had their first thought and attention, and the various undertakings stood in a high state of efficiency. They believed that their system of working was one of the most economical in the running and timing of cars so as to prevent duplication. During the past year they had had granted them an extension of their lease at Stonehouse, which was a part of their Plymouth, Stonehouse and Devonport system. They had now a 25 years' lease there, and although they had to pay an increased price for wayleave, they believed it to be quite satisfactory. Negotiations were at present going on for an extension of leases in other places, and they hoped to be able to report satisfactory results at the next meeting. The permanent way and rolling stock had been kept in a high state of efficiency, and new machinery and an electric battery had been added to their plant at Grimsby, at a cost of £2,193, to enable them to deal efficiently with the increased business. Last year the shareholders passed a resolution giving the board power to run motor-omnibuses, cars, char-à-banc and other mechanically-propelled vehicles, either in connection with the tramways or otherwise. During the past year they had taken advantage of that resolution with good results. Not only had these vehicles increased their profits, but they had warded off competition from their tramways. They hoped to continue that new method of passenger traffic in the future. After briefly referring to the accounts,

The Chairman moved the adoption of the report.

Mr. S. Hern, in seconding the motion, said that while congratulating the shareholders upon the excellent results, they must not be disappointed if next year did not prove to be quite so good, for as the chairman had told them they had this year been favoured with exceptionally fine weather.

Col. Bause, as an old shareholder, congratulated the directors on the position of the company. With regard to the £2,000 set aside for third-party insurance, he would like to know whether the directors had had any experience of acting as their own insurers.

Mr. J. Barber Glenn, the secretary, said that that was the first time the company had set aside money for third-party insurance. He might say that it had been the practice of the company and also of the Isle of Thanet Co., with which he was connected, to insure in an office, and of course the payments were very considerable. In the Isle of Thanet Co. at one time it was a very disastrous transaction for the insurance company; the Provincial Tramways had always been a very good risk, but as they could well understand, accidents were always a very uncertain factor, and the last people that insured them at Gosport had not paid a single 6d. during the year until within a fortnight of the end of the 12 months, when a control wire got adrift and injured a young woman, who recovered £550 damages and £170 costs. The directors had made a start towards insuring their own risks by setting aside £2,000. They were insured with an office up till next September, and possibly, when they had got the fund up to £4,000 or £5,000, they might, he thought, safely do their own insurance altogether. It was, however, entirely a question of policy.

The report was then adopted.

Subsequently a resolution was passed increasing the directors' fees from £200 to £300 a year in the case of the ordinary directors, with an additional £100 to the chairman.

Barbados Electric Supply Corporation, Ltd.

The directors report that the results for the year ended June 30th, 1913, show a profit on operation of £335, as compared with a loss of £467 in the previous year. Considerable progress has been made during the year, but the results have been affected by the high cost of oil fuel which prevailed during the whole period. The directors' fees for the year, and the fees of the advisory committee in Barbados for the half year to June 30th, 1913, although debited in the profit and loss account, have not been drawn. The total number of lamps and motors connected, of an equivalent of 25 c.p., was 9,430 at June 30th, 1913, which shows an increase of 4,020; and the number of consumers connected to the mains was 456, as compared with 247 at the close of the previous year. The number of consumers awaiting connection is encouraging. The growth of revenue has been steady, but the slow progress made was due to the small number of units consumed per lamp connected and to the low load factor. Negotiations are at present proceeding for the supply of power to the Tramway Co., which intends shortly to convert its line into electric traction, and, if these negotiations can be brought to a successful conclusion, the average cost of generation per unit will be materially reduced. This contract, if obtained, will necessitate further capital being raised to meet the expenditure on the plant which would require to be installed. The company is now supplying a portion of the public lighting at Bridgetown, and an additional contract has recently been obtained. A contract has also been obtained from the Government for lighting the wharves and inner basin. Capital expenditure during the year, amounting to £2,485, represents expenditure on extensions to mains for public lighting and general service, and for house connections with consumers. The general manager reports that the plant and distribution system are in satisfactory working order. The meeting is called for Monday next, at Basildon House, E.C.

Prospectuses.—*Portarlington Electric Light and Power Co., Ltd.*—A prospectus is in circulation offering for subscription 2,600 cumulative preference shares of £1 each in this company, which has been formed to supply electric light and power in Portarlington district. The works will be constructed by Messrs. Foote & Milne, Ltd. The Mountmellich and Cloneygowan Councils have given permission for the erection of overhead lines. It is proposed to install a semi-Diesel type of engine consuming crude oil, and a battery. Applications have been received for 800 lights. Messrs. Wilkins & Burden, of Dublin, are consulting engineers to the company, and the offices are at 66, Victoria Street, London, S.W. The list is to close on December 8th.

The British Electric Heater Co., Ltd.—As will be seen from our advertisement pages to-day, this company, which has a nominal capital of £50,000, is making an issue of 30,000 6 per cent. participating preference shares, of which 7,457 have already been allotted, leaving 22,543 of £1 each for subscription. The company has been formed to acquire the patents for an apparatus for heating water by electricity, invented by Mr. Charles Kratt, electrical engineer, Glasgow, and to manufacture and sell such heaters. The purchase price payable to the vendors, the K.P.H. Syndicate, Ltd., is £3,000 in cash, £20,000 in ordinary shares, and £17,500 in participating preference shares, or in cash, at the option of the company. A royalty of 1s. 6d. per towel rail sold is also payable by the company. The apparatus was described in our pages some years ago, and in its improved form in our issue of March 14th; it is undoubtedly ingenious and practical, but whether the demand for such apparatus will justify so large an issue and so high a price, to say nothing of a royalty in addition, may be open to question.

Continental.—Germany.—With the view of providing the necessary funds for the development of several of its subsidiary undertakings, the Elektricitäts Gesellschaft (W. Lahmeyer & Co.), of Frankfort-am-Main, is increasing its capital from £1,250,000 to £1,500,000.

Under the auspices of Messrs. Brown, Boveri & Co., of Baden, and the Rhenish Credit Bank, a new company has just been formed in Mannheim, with a capital of £150,000, and the title Die Elektrische Kraftversorgung Gesellschaft, to establish plants for the supply of electrical energy for power purposes.

Norway.—It is announced from Christiania that a company has just been formed, with a capital of £222,000, and the title "Det Norske Aktieselskap for Elektroteknisk Industrie," with the object of developing the electrical industry in the country by promoting new enterprises and assisting financially in the extension of those already in existence.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in:—

Stolz Electrophone Co. (1913), Ltd.—35,000 shares of £1 each, fully-paid, Nos. 1 to 35,000.

And to allow the following to be quoted in the Official List:—

Columbia Gas and Electric Co.—$50,000,000 capital stock in shares of $100 each.

STOCKS AND SHARES.

Tuesday Evening.

With the Money Market showing a tendency to become more accommodating to borrowers, the prices of investment stocks and shares are certainly disposed to improve; and although indications are not wanting that the festive season is near at hand, there is still a fair amount of business proceeding in Stock Exchange markets. Those especially favoured are concerned with Colonial stocks and Home Rails. The publication of various Parliamentary notices in connection with electric lighting schemes has had no effect upon prices up to the present.

One of the most interesting of these announcements is that of the County of London Electric Supply Co. A Bill is being promoted to enable the County of London Co., on behalf of itself and other electric lighting concerns, to come to an agreement with the L.C.C., with a view to extending the Council's time of purchase and generally to modify the present arrangements. This is the most significant step which has yet been taken in connection with the proposition to unite into one homogeneous body the various interests at present concerned in the supply of electric current to the Metropolis.

In the Stock Exchange, the proposal (tucked away, as it was, in the advertisement columns of the *Times*) attracted comparatively little attention. A few scattered references to it have been made in the daily Press, but the effect upon the share market has been just nil. In this there is cause for satisfaction, for, manifestly, the matter is not yet far enough advanced to justify any speculative purchases of electric lighting shares upon the basis of a Bill which is to be promoted, and which will not come before Parliament until next session. The importance of the step resides in its practical character; and, after these many years of strenuous work, the supporters of the scheme may be congratulated upon having brought it well within the range of practical politics.

The price changes on the week are unimportant. City "Lights" were put up ¼, to lose the fraction later, but the Preference rose ½, and held the improvement. London Electric Preference, Metropolitan Preference and South London Ordinary are better, although the rise in the last-named simply replaced the loss of last week. There is rather more inquiry for some of the Debenture stocks, and the disposition of the market, as a whole, is firm. Manifestly, proprietors are not likely to sell their shares with the prospect of agreement between the different undertakers in sight at last.

Home Railway stocks show pronounced strength. After being plunged into the depths of depression, there came substantial revival, the steam stocks advancing gaily. In the Underground group, the attention drawn here last week to London Electric Railways 4 per cent. Preference stock, considered as a speculative investment, led to a slight hardening of the price. Metropolitans and Districts are both features of strength; the price of the former went back to 39¾, but has since shot up to 43½. Districts put on 1¼. The London and Suburban issues remain depressed. London United Tramways Debenture is a point higher. The British Electric Traction group inclines to the duller side. Metropolitans owe their rise partly to "bear" covering, partly to the announcement that the Great Northern Railway proposes to establish a direct connection with the Great Northern and City Railway, which, of course, the Metropolitan now owns.

Telegraph stocks, taking the market all round, are dull and inactive. Investors are not showing much interest in the stocks at present, although the returns from Eastern Telegraph stock, Eastern Extension shares, Western Telegraphs and Globe Ordinary range from 5¼ to 5½ per cent. on the money. In all of these there is a tolerably free market. But no doubt there remains still in the public mind some slight fear less the wireless competition should damage the earnings of the older companies. Marconis went back sharply, the price getting down to $3\frac{5}{16}$, but they improved again to $3\frac{9}{16}$ as the approach of the Stock Exchange settlement drove bears to buy back. The announcement that a telephone message was sent from a German port across the Atlantic, and that the words were heard distinctly, was noticed with a good deal of interest in the Stock Exchange, while its denial caused no particular surprise. Stock Exchange arbitrage business, by the way, between London and Paris, does not appear to have been greatly stimulated by the reduction in the cost of telephoning between the two centres, which is now, of course, 4s. for three minutes, instead of 8s.

Mackay Common and Preferred are flat, and American Telephone issues have receded. On the other hand, rises occurred in Anglo-American Telegraph Deferred and Direct United States Cable shares, while West India and Panama gained a small fraction.

News from Mexico is still of a very mixed character, and the Stock Exchange hardly knows what to make of the position out there. Some of the smart recoveries which occurred in the utility companies' issues have been partially lost; for example, Mexico Tramways Common went back 1½, although the 6 per cent. bonds are a point up. Mexican Light and Power Common fell 2, while the Preferred gained a similar amount. The recovery in Monterey bonds has been held; yet, on the other hand, Pachuca Fives fell 3 points to 72½. Canadian General Common and Shawinigan Water Capital stock have both hardened. The principal feature in this group, however, is a jump of 5½ points in Electric Supply of Victoria Debentures, which took the price to 94½. This was due to demand for sinking-fund purchases, and the dealers report that it failed to bring out much stock. The Anglo-Argentine division is steady, except for a decline of $\frac{1}{16}$ in the First Preference shares. City of Buenos Ayres Trams rose ⅛ to $5\frac{5}{16}$.

Willans & Robinson Preferred stock, after its rise of 4 points last week, has risen another 7, the stock now standing at 21½, while the Debenture is a point to the good. There has been further buying of British Westinghouse Preference, and with few shares about, it did not take much to raise the quotation ⅛. Castner-Kellner's eased $\frac{1}{16}$ after the announcement of the dividend and share bonus; and British Aluminium Ordinary shaded off to $1\frac{5}{32}$.

The Rubber market shows hesitancy after being good. Apparently there is a good deal of the "pull devil, pull baker" business going on in connection with the raw rubber market, some maintaining that the price ought to be taken up to 3s. 6d. per lb. as quickly as possible, while others think that its retention at something between a florin and half-a-crown, for the time being, would be more desirable in the interests of the industry as a whole. Meanwhile, share prices are as a rule better, with people putting a fair amount of money into the market. Large blocks will be lifted at this week's Stock Exchange account. But the produce is lower at 2s. 3½d. per lb., and this disappoints the optimists.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	3d.	..
a ,, Sulphuric	per cwt.	5/6	.
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£24	..
a Lead, Nitrate	,,	£30	..
a ,, White Sugar	,,	£28	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	92/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£96	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£121 6 8	..
b ,, Sheet, in ton lots	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅜d.	⅛d. dec.
c ,, Tube (brazed)	,,	9⅜d.	⅛d. dec.
c ,, ,, (solid drawn)	,,	8⅜d.	⅛d. dec.
c ,, Wire, basis	,,	7⅜d.	⅛d. dec.
c Copper Tubes (brazed)	,,	10⅜d.	⅛d. dec.
c ,, ,, (solid drawn)	,,	10⅜d.	⅛d. dec.
g ,, Bars (best selected)	per ton	£83	£3 dec.
g ,, Sheet	,,	£83	£3 dec.
g ,, Rod	,,	£83	£3 dec.
d ,, (Electrolytic) Bars	,,	£69 10	£4 10 dec.
d ,, ,, Sheets	,,	£87 10	£4 10 dec.
d ,, ,, Rods	,,	£75	£4 10 dec.
d ,, ,, H.C. Wire	per lb.	9⅛d.	⅛d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/6	..
h India-rubber, Para fine	,,	3/1	3d. dec.
j Iron Pig (Cleveland warrants)	per ton	49/3	4d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 15 to £19	£1 10 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	5/- inc.
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	8/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£182 to £183	£1 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Deanis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 25th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5	5†	9½ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8⅝ — 8⅞	— ⅛	5 12 8
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅞	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	93 — 96	..	4 3 4
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	+ ½	4 6 6
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16 — 17	..	5 6 0
Do. 6 % Cum. Pref.	10	6	6	13 — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	5	5†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	5	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Edmundson's, Ord.	£3	..	..	5/16 — 11/16	— 1/16	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	— ⅛	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	5 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	7⅞ — 8⅛	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7½ — 8	..	5 [illegible]
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 [illegible]
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 14 7
Do. 6 % Pref.	5	6	6	4⅞ — 5½	+ ⅛	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	+ ⅛	4 [illegible]
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 — 102	..	4 [illegible]
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅜	..	5 11 7
Oxford	5	7	6†	6 — 6⅛	..	5 7 [illegible]
St. James' and Pall Mall, Ord. ..	5	10	10†	8⅝ — 9⅛	..	5 [illegible]
Do. 7 % Pref	5	7	7	6⅞ — 7	..	5 0 [illegible]
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅛ — 3⅛	+ ⅛	7 [illegible]
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 [illegible]
South Metropolitan, 7 % Pref. ..	1	7	7	1 7/32 — 1 9/32	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅝ — ¾	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4¾ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7†	107 —112	+1	6 7 3
Do. 7 % Pref.	$100	7	7	118 —123	+1	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	5/8 — 13/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	+ ½	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	+5½	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	+1	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El. Lt, 5 % 1st M. Bds.		5	5	68 — 73	+2	7 0 10
Mexican Lt. & Power, Common	$100	4	4	48 — 52	—2	7 8 2
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	+2	8 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	68 — 73	..	6 17 0
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	212 — 218	..	4 11 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	99 —104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	132 —137	+1	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	..	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	97½ — 99½	— ⅛	4 9 6
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	37/32 — 39/32	— 1/32	6 12 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅛	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	122 —124	—1	6 9 0
Do. Collat. Trust	$1000	4	4	88 — 91	—1	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½—105½	..	5 13 9
Do. Def.	Do.	30/-	..	23⅞ — 24⅛	+ ⅜	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	5	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8¼ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 16½	..	6 11 2
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6⅜ — 6⅞	+ ⅛	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 —129	..	5 8 6
Do. 8½ % Pref. Stock	Do.	8½	8½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12⅛ — 12⅜	— ⅛	5 11 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅜ — 12⅝	— ¼	4 19 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	..	6 2 8
Indo European Telegraph ..	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	78 — 82	—8½	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	—2½	5 17 8
Marconi's Wireless Telegraph ..	1	20	..	3⅛ — 3⅜	+ ⅛	5 10 2
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅝ — 2⅞	+ 1/16	5 16 3
Monte Video Telephone, Ord. ..	1	6	6	¾ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/16	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	96½ — 97½	..	4 12 1
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9½	..	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6½ — 6¾	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2½ — 2⅝	+ 1/16	5 0 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12½ — 13½	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Nov. 25th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	— ½	..
Do. Do. Deferred	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	48 — 51	..	5 17 8
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	+2	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 8
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	95 — 97	..	5 3 1
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	1/8 — 3/8	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 3/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	3/16 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/2 — 5/8	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	+1	6 11 2
Metropolitan Railway Consol.	100	1⅝	1⅝†	43 — 43½	+2⅜	3 14 9
Do. Surplus Lands	100	2⅜	2⅜†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	29¾ — 30¼	+1½	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 83	..	5 8 5
South Metro. Trams, 6 % Pref.	1	6	6†	5/8 — 3/4	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	8⅝ — 8⅞	..	Nil
Do. "A"	1/-	..	..	7/16 — 1/2	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 — 113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding). Ord.	5	Nil	..	1/2 — 1/2	..	Nil
Do. 6 % Pref.	5	3	1½†	3½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo Arg. Trams, 1st Pref.	5	5½	5½	4 9/16 — 4 13/16	..	5 14 8
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89½ — 91½	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Do 5 % Deb.	100	5	5	98½ — 100⅜	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 — 103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	5	5	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86 — 88	— ½	6 16 4
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	114 — 119	..	6 14 6
Do. Pref. Ord.	100	6	6	101 — 106	—1	5 13 2
Do. 5 % Pref.	100	5	5	100 — 103	+ ½	4 17 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 — 100	..	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	100 — 104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5 1/2 — 6 3/8	..	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5 3/16 — 5 7/16	..	4 12 0
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4⅜d.	6	5/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1½ xd	..	4 16 1
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	76 — 79	—1½	8 17 2
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 85	..	5 17 8
Do. 6 % Bonds	100	6	6	82 — 85	+1	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5¾ — 6¼	..	8 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96 xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ — 100½	+ ⅜	4 19 6
Do. 5 % Mort. Bonds	100	5	5	88 — 90	..	5 11 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5⅛	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	—2½	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	13/16 — 15/16	..	7 13 4
Babcock & Wilcox	1	16	..	2⅞ — 3	..	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/32 — 1 7/32	— 1/32	..
Do. 6 % Cum. Pref.	1	6	6	1/16 — 1/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	— ½	5 15 0
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5¾ — 6½	— ¼	4 16 0
Do. Deb.	100	4½	4½	100 — 103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1 5/16	+ ⅛	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 6¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	3 13/16 — 3 15/16	— 1/16	5 14 8
Do. Deb.	100	4½	4½	102 — 105	..	4 5 9
Crompton & Co., Deb.	100	5	5	64 — 69	..	7 5 0
Dick, Kerr	1	Nil	..	5/16 — 7/16	..	..
Do. Pref.	1	6	6	13/32 — 15/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/8 — 1/8	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	68 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 3/16 — 1 5/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 3
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 1/2 — 5 1/8	..	4 8 11
Do. Deb.	100	4½	4½	101 — 103	..	4 7 5
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7 3
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	56 — 61	..	6 11 3
Do. B 4 % Cum. Pref.	100	..	..	19 — 24	+7	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 818)

The Scott.—Prominent among the new combined car electric lighting dynamos and engine starters is the "Scott," made by Scott's Starter Syndicate, Ltd., Norwich, to the designs of Mr. W. H. Scott, M.I.E.E, the technical managing director of Messrs. Laurence, Scott & Co., Ltd. In the first place, it may be mentioned that, in its new form, the machine considerably differs from the one described and illustrated in these columns about a year ago, in which, it may be remembered, a series-parallel system of electrical connections, with a differential winding for keeping the charging current constant with varying engine speeds was employed. It was found that certain disadvantages were entailed, *e.g.*, both complication of the wiring, and the difficulty of getting equal charging of cells when in parallel. It was, therefore, decided to construct the machine on the single-voltage system. With this system, it is explained that the

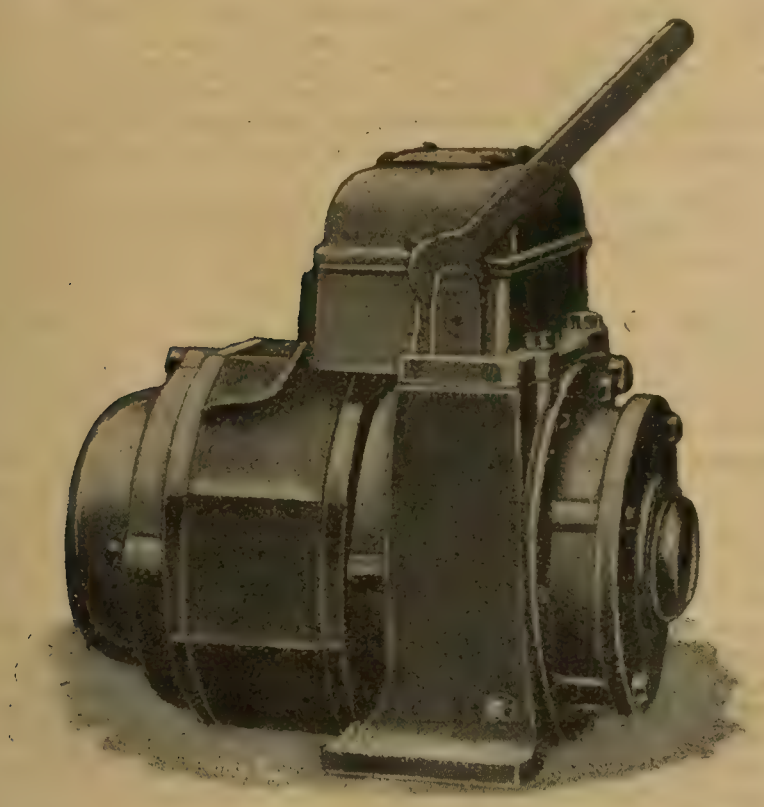


Fig. 8.—Scott Combined Lighting Dynamo and Engine Starter.

differential-winding method of regulation is not possible, unless a separate additional series-winding be employed for the charging. It is further contended that any differential winding system of regulation has the disadvantage that as the voltage of the battery increases the charging current increases, which is the opposite to what is desirable from the point of view of life of the cells. An automatic regulator in the shunt winding was, therefore, tried, and, after considerable experimenting, has, it is claimed, proved a success. The armature is of the standard slotted drum pattern; the field magnet windings are suitably proportioned so that the machine can act as an ordinary shunt dynamo when driven by the engine, and also as a powerful series-wound motor to drive the engine through an epicyclic gear which gives a speed reduction of 14 to 1, the latter, however, being capable of modification to suit the particular engine to which it is to be adapted.

As a motor the machine takes current at 24 volts, *i.e.*, using a battery of 12 cells, and as a dynamo the voltage is the same, but as the lighting circuit is arranged on the three-wire system, 12-volt lamps are used. An important advantage of the special field magnet proportions and armature windings is that the current at the instant of closing the circuit is comparatively low.

Perhaps the most interesting part of the starter is in connection with the gearing. Referring to the drawing, fig. 9, which is to be regarded as purely diagrammatic, in the planetary gearing shown, the armature shaft gears into the three planet wheels, which revolve on pins fixed to the disc-wheel; these three pinions gear into what is termed the engine wheel, which carries the sprocket wheel for connecting to the engine shaft. The disc-wheel, if free, will revolve in the opposite direction to the armature shaft, and no power will be transmitted to the engine wheel, but if the band brake is applied, the engine wheel will be driven in the same direction as the armature shaft; the leverage being, as before noted, usually of the ratio of 14 to 1. The band brake, however, can only prevent the rotation of the disc wheel in the one direction, because of the free wheel clutch shown; this being an essential feature of the starter. The starter can be operated or controlled in several ways, according to its position on the car; the usual way being by means of a pull handle in front of the driver, which first switches on the current to the starter, causing the armature to start freely. A further motion of this pull handle tightens the band brake on to the disc wheel of the planetary gearing, and the armature then drives the crankshaft through this gearing and the chain drive that is usually employed. The band brake, however, only holds in one direction, and as soon as the engine fires, the planetary gearing revolves as a whole, there being a free-wheel on the armature spindle which is free when the armature drives, but which locks the gearing when it is being driven. When the engine starts, the pull handle, which has a spring return, is let go, a spring catch being thereby pulled into the charging position, so that the driver is relieved of the task of remembering to put on the charging switch after starting.

The generation of current for charging the cells is done through the locked free-wheel already mentioned, the output as a dynamo

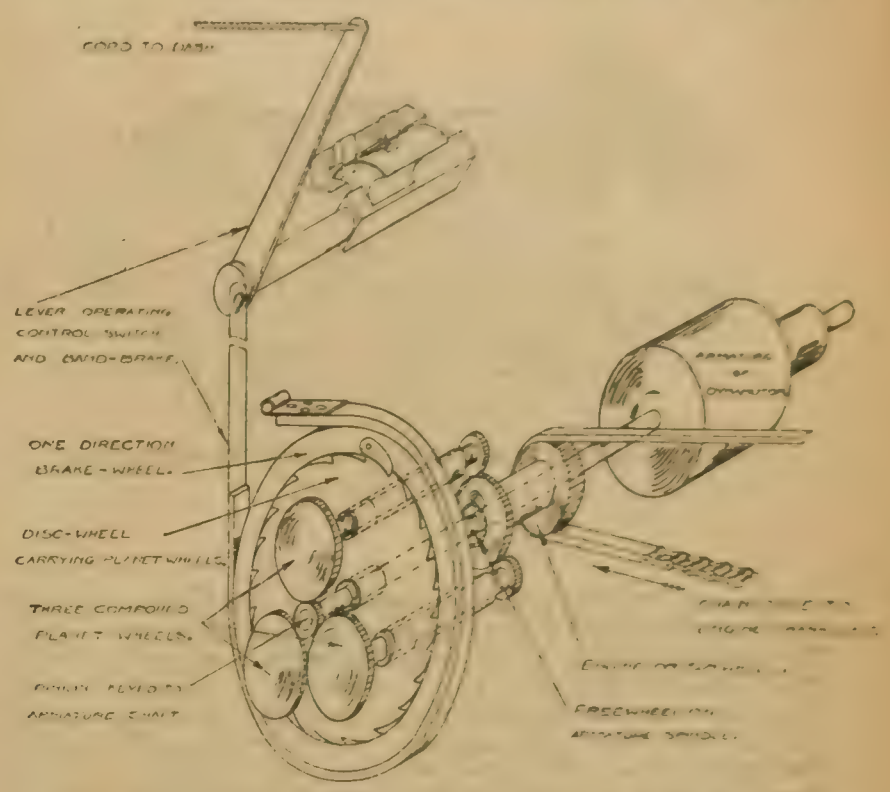


Fig. 9.—Scott Engine Starting Arrangement.

being controlled by an automatic resistance embodied in the switchboard. This device is actuated by a solenoid form of magnet and regulates the shunt current in the dynamo. Charging begins at 12 to 15 miles an hour, this depending on the gear ratio fitted. Provision is also made for disconnecting the dynamo from the battery when the latter is fully charged, and in the event of the circuit being left closed, when the engine is stopped, the armature is merely slowly revolved by the battery current. This, it is claimed, involves but little loss and is quickly noted by the slight click of the free-wheel. The machine is being made in three sizes, suitable for engines of low, medium and high power. The brushes are easily accessible by removing the end cover, and the epicyclic gear is enclosed in an oil-tight casing at the opposite end.

The U.S.L.—One of the most interesting combination car lighting dynamos and engine starters is that known as the U.S.L, made by the United States Light and Heating Co., of New York, which has been adopted on the Sheffield Simplex (British) cars. Differing from any of the machines so far described, the U.S.L. device is



Fig. 10.—U.S.L. Lighting Dynamo and Engine Starter.

built up as an integral part of the engine of the car, the usual fly-wheel being replaced by an armature having the same weight

and inertia characteristics. Fig. 11 shows the motor-generator dismantled; on the left is the casing bolted to the engine crank case and carrying the field magnets. Next is the revolving armature, to which the clutch casing is bolted, and next to that a stationary ring carrying the brushes within which the commutator on the armature runs. On the right is a domed cover which envelops the whole. The machine has a compound field, series and shunt coils working cumulatively as a motor, and differentially as a generator. The combined ampere-turns of the shunt and series coils are sufficient to saturate the magnetic circuits, so that a high starting torque is claimed to be obtained. The only



Fig. 11.—Component Parts of U.S.L. Starting and Lighting Device.

moving part is the armature, while the brush gear is of an ingenious form, and claimed to have a life equal to 32,000 miles. The starting current varies from 125 to 250 amperes at 24 volts. The torque is exerted at a distance of from 6 to 7 in., depending on the size of the engine, the turning moment being exerted at all points on the periphery of the fly-wheel, so that no extra pressure is thrown on the engine bearings. When running as a motor, the machine is capable of driving the engine at a speed of from 150 to 400 R.P.M., the makers furnishing instances of its use for starting a four-cylinder engine, 4 in. bore × 4½ in. stroke, at 350 R.P.M. on 50 amperes, and a terminal pressure of 22 volts, or approximately 3·15 watts per revolution, and another case of a 4½ in. × 5 in. four-cylinder engine, taking, at 280 revolutions, 70 amperes at 21 volts, equal to 5·25 watts per revolution. The starting switch is of a revolving drum type, with five spring-controlled contacts, somewhat similar to those used in tramcar controllers. The switch is only used for starting the engine, and is controlled by the driver's foot, its normal position making generator connections. The contacts break in oil, and when the engine starts to fire, the current is very low so that no sparking occurs. For engine starting a 100 ampere-hour 12-cell battery delivers current at 24 volts, while, when the pedal is released a spring automatically returns the switch to the generating position, and at the same time links up the cells into two parallel groups of six. An automatic cut-out is provided, by means of which, when the battery is fully charged, the field is cut out, and therefore no damage can occur to the winding of the dynamo through an overcharge of the accumulators. The insulation of the winding is also made heavy, so that the accumulators cannot give out sufficient current to burn or short-circuit the field winding of the dynamo. It is claimed for the system that, acting directly as the engine fly-wheel, the efficiency is higher than where gears, chains, or other power transmission devices are employed.

The White.—On the White petrol cars, which are built at Cleveland, U.S.A., a combination lighting dynamo and engine starter is employed, this working in conjunction with a nine-cell battery. Notwithstanding that the two functions are combined in the one machine, the armature remains the only moving part; it is of a relatively low-speed type, enabling it to be permanently connected to the engine at a low gear ratio, it being claimed to have an advantage in this respect over those in which gears have to be brought into and out of mesh. The machine is driven by and starts the engine through a chain drive, the full 18 volts being employed for starting, while only 12 volts are used on the lighting circuit.

(*To be continued.*)

Eye-preserving Glass.—As the result of a prolonged research, Sir William Crookes has succeeded in devising glasses of special composition which effectually preserve the eye from the injurious effects of intensely-heated molten glass, &c., cutting off practically all the ultra-violet rays and more than 90 per cent. of the heat rays. Unfortunately, these qualities cannot be combined in one specimen of glass in the highest degree; but a glass can be made which possesses both to a great extent.

Finsbury Technical College O.S.A.—Finsbury old students are asked to note that Mr. F. R. C. Rouse's new address is 15, Clifton Gardens, Golder's Green, London, N.W. He will be glad to receive particulars of the doings of any old students, especially in the electrical department.

STEAM BOILER WORKING IN ELECTRICAL POWER STATIONS.

The paper on this subject, read by Mr. J. W. Jackson before the Institution of Electrical Engineers (for abstract see Electrical Review, page 779), was discussed at Newcastle on November 10th.

In opening the discussion, Mr. C. Turnbull (Tynemouth Corporation) said that mechanical stokers were not used at sea, because they were only adapted for using small coal, and the cost of installing crushing apparatus would probably outweigh the saving due to the use of mechanical stokers.

Mr. H. H. Baker said that no doubt the superheater position shown in fig. 1 was very nice from a maintenance point of view, but he did not see how high superheats were going to be attained with the superheaters so far removed from the furnace. Another point was that, as the width of a boiler was generally restricted, for greater outputs one had to increase the height of the tubes, and this again meant that the gases would be unable to give the necessary superheat with the superheater in the position shown in fig. 1. He doubted very much whether there was much difference in the cost of maintaining superheaters in either position.

Mr. Innis said that he had had personal experience of superheaters placed low down amongst the tubes, over a period of 3½ years, and so far he had seen no signs of buckling or warping. He admitted that the tubes sooted up, but he did not think that, in this respect, they were appreciably worse than those shown in fig. 1.

Mr. W. M. Selvey said that it was a well-known fact that when a boiler was started up clean the superheat gradually rose as the lower tubes of the boiler got dirty, and when the superheater tubes began to get dirty the degree of superheat commenced to fall. He thought that the figure of 75 per cent. of the total evaporation of a boiler taking place in the front two or three rows of tubes was too high, and, personally, he would not put this above, say, 65 per cent. With regard to the "Bonecourt" and "Nicholson" boilers, his first impression had been that the claim that low final temperatures could be produced without corrosion could not be maintained, especially as gas engine people had, for years, been keen on recovering heat from the exhaust gases, which could not be reduced below a certain temperature without causing corrosion troubles. He had, however, gone very carefully into the matter, and had found that in a boiler using coke oven gas, 78 per cent. of the heating value of which was due to hydrogen, and where 100 per cent. excess air was used, the dew point of the mixture was nearly 100° F., or, in other words, until the gas was cooled to 100° F. no moisture could be deposited. For furnace lining silica bricks were very much superior to bricks containing any traces of iron. He did not think that there was any difficulty whatever in fitting "Lancashire" boilers with mechanical stokers.

Mr. W. Baxter said that while the water-tube boiler was undoubtedly much more "lively" than the Lancashire boiler, the latter had many points of superiority, and he could not understand why greater advantage had not been taken of a combination of these boilers, the Lancashire boilers for the steady part of the load, and water-tube boilers to take the peak load. Mr. Jackson had mentioned the possibility of using superheaters up to 900° F., and he would be glad to have Mr. Jackson's views on the type of turbine blading which would be suitable for these high temperatures. He thought that a good many of the earlier troubles were due to want of consideration or want of knowledge of the theory of combustion, and in view of later knowledge it was difficult to see how anyone could ever expect a Lancashire boiler fitted with Galloway tubes to be smokeless. With regard to air leakages, very few people appreciated what a large amount of air could leak through a brick wall, even if it was free from cracks and well jointed. It had been stated that there was no condensation of sulphuric acid in the "Bonecourt" boiler, but he thought that there must be some because the Skinningrove Iron Co. had lined the chamber at the back of their "Bonecourt" boiler with lead, in order to obviate corrosion. With regard to electrical schemes for the prevention of corrosion in boilers, one at least of these had passed the experimental stage, and he thought that it was largely a question of time before such electrical methods would come into general use.

Mr. Clemitson said that he would be glad to know what was the minimum quantity of steam which could be passed through a superheater without damage to the tubes. He had not observed any great drop of pressure in well-designed superheaters, the area of the tubes in which would be at least two to three times the area of the stop valve; nor had he observed such a great difference as 12 in. between the level of the water in the front and back drums, and he thought that 6 in. would be nearer the mark, even when working at an evaporation of 7 to 8 lb. per sq. ft. Rather than adopt the plan of altering the level of the different drums, as suggested by Mr. Jackson, he thought that it would be much better to lower the water gauge on the middle drum by, say, 6 in. or 7 in., and one would then always be certain that the front drum contained plenty of water. Under the system proposed by Mr. Jackson, in the event of the boiler stop-valve being closed there would be very little water left in the front drum, with the consequent danger of damage to the tubes.

Mr. P. G. Watson (Newcastle Electric Supply Co.) said that it would be a mistake to pay stokers according to the amount of CO_2 produced, depending upon the men handling the ashes to raise questions regarding unburnt fuel, because these men were drawn from the same class, and it would be an easy matter for them to arrange to share the bonus.

Mr. Chas. Vernier, (N.E.S. Co.) Chairman, said that the "Bonecourt" boiler was a very attractive proposition, especially on account of the economy of space, when one considered the relative space occupied by the boilers and turbines in a modern installation. There were three ways of gasifying coal:—(1) Gasifying the coal in producers, and recovering sulphate of ammonia and tar. According to a recent article in the Electrical Review, out of a ton at 13s. 6d., 98 lb. of sulphate of ammonia, value 9s. 9d., could be recovered, and also 2½ cwt. of tar at 10s. per ton, the product thus recovered being worth 11s. out of a total cost of 13s. 6d., and, of course, the gas was produced in addition. (2) The coal could be coked in the usual way. The third system was to combine the first two, first carbonising the coal at low temperatures, and recovering the more volatile products. Out of a ton of coal one could get 20 gallons of good tar worth 30s. a ton, 20 lb. of sulphate of ammonia worth 2s., and 13 cwt. of coke. If the coke was burnt in a gas producer a further 45 lb. of sulphate of ammonia was produced, making altogether 65 lb., and under this system 12s. 6d. worth of by-products was recovered out of 13s. worth of coal, and a total of 20,500,000 B.TH.U. was available.

Mr. J. W. Jackson (in reply) said that he did not know of any experiment with mechanical stokers on ships, but he did not think that there would be any difficulty in procuring the necessary small coal. The old type of superheater was undoubtedly more costly than the new type, but had a much longer life, and lower maintenance costs. In the earlier type of superheater the temperature of the gases would be somewhere between 1,200° F. and 2,000° F., and this should be ample, even for superheats as high as 900°. The figure of 75 per cent. was a comparative one only, and he would not like to be tied to it. He agreed that pure silica bricks were very satisfactory, except that they had low mechanical strength, and were frequently crushed due to pressure on the arches. With regard to the type of blading most suitable for highly superheated steam, he thought that the impulse type was undoubtedly the best. In his opinion Galloway tubes had nothing to do with the production of smoke in a boiler, as combustion should be completed before the gases had time to reach the tubes. The minimum quantity of steam it would be safe to pass through a superheater would depend upon its exact position in the furnace. He still maintained that it was advisable to vary the level of the drum in a water-tube boiler.

It was quite a good scheme to put sheet steel round boiler settings, but care had to be taken that, in the event of the brickwork cracking, part of the gases did not find their way between the brickwork and the sheeting, thus short-circuiting the boiler. With regard to Mr. Watson's objection to the scheme of paying firemen according to the CO_2 produced, he did not think that even extra money would induce the men handling the ashes to work in a tunnel in which there was a large quantity of burning fuel. With regard to the gasification of coal, up to now one had had to be content with promises and figures, and he thought that, in any such scheme, the capital cost would be unduly high.

PAYMENT BY INSTALMENTS.

[FROM OUR LEGAL CONTRIBUTOR.]

It constantly happens that in the carrying out of engineering works it becomes necessary to provide for payments on account as the work proceeds. Most contractors would be unwilling, and many would be unable, to find all the capital in the first instance; and a custom has accordingly sprung up, according to which, when a certain part of the work is done, the contractor is entitled to a certain percentage of the contract price.

While the chief duty of the engineer in relation to a contract for the erection of machinery is to supervise the work of the contractor, it is by no means an unimportant part of his duty to decide, subject to the terms of the contract, how the contractor shall be paid, and whether he is keeping up to time, having regard to all the unforeseen difficulties which may arise. Thus, at the very outset of the work, it may become impossible, owing to the flooding of foundations or other unexpected difficulty, for the contractor to proceed. In these circumstances, what about the payment of instalments?

It may be premised that where the method of payment is fixed, nothing becomes due until the contractor has done everything to entitle him to receive payment. Each certificate for an instalment creates a debt due, and the contractor is entitled to immediate payment thereof, subject to the terms of the contract, and to any right of the employer to any set-off or counterclaim. As a rule the engineer authorises the contractor to be paid and otherwise expresses his approval of work done by means of a certificate. To save trouble and to avoid disputes the contract should provide for a written certificate. Otherwise a mere verbal statement may be sufficient. For instance, in Elmes *v.* Burgh Market Co. decided in 1891, a contract provided that "the contractor shall receive payment for his work at the rate of £80 per cent., for the works completed on the surveyor's certificate of completion, and the balance at the end of the term of maintenance, less deductions that may be made in accordance with the terms of the contract, and on the surveyor certifying that the whole of the works are in a complete and satisfactory state." It was held that a certificate within the meaning of this clause might be given orally by the surveyor. Where a written certificate is expressly required, the contractor is helpless unless it be forthcoming. He cannot sue the employer for the price of the work he has done, unless, indeed, he can show that the certificate has been withheld by the engineer acting in collusion with the employer.

The mere fact that the engineer by granting a progress certificate during the course of the work appears to express approval of that which is already done, will not enable the contractor to sue for payment. The "progress certificate" is sometimes termed a "certificate on account." In the form of model conditions sanctioned by the Institution of Electrical Engineers it is specially provided that no such certificate is to prejudice the rights of the purchasers against the contractor or relieve the contractor of his obligations for the due performance of the contract. It is usual to make provision for progress certificates by saying that the contractor shall be entitled upon the certificates of the engineer to payments by the employer in accordance with provisions to the following effect:—(1) As the works progress 80 per cent. upon the contract value of the work from time to time delivered or executed on the site to the satisfaction of the engineer; (2) the remaining 20 per cent. (usually termed the retention money) in respect of each distinct section or part of the works as follows:—(*a*) 10 per cent. at the expiration of one month after the employer takes over the works, and (*b*) 10 per cent. at the expiration of nine months after the first 10 per cent. becomes due under (*a*). Payments made under the former provision are made on "progress certificates." To avoid any chance of misunderstanding, it is as well to insert a clause providing that the certificates given during the work shall not in any way prejudice the employer in the final settlement of accounts in case it should appear that the contractor has been paid too much.

Where, after the payment of money to the contractor on account, he fails to complete, owing to his own default, or abandons the contract without good cause, the employer may be entitled to recover the instalments paid on the ground that the consideration has wholly failed; but at all events the employer would have a ground of action for a breach of the contract to complete in which the damages recovered might be equal or exceed the amount paid on account.

Lead.—Messrs. James Forster & Co. report as follows, under date November 22nd:—"Closing prices last week were £18 12s. 6d. November, £18 7s. 6d. December, £18 March, with buyers for prompt at £19, and February £18 2s. 6d. After the severe fall in values at the end of last week, we had a moderate recovery at the beginning of this week, the best prices being reached on Wednesday, when £19 3s. 9d. was paid for November, £18 15s. December, £18 6s. 3d. February, with buyers at £18 10s. January. The market has since reacted, the closing prices being £18 17s. 6d. November, £18 10s. December, £18 2s. 6d January, £18 February, and £17 18s. 9d. March. Arrivals for the first half of the month amount to the large total of about 8,000 tons, which has given a welcome relief to the long-prevailing scarcity. Lead, however, continues scarce, little prompt stuff is offering, and the intrinsic position does not justify any considerable reaction in prices, but sentiment is pessimistic in all metals; there is no speculative activity on the "bull" side, and with leading interests selling, the tendency is slack. Export demand is active, but home consumers are not in evidence as buyers. With Mexican affairs still at a deadlock, there is little prospect of a plentiful supply, but, on the other hand, trade in lead, as in other metals, is falling off, and existing supplies seem to be sufficient in the meantime. English lead, £19 5s. to £19 10s."

PRESSURE RISES.

By W. DUDDELL, F.R.S.

(*Abstract of Inaugural Address delivered by the President of the* Institution of Electrical Engineers, *Nov. 13th*, 1913.)

The principal causes of pressure rises may be broadly divided into three classes:—(1) Resonance, (2) Switching, (3) Arcs and sparks.

Resonance.—An electric circuit which contains self-induction and capacity has, as is well known, a free period of its own, and electric oscillations may be produced in it provided that the resistance does not exceed a certain limit. If an alternator is connected to such a circuit, and if the period of the circuit is the same as the periodic time of the alternating E.M.F., then very violent oscillations may be set up in the circuit.

A limit to the strength of the oscillation is set by the apparent resistance of the circuit—by apparent resistance in this connection I mean a quantity which, when multiplied by the square of the current, gives the total losses in the circuit, including iron losses, eddy-current losses, etc., under the given conditions. For instance, if the apparent resistance R is comparatively small, then the voltage on the condenser or self-induction may rise to approximately ω L/R or 1/ ω C R times the E.M.F. of the alternator, where L is the self-induction, C the capacity and $\omega = 2\pi f$, f being the frequency.

The most general case that occurs in parctice is a long unloaded cable which is connected to an alternator. In this case the self-induction in the circuit is mainly the self-induction of the alternator itself, and the capacity is the capacity of the cable. Resonance may be expected to take place if the period $1/f$ of the alternator is the same as the free period of the circuit. This case does not occur frequently under normal working conditions.

It is easy to show that in order to obtain resonance at any frequency the capacity current taken by the cable under normal voltage must be equal to the short-circuit current of the generator at normal excitation and at the frequency considered. No station could very well be run in this condition, as it means that the capacity current of the cables considerably exceeds the normal output of the generator. Although I have observed many cases of resonance of a 3rd, 5th, 7th, and higher harmonics, I have seldom seen cases of resonance of the fundamental.

If the wave form of the alternator is not a pure sine wave, a resonance of one of the upper harmonics is quite possible, since it is evident that as the frequency increases the capacity current taken by the cable increases and the short-circuit current for that frequency decreases, so that they rapidly approach one another. Resonance of the 5th and higher harmonics may be expected in practice.

With modern alternators resonance seems to have practically disappeared in this country. In the early days I had some bad cases to investigate when resonance of one or other of the harmonics took place, which either caused failures or difficulties in regulating the voltage. With the modern machines the 3rd, 5th, and 7th harmonics are generally so small that there is no trouble from their resonating. Resonance of the higher harmonics is more likely to take place, but owing to the very much greater losses due to eddy currents, hysteresis, etc., the resonance of these higher harmonics does not in general attain a serious magnitude, especially if there is any load on the machine.

In the ordinary three-phase systems the wave forms between the phases are practically free from the 3rd harmonic, but this is not necessarily true of the wave form between each of the terminals and the neutral point. Care must therefore be taken that the resonance of this harmonic does not occur.

Fig. 1.

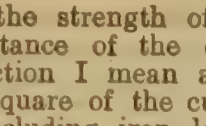


Fig. 3.

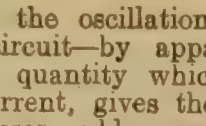


Fig. 2.

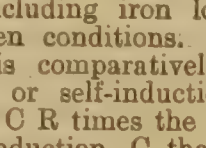
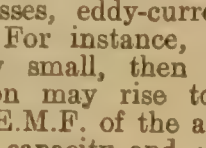


Fig. 4.



From this cause there might be quite a considerable potential difference between each of the cores of the cable and earth, whereas a record of the wave forms taken between the cores might show nothing abnormal.

As a few examples of resonance of the higher harmonics observed in generating stations when the alternators were connected to feeders on open circuit, the following may be of interest.

Fig. 1 is the open-circuit wave of an old type of 400-kw. 2,000-volt alternator, and Fig. 2 is for the same machine connected through a 3:1 transformer to two of the feeders. The record which was taken on the high-tension side of the transformer shows a marked resonance of the 3rd harmonic, causing the potential-difference wave to fall almost to zero once during each half-period. The maximum volts are 10,140, or 1.60 times the R.M.S. value instead of 1.41 times for the sine wave. This is quite an exceptional case, owing to the shape of the open-circuit wave and the large capacity of the cables in comparison with the size of the machine.

Fig. 3 shows the open-circuit wave of a more modern 500-kw. three-phase 6,600-volt generator, and Fig. 4 is for the same machine connected to two of the feeders. A resonance of the 13th harmonic has taken place and the maximum voltage has risen to 14,000, or 2.33 times the R.M.S. value.

The effect of the changes in speed on the wave form near a resonance is exemplified in Fig. 5, which shows the open-circuit wave of a 330-kw. 5,000-volt generator at normal speed, and in Fig. 6 for the same machine connected to four feeders. An increase of 8 per cent. in the speed produces Fig. 7, and a reduction of 26 per cent. Fig. 8.

Fig. 5.



Fig. 7.

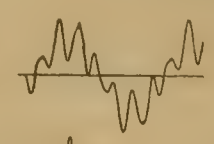


Fig. 6.

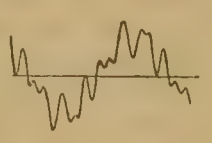
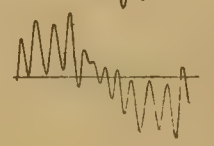


Fig. 8.



The importance of the observation is that alternators should never have their speed run up or down when excited and connected to cables on open circuit, for fear of passing through a possible resonance of an upper harmonic. In this connection I should like to draw attention to the case of switching-off at the generating station a feeder connected at its far end to a running motor or rotary converter. When the switch opens, the cable is left connected to the running motor or rotary converter, which acts for a short time as a generator. As the machine slows down there is a considerable risk of a resonance, the more so as the self-induction of the motor or converter may be high enough to give a resonance even of the fundamental. An example of this effect is shown in Fig. 9, in which a feeder supplying two motor-generators in a sub-station was disconnected from the busbars by tripping the oil switch.

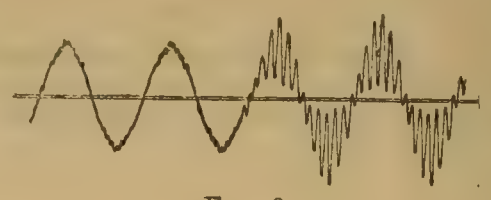


Fig. 9.

The busbar pressure was 6,420 volts, but the maximum peaks on the record after the switch had opened are no less than 16,200 volts, due to a resonance of the 13th harmonic during the short time that the motor-generators were slowing down with the feeder on the open circuit connected to them.

Directly there is any appreciable load on the system the risk of a serious resonance becomes very small and rapidly vanishes. Should, owing to any cause, the load be suddenly switched off the ends of long feeders so as to leave them unloaded and connected to the generator, there is the probability of a pressure rise due to the combination of resonance, a rise in the speed of the generator, and interrupting the current, referred to below under "Switching."

There are certain special cases in which resonance of the fundamental may appear in unexpected ways. In an actual example, a three-phase voltmeter transformer was connected to the busbars on the high-tension side by means of a fairly long length of cable. At the busbar ends of the cable were disconnecting links. It was found that if one of the links at, say, *b* (Fig. 10) were in place, the other two being open, a high voltage occurred between either of the other terminals and earth. The neutral point of the generator was earthed, and each of the cables between the busbars and the instrument transformer had a capacity of about .005 mfd. to earth. A circuit was thus formed through the closed link *b*, two coils of the transformer in series, and the capacity of the lead to earth back to the neutral point. The self-induction of the two coils of the transformer in series was just about sufficient to give a resonance when in series with the capacity of the cable to earth at the ordinary working frequency. The voltage, which should have been 4,620 (8,000 volts between phases) between *a* or *c* and earth was observed to be 10,100, or more than double the proper value. On disconnecting the pieces of cable between *a* and *c* and the transformer, the observed voltage on the open legs of the transformer fell to 4,700, practically normal value. Every time a voltmeter transformer was put in or out of circuit by withdrawing the link, the somewhat dangerous condition had to be passed through where one of the legs of the transformer was submitted to something like twice the normal pressure.

As another possible example take the case of a 100-kw. single-phase transformer supplied at 6,000 volts through a feeder one mile long and feeding into a distributing network. If the capacity of the feeder be taken as 0.25 mfd. the capacity current at 50 frequency will be just under

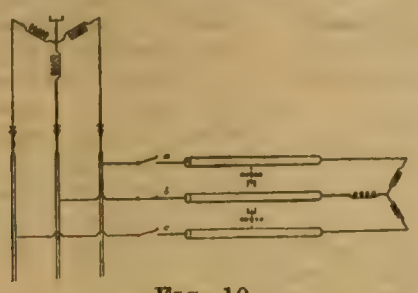


Fig. 10.

½ ampere. The magnetizing current of the primary of this transformer may not differ much from ½ ampere, and there is thus a possibility of a pressure rise should the feeder be disconnected at the generating station, leaving the transformer connected on the low-tension side transforming up and making the cable alive. If there was much magnetic leakage in the transformer this rise might be serious.

In two-phase or three-phase systems a number of combinations of the cables and transformers exist where, if a connection be opened, or during switching, the self-induction of the transformers may be in series with the capacities of the feeders, as pointed out by Steinmetz.

Summing up, it may be said that resonance at the fundamental frequency is rare but very dangerous when it does occur. Resonance of an upper harmonic is much more frequently observed, but with the good wave forms of modern turbo-alternators the amplitudes of the upper harmonics are so slight that their resonance does not generally produce any dangerous pressure rise.

Switching.—In switching apparatus in and out of circuit there are a certain number of cases in which the pressure may rise considerably above the normal irrespective of any arcing or sparking which may take place at the contacts. The best known is probably the ordinary case of opening an inductive circuit such as the field coil of a generator. If the rate at which the current is suppressed is sufficiently great, very high voltages can be produced, because the whole of the energy that is stored in the self-induction is set free, and must be either dissipated or stored in some available condenser. If an uncharged condenser is suddenly switched on to a generator, then in the general case the potential difference between the terminals of the condenser will rise not only to that of the generator but will overshoot the mark, and may, in the extreme case if there are no losses, reach twice the value. This is analogous to the ordinary case of the ballistic galvanometer in which, when the damping is small, the initial deflection on switching it into circuit is twice the steady deflecton.

We have here, therefore, two fundamental cases where pressure rises may easily occur in practice, namely, when inductive circuits are suddenly opened or when condensers

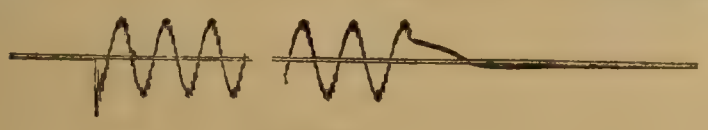


Fig. 11.

such as cables are suddenly charged. The simple case of the inductive circuit is so well known that nothing more need be said about it except to point out that in the case of long feeders where the currents are large the energy stored in the self-induction of the feeders may be quite considerable; this is especially the case with continuous-current feeders.

As examples of the voltage rise when switching on a capacity, Fig. 11 shows the case of switching on and off 3 miles of cable on open circuit at 5,600 volts to a 1,000-kw. generator by means of an oil switch. The peak of the potential-difference curve is 14,500 volts, or about 2.6 times

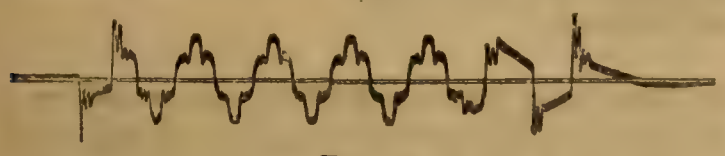


Fig. 12.

the R.M.S. value. The switching-off of the cables gives no rise, the cable behaving like a simple concentrated condenser. The fine ripples on the curve are due to a high harmonic slightly resonated.

As another example, Fig. 12 shows the switching on and off of about 2 miles of cable by means of an air-break switch from a 5,000-volt generator of an old type which had not a very good wave form. At the moment of switching on the potential difference rose to 11,000 volts, or 2.2 times the R.M.S. value. It is to be noted that after the first contact at the switch the cable becomes charged by the oscillations. The switch then breaks contact and the charge in the cable leaks away through the oscillograph giving part of a discharge curve. About 1/200th of a second later, while the cable is still partly charged, the switch makes contact again and the cable is recharged, but this time in the reverse direction, from the following half of the wave form. The cable again becomes charged by the oscillations and finally settles down.

This effect of a switch not making perfect contact may lead to high pressures, because the upper limit to which the voltage on the condenser may swing is twice the difference of potential which is suddenly applied to it. For instance, if after the first contact the cable is left charged to a potential $+ v$ and then contact is made again at the middle of the following half-period when the voltage is $- v$, the change of voltage applied to the condenser is $V+v$, and the first swing may amount to $2 (V+v)$, or the voltage rise measured from the zero line, $2 (V+v)-v$, say $2 V+v$. In the worst case of $v=V$ we have a maximum of 3 V; or for a sine wave say 4.2 times the R.M.S. voltage.

I have already stated that no rise of potential takes place when switching off a condenser. If, however, sparking or vibration takes place at the contacts the effect just mentioned may occur. Fig. 12 is a good example where the cable was switched off from the machine, and it shows that while the cable was discharging after the first switching off the switch made contact again and re-charged the cable in the reverse direction. During the following discharge the switch again made contact and re-charged the cable, giving a pressure rise to 12,900 volts. The switch now finally breaks contact and the cable discharges with a tendency to a slow oscillation.

A bad case of vibration of the contacts of switching combined with a resonance is shown in Fig. 13, in which about 12 miles of feeder were switched on to the 400-kw. generator already mentioned (see Fig. 1). The cable was not quite discharged from previous experiments at the moment the switch made contact. The ordinary rise, but

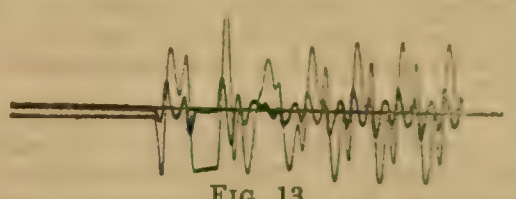


Fig. 13.

not a serious one, took place, and the switch remained closed for little over half a period. It then broke contact for approximately half a period; after which it re-made contact, giving a high rise in the reverse direction to 5,100 volts from a R.M.S. value of 2,000. During the next half-period the switch appears to have made good contact, but during the following one it has again been faulty in its contact. The moral is: Use a switch which closes quite clean without any chattering of its contacts, and switch on under oil, as the risk of a leading spark is thereby greatly decreased.

The smaller curve is the current flowing into the cable, which current it will be noticed has three times the fundamental frequency, owing to the fact that the conditions are practically the conditions of the resonance of the third harmonic of this machine already referred to. The results of a very large number of tests of switching on and off cables on open circuit show that in general on switching on the cable, if no sparking takes place, the peak rarely exceeds twice the R.M.S. voltage, and that there is no rise on switching off. If, however, vibration of the contacts takes place or sparking, which will be referred to again later, then the peak may be more serious. If the switch is in good condition, however, the upper limit of the peak may, I think, be safely taken at three times the R.M.S. voltage.

As all cables and apparatus should at least be able to stand safely twice the working voltage for short periods, to switch on a cable should be quite safe provided no serious sparking takes place at the contacts.

I have so far mentioned the cases of a capacity or a self-induction, *i.e.* a cable or a winding of a machine suddenly switched in or out of circuit. The next case is the switching in and out of a circuit which has both capacity and self-induction; in this case oscillations may be produced if the resistance is low enough.

Consider an infinitely long cable, and let it be suddenly connected to an alternating-current generator at the moment when the potential difference is zero. As the potential difference increases at the generator end of the cable a current will flow into it charging up the condenser formed by the cable and earth, and this charge will travel along the cable with a certain velocity. Owing to the resistance and capacity of the cable the quantity of electricity flowing along it will become less and less as the charge travels along, so that one may look upon the wave travelling down the cable as being of continually decreasing amplitude. As the wave travels down the cable with a certain velocity the alternator continues to revolve, that is to say, the phase of the current wave applied to the end of the cable is continually changing, so that the phase difference between the alternator wave and the current wave travelling down the cable increases progressively. The net result is that in a very long cable the wave travelling along the cable continually diminishes in amplitude and lags behind the generator in phase.

(To be continued.)

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. Evershed, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, November 26th, and London, November 27th*, 1913.)

During recent years a great deal of valuable research work has been done to increase our knowledge of the properties of insulating materials, yet notwithstanding the progress so made the natural laws governing insulation resistance are but little understood.

The only insulating materials whose behaviour in use corresponds with their predetermined dielectric properties are those which are non-absorbent. Of the remainder, and they form the majority of the materials in common use, we can only predict that the insulation resistance of any electrical system in which they are used will be governed almost entirely by the moisture they absorb. Everyone knows that insulation resistance decreases on a damp day and recovers during dry weather. It is perhaps not so generally known that in most cases insulation resistance decreases, in a perfectly definite way and almost instantaneously, as the electric pressure upon it is increased, and slowly recovers if the pressure is restored to the initial value or cut off altogether.

The effects of moisture, voltage, polarity, and other phenomena commonly met with in insulation have been forced upon the author's attention for many years past, and the pressing need to find answers to the questions that so frequently arise in connection with insulating materials induced him to undertake an experimental research with a view to the better understanding of their behaviour in everyday use. This work has been in progress for three years. The author has sought, by investigating the nature of leakage conduction, to establish some definite relation between applied potential difference and insulation resistance. If the curve expressing this relation be traced from a few volts up to the breakdown point, it will be found to consist in general of two parts of opposite curvature more or less like the voltage-resistance curve shown in fig. 1.

The shape of the first part of this characteristic curve is determined by the extent to which leakage is due to moisture; leakage through the substance of the insulator—dielectric leakage—is negligibly small compared with that caused by the merest trace of moisture. For most practical purposes an insulator may be regarded as having no inherent conductivity, the conducting power which it appears to possess being usually caused by leakage over damp surfaces, and if the insulator is porous, through the capillary channels inside the material.

The investigation of the second or breakdown part of the complete curve (see fig. 1) is still in the preliminary stage, and the present paper deals mainly with the first part up to the point or region of inflection.

When a conductor resistance is measured, care is taken to avoid the introduction of any extraneous electromotive forces due to polarisation, induction, capacity or thermo-electric junctions. But with insulating materials similar precautions are not generally possible, and all that can be done is to measure the ratio of applied potential difference to the resulting current, V/I, and call that the insulation resistance, though the "ohms" so obtained are not necessarily of the same nature as the ohms in a metallic conductor.

The greater part of the work was done by means of a Broca galvanometer, made by the Cambridge Scientific Instrument Co.; the pressure was supplied by a battery of secondary cells giving about 500 volts. When leakage conduction is to be detected or measured, continuous current is essential.

Guarded insulation—the method of Price's guard wire extended to include every material insulating point in the testing apparatus—is now universal in insulation testing. This happy invention was used throughout the present investigation, and hence the current measured was in every case the current it was intended to observe and nothing else.

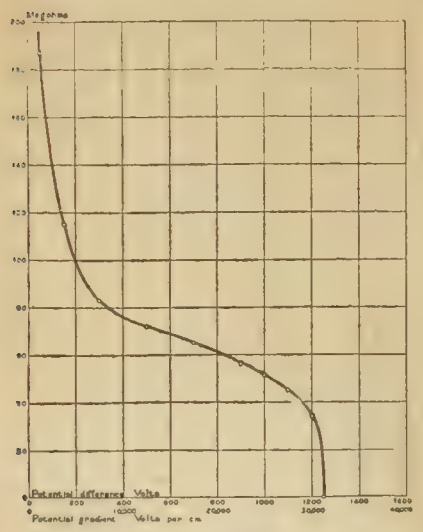


Fig. 1.—Complete Characteristic Curve for Cotton containing a Normal Amount of Moisture Absorbed from the Air.

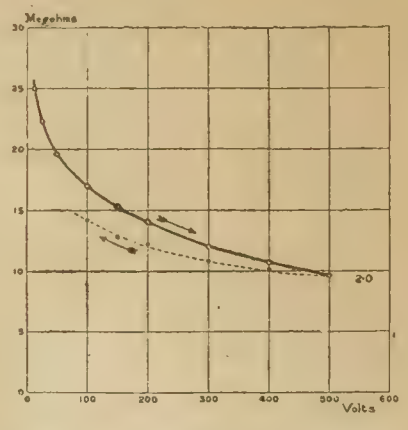
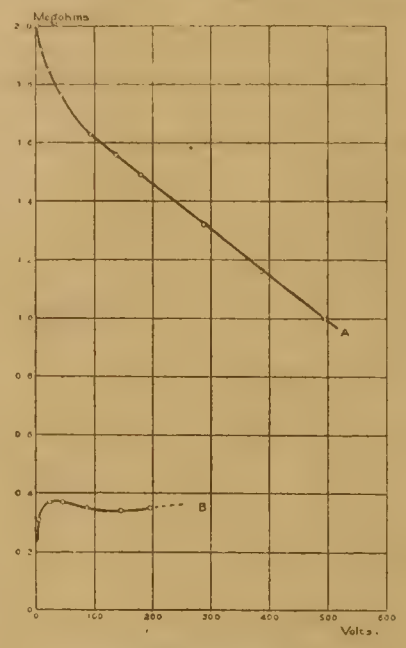


Fig. 2.—Insulation Resistance of a Dynamo Armature, Showing Hysteresis Effect.

In the choice of examples it does not matter what kind of insulators are involved; so long as their resistance is within the range of measurement, they will nearly all tell the same tale of a gradual fall in the resistance as the testing voltage is increased.

Fig. 2 is a typical moisture curve, indicating that the insulation is entirely composed of absorbent materials. It is important to note that when the curve was retraced backwards a kind of hysteresis effect appeared. With absorbent insulators this effect is nearly always to be found. The two curves in fig. 3, one traced on a wet day and the other after a spell of dry weather, show that a large excess of moisture not only lowers the general level of the resistance but also brings about an entire change in the character of the curve. In the lower curve three things which are characteristic of conduction by moisture are struggling for the mastery. On a wet day every solid insulator is covered with a film of water, which if it were in stable equilibrium would conduct according to Ohm's law and give a horizontal straight line. But instability is a marked feature of films when they are exposed to the air, and hence in practice the curve is never a simple straight line. In addition there is some typical conduction through absorbent insulators, and the curve is the resultant of all three effects.



A, in dry weather.
B, in very wet weather.

Fig. 3.—Insulation Resistance of Lighting Circuits.

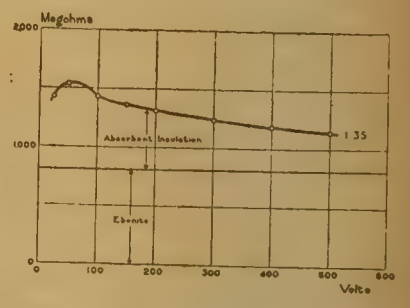
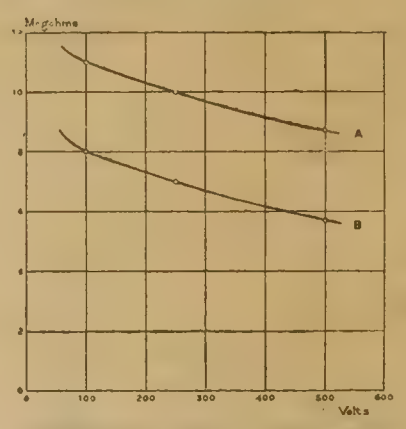


Fig. 4.—Insulation Resistance of a Supply Meter.

The curve in fig. 4 is typical of insulation that is made up of an absorbent insulator in series with one which has a more nearly constant resistance. Fig. 5 is remarkable because it shows that the resistance was affected by polarity. The polarity effect is a strongly marked characteristic of earthenware insulators.

Prolonged experiments were made on a large number of materials which are in common use for insulating purposes. The materials included rubber, gutta-percha, micanite, porcelain, cotton, paper, silk, oils, and varnishes.



A, with wires positive, earth negative.
B, with wires negative, earth positive.

Fig. 5.—Insulation Resistance of Interior Wiring, Showing Polarity, or "Valve," Effect (Ohmmeter Test).

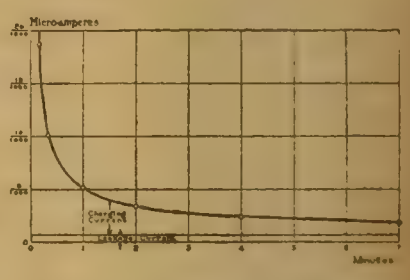


Fig 6.—Leakage Current Plus Charging Current Flowing into a Rubber Cable, from 0 up to 7 Minutes.

Our object being to learn something about conduction through moisture, any dielectric leakage there may be through the substance of the insulators can only be ignored if we first show that dielectric resistance is enormous in comparison with the resistance of the leakage paths which are formed by traces of moisture.

The only non-absorbent insulators which were tested were gutta-percha and rubber. These are both non-absorbent in the sense that what little water they may be capable of absorbing is entirely unable to form leakage paths through the insulator. Submarine cables insulated with these materials have been lying on the bottom of the sea for half a century or more, and, so far as the author is aware, no trace of conduction by absorbed water has ever been detected in a sound cable.

Rubber as an insulator for cables is so extensively used in every branch of electrical industry that it is naturally the example chosen for illustration. The test sample was a rubber-covered flexible cable made up of 64 6-mil wires, insulated in accordance

with the standards of the Cable Makers' Association, and guaranteed to have an insulation resistance of not less than 600 megohms for 1 mile after 1 minute's electrification. The rubber is between 35 and 37 mils in thickness, and consists of one layer of pure Para and two layers of vulcanised rubber. This flexible is used by the author's firm for the interior connections of naval gear, and for that purpose it is supplied without any covering outside the rubber; it was, therefore, in suitable form for an under-water test. A length of this cable—equal to one-sixteenth of a mile—was put into a bucket of water, where it remained for 40 days. The tests which were made during that period consisted in charging the cable at about 500 volts and observing the total current flowing into it at intervals of time, so that a time-current curve might be drawn.

The charging current dies away rapidly at first, then more and more slowly. Ultimately, possibly after many hours, the only appreciable current passing through the galvanometer will be the true dielectric leakage. The actual result of a test of this kind, made after the flexible had been in the water for 10 days, is shown in figs. 6 and 7. In fig. 6 the time-current curve is given from 10 seconds up to 7 minutes after the closing of the charging circuit; while fig. 7 shows the same curve from 3 minutes up to 420 minutes (7 hours).

Incidentally, these two diagrams afford a good illustration of the misleading appearance of curves of this class. Judging from fig. 6, one would infer that within 4 or 5 minutes the current was

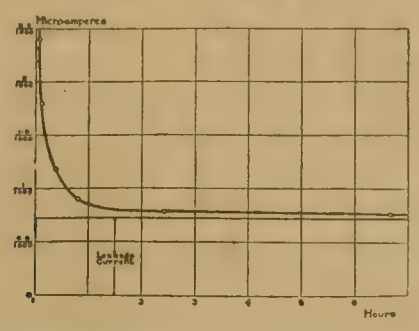


FIG. 7.—LEAKAGE CURRENT PLUS CHARGING CURRENT FLOWING INTO A RUBBER CABLE; CONTINUATION OF THE TIME-CURRENT CURVE IN FIG. 6, UP TO SEVEN HOURS.

already nearly approaching its final steady value. But we have only to change the time scale from minutes into hours, and magnify the current scale by a substantial amount, and the curve conveys a very different impression. Instead of a few minutes, an hour or more must elapse before the current can be said to be "well round the bend of the curve."

The charge was continued for 27 hours without a break, and by that time the current had fallen to 0·00072 micro-amperes at 525 volts. This was assumed to be the true dielectric leakage current, and its value is indicated on each of the diagrams by a horizontal line.

(*To be continued.*)

University Education in London.—The President of the Board of Education has sent to the Vice-Chancellor of London University a letter in which he announces that the Government, after careful consideration, have decided that the scheme of the report of the Royal Commission on University Education in London is calculated to produce a University of London worthy of the name. It will be the business of the Departmental Committee to discover how far the numerous bodies and persons concerned are prepared to co-operate on the basis of the principles underlying the scheme.

Those principles may be shortly stated as follows:—

1. That the government of the University, and particularly its financial administration, shall be entrusted to a small Senate predominantly lay in its composition, and not representative of special interests; and

2. That, on the other hand, the control of the teaching and the examinations of students in colleges of the University shall be in the hands of the teachers.

3. That the educational and financial control of the constituent colleges shall be vested in the University.

4. That as much of the University work as possible, together with the University administration, should be concentrated in a central University quarter.

5. The scheme of reconstruction should provide effectively for continuance of access to University examinations by external students, *i.e.*, by those who are not attached to any college or school of the University.

As regards the future of the Imperial College, it has never been proposed that the college should be moved from its present site. It is, however, an essential part of the scheme that it should become a constituent college of the new University under "the educational and financial control" of the Senate.

On the conclusion of the necessary negotiations the Government hope to introduce legislation in due course to give effect to these principles.

The scheme of the Royal Commission is the only one in the field, and if it fails of accomplishment all chance of reform and progressive development may be gone for many years.

The Government will be prepared, in the event of the scheme taking shape in legislation, to make substantial new contributions to the resources of the University.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CAMEROONS.—A new tariff, which has been put into operation as from August 24th last, provides for a duty of 20 per cent. *ad valorem* on iron wares of all kinds and a duty of 10 per cent. on goods not specially mentioned in the tariff as not included in the free list.

FRANCE.—The Board of Trade have received information from the French Customs Department to the effect that the Customs Service may take the declaration respecting the electric equipment of tramway cars to be correct if such declaration is corroborated by a detailed note showing the weight of each part of the equipment and where such part is to be used.

The October issue of the Circular of the British Chamber of Commerce calls attention to a method of importing heavy machinery into France at the lowest rates possible. It often happens that a machine is too heavy or too bulky to be sent in one shipment. If, however, it is sent in two or more shipments, the French Customs authorities refuse to accept its declaration as a complete machine. The Circular suggests the following method by which British shippers of machinery may avoid this difficulty, and in many cases save expense:—Application should be made to the local Director of Customs for permission to import the machinery in two or three shipments, as the case may be, within a time limit of 60 days. A plan of the machine and a list of all its parts must be deposited in advance at the importing Custom House, and each shipment must be accompanied by a list carefully designating the parts contained in that shipment. The importer must sign a "soumission," undertaking to pay on the whole as "detached parts" if, after final shipment, it is found that the machine is incomplete. All shipments must be made through the same Custom House, and it is, of course, understood that spare parts will have to pay the duty proper to them as "detached parts."

PORTUGUESE COLONIES.—A decree of the Minister of Colonies provides that the exemption from duty of goods imported into the Portuguese Colonies by, or for the use of, the Government, shall be extended to telegraphic materials. In order to enable these goods to be imported free of Customs duty, the authorisation of the Governor of the Colony must be obtained and the legal formalities in connection with Customs clearance must be carried out.

BARBADOES.—In connection with the provisions of the recent treaty between Canada and the West Indies, which provides for preferential treatment of British and Canadian goods, an Act of the Barbadoes Government provides that in the case of goods imported at general tariff rates between June 2nd and September 30th, 1913, and in respect of which satisfactory evidence has been, or shall be, produced to the Comptroller of Customs that such goods are the produce or manufacture of a British country and entitled to preference under the existing laws of the island, a refund of any payment in excess of the amount payable under the British Preferential Tariff will be made on the order of the Comptroller of Customs. The Act also empowers the Comptroller of Customs to decide any question that may arise as to the origin of goods imported up to October 1st last.

NICARAGUA.—The Board of Trade have been informed by the Foreign Office that in connection with the certificates of origin for goods liable to a rebate of 25 per cent., in accordance with the treaty between Nicaragua and France (which is also applicable to British goods), any form of certificate of origin which properly describes and identifies the goods shipped, will suffice to obtain for the goods the rebate of duty in question, provided that it contains a certificate from a Chamber of Commerce or a competent officer of the Government of the country of origin to the effect that the goods are the produce or manufacture of that country.

BOLIVIA.—A Bill has recently been laid before the Bolivian Congress, by which it is proposed to authorise the Executive to reduce the export duty on rubber, if necessary, to 2 per cent. *ad val.* from the present legal minimum of 8 per cent. It is proposed that the tax shall be levied upon 70 per cent. of the London market quotation of the rubber, 30 per cent. being deducted for cost of production.

NEW PATENTS APPLIED FOR, 1913.

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,621. "Electric soldering irons." L. NEWITT and F. P. FLETCHER. November 10th.

25,625. "Shades for electric and other lights." J. RED. November 10th.

25,643. "Telephonic receiving-apparatus." WESTERN ELECTRIC CO., LTD. November 10th. (Franklin Tuthill Woodward, Belgium.) (Complete.)

25,659. "Telephone repeaters." WESTERN ELECTRIC CO., LTD. November 10th. (Franklin Tuthill Woodward, Belgium.) (Complete.)

25,666. "Electric-light pendants." F. DEHLER. November 10th. (Convention date, February 15th, 1913, Germany.) (Complete.)

25,668. "Apparatus for the preparation of electric baths." J. DUIVEN. November 10th. (Convention date, November 13th, 1912, Switzerland.) (Complete.)

25,675. "Attachment plug for electric circuits." F. H. CHAPMAN and O. E. KENNY. November 10th. (Convention date, February 24th, 1913, United States.) (Complete.)

25,695. "Reactances or choking coils." K. M. Faye-Hansen. November 10th.

25,701. "Device for discovering fractures in wire cables." R. Wahn. November 10th. (Convention date, November 11th, 1912, Austria.) (Complete.)

25,716. "Electrical measuring apparatus." M. E. Leeds. November 10th. (Convention date, November 18th, 1912, United States.) (Complete.)

25,717. "Apparatus for recording electrical, chemical, mechanical, physical, and other quantities." M. E. Leeds. November 10th. (Convention date, November 22nd, 1912, United States.) (Complete.)

25,720. "Telephone systems." M. Suwa. November 10th. (Complete.)

25,727. "Electrical accumulators or secondary batteries." H. W. van Raden. November 11th.

25,743. "Shade holder and lamp lock for incandescent electric lamps." T. McClelland, Junior. November 11th.

25,767. "Electro-magnetically-operated reciprocating mechanism." W. H. James. November 11th.

25,774. "Method and apparatus for electric code impulse signalling systems." Western Electric Co., Ltd. November 11th. (F. T. Woodward, Belgium.) (Complete.)

25,780. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and A. B. Sperry. November 11th.

25,787. "Compounds for use as coatings or coverings for insulating purposes." A. J. Roach-Cuming. November 11th.

25,788. "Compounds for use as coatings or coverings for insulating purposes and the like." A. J. Roach-Cuming. November 11th.

25,790. "Insulating covering for overhead wires." G. H. Vaughan. November 11th.

25,795. "Audible electric signalling devices and the like." W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. November 11th.

25,796. "Audible electric signalling devices and the like." W. A. Crosbee, F. S. C. Crosbee, and T. S. Rogers. November 11th.

25,818. "Electric switches and fuse switches." H. H. Berry and W. J. Markham. November 11th.

25,833. "Electric switches." F. B. Holt and H. Smith. November 11th.

25,834. "Electric motor-driven vehicles." K. von Kando. November 11th. (Complete.)

25,846. "Apparatus for converting alternating to direct current." H. Wade. November 11th. (D. A. Heyman, United States.) (Complete.)

25,849. "Vacuum tubes." British Thomson-Houston Co., Ltd. November 11th. (General Electric Co., United States.)

25,852. "Apparatus for regulating electric circuits." H. Leitner. November 11th.

25,855. "Method of generating high tension sparks for ignition purposes." F. H. Teagle. November 11th. (Complete.)

25,901. "Electric signalling system for railways." C. C. Wilson. November 12th.

25,903. "Ignition systems of internal-combustion engines." P. W. Harley. November 12th.

25,914. "Joint for metallic conduits and fittings for electric cables." Simplex Conduits Ltd., and L. M. Waterhouse. November 12th.

25,915. "Electric switches and the like." D. Adamson. November 12th.

25,919. "Apparatus to keep constant the voltage of an electric current obtained from an alternating current dynamo, particularly of the type fitted to certain makes of motor-cars." A. H. Simmons. November 12th.

25,928. "System of apparatus for the distance control of motors." A. Mond. November 12th. (Maschinenfabrik Oerlikon, Switzerland.) (Complete.)

25,951. "Device for tightening-up and separating the sections of trolley wires." F. Lautenbacher. November 12th. (Convention date, December 2nd, 1912, Germany.) (Complete.)

25,954. "Secondary storage batteries or electrical accumulators. O. Oldham. November 12th. (Complete.)

25,957. "Manufacture of alkali metals and alkali metal alloys by electrolysis." Chemische Fabrik von Heyden Akt. Ges. November 12th. (Convention date, November 18th, 1912, Germany.) (Complete.)

25,975. "Method of and means for the electric transmission of signals and speech in mines." R. Haddan. November 12th. (J. H. Reineke, Germany.) (Complete.)

25,977. "Electrically-operated clock mechanism." E. C. Clerc. November 12th. (Convention date, November 21st, 1912, France.) (Complete.)

25,989. "Electric-lampholders." G. St. J. Day. November 13th.

25,990. "Automatic engaging and releasing mechanism." I. H. Parsons. November 13th.

25,991. "Line selector switches." I. H. Parsons. November 13th.

26,006. "Automatic electric circuit-breakers." A. Crawford. November 13th.

26,050. "Method of electrical speed control." E. R. Clark. November 13th.

26,060. "Electrical devices for operating door sashes of automobiles and other vehicles." J. F. P. de la Riboisiere. November 13th. (Addition to 15,648/13. Convention date, December 21st, 1912, France.) (Complete.)

26,061. "Method of and apparatus for electro-osmotic processes." Ges. fur Elektro-Osmose m.b.H. November 13th. (Convention date, July 21st, 1913, Germany.) (Complete.)

26,069. "Electric-starters and lighting and battery-charging systems applicable to motor-vehicles and the like." W. H. Glaser and H. R. Lloyd. November 13th.

26,100. "Interior for electric light lampholders." E. Phillips. November 14th.

26,105. "Electrical slip-ring or collecting-ring." H. C. Sanders. November 14th.

26,109. "Electrical knock locator for use in connection with engines, pumps, and the like." J. L. Cochrane. November 14th.

26,149. "Method of manufacture of insulation between two metallic bodies." S. G. Leach and H. F. Joel, Junr. November 14th.

26,150. "Springs used in electrical work." S. G. Leach and H. F. Joel, Junr. November 14th.

26,181. "Dynamo-electric machines." T. W. Tattersall and J. W. Tattersall. November 14th.

26,198. "Pulleys for the trollies of electric railways, tramways, and like purposes." A. Welsh. November 15th.

26,226. "Electric signalling system for railways." C. C. Wilson. November 15th.

26,251. "Electrical accumulators." H. C. Weeks. November 15th. (Complete.)

26,252. "Apparatus for perforating strips in dot-and-dash codes or the like." C. F. Casella & Co., Ltd., and R. M. Abraham. November 15th.

26,268. "Contacts for closing electric circuits." J. E. Colas. November 15th. (Convention date, November 15th, 1912, Belgium.) (Complete.)

26,273. "Systems of electro-medical and therapeutical treatment." J. P. Pullin. November 15th.

26,278. "Automatic telegraph transmitters." Eastern Telegraph Co., Ltd., K. L. Wood, and A. Fraser. November 15th. (Complete.)

26,287. "Telephone systems." E. A. Graham. November 15th. (Complete.)

26,288. "Telephone systems." E. A. Graham. November 15th. (Complete)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Electric Starters for Motors, Alternating or Direct Current. C. B. Pinkerton and A. E. Wason. 21,974. September 27th.

Holders for Electric Incandescent Lamps. W. E. Lake (Geb. Jaeger.) 24,154. October 22nd.

Signal Devices for Use on Motor Vehicles. H. P. E. Miller and E. Tetlow. 24,238. October 25th.

Condensation Products for Making Plastic Substances, Impregnating Solutions, and the Like. British Thomson-Houston Co. (General Electric Co.) 24,255. October 23rd.

Impulse Transmitters for Electrical Circuits. W. M. Bruce, Junr. 24,409. October 25th. (December 7th, 1911.)

Contact Breaker for Electric Bells and the Like. The Sterling Telephone and Electric Co., and F. G. Bell. 24,439. October 25th.

Cases for Electric Batteries Preserving Food and other Purposes. H. F. Joel, Senr. 24,443. October 25th.)

Electric Reversing Switches for Electro-Magnetic Ratchet Feeding Devices. G. A. Vassberg. 24,550. October 26th.

Electric Oven. Simplex Conduits Ltd., and F. G. Taylor. 24,586. October 28th.

Power Transmission. J. G. P. Thomas and Thomas Transmission Ltd. 24,618. October 28th.

Mariners' Compasses. L. W. P. Chetwynd. 24,768. October 29th.

Lamp Jack Strips for Telephone Switch Boards and the Like. Siemens Bros. & Co., Ltd., and E. A. Petithory. 25,237. November 4th.

Alternators Particularly Applicable to Radio-Telegraphy. E. Girardeau. 25,356. November 5th. (November 6th, 1911.)

Means of Communicating with Submarines or other Vessels when Submerged. A. Turpin and R. Robinson. 25,499. November 7th.

Manufacture of Objects from Molybdenum. Chemische Fabrik von Heyden Akt. Ges. 25,976. November 12th. (June 19th, 1912.)

Electric Igniting Means for Gas Burners. South Metropolitan Gas Co., and J. M. Somerville. 26,156. November 14th.

Dynamos and other Like Electric Machines. G. Plaisant. 26,177. November 14th. (November 24th, 1911.)

Method of and Means for Testing the Electrical Resistances of Metal Bodies. C. Sarel. 26,639. November 20th.

Solenoids for Alternating Current. C. G. Major and Smith, Major & Stevens, Ltd. 26,935. November 23rd.

Regulating Mechanism for Electric Distribution Systems. British Thomson-Houston Co., E. Garton and A. H. St. C. Watson. 27,758. December 2nd.

Magneto Electric Machines. R. C. Staunton. 28,469. December 10th.

Tube Coupling for Electrical Circuits. J. H. Jackson. 28,929. December 16th.

Conduits for Eletric Conductors. H. G. Coventry and G. Rushton. 28,979. December 16th.

Reflectors and Shades for Indirect Lighting. H. Hirst and T. C. Cash. 29,348. December 20th.

Adjustable Electric Lamps. H. Fairbrother. (Vesta Accumulator Co.) 29,698. December 24th.

Electro-dynamoter Instruments. J. T. Irwin. 27,348. November 28th.

Galvanic Batteries. A. F. Hawdon. 27,351. November 28th.

Electric Lamp Holders. M. J. Railing and J. H. Collings. 27,503. November 29th.

1913.

Systems of Voltage Regulation for Electric Circuits. A. H. Olmsted. 1,207. January 15th.

Incandescent Arc Electric Lamps. M. S. Okun. 2,125. January 27th. (January 26th, 1912.)

Electrodes for Electric Accumulators. H. F. Joel, Senr. 2,269. (Divided Application on 24,443/12. October 25th.) January 28th.

Circuit Arrangements for Telephone Exchanges. Siemens & Halske Akt. Ges. 3,132. February 6th. (February 6th, 1912.)

Means for Signalling Disagreement between Engine, Controlling Gear and the Like and Order Telegraph Indications. J. V. Fowler. 3,266. February 7th.

Telegraph System Unaffected by Static Charges from Neighbouring High-tension Lines. Siemens & Halske Akt. Ges. 3,432. February 10th. (February 12th, 1912.)

Sockets for Incandescent Electric Lamps. H. Hubbell. 3,656. February 12th.

Device for Assisting in Setting or Timing the Ignition and Valves of Internal-Combustion Engines. W. H. Leek and A. J. Wilesmith. 4,239. December 19th. (Cognate Application 8,450/13.)

Electric Contact Makers for Use with Resistance Boxes, Wheatstone Bridges, and the Like. T. E. Gambrell. 4,862. February 26th. June 2nd, 1913.)

Electric Circuit Interrupting Devices. British Thomson-Houston Co. (General Electric Co.) 4,945. February 26th.

Method and Means for Starting Four-stroke-cycle Diesel Motors. J. M. Bukh. 5,309. March 3rd. (May 18th, 1912.)

Electric Fuse-holders. Electric and Ordnance Accessories Co., and E. Howell. 5,836. March 10th.

Electrostatic Separators. J. Kraus and E. Oppen. 6,336. March 14th. (March 14th, 1912.)

Ignition Devices for Internal Combustion Engines. W. Burton and L. J. Yates. 6,434. March 15th.

Process and Apparatus for the Production of Copper by Electrolysis. M. Perreur-Lloyd. 6,897. March 20th. (March 22nd, 1912.)

Electric Current Generators. F. W. Howorth. (Ryder.) 9,070. April 17th.

Reflectors. W. H. Gwynn and H. E. Clerk. 10,152. April 30th.

Wireless Telephony. F. Majorana. 10,153. April 30th.

Safety Signalling-apparatus for Use in Mines. R. Nelson. 11,166. May 13th.

Electric Cut-outs with Multiple Safety Fuses. F. Despessailles. 11,850. (March 31st, 1913.) May 21st.

Vapour Electric Devices. F. Conrad. 12471. May 28th. (June 21st, 1912.)

Night-sights for Rifles and the Like. F. A. Schanz. 12,549. May 29th.

Electric Arc Lamps. Siemens Bros. Dynamo Works, Ltd. (Siemen-Schuckert-werke Ges.) 12,575. May 29th.

Protection of Alternating Current Electric Motors. G. Ellison. 12710. May 31st. (Addition to 13285/07.)

Timing Gear in Electric Ignition Devices. W. Ruthardt. 12871. June 4th.

THE

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION.

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

TO POPULARISE ELECTRICITY.

WHY was it that the names of William Preece, Robert Ball, and certain other men of science became household words? We venture the opinion that in their ability to step down from a scientific pedestal and discuss in the terms and phraseology of the man in the street the fascinations of electricity and astronomy is to be found the explanation. Notwithstanding all our exhibitions, technical schools, popular lectures, scientific magazines and books, the fact remains that our many millions to-day are in the mass almost wholly uninformed with regard to electrical matters. Let any of our readers begin to talk at all knowingly on electricity, and what it has done, is doing, or is going to do, to any fellow traveller in the train or tramcar, or to an acquaintance at luncheon in a city restaurant, and he will find his companion to be ignorant yet eager for information.

We are convinced from careful observation that, speaking generally, the people are quite ready to listen to the man who is able to give them information on what is essentially a subject of present-day interest, provided he can do it attractively. Technical precision is a point of only secondary importance in such a case so long as the definite impression that the untutored mind can receive is made.

Commercial considerations naturally carry weight with the man of business, and his interest will be excited along that line of thought when we want to secure him as an electrical consumer; but we are inclined to question whether the "domestic" consumer, as we describe every householder and his wife in their private capacity, will be as easily won by our approaching the position directly with the commercial argument. There are many other possibilities in electricity and electrical service that might be found more attractive means for stimulating interest.

Say all that we may about publicity literature and the need for more of it of the right kind prepared expressly to meet the conditions of a locality, we cannot shut our eyes to the desire of the public to see actual articles at work. The pamphlet or the newspaper advertisement may tell them sufficient to promote that desire, but observations at exhibitions—take the popularity of the recent motor-car show at Olympia as a case in point—prove that the people will come where they can see, and observations at lectures prove their willingness to go where they can hear.

Everybody has been talking motor-cars during the last year or two; as the price of cars has fallen interest has risen, and purchasers and Olympia visitors have increased in number. What we need is for everybody to be talking electricity; the price of energy is falling, the cost of apparatus is down, and if only we can get the interest sufficiently aroused, the commercial result that we all desire will follow.

It seems that what we want at the present moment is more widespread lecturing of the popular order. Powder and shot are undoubtedly very useful in their way, but let

them be adopted in co-operation with the popular appeal that ocular demonstration can make. If we can secure the public interest and leave the hearer without any following suspicion that he has been subjected to a leg-pulling process, we will allow gas-signs to continue to give forth the false claim that "Gas is Cheaper than Electricity for All Purposes," without the least fear that such a statement can do our rivals any good. Lecturers who have travelled the country giving demonstrations of electric heating and cooking have done splendid service for the particular makes of apparatus in whose interest they have lectured, and have simultaneously assisted general electrical progress by educating the audiences that have gathered to hear them. All responsible for these demonstrations are to be congratulated upon their enterprise. Central-station men have not been slow to take advantage of the opportunity thus presented, and nobody will begrudge those who have spent the money, their reward.

But there seems to be room for far more both of this and other kinds of local lecturing and demonstrating, and the question will probably be asked as to who is to arrange it. We believe that electricity supply departments should take the initiative, and that they should operate in conjunction with the various firms who are making apparatus of kinds that will appeal to the average consumer.

Our American contemporary, the *Electrical Review and Western Electrician*, has lately been writing editorially upon the necessity for and benefits following upon central-station lecture service. An instance is quoted where an experienced lecturer appeared on the popular platform on an average three times a week from January to June, and it was found that in every instance new business resulted, the inquiries and subsequent application for service being directly traceable to the interest stimulated by the platform orator. Contracts were signed at the office as soon as it was realised that service could be had at rates far below the cost of luxuries. Here we find the commercial argument clinching the business after the interest has been sufficiently aroused to induce the visitor to attend and be informed. In one small American town the owner of a large residence applied during the evening for service involving over 200 lamps "as a direct result of the speaker's talk and illustrations."

We have no doubt that some of our readers could relate valuable experiences of a like kind as a result of conversations with exhibition visitors and after local lectures. Such experiences would be very welcome, and, we believe, would encourage in all parts of the country greater activity of the kind we commend above.

The L.C.C. Tramway Termini.

We wonder if anyone in authority in connection with the L.C.C. tramway system ever tries to board a tramcar at, let us say, Southwark Bridge or Westminster Bridge, to mention only two places among others which might be enumerated, between the hours of 5.30 and 7 p.m. Some attempt has been made to control the traffic at Southwark Bridge by erecting chains along the kerb, and indicating by signs where passengers should wait for various cars. Before these were erected it was the custom for passengers to wait in a long queue extending upward from Southwark Street to the terminus, and as soon as a car had crossed Southwark Street they would board the moving car as quickly as possible, until the rear platform and steps were packed and no others could find a foothold. The unsuccessful ones would then race the car, as many as possible hanging on to the handrail, or standing on the buffer in the hope of scrambling on before the car came to rest, by which time a compact mass of men and women, youths and girls would be struggling and jostling each other to try to get a position near the step. It was presumably to improve matters that the chain barriers were erected. The cars for certain destinations now have their appointed stopping places; the passengers line up behind these until a car arrives, and then they proceed two by two to enter. At least that is what they are supposed to do, but in practice they do nothing of the kind; they stand behind the chain until the car is coming down from the terminus, when they advance in a solid body to meet it, the strongest or roughest (and there are some very rough ones in the crowd) gaining the platform first, whilst the rest form a tightly-packed mass behind. With some pushing from the back, and others from each side of the step whilst the car is still in motion, it speaks well for the physique of the race—particularly the female portion of it—that serious accidents do not nightly occur.

Along the Embankment between Charing Cross and Westminster Bridge, and, perhaps, in a somewhat milder form near Waterloo Bridge, much the same kind of thing takes place, but here we have more of the running-jump order of things, those who manage to secure a foothold whilst the car travels along acting the part of a human scythe to those waiting along the kerb.

We have seen non-combative passengers miss car after car by being rudely pushed aside by the more self-assertive and unscrupulous members of the waiting crowd, who for the time being behave like the worst type of hooligans. This kind of thing does not occur at the doors of a theatre, where a queue lines up and the people enter in the order of their coming.

We are apt to speak derisively of the disciplinary rules and regulations in vogue in Germany, but we think that neither in Berlin nor in Paris would such a disgraceful state of things be tolerated. In Paris it was once, and may still be, the custom for waiting passengers to take a numbered ticket at the terminus or waiting room, and when the car or 'bus arrived to enter in the order of their numbers. It seems such a simple method, and is so effectual in practice that one wonders why the same system cannot be adopted here. Perhaps, as in the case of the railways, it needs the sacrifice of human life to stimulate the authorities to a sense of their responsibilities.

Rubber.

Although the best figures recently reached have not been entirely maintained, the tone of the rubber market has certainly of late undergone a substantial improvement with a moderate accession of confidence upon the part of consumers, due probably to a certain extent to the conviction that some sort of regulation of the distributive end of the trade would be undertaken as the result of the negotiations between plantation producers. Something like a settled attempt is being made to put matters on a rather better basis, without imposing restrictions of an unsound character, such as might eventually bring about fundamental weakness in the position. The idea seems to be that there should be a combination of the plantation interests, the arrangements in connection with which involve a fixed contribution per lb. of rubber produced, and which also tend to the introduction of something approaching uniformity in connection with the standardisation of plantation rubber. The greatest importance is attached to a system of standardisation, by many of the best friends of the commodity, and their efforts are being directed strongly and consistently towards the attaining of this desirable end, as a means of helping the market gradually to recover lost ground. In principle, most of the plantation companies are in favour of a combination, but there has hitherto been a certain amount of jealousy felt in some directions which has prevented the more general acceptance

of proposals put forward, having for their object the forming of an alliance of interests for what amounted to the mutual protection of the plantation industry. When this or that group starts too closely weighing up its own merits against those of its rivals, and is apprehensive that it is not getting all of the honey out of the pot, the formation of any effective and lasting plan of combination is hardly possible.

In any event, and whatever the outcome of the proposals, it is clear that sooner or later the all-important question of standardisation must be taken thoroughly and effectively in hand, for even yet plantation rubber does not meet with that acceptance in all directions which its many merits entitle it to receive. This matter was dealt with very concisely a few days ago at the meeting of the Tebrau Rubber Co., when Mr. P. M. Mathew pointed out that plantation Para rubber stands in a class by itself and requires different treatment from any class of wild rubber. The difference between plantation and wild rubber was, he said, a subtle one, which up to now had been impossible of solution by any chemist. It was certain, however, that it was not a question merely of curing, because the greater part of the world's supply of rubber was uncured. It was, nevertheless, possible that the superiority of fine hard Para arose partly from the particular process of curing to which it was subjected, and he suggested that until the same result could be attained in the Middle East by the means available, consumers would not be able to dispense wholly with the Brazilian product. To-day the output of plantation rubber was uncured, for smoking or treating with antiseptic vapour during the process of drying was not curing, nor did it impart to the rubber the characteristics of fine hard Para. Certainly, on a few estates a limited quantity of smoked sheets was being turned out, which, for the time being, realised a premium over crepe, but much of the smoked sheets coming forward was in a more of less damaged condition, and was wholly unfit for first-class work. In time, of course, the problem of curing will be solved, but the really big question of the day is that of standardisation. There has been an experimental station established at Kuala Lumpur by the Rubber Growers' Association, at which the manufacture of vulcanised rubber can be carried on, and this might be of the greatest possible service to the industry. The output of the Federated Malay States continues to expand, the total advised for the first 10 months of the year being 42 million lb., compared with 28 million lb. last year, and 15 million lb. in 1911. The really wonderful thing is that the world seems to be absorbing everything turned out, which is conclusive proof of the rate at which consumption has grown.

Is the Modern Petrol Car Misnamed?

In view of the many electrical devices that are found on the modern petrol car, one is inclined to ask whether it is not somewhat misnamed. First of all, one of the most vital constituents of an automobile is the highly-developed magneto that generates the spark for igniting the explosive mixture in the cylinders of the engine. The magneto displaced the old method of ignition by primary or secondary battery in conjunction with an induction coil, but the battery of accumulators has again made its appearance on the car, this time in a larger form and in conjunction with a dynamo, a switchboard, and the necessary adjuncts of wiring and electric lamps of various shapes and sizes. To these is now being added an electric motor, either combined with the dynamo or in separate form, to replace the old starting-handle method of starting the petrol engine. Still another departure, in which electricity is to play a leading part, and which, although found in only one instance at the recent Motor-Car Exhibition at Olympia, is already a feature of several cars of American construction, is that of doing away with the usual hand-controlled change-speed lever, and replacing it by an electrical method—controlled by a series of push switches on or about the steering wheel—of bringing the desired pair of pinions in the gear box into mesh. Having all this in mind, and also the fact that modern cars are also mostly equipped with electrically-operated motor horns, electric communicators, cigar lighters, and some even with telephones so that the rear passengers may give instructions to the driver, it would almost seem that the modern automobile is as much an electric as a petrol car.

The point that we wish to lead up to is this: seeing that the up-to-date car is being equipped with, in addition to a petrol engine, a dynamo, a motor, and a battery of accumulators, cannot the latter, instead of being additions to a chassis, also be employed as substitutes for some part of the mechanism? What we have in mind is the petrol-electric car, which has hitherto been somewhat swamped by the purely petrol vehicle, but which even for 'bus work is proving quite successful. It seems to us that now that the use of dynamo, motor and battery on a petrol car has become an accepted fact, it should only need a slight development to reach the stage where the power generated by the petrol engine would be transmitted to the rear road wheels electrically, thus doing away with the usual and still somewhat complicated system of mechanical gearing that exists between the engine and the wheels, in particular, the change-speed gear box, and at the same time performing the additional functions of engine starting and car lighting.

Unemployment Insurance.

From statements that are being made in various directions, fears are apparently entertained of a coming decline in the great wave of prosperity which has recently affected the trade of the country. Monetary stringency in different markets abroad limits the power to pay for requirements, and orders, in consequence, are held in abeyance, with adverse effects upon industries in this and other manufacturing countries. Mexico and other disturbed regions are also unsettling factors. We have no desire to meet troubles before they come, nor do we think it necessarily follows that electrical trade falls off materially when there is depression in some other trades; nevertheless, it may be of some interest to consider the position of those who have been contributing to the Unemployment Insurance Fund. Amongst these there must be a very large number of persons who are directly or indirectly concerned with the electrical trades. According to a report published by the Board of Trade a few months ago (Cd. 6,955), there is a very considerable sum now in hand. The following figures, which relate to a period of six months' working of the Act, are taken from the report:—Some 2,500,000 unemployment books were issued during the year. Of the total number of workmen insured, less than one-fifth were previously voluntarily insured against unemployment. The general income of the unemployment fund (from masters and men) was about £1,800,000, or, including the State contribution, £2,400,000. Expenditure on benefits, refunds and administration, has been at the rate of £700,000—but this, of course, was in a year of exceptionally good employment. About 560,000 claims were made on the fund. Broadly speaking, it is stated that the financial position at the end of the first year compares favourably with the estimates made by the actuary for a year of good employment; while the adoption of compulsory insurance has strengthened the tendency of workmen's associations to make voluntary provision for such insurance. A large number of associations (275) with a total membership of 1,104,000 have been admitted as satisfying the conditions enabling them to claim the State contribution in aid of their unemployment benefit, and of these members more than half are outside the insured trades.

Inasmuch as the Act has only been in operation during a time of exceptional trade prosperity, it is too soon to judge of the ultimate economic and social effects of the scheme. Its working during a period of depression has yet to be experienced. At any rate, there is a prospect that the insured trades will enter upon their next period of depression with an accumulated reserve fund of some millions sterling laid up during the present period of prosperity, together with an organisation already in being capable of applying that reserve to meet the needs of each of the trades in every part of the United Kingdom.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Continued from page* 890.)

Apart from the new departure in the way of electric engine starters, the most outstanding feature of the 1914 models of the leading motor car manufacturers is the provision of an electric lighting equipment; although still mainly employed on large cars, and those used for town purposes, electricity is rapidly ousting acetylene as the medium of illumination, even on more popular-priced cars, the range of electric lighting sets now available not only being extensive, but including some that are well within the reach of even the most humble motorists. Indeed so rapidly is the number of different dynamos increasing that at the present rate, there will soon be as many machines as there are makes of motor cars. At the recent Exhibition, I counted no less than 32 systems—not including those in which the dual work of car lighting and engine starting is combined—and those displayed do not include all that are at present on the market.

While there are many what may be termed intermediate systems, the principal means of current, voltage and output regulation range themselves into two main classes—one in which the work is accomplished electrically, that is, either by counter winding, subsidiary poles or extra brushes, and the other in which any increased speed of the dynamo is checked or prevented by centrifugally-controlled slipping clutches or other mechanical means. Without entering into a consideration of the relative merits and drawbacks of slipping-clutch and electrical current regulation, the opinion may be expressed that the tendency would appear to be in the last-named direction. Probably the greatest drawback to the system is the heat that is generated, but in many of the modern dynamos this is a difficulty that has, by careful design, been largely overcome. In fact, generally speaking, the dynamos show many improvements in detail; not only are commutators being made larger and wider, with the view of increasing their useful life, but the brush gear has been made either larger or has been duplicated, and, at the same time, rendered more accessible. There is a tendency, too, to run the machines at a slightly slower speed. Another indication that electric lighting has become the recognised medium of car illumination is seen in the fact that whereas a few years ago, the dynamo had to be located as best it could on a car, many of the leading motor manufacturers have now so re-designed their engines or chassis that even when electric lighting is not made a part of the standard equipment, provision is made for the driving of a dynamo, so that a generator can be added at any time. Just as, however, there is variation in the different dynamos, so is there a wide divergence of opinion as to the most suitable location of the generators and in the methods of driving the same. There is, furthermore, no standardisation in the methods of driving, for these comprise almost every possible form—belt, pinions, chain, and friction, and, in some cases, a combination of two of these methods. One feature of the growing popularity of car electric lighting has been the revival it has brought about in the business of accumulator makers, who with the advent of the magneto as the medium of ignition, experienced a considerable falling off in demand for the 4-volt batteries, which formerly supplied the current for ignition. As regards the switchboards used in connection with these lighting installations, these have probably undergone more improvement than even the dynamos. Not only are they now made almost entirely of metal, but more attention has been paid to the wiring connections, and to the form of switch used. In most cases, too, an ammeter and voltmeter are neatly embodied in the board. A good deal of the success or otherwise of a car-lighting installation depends not merely on the dynamo, battery, switchboard and lamps, that have been briefly touched upon, but on the methods and care adopted in connection with the wiring. A good feature to which attention may be drawn is that junction boxes are being employed, to which all the wires that must be partially on the chassis and partly on the body of the car, are connected.

From the following brief description of the different lighting systems displayed at Olympia, it will be noted that, the same as with the engine starting question, there is a wide diversity of opinion on various questions associated with car lighting by electricity, among them being the must suitable voltage, and the question of single or double wiring, all of which tend to show that there is little chance of standardisation for some time to come. It is therefore necessary, as has already been pointed out in the *Review* for each maker to issue with his productions a comprehensive handbook, written in non-technical language, so that users will be able to easily make themselves cognisant of the care and attention that must be given to the particular system adopted.

The C.A.V.—Dealing first with the British machines, it may be mentioned that the C.A.V. dynamos of Messrs. C. A. Vandervell and Co. continue to occupy a leading position among the many car-lighting equipments now on the market. They are being made in about half a dozen different sizes, and with voltages of 6, 8, and 12, being designed to meet the varying requirements as to output and driving speed. The feature of all the machines is the self-contained method of securing a steady output. The dynamo is provided with four poles, two of which are unwound and two wound in the usual way. Certain coils of the armature are continually short-circuited, the effect being that the magnetic flux is so distorted that the unwound poles become magnetized, the current passing to the battery in the usual way. As soon as the E.M.F. reaches a certain value, the subsidiary coils begin to act in opposition to the main ones, and as this antagonistic action increases in exactly the same proportion as the strength of the main fields is increased, a perfect balance is maintained between the two, thus preventing the current output exceeding a pre-determined limit. The machine, which is designed to commence to deliver current at about 400 R.P.M., gives its full output at 1,150 revs. Instead of an electric cut-in and cut-out device, a free-wheel clutch on the armature spindle, prevents the battery from discharging itself through the dynamo at low speeds of the latter. An improved form of brush gear is now fitted to the machines, there being four separate, wide brushes, the design being such as to ensure almost indefinite wear.

The Dependence.—A newcomer is seen in the "Dependence" dynamo, introduced by Messrs. J. and R. Oldfield, Ltd. The machine is of circular shape, the brush gear and commutator being enclosed by readily-detachable covers. The field magnets are shunt wound; the former-wound armature coils terminate in a commutator built up of 48 segments of hard-drawn copper, insulated from each other by mica. Radial-type coppered carbon brushes serve to collect the current, they being held in firm contact with the commutator face by four springs of the "safety-pin" type. The control of the current output is effected by the special shape of the two pole pieces, which cause an opposing current to be generated in the field windings, of a strength dependent on the distortion of the magnetic field, which is again proportional to the armature speed. Above a certain point, which is coincident with the attainment of the maximum output from the dynamo at a speed of about 1,750 R.P.M., the magnetic flux decreases owing to this cause; and this, in conjunction with the reaction in the armature coils, restrains the current output to a pre-determined limit, viz., 10 amperes at 12 volts. The automatic minimum cut-out switch, which is enclosed in a cap at the commutator end of the spindle, is of the mechanical type, with only one moving part working on the centrifugal governor principle. A 60-amp.-hour 12-volt battery is used with the set, an 8-volt equipment being also made.

The Kohinoor.—This new machine is made by Messrs. J. T. Williams and Co.; two sizes are made—75-90 watts and 120-140 watts both working at 12 volts. The principal features are the use of a mechanical governor combined with the driving pulley which automatically prevents the machine being driven above a definite pre-determined maximum speed. The controlling switch, which is of the rotary type, is so arranged that whenever the head lamps are switched on, the battery charging switches are automatically put on at the same time; only the side and tail lamps used alone can be switched on at any time without putting the charging switch

in circuit also. Consequently, it is claimed that at no time is it possible to put a heavy strain on the accumulators.

The L.F.—Still another new dynamo is that made on the Lyons-Fellows system by Messrs. Arthur Lyon and Co. The machines, which are made in four sizes—4 volts, 30 watts; 8 volts, 90 watts; and 12 volts, 100 and 200 watts, are of the shunt-wound type with special provision for maintaining a constant output beyond a certain pre-determined speed, ranging from 600 to 900 R.P.M. according to size of the machine, this being effected by weakening the field magnetism as the speed rises. The main feature of the new machine is claimed to be the automatic cut-in and cut-out device which is combined with the switchboard.

The Lucas.—The dynamo lighting system made by Messrs. Joseph Lucas, Ltd., Birmingham, has been on the market for the past few years; the machine, which is of the enclosed shunt-wound type, is made in three sizes, viz., 8 volts, 6 amps., and 12 volts, with outputs of 8 and 12 amps. In the newest design the automatic regulation of the current output is effected by electrical means comprised within the dynamo itself, a third brush being provided to bring about a reversal of current at excessive speeds. It is claimed that a perfectly constant output over a wide range of speed, from 1,450 R.P.M. upwards is obtained.

The Lithanode.—Although still wanting a four-volt dynamo, Lithanode, Limited, have introduced two new machines, giving respectively 8 and 12 volts, with outputs of 9 and 7-8 amps. respectively. The machines themselves are of the usual shunt-wound variety, the feature of the system being that the regulation is entirely effected in the external circuit. The cutting in and out of the dynamo with the battery, which takes place at about 750 R.P.M., is effected by a centrifugally-controlled switch, mounted on one end of the armature spindle. The current is collected by means of two carbon brushes pressing on a couple of gun-metal slip-rings at the rear of the circular disc on which the switch is mounted. The generator delivers its full output at a speed of about 1,350 R.P.M. and, at any speed above this, the current is maintained at a steady level by means of a length of metal wire, which forms a resistance having a high temperature co-efficient. Any surplus production of current is dissipated through the resistance in heat, and this fact is made use of to provide, where desired, an electric foot warmer for the comfort of car passengers.

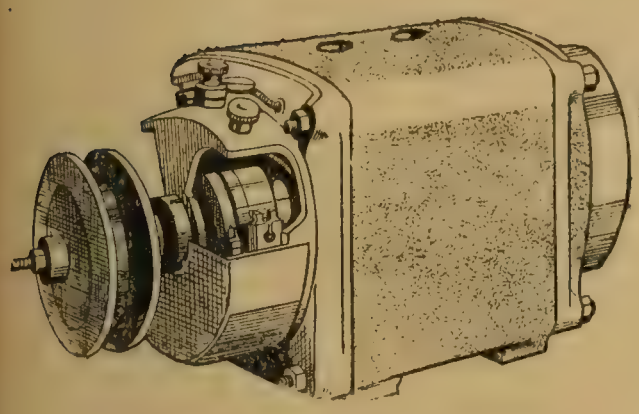


Fig. 12.—Lithanode Dynamo.



Fig. 13.—Lithanode Armature and Cut-out.

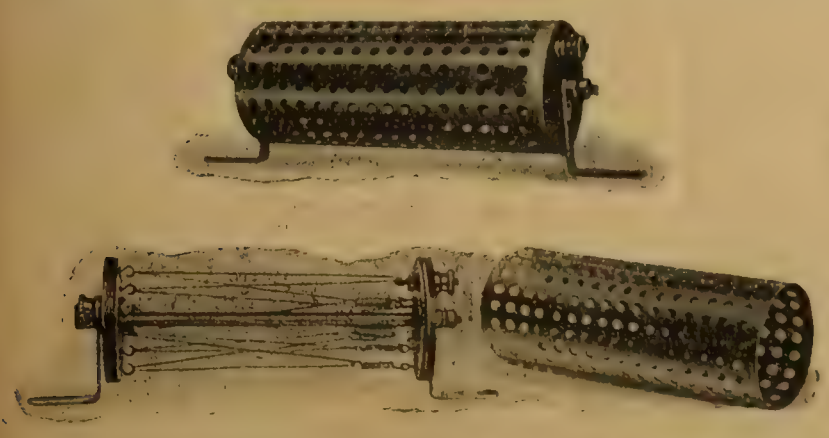


Fig. 14.—Lithanode Regulator, showing Cover Removed.

The Rotax-Leitner.—Among the popular types of car lighting dynamos is the Rotax-Leitner, controlled by the Rotax Motor Accessories Co. As the generator is made on the well-known Leitner system, it need only be mentioned that it is of the simple shunt-wound type with the addition of a third or subsidiary brush. The current from the latter passes through the fields and automatically regulates the dynamo output against fluctuations in speed. At the low speed the subsidiary current assists the excitation of the fields; at normal speed it is inoperative, while, at high speed it is in opposition to the main field windings. Several sizes of the machines are made, all working at 12 volts. The latest departure is a Leitner motor for engine-starting purposes, this being a simple series-wound machine, designed to be used to start the engine either through a friction roller or a pinion, both acting on the engine flywheel. A 20 to 1 reduction is provided for, a motor being also supplied having embodied with it a 4 to 1 reduction gear. A combination dynamo and starting motor is also being made; it is connected with the engine by a silent chain, the gear ratio, as a generator being 2 to 1, and, as a motor, through enclosed gearing, 18 to 1.

The Mira.—The Mira dynamo, made by the High Tension Co., is of the permanent-magnet type, and outwardly closely resembles an ignition magneto, there being only one moving part—the tunnel-wound laminated armature. The cutting in and out of circuit of the generator with the battery is controlled by an improved centrifugal device combined with the driving pulley. In the new arrangement, a curved arm which forms the balance weight, carries a platinum contact maker, which moves outward, closing the circuit, at a predetermined speed. The output of current at high engine speeds is maintained constant by armature reaction, this, however, only balancing the field magnetism and in no way tending to demagnetise the magnets.

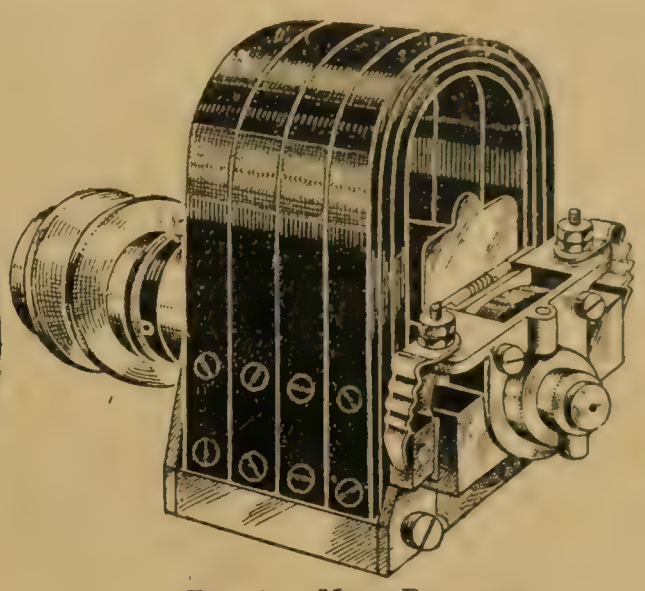


Fig. 15.—Mira Dynamo.

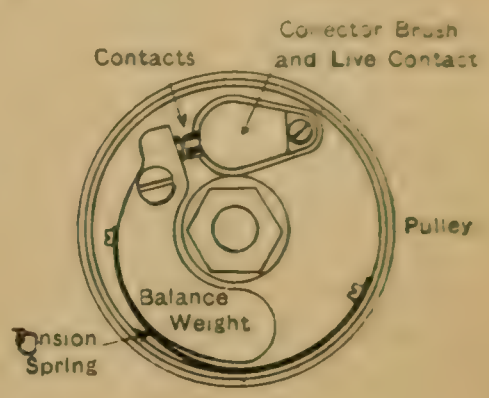


Fig. 16.—Centrifugal Cut-out, Mira Lighting Set.

The P and H.—Messrs. Powell and Hanmer, Ltd., who have for some time been supplying a lighting dynamo of the permanent magnet type, have now substituted for this a generator of the more commonly used design. The machine is entirely electrically controlled, the output at engine speeds beyond the pre-determined maximum, being maintained constant by the use of opposing pole pieces and the special winding of the armature. A feature of the machine is that the automatic cut-in and cut-out switch, which operates at from 500 to 600 R.P.M., is directly mounted on the dynamo above one of the main pole pieces, thus securing, it is claimed, a positive and powerful action of the switch. The generator is only made in one size, with an output of 90 watts at 12 volts.

The P. and R.—Messrs. Peto and Radford, Limited, are making three sizes of their 12-volt lighting dynamos of respectively 250, 150 and 90 watts capacity. The last named is a recent introduction; like the others it is of the plain shunt-wound type, the output of current being prevented from rising above a pre-determined maximum by means of an automatic slipping clutch carried in the driving pulley on the armature spindle. Working in conjunction with the dynamo is a magnetically controlled automatic cut-in switch.

The E.B.C.—The dynamo lately introduced by the Electric Battery Co. differs from most of the others that have been described in that the control and regulation is entirely of a mechanical nature. The output of the dynamo, a shunt-wound machine, is maintained constant, by making provision for it to be driven at a constant speed. To this end the driving pulley is connected with the armature spindle through a special form of four-armed centrifugal clutch which is in full engagement up to a speed of about 1,300 R.P.M., when by centrifugal action the two portions of the clutch become more or less disconnected. The dynamo begins to supply current to the battery at a speed of 250 R.P.M., the usual automatic cut-out to prevent the battery discharging through the dynamo at low speeds being replaced by a special free wheel clutch, as used on bicycles. The machine is made in three sizes, with outputs of respectively 80, 130, and 200 watts.

(*To be continued.*)

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Association of Mining Electrical Engineers.

I am told that to disagree with an editorial is almost as bad as trying to argue with a woman, and that in either case it is quite impossible to get the last word, but I think that some protest is called for by the leading article in your issue of November 21st.

Judging from the latter part of the article on "Electrical Accidents in Mines and their Prevention," it must have been written by someone with a grievance against the Association of Mining Electrical Engineers.

This, of course, is only an opinion, but there can be no two opinions that the writer does not know very much about the Association, or about its members.

I have looked very carefully into the composition of the (North of England branch as given in Volume No. 3 1911-1912) of the *Proceedings* and find that out of 159 members, 111 are employed by colliery companies, as agents, managers, engineers and electricians, 27 are engaged in sales work, eight are engaged in local works, six by the local supply company, five are consulting engineers, one is a boiler insurance company's inspector, and one a professor of electrical engineering.

Since the list given in Vol. 3 of the *Proceedings* was made up, about 40 additional members have joined, all without exception colliery electricians or officials.

Turning to the Committee of the branch for the current year, we find this to comprise one consulting engineer, one professor of electrical engineering, a colliery agent, two colliery managers, one supply company's engineer, seven colliery electricians, and only two who are "members for what they can get out of it," to quote the elegant phraseology of your leader writer.

Of course, the composition of other branches may differ from that of the branch to which I am referring, but as "one of those out for trading purposes," I have neither the time nor the knowledge of the other branches to enable me to give particulars of their composition.

As one who has looked to the ELECTRICAL REVIEW for light and leading during the last 16 years, I trust you will allow me this expression of my regret that you should have allowed your columns to be made the medium for an attack on an Association which, according to the Chief Inspector for Scotland, is doing a great deal towards increasing the safety of colliery working.

W. Baxter.

Newcastle-on-Tyne, *November 25th*, 1913.

[The leader criticised by our correspondent was written by the author of the article which led to the formation of the Association, who is familiar with almost every colliery in the country. Mr. Baxter's analysis indicates that 111 out of 159 members of the North of England branch are "agents, managers, engineers and electricians"; will he go further and tell us how many of these are "electricians"—the class by which, and for which, the Association was founded? One of the leading officials of another branch writes privately, saying that we are "quite right as to the colliery managers being on top in the Association, and any places which they have not captured are in the hands of the commercial members."—EDS. ELEC. REV.]

Electric Clocks.

Having had experience with both the Synchronome and the "Silent" system for electric time service, I was very much interested in the two letters *re* electric clocks in your recent issues.

It would be very interesting to many of us to know what the principles of electric time service are which Mr. G. B. Bowell has habitually transgressed. If Mr. Hope-Jones refers to the fact that in the "Silent" system the duration of the working impulse is longer than his economical mind approves of, I can only say that I consider the strong point of the Silent system is that every dial has the current on amply long enough to ensure the proper mechanical action of each dial. If the duration of the impulse is very short then any slight mechanical sluggishness in any dial results in that particular dial either missing fire altogether or getting along by the "skin of its teeth."

Batteries are cheap and skilled attention is dear.

If the "Judgment of Solomon" was pronounced on the "Short impulse babe," I can understand why Mr. G. B. Bowell would have willed its death. Nevertheless, I do not think that Mr. H. T. W. Bowell gives Mr. Hope-Jones the credit which is his in the technical development of electric clocks.

A. J. Bousfield, A.M.I.Mech.E.

Broadstairs, *November 25th*, 1913.

Joints in Submarine High-Pressure Cables.

In your issue of July 11th last appears a description of a submarine cable installation in the Baltic, in which it is stated that the installation in question affords the first instance of joints in high-tension cables being fitted at sea. Interpreting the expression "at sea" in its most general sense as meaning "not on shore," which is the only sense which appears applicable in the present instance, it appears to me that the installation in question is comparable with the installation of submarine cables across Sydney Harbour in the year 1902. In that particular installation, each of the two cables laid, consisting of three-core 37/16 paper-insulated, lead-covered, and double-armoured cables, contains several joints, made, as in the installation you describe, on a barge and lowered into water to a depth in some cases of 100 ft. After one unsatisfactory attempt, a suitable joint was evolved, and the cables laid with these joints remained in operation for several years until pulled up by a ship's anchor, as described in one of your issues at the time. I believe I am right in saying that the installation I have described was the first instance of submarine high-tension cable joints at such a depth, and I am glad to be able to say that the credit for these joints was due to the British Insulated and Helsby Cables, Ltd., at that time the British Insulated Wire Co., who were contractors for the cable, and my object in writing this letter is to direct attention to the fact, in order that credit may be given to the British firm, instead of priority to a German firm, as in your article.

O. W. Brain,
Electrical Engineer, New South Wales Government Railways and Tramways.

Sydney, *October 23rd*, 1913.

Diesel Engines.

Referring to my letter of November 17th and to your footnote, I said "articles," and was not particularly referring to your leader. The suggestion of panic was your own—"nerves" is a very different thing. Were my suggestions "derisive"? Anyhow, one is Mr. Taylor's, and appears in his report.

I am afraid I am rather inquisitive, but I do want to know why, if a reflux valve consisting of a box, a cage, and a ball is such an improvement and safeguard, it has not been put on the market and on every running Diesel engine long since? Might I very, very humbly venture to suggest that a "Sparklet" bulb be substituted for the ball.

I agree with you that Mr. Taylor's report is a very "model," and though we may differ with his conclusions, we must agree that it is well thought out, very practical, and worthy of careful consideration by anyone interested in Diesel engines.

Messrs. Elliott are the only firm who responded to my invitation to send particulars of a blast pressure recorder, and I fully expect that in time to come these instruments will be fixed with every Diesel engine.

C. J. Wood.

Sale Electricity Works.
December 1st, 1913.

A Question of Terms.

I am continually coming across the terms "fool-proof" and "mistake-proof" in reading descriptions of switchgear in your journal.

Previously the term was always "fool-proof," and one sees this term applied to the simplest as well as to the most complicated pieces of apparatus. Lately, in many instances, the term "fool-proof" has been replaced by "mistake-proof," evidently with the idea of conveying some fresh meaning.

It would be interesting to receive from your readers their definitions of these two terms.

P. W. Laverick.

London, S.E.

Canadian Electrical Trade.

In your last issue I replied briefly to a criticism by Mr. Leonard Andrews, and I then stated that I found myself in agreement with Mr. Andrews on the broad principle of Canadian electrical trade, but that I differed in specific details.

I venture to give below one or two of the details to which I referred.

In Mr. Andrews's fifth paragraph he says:—"My own opinion is that the interests of British investors who, according to Mr. Berry, have provided considerably more than half the funds for Canadian fire insurance, have been far better protected by rules and regulations drafted to cover the actual apparatus in general use than if they had been broadened to include apparatus manufactured in accordance with British practice, which is at present almost unknown in that country."

Surely, Sir, this method of reasoning is somewhat illogical. Surely it is putting the cart before the horse.

I submit that British investors would be better protected if the rules and regulations were drawn up in such a manner that they would admit the best electrical practice, irrespective of whether the goods are manufactured in Canada, the United States or Great Britain. In other words, the degree of safety to be obtained should be specified; not the method of carrying it out.

If we paraphrase Mr. Andrews's remarks with the context of his letter, he says: "My own opinion is that the interests of British investors *in Canada* have been far better protected by rules and regulations *drawn up by a committee of American specialists and represented by the National Board of Underwriters of Chicago*, and drafted to cover the actual *apparatus manufactured by American manufacturers*, and in general use in the United States and Canada, than if they had been broadened *with the assistance of British engineers* to include apparatus *manufactured by British electrical manufacturers* in accordance with British practice which is at present almost unknown in Canada."

Mr. Andrews says he agrees with me that the National Electric Code is built up "around the specialities of American manufacturers." Is it, then, surprising that apparatus manufactured in accordance with British practice is at present almost unknown in Canada? I think Mr. Andrews has unwittingly supplied the reason, but my untutored commercial mind finds it difficult to understand how the British investor has been "far better protected."

The next detail in which I differ from Mr. Andrews is in connection with the life hazard in Canada. The National Electric Code is not drawn up to safeguard life, except incidentally the loss of life by fire. A brief perusal of the Code makes this very obvious, but this point need not be laboured, for the Underwriters' engineers themselves admit that it was not their primary intention.

An insurance scheme for considering the life hazard, apart from the fire hazard, has, I am informed, been conceived by a prominent official of the Underwriters' Bureau, but it has never matured. It is obvious, however, that the life hazard cannot well be protected unless such regulations are enforced by the State under penalty.

In my original letter I referred to the inconsistency of a Code which insists upon an insulating lining for a metal cover to a 3-ampere switch, but at the same time allows in the same factory a switch of different construction one hundred times larger without any protective cover whatever. I do not wish to labour this detail either, for the Underwriters' engineers themselves admitted this obvious inconsistency.

Their defence, however, differs from the defence put forward by Mr. Andrews. They replied that their business was primarily to look after the fire hazard.

Mr. Andrews has wrongly assumed that it is only main switches which are allowed to be of the open type without any protected cover, but this is not so. Under the National Electric Code any branch switch from 5 amperes upwards, controlling a motor or any other piece of machinery, can be, and generally is (until the first or second accident occurs), left entirely exposed. No defence is offered for this inconsistency. It is an admitted anomaly.

It is because the Code has been built up "around certain well-known American specialities," instead of the specialities being built up around a suitable Code. It is the cart before the horse again. Mr. Andrews has also assumed that I take exception to an insulated cover to a 3-ampere switch, but I did not say so. I only drew attention to the inconsistency of a Code requiring it on a small switch, and not on the larger sizes. I accept the challenge, however. In point of fact, how many millions of 3-ampere switches are there in this country in use to-day, and how many have fibre covers? They are, as everybody knows, practically obsolete. In Canada the normal voltage is 110; in this country it is anything between 200 and 250, a much more difficult condition. In the early days when the voltage of supply was changed in this country from 100 to 200, a few engineers, out of a desire for extra precaution, specified a fibre lining for the tumbler switch, but it soon died a natural death; but what a calamity it would have been if our Fire Insurance companies, having heard that a few people had received a shock in a bathroom, made it compulsory that the other millions of switches of the same class should have fibre-insulated covers. Every self-respecting contractor would put up an all-porcelain covered switch in such a position in a bathroom, or ground a metal cover.

Some of our Fire Insurance companies possess engineers whose experience of wiring work is unsurpassed in any country, but I have never yet known any one of them who called for a fibre lining to the cover of a 3-ampere switch, nor have I ever heard of an outbreak of fire arising because this precaution was omitted. I should like to hear the opinions of, perhaps, two of our best-known fire insurance experts, Mr. Castle Russell and Mr. Lester Taylor.

In my letter to the *Canadian Electrical News* I stated a case showing another example of the danger of building a code around any speciality. I refer to the wholesale and injudicious use of the cartridge and plug fuse upon 110 volts alternating. What is the net result? An annual dead loss to the country of hundreds of thousands of dollars, or the admitted alternative, when the cartridge is abused—"not fuses, but fireworks."

This latter case is not criticism—it is a mere statement of fact, which up to the present I have not heard disputed. I trust, if there is a sound defence, it will be communicated to your journal. The mere plea of "interchangeability" cannot justify the situation. What I claim, as a prospective Canadian manufacturer with an increasing stake in the Dominion, is that we need to "get together" upon equal terms, without regard to nationality, to remove the admitted anomalies in the National Electric Code (as regards its application in the Dominion).

Is there any American, Canadian, or Britisher who thinks this unreasonable? If so, I trust he will accept the hospitality of your columns to give his reasons.

Herbert H. Berry.

London, *December 1st*, 1913.

Remarkable Motor Records.

I regret that time will not permit me to reply to the letter appearing in your issue of November 28th as fully as I should wish, but I hope to be able to do so next week.

Meanwhile, I would point out that if the machine described by your correspondent was run under the same conditions as the machines described in your article of October 10th, which have to run at 650 R.P.M. with less than one-third their full field, instead of 80 B.H.P., it would only be giving about 26 B.H.P.

H. Chitty.

London, N., *December 2nd*, 1913.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Standard" High-speed Alternator.

Mr. W. P. Durtnall, in collaboration with Mr. A. H. Binyon, has recently worked out a remarkable type of alternator, which offers notable advantages when driven by a steam turbine. While the latter should be run at a high speed in order to attain the highest efficiency in operation, as well as economy in construction, weight, and space occupied, the speed is often restricted by the frequency required of the generator; thus an ordinary 15-cycle alternator, even with two poles, cannot run faster than 900 R.P.M., and a 25-cycle two-pole alternator must run at 1,500 R.P.M. Obviously a great advantage can be gained if the rotational speed can be doubled without increasing the frequency, and Mr. Durtnall claims to have attained this end in his new generator, which embodies principles which have already been utilised in other machines of his invention.

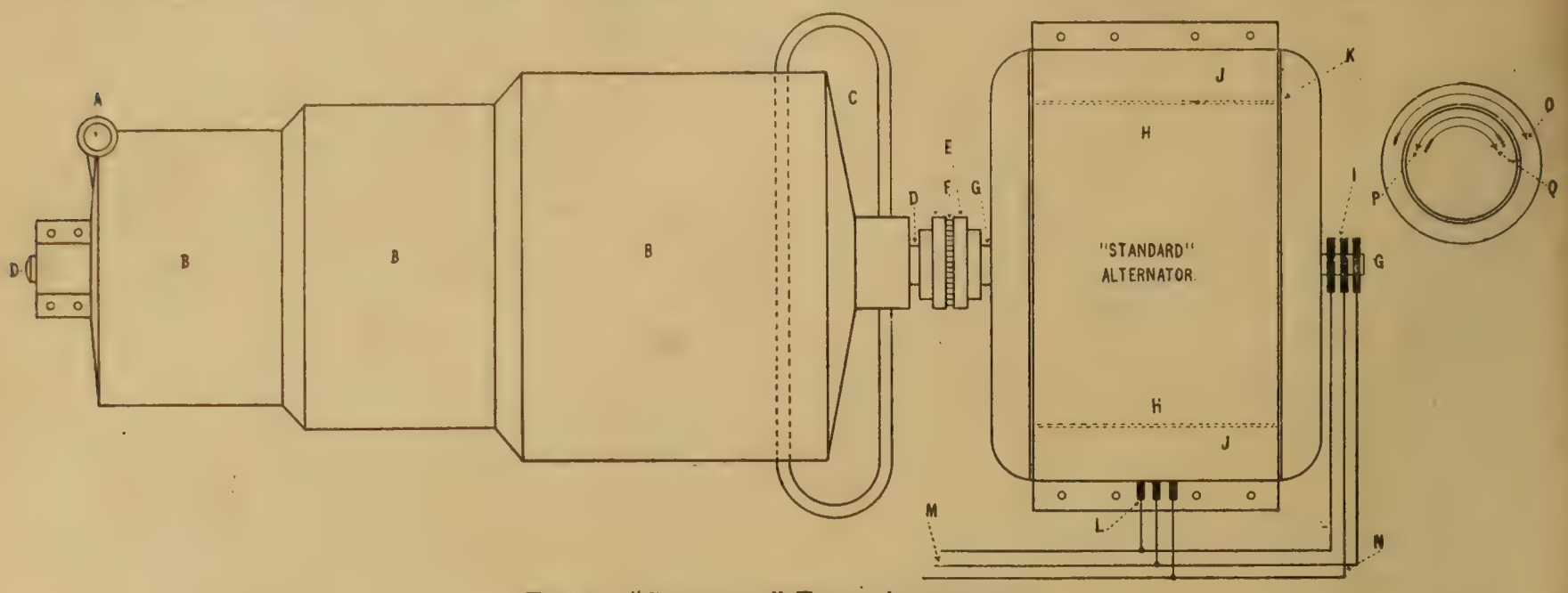


FIG. 1.—"STANDARD" TURBO-ALTERNATOR.

The "Standard" turbo-alternator is illustrated diagrammatically in fig. 1. Steam is supplied to the turbine at A, expands through the stages B B, and is exhausted to the condenser at C; the turbine shaft D is driven at 3,000 R.P.M., and is provided with the universally flexible coupling E, which was described in our issue of October 3rd last, the flexible spring bolts being shown at F. The generator shaft G carries the rotor H, the windings of which are connected to the slip-rings I. The stator J has similar windings of the same number of poles, which are brought out to the terminals L, and the mains M are connected to both the stator and the rotor windings; it will be noticed that the leads of two of the phases are reversed at N.

This generator can be coupled in parallel with other alternators without preliminary synchronising. The process is as follows, starting from rest:—

First the slip-rings of the rotor are disconnected from the stator windings, and three-phase current from the bus-bars is supplied to the stator windings. The rotor slip-rings are now short-circuited through a couple of choke coils, and the machine starts as an induction motor, running up to a speed of approximately 1,500 R.P.M., and driving the turbine rotor. Next, the slip-rings are connected through the choke coils with the bus-bars, the connections being made so that the resulting magnetic flux in the iron of the rotor revolves in the direction shown in the small diagram at P, while the direction of rotation of the stator flux is that shown at O. The machine then runs up to a speed of 3,000 R.P.M. in the direction shown at Q, owing to the interaction of the magnetic fluxes in the stator and rotor. Both of these elements being supplied with alternating current, the rotor runs in exact synchronism with the bus-bar pressure, and when steam is admitted to the turbine, the choke coils being cut out and the connections made as shown in the drawing, the machine becomes a generator. Each element, both rotor and stator, contributes to the output, and there is no separate exciter, though, of course, like an asynchronous machine, the generator cannot operate unless the bus-bars are charged from another source. When, therefore, a "Standard" generator has to take the whole load, a small alternator of ordinary type or a double-current generator must be run in parallel with it, or mounted on the end of the shaft like an exciter.

The inventor claims not only that a 25-cycle turbo-generator can thus be run at 3,000 R.P.M., and, of course, a 50-cycle two-pole machine at 6,000 R.P.M., but also that the electrical design of the alternator is greatly improved by the division of the output between the rotor and stator, giving reduced weight of iron in each member, higher efficiency, a higher critical speed and less vibration. For large machines it will be possible to use four poles, while still running at 3,000 R.P.M., 50 cycles per second.

In the case of a 100-H.P. turbine running at 6,000 R.P.M., the steam consumption per B.H.P. is only 32 lb. per hour; the same turbine, when running at 3,000 R.P.M., gives only 50 B.H.P., and uses as much as 50 lb. of steam per B.H.P.-hour (non-condensing). The improvement shown is due to the higher speed rendered possible by the new design.

These machines are being introduced by the "STANDARD" ENGINEERING ASSOCIATION, of 76, Gladsmuir Road, Whitehall Park, N. At first they will be of foreign make, but we understand that negotiations are in progress for their manufacture in this country.

It may be observed that the principle of independently rotating fields utilised in this machine can be applied also to the design of motors to run at two synchronous speeds, and to other purposes.

Governor Control Switch.

A new design of switch for mounting upon switchboard panels is shown in the accompanying illustration, fig. 2. It is designed to mount upon generator panels for the purpose of raising or lowering the speed of the generator by means of a motor controlling the governor.

The control switch shown is of a double-pole double-throw type, with a spring acting on the drum and returning it to a "mid-off" position when the handle is released by the hand of the operator.

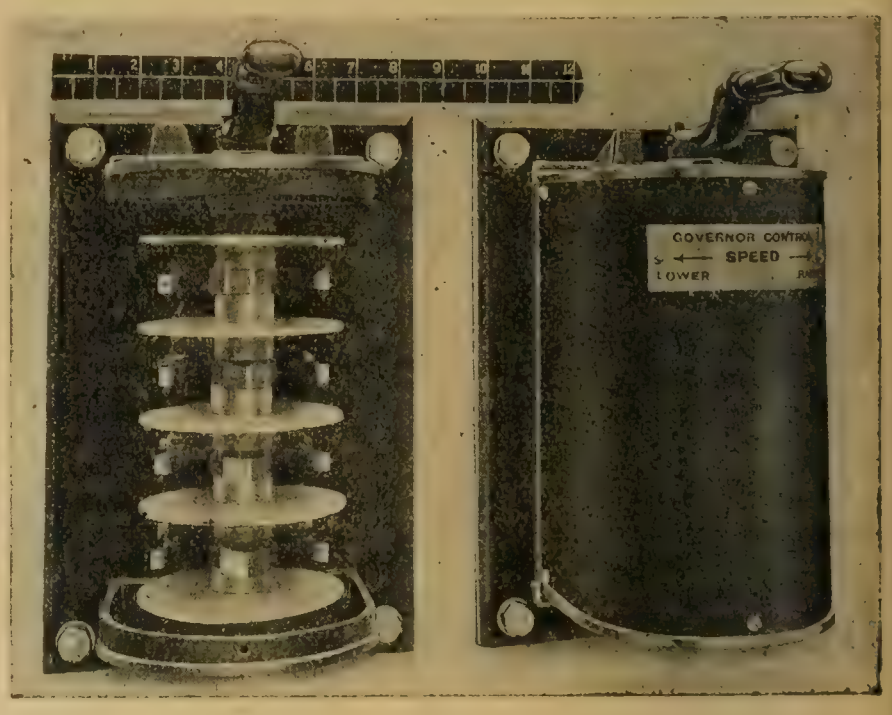


FIG. 2.—GOVERNOR CONTROL SWITCH.

The contacts and terminals are neatly enclosed in a cover which can readily be removed for the purpose of inspection, cleaning, &c.

The device is manufactured by MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne.

Liquid Starters.

A new design of liquid starter has recently been manufactured in large quantities by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., in connection with a number of complete installations for flour mills, cement works, and so forth, with which they have been entrusted. In this starter the cast-iron tanks, which contain the electrolyte, are mounted on a steel framework, the supporting bars being completely covered with moulded micanite—indeed, all tie bars that are required for mechanical strength are insulated throughout their whole length. The plates are lowered into the liquid by the rotation of a handwheel; the gear ratio is high, so that a rapid motion of the handwheel only slowly lowers the plates into the liquid, and it is impossible for the plates to descend by reason of their own weight. For completing the circuit between moving and stationary parts, each phase or pole is provided with heavy contact blocks, in addition to sparking rollers, which protect the contacts in the event of the starter plates being raised while the motor is running without its slip-rings short-circuited.

In view of the importance of keeping down the head room of liquid starters for colliery work, the larger sizes of G.E.C. starters

have been designed with two tanks in parallel per phase or pole, and a considerable reduction in the head room is thereby effected.

The whole of the internal arrangements are thoroughly protected, and enclosed by sheet steel covers. For direct-current work



Fig. 3.—Dust-Tight G.E.C. 400-h.p. Liquid Starter.

with shunt or compound-wound motors, non-inductive field discharge resistances can be accommodated in the bottom of the

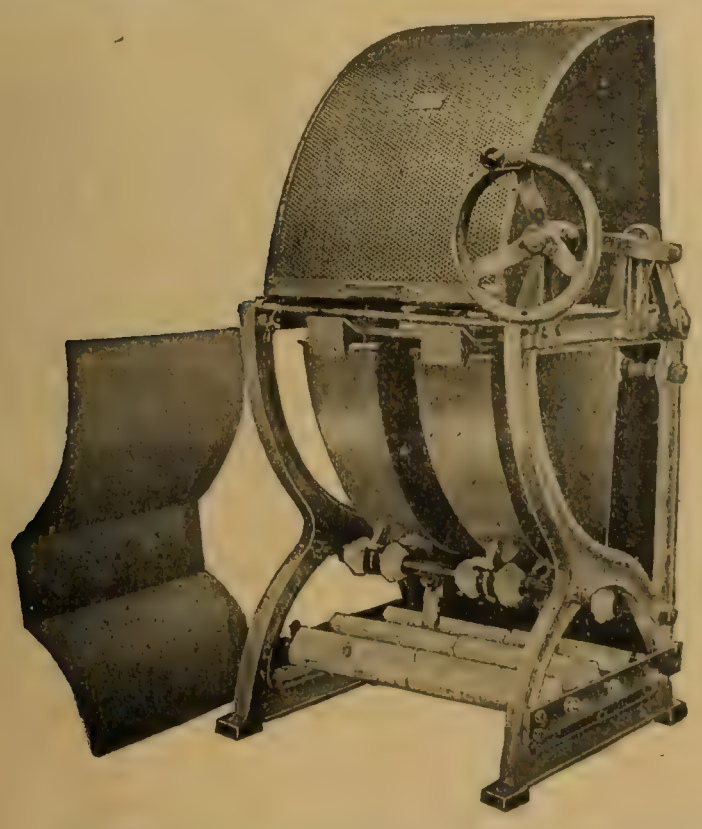


Fig. 4.—G.E.C. Liquid Starter for Continuous Current with Field Discharge Resistance.

starter. These are mounted on porcelain insulators in the fashion shown in fig. 4.

That these starters have filled the demand is evident from the fact that over 5,000 h.p. have been ordered for cement works alone.

British Radium Standard.—The National Physical Laboratory informs us that it is in possession of the British Radium Standard, which has been certified by the International Committee after comparison with the International Standard prepared by Madame Curie, and is ready to undertake the standardisation of radium and mesothorium preparations by comparison with the Standard. For the present, the Laboratory will confine itself to the testing of specimens which permit the use of methods depending on the measurement of the penetrating gamma rays. Tests on radioactive minerals, waters and the like, which are of feeble activity, cannot be undertaken. Particulars of the fees and conditions can be obtained from the Director of the Laboratory, Teddington.

LEGAL.

X.L. Electric Co., Ltd., v. Aron.

This action, which related to the protracted disputes between Mr. Aron, the inventor, and his co-director, Capt. Wiener, came on for hearing before Mr. Justice Neville, in the Chancery Division on November 27th.

Mr. Moritz represented the plaintiffs, and Mr. Aron appeared in person.

Counsel said it was a case in which the company was seeking to restrain a director who had assigned his patents to the company from doing such acts as would prevent the patents from becoming effective. There were sufficient admissions in the affidavits to entitle the company to judgment, but Mr. Aron had put in a counterclaim. He, however, asked for an order for specific performance of the contract whereby the defendant should sell to the plaintiff company the entire benefit of the inventions set forth in the schedule. The statement of claim set out three patents as being in existence. The plaintiffs had in their possession certain letters that showed that the defendant had been requested to assign the patent and had refused to do so. One patent, No. 19,257, was still before the Comptroller, and in May last the defendant wrote to the patent agents, threatening that unless certain things were done he would block the proceedings. The matter was accordingly brought before the Court, and had been the subject of several interlocutory orders. An interim injunction had been granted restraining the defendant from preventing the protection being obtained, and requiring him to do all things necessary to carry out his agreement with the company, and it was now asked that that injunction should be made perpetual.

His Lordship said that the agreement was fairly plain; what was Mr. Aron's objection to carrying it out?

Mr. Aron said that under it the company were to supply the necessary money to complete the protection, and that they had not done.

Mr. Moritz said that the company had always been ready and willing to pay all the expenses under the contract.

His Lordship pointed out that whatever the defendant's rights might be under the counterclaim, there seemed to be no defence to the action.

Mr. Moritz said the same counterclaim had been put in in a King's Bench action which was pending, and had been struck out.

Mr. Aron said he was counterclaiming for arrears of salary, damages for breach of agreement, and wrongful dismissal, and money lent to the amount of £240. He pleaded the breach of the agreement in his defence, and he contended that that was a good answer to the claim for specific performance.

Mr. Moritz said that though a great deal of prejudice had been imported into the case, he was willing to make an offer which he thought would be fair and reasonable. The plaintiffs were clearly entitled to an injunction and to a mandatory order with the object of obtaining specific performance of this agreement, and if the defendant would submit to that they would not ask for costs. They had already paid upwards of £400 in respect of costs of interlocutory matters, and did not think any order for costs against Mr. Aron would be of any value. The company had carried on for a considerable time, but owing to these unfortunate differences it got into difficulties, and Capt. Weiner, who held the debentures, appointed a receiver. There was no claim on the defendant for the patents. Where the patent agents' claims had not been paid they had looked to Capt. Wiener for payment. The company were quite willing to hand over to Mr. Aron the 4,400 shares he claimed. They had the scrip in their possession.

Mr. Aron said that was not of much use now, as Capt. Weiner had secured the assets of the company for £6,000.

His Lordship pointed out that as the company had apparently now no assets, it would not benefit the defendant if he succeeded in his counterclaim and the costs of the action, which would most likely exceed the costs of the counterclaim, even if awarded to him. Mr. Aron must remember that this was an action by the company and not by Capt. Wiener, and whatever claim he might have could not be enforced against Capt. Wiener by counterclaim in this action. The company had a large claim against Mr. Aron for costs, and were willing to give him a clean slate up to that time.

After some further discussion, it was agreed that, on the company's undertaking to pay all the costs incidental to the carrying out of the agreement, and to make no further claim upon the defendant in respect to anything up to that time, there should be an order on the defendant to do all things necessary for carrying out the agreement. As certain documents required signature, it was agreed that the order should not be drawn up until Tuesday, December 2nd, and that the defendant should attend before the registrar on that day and sign them.

Dundee Tramway Accident.

Before Sheriff Neish last week an action by a farmer, who sued the Corporation for £200 in respect of damages alleged to have been sustained by him in a tramway accident, was heard. The farmer, whose van was struck by a car, said he did not think the car was under proper control, and that it was going far too hard. He had learned that the driver was a spare man. Mr. Peter Fisher, the tramway manager, in his evidence, said that under the circumstances the emergency brake was the proper one to use, and that the slipper brake would have been absolutely useless. The Sheriff made avizandum.

Speake *v.* J. Stringer & Son.

At Blackburn County Court, on Monday, before Judge Sturges, Thos. Speake, electrical engineer, claimed £3 5s. from John Stringer & Son, Railway Road, Blackburn, damages for breach of warranty on the sale of a gas engine. Mr. H. Haworth appeared for the plaintiff, and Mr. Riley for the defendants. Plaintiff stated that he purchased the engine, which was a secondhand one, from defendants for £9. The salesman guaranteed that it was as good as new in every way, and in good running order. The engine was fixed, and it was then found that the water jacket had a crack in it. The defence was that defendants did not give a warranty. It was stated on the invoice that the gas engine was purchased "as seen." A verdict was given for plaintiff for the amount claimed.

Baxter & Caunter, Ltd., *v.* Levetus.

In the King's Bench Division Mr. Justice Coleridge and a jury were engaged during three days—November 24th, 25th and 26th—in hearing an action for damages and an injunction brought by Messrs. Baxter & Caunter, Ltd., against a Mr. Levetus.

According to the statement of Mr. Ralph Bankes, K.C., who appeared for the plaintiffs, the claim for damages was made on the ground that the defendant had injuriously interfered with their business, an allegation which the defendant denied. The plaintiffs, said Mr. Bankes, carried on a very considerable business in electrical goods of all kinds in the Tottenham Court Road. The extent of their business might be gauged by the fact that they received about 4,000 letters a week. The defendant was an exporter, and in the course of the case, said counsel, he hoped to be able to show that he (defendant) had entered into an ingenious scheme with one of the plaintiffs' employés to get their business away. The scale of prices for the home trade was a good deal more than that for the export trade. The firm sent out two lists, one of which was for the home trade, which was a very large one dealing with everything connected with electrical appliances. There was also a dead net price-list for the export trade. This list was sent amongst others to the defendant, who had another name under which he transacted certain business—(Rodwell & Co.). He sent out a circular letter to about 45 of the plaintiffs' customers, in which was enclosed a copy of plaintiffs' export price-list, and in which special goods were offered at such prices. Thus he endeavoured to sell plaintiffs' goods in this country at the export prices, and when Rodwell's obtained an order the defendant sent a similar order to the plaintiffs as an export order. Then having got the goods at export prices he sent them out from Rodwell & Co., thus cutting the plaintiffs' home trade.

A number of witnesses were called in relation to the manner in which the plaintiffs' trade had been affected by the defendant's conduct.

In the result the jury found for the plaintiffs, assessing the damages at £10.

His Lordship entered judgment for the plaintiffs for the amount of the verdict, with costs on the High Court scale, and gave liberty to apply as to the injunction, if necessary.

Workmen's Compensation Claim.

At Manchester County Court on Tuesday, before Judge Mellor, Charles Martin, aged 29, claimed compensation in respect of an accident, from Messrs. Mather & Platt, of Park Works, Newton Heath, by whom he had been employed as an electric crane driver.

Applicant told the judge he was driving a crane down the shop empty, and moved a lever which brought it round to the right, where it struck some machinery. He received a shock, he alleged, through the crane coming into contact with the machinery. After the accident he was attended by a doctor, and later was an inmate of the Booth Hall Infirmary.

The respondents, for whom Dr. Eastham appeared, contended that the applicant could not possibly have received an electric shock in the manner alleged, that the man suffered from general paralysis, and that his condition was in no way connected with any accident. It was stated that Martin could not have received an electric shock, as an examination of the electric wires after the accident showed that they were quite intact.

The Judge, having received the report of the medical referee's examination of the applicant, decided in favour of the respondents, stating that the doctor found that Martin's condition was entirely due to natural causes, and could not have been caused by any accident, let alone such has had been described.

Dr. Eastham said he would not ask for costs unless there was a Union concerned in the case.

The Judge: Have I power to grant costs against a Union? I have no evidence before me that there is a Union.

Mr. Thorpe: I will satisfy my friend at once that there is no Union.

Dr. Eastham: That being so, I don't apply for costs, but I should have done so if there had been a Union.

Hankow Light and Power Co., Ltd.

In the Chancery Division on November 26th Mr. Justice Joyce heard a motion by the plaintiff in the action referred to in our last issue, to restrain the defendant company from declaring a cumulative dividend on their ordinary shares in prejudice to the rights of the holders of deferred shares.

Mr. Stone on behalf of the plaintiff, said that Article 5 of the memorandum of association provided that ordinary shares should be entitled to a non-cumulative dividend, but Article 6 gave the company power to reduce and sub-divide capital, or to issue any shares original or increased "with any preferential rights, privileges or position as to capital dividend or voting." All the shares issued had been allotted between February 9th and March 1st, 1906, and the complaint was that on February 9th a meeting was called for the 16th to consider a resolution for giving the ordinary shares a cumulative dividend. It was, he submitted, an abuse of the powers of the company to call a meeting with reference to the rights of shareholders and then allot deferred shares to people who probably knew nothing about it, but whose rights would be affected. Although the resolution had been passed so long ago, the company had only recently come into a position to pay dividends, and therefore the question had not arisen until now.

Without calling on counsel for the company, his Lordship refused the motion on the ground that the plaintiff had not made out his case, but said he was by no means clear that at the trial the plaintiff might not be entitled to relief.

Tramcar Obstruction.

The driver of a motor-lorry has been fined £3 and costs for obstructing a tramcar of the East Ham Corporation, in Barking Road, on November 11th. The lorry remained on the metals running at a speed of 3 or 4 miles an hour, while a tramcar gong was sounding in its rear for eight minutes.

Electricity in Mines: Prosecutions.

At Doncaster West Riding Police Court, last week, George Williamson, electrician, of Mexborough, was fined 5s. and costs, for having committed a breach of the Mines Act by leaving his lamp-holders, which were terminals, on a live electric circuit, in the Denaby pit approach, in an unprotected state, rendering open sparking liable to take place.

At Airdrie Sheriff Court on Monday (December 1st), David Reed, colliery electrician, Armadale, and James Eadie, certificated manager of No. 11 Blairmuckhill Colliery, Harthill, were charged with having in the case of the electrician, failed to make a thorough examination of all the electrical apparatus in that mine, including the testing of earth connections and metallic coverings, and in the case of the manager with failing to have electric cables covered with insulating material, with the result that some of the cables specified in the complaint had been left bare and open to danger. Both respondents pleaded guilty, and it was explained that they did so to a technical breach only. The mine had had an installation of electrical plant for over 14 years, and during all that time its working had been absolutely satisfactory until quite recently it was recognised in practice that a qualified electrician was responsible apart altogether from the responsibility of the manager, and it was in consequence of a recent decision of Sheriff Shennan, at Hamilton, that that view was disturbed. In this case it was thought that there would be justification for distinguishing between the manager and the electrician, and that no penalty should be imposed on the manager and a nominal fine on the electrician. The Fiscal pointed out that the Inspector of Mines was strongly of opinion that electrical apparatus in all mines should be in such a condition that no accident to the workers could occur. The charges against the manager were of allowing cables in the roads to be bare and open, with the serious risk of workmen coming in contact with those charged cables. The electrician was bound by the rules to make daily inspection of all the electrical plant within the same mine, and at once report defects and get them put right. In this case there were a great many parts of the cable bare, and the consequences might have become serious if the cables had been charged.

Sheriff Lee said the fact that heavy penalties were imposed under the Act on ordinary workers contravening it, made it quite necessary, when the management was at fault, that there should be considerable penalties enforced. He thought he was justified in looking upon the charges here as being against the management of the colliery, and that the person primarily responsible was the engineer. If the manager put a qualified electrician in charge of his mine, it was difficult to see how he could do more, but he, personally, was not supposed to be an expert in electricity himself, and interference on his part might not only be an impertinence, but a danger. At the same time, the manager was technically wrong if he did not discharge the duty of supervision, so that ultimately he was responsible.

His Lordship fined the electrician £5, but imposed no penalty on the manager.

London Tramways Assessments.

In the Divisional Court, before Mr. Justice Bray and Mr. Justice Lush on Tuesday, Mr. E. Charles, K.C., appeared on behalf of the Islington Assessment Committee, to show cause against a rule for a mandamus granted in July last, ordering the committee to appoint a person to make a provisional valuation list with a view to inserting a portion of the London County Council tramways in the borough at a reduced assessment in consequence of a reduction in profits owing to motor-'bus competition. According to the report in the *Daily Telegraph*, Mr. Charles said that in order to

justify a reduction in the assessment it must be shown that the reduction was substantial, continuous, and permanent. The Assessment Committee, some time ago, appointed a valuer who had formed his own conclusions on the figures supplied by the London County Council themselves. He had come to the conclusion that there was no *prima facie* case for reduction at all. The quinquennial valuation was never intended to be disturbed by trade fluctuation.

Mr. Ryde, for the County Council, maintained that for the purpose of ascertaining whether there had been a reduction in profits the figures for the year in question must be compared with those of the preceding year, and not with those of the year in which the quinquennial valuation had been made.

Mr Justice Bray said it was necessary not to look merely at the reduction which had taken place during the year preceding April 5th, 1913; they must go back a little further. One could only have the impression that the 'bus traffic must have had a considerable effect upon the receipts of the tramways running along the same routes. He was of opinion that sufficient continuity of decrease of profits had been shown, and that this was not a mere fluctuation. It was also clear that the Assessment Committee had gone wrong on a matter of law.

Mr. Justice Lush said that, in his opinion, a *prima facie* case had been made out. Therefore the mandamus ought to go.

The Court made the rule absolute for peremptory mandamus, with costs.

REVIEWS.

Switches and Switchgear. By Prof. R. Edler. Translated by P. Laubach. London: Constable & Co., Ltd. Price 15s. net.

Up to the present there have been very few books dealing with switchgear printed in English, but apparently this dearth will rapidly be remedied. This translation of Prof. Edler's well-known and comprehensive work will decidedly help to fill the gap, although it naturally deals far more extensively with German than with English practice, and further, in several instances, the book does not correspond with modern ideas of design. For example, in the introductory chapter, special attention is directed to the statement that the hinge or pivot of a switch must not carry current—a false idea which has been exploded for a considerable time.

Chapter II deals with the design and proportioning of connecting leads, cable sockets, contact blocks and so forth, and the treatment is detailed and thorough. In large switchgear the dimensions are fixed by the permissible temperature rise of the current-carrying parts, and due attention is paid to this.

In Chapter III we have a discussion on the design of contact springs, brushes, carbon contacts and devices to eliminate sparking at the main contacts. A number of illustrations are introduced, and though to a somewhat small scale, they are so beautifully executed as to show the various types of construction quite clearly.

A good description of several types of switches and change-over switches is given in the succeeding chapter, together with some empirical rules for determining centres, &c. The essential principle of the quick-break switch is emphasised, *i.e.*, it is pointed out that it consists in making the speed of breaking a circuit independent of the speed at which the switch lever is moved, so that no matter how slowly the lever is moved, the path of the current is always opened at one and the same predetermined speed. The design of the necessary tension springs is entered into in detail.

Chapter V deals with the delicate subject of high-pressure switches. The difficulties associated with such apparatus are fully discussed, and the methods for successfully overcoming them are clearly described, although the reviewer would not care to see several of those illustrated on a high-pressure circuit. The numerous forms of horn-type lightning arrester, and the multiplicity of oil switches now on the market, receive detailed attention.

The design of fuses for all types of circuit is next dealt with, and a great quantity of information is given, being based, of course, practically entirely on German experiments, which appear to agree, however, as far as the reviewer has been able to check them, with the classical experiments on this subject by Prof. Schwartz.

Chapter VII is devoted to the discussion of automatic circuit-breakers, time-limit and reverse-current relays. The principles underlying the various contrivances are first explained, and then a large number of fairly well-known automatic switches are examined in detail. Several useful connection diagrams are included in this chapter.

By far the largest chapter in the book is the next, dealing with starting and regulating switches and controllers. The theory of the calculations for the starting resistances for direct-current motors is first expounded, and exemplified by its application to a 10-H.P. shunt-motor. Kapp's graphical construction, as given in "Die Gleichstrommaschine," is described at considerable length. The theory of starters for alternating-current motors is next dealt with in a similarly satisfactory manner. Regulating resistances for all types of generator and motor are then considered in great detail. A large amount of analysis is used, and this is quite in order from the point of view of accuracy. The mechanical design of the resistances, such as the pros and cons of circular coils, strip, &c., is then discussed, a large number of useful illustrations being given. Automatic and relay starters receive a due amount of consideration in the succeeding section, and finally the tramway type controller is discussed in relation to the large field of work for which it is peculiarly adapted.

The concluding chapter deals solely with battery switches and their appendages, and is quite satisfactory; a short index is added.

As a whole, the book is quite desirable, although practically all the references refer to German publications and researches, while the account of the apparatus made by one firm, and the frequency with which its name appears in the text and in footnotes, get rather monotonous after a time. English units and dimensions are used as a rule.

The book is well printed and bound.—H. G. S.

Graphs in a Cable-Ship Drum-Room. By E. Raymond-Barker. London: H. Alabaster, Gatehouse & Co. Price 2s. 6d. net.

This work is a reprint of the articles which appeared in the Electrical Review this year, treating of different ways in which the usual calculations relating to cable operations can be made—namely, the length of cable picked up or payed out in a given time, the rate at which it enters or leaves the ship and the percentage slack in paying out.

Dealing with the first-mentioned topic, the author gives a curve or ratio graph showing the variation in the drum constant for different sizes of cable on a drum of given dimensions. The increase of length per drum revolution for different sizes of cable is further considered as a percentage, and the length of cable in an actual case for a given number of revolutions is worked out by the aid of a curve or ratio line of percentage, as well as by the customary method. While such a way of arriving at the true length picked up might be regarded as an instructive alternative, we hardly think the author would recommend it in place of the single calculation usually made, namely, dividing the revolutions by the drum constant for that particular cable. For the percentage method involves three arithmetical calculations, as well as a curve observation, thus introducing greater liability to error, and requiring more time.

The same may be said of the example given on pages 21 and 22, in which four types of cable are successively payed out. By the usual method of computing the lengths, only one calculation (division) is required for each type of cable, but in the graph method described it is necessary to inspect a curve to obtain the percentage increase of length and then make three arithmetical calculations (division, percentage of mileage, and addition). Thus in this particular example there are 16 things to do by the graph method as against four by the ordinary calculation.

In Example 34 the uncorrected constant given does not agree with the lettering in fig. 3 referred to, which leads to confusion; probably d_3 should be substituted for d_1 in the text, and if so the correction should be made in three places on pages 20 and 21.

Certain marks appear on the curves or graph lines in figs. 3 and 4, indicating values stated to be taken from the tabular records of two cable expeditions. This rather conveys the impression that the data referred to have assisted

in the plotting of the ratio lines, especially as the points are marked thereon. It would perhaps be as well to explain that the only dimension necessary is the drum diameter or circumference. The graphs or ratio lines can be plotted for a given drum to cover any range of cable or rope circumferences without reference to, or confirmation by, any tables used in expeditions. They are hard and fast physical relationships, and the various points marked on the lines are for that reason bound to fall thereon. If two points only are calculated, one at each end of the scale, and a straight line is drawn connecting them, that line will be correct for all intermediate values.

The introduction of the drum constant reciprocal on pages 14 and 15 is a little unfortunate, as it is never required and means the extra complication of a figure to six or seven places of decimals. Division on the flat slide rule is more readily performed than multiplication, and where both operations are successively required practised hands always make the division first, for well-known reasons. In examples 36, 37 and 79, it would be more straightforward to use the drum constant instead of the reciprocal. It might have been explained that it is not practicable to measure cable circumference to the third place of decimals as in the list on page 14 by the method given on page 16, nor is it possible to read to the third place of decimals in the chart on page 15 even when the dimensions of ordinates are doubled.

In the reference to drum-revolutions per minute on page 21, it might have been explained that in accurate work it is impracticable to observe fractions of a revolution on a rotating drum or measuring wheel, and the revolutions over a period of several minutes must be taken and divided by the number of minutes. For instance, the drum speed of 45·7 revolutions per minute and the measuring wheel speed of 118·3 revolutions per minute given on page 32 would be taken this way. When time admits of only one minute or thereabouts for an observation a whole number of revolutions must be counted, say 40, and the time in seconds taken by a stop-watch. Then the correct revolutions per minute is obtained by dividing the revolutions by the time in seconds and multiplying by 60.

Dealing with cable slack calculations, the author describes the use of his "calculator board" applied to this purpose. Of the two arrangements shown on pages 28 and 32, the latter is probably the more useful, being limited to the cable drum and measuring wheel speeds in common practice. The board on page 28 might with advantage have been omitted altogether, as it deals with so wide a range of speeds that three sets of percentage lines are required, and liability to a mistake in using the proper set of lines would be an unreliable feature in actual work if such a board were employed. The board on page 32 should involve no liability to mistake in careful hands, but its use would not appear to save any time, as attention to accuracy is necessary in setting the cursor threads at the correct figures and fractions, and in making sure they are set truly square. The means provided for setting the threads described in paragraph 84 are not very satisfactory, and might be improved in obvious ways. The relation dealt with is between three quantities, any one of which may be determined from the other two, and such calculations can be made expeditiously enough on the slide rule.

The author appears to have seen the necessity of some simpler appliance if any aid to such calculations is required, and in the last few pages shows the lines on which he has developed the disk calculator. This is a more simple appliance, free from the disadvantages of the calculator board above referred to. Many such disk calculators are in use, and the difficulty the author has experienced with the transparent disk (Paragraph 100) may be overcome by fitting both disks in a metal ring, having a slot in which the transparent disk works, and by giving it a concentric corrugation.

The experienced engineer usually prefers to steer clear of all such aids if he finds their use tending to divert his attention from the direct object of his calculations. He may make up tables or other aids himself, and use them; but being his own he employs them with reliance and without having his mind led into channels other than the object in view. It must, however, be borne in mind that this book is addressed to juniors, and to such the work should be of service in pointing out different ways in which calculations on board ship may be made. In following out the ideas in the book the reader will note with satisfaction that the figures are taken from actual work at sea, and that the author is one whose wide experience imparts especial value to any particular line of exercise or instruction he may suggest.

The book is illustrated in a novel fashion by photographs of incidents in ship and shore work having no direct connection with the text, but the book is thereby lightened and the pill well sugared for any juniors who may require a stimulating inducement in their studies.

The Management of Public Electric Supply Undertakings. By A. Hugh Seabrook. 1913. London: *Electrical Times*, Ltd. Price 7s. 6d. net.

Outside the technical details of the practical side of electric supply management, as dealt with in the present book, there are two points of particular interest incidentally raised. The one is in respect of the much debated question of municipal *versus* public company management, and the other in regard to the relative values of the commercial and engineering sides. Taking the first of these points, it is interesting to note the view of the author expressed so very strongly in favour of electricity supply being controlled by companies—especially in view of his lengthy experience of municipal control, covering the Barking, West Ham and St. Marylebone undertakings. On this point, Mr. Seabrook writes as follows:—

"One thing at least is certain, and that is that the proper realisation of the duties and responsibilities of management cannot be present when the board of management no longer consists of men who have big financial interests in the undertaking, and who are mere delegates with no personal responsibility. If the undertaking fails they are practically unaffected, and if, as is quite unlikely, however, it becomes a gigantic success, they are no better off. The absence of profit and risk sharing bars the way to maximum efficiency being obtained."

"These difficulties of municipal management are unavoidable, and it is as a result of them that the municipal public electric service is prevented from reaching its highest efficiency."

The above paragraphs, of course, only touch one of the many cogent arguments which the writer advances against municipal trading. It is interesting, in the broader aspects of this matter, to note that quite recently the consolidation of the electrical interests of Paris (and this under the most enthusiastic Republican *régime*) has been placed in the hands of a company working under concessions modified by limited municipal representation on the administration committee. In Germany, too, where Socialistic feeling is extremely strong, the supply to Berlin is in the hands of a company, and again, in America, the municipal undertakings only amount to 23 per cent., as against 77 per cent. of undertakings of independent companies or syndicates. The foregoing facts indicate the general trend of practice, and it might well be surmised that, if the time were to come over again, a different attitude would be taken by the Parliamentary Committees in respect of their earlier leanings, for some years onward from 1882, towards municipal control.

Then, as to the second point mentioned above, viz., the adjustment of control between the engineering and the commercial sides of the undertaking, until comparatively recently, in the majority of undertakings, it had been assumed that the whole matter of the commercial direction of the business was a more or less subordinate matter, and one which naturally fell into the hands of the engineer. (This obtains, in fact, to-day in the majority of cases where the supply is in the hands of municipalities.) Gradually, however, there has come to be recognised, what any business man would have recognised at first, viz., that the business of electricity supply is primarily a matter purely of trading, and that as such the whole success of the undertaking depends on the commercial handling of it; and that the engineering side, necessary although it may be, must fall into a secondary place.

The very existence of Mr. Seabrook's book—to say nothing of the powerful arguments throughout its pages—

strongly supports this contention. Some of the companies have led the way in this direction, and the sound commercial footing on which they now stand is entirely due to their recognition of the fact that their undertakings had to be directed and controlled by the commercial side, and not to be left to the uncertain handling of the engineering side. The first duty of the latter is obviously the efficient generation and distribution of electrical energy, which, of course, demands entirely different qualifications from those connected with the selling of the product and the running of the concern, as a whole, on proper financial lines. It is the emphasis which this book lays on the importance of the commercial aspect of the undertaking, that gives it its chief value.

The book deals in a businesslike way with the general organisation of the various departments, dividing up the whole of the staff—under a general manager—under four headings: Secretarial (including accountancy), generation, distribution, sales management. With the help of tabulated diagrams, these departments are dealt with in detail in their respective chapters, which give the general framework on which most big undertakings are at present working.

The managers of big undertakings, of course, may have little to learn from the book, but undoubtedly to the engineers of many of the small undertakings, whose ideas of management are perhaps somewhat confused and whose organisation often leaves much to be desired, the clear treatment of the subject will certainly be of assistance in giving them a comprehensive idea of the lines of proper organisation, and helping them to frame some modified system adapted to their own requirements.

Those who demand a modicum of humour may find a reward in searching through a few of the opening paragraphs of the chapters which deal with the ethical side of management, as, for instance, in the enthusiastic pages about the "square deal" and its commercial value, which apparently embody Mr. Seabrook's re-discovery of the value of his copybook maxim of juvenile days—"Honesty is the best policy."

BUSINESS NOTES.

Patent Application.—Application for restoration of Patent No. 14,495, of 1906, for "Improvements in Railway Signalling Mechanism and the Like," has been made by Wm. Reid and the Australian Signal Controller Co. Proprietary, Ltd.

Lead.—In their report dated November 29th, Messrs. James Forster & Co. say that "the great scarcity of prompt lead, which has been so marked a feature for many months past, is at last beginning to show signs of relaxation, and we have little doubt that this is due to a slowing down in consumption in the electrical trade centres (particularly in Germany), which has relieved the strain and allowed more lead to come to London. . . . It cannot be wondered at that the effect of falling trade all over the world is at last telling on the consumption of lead, the price of which is still very high and much above the average of past years."

Montreal Electrical Exhibition. — Our Montreal correspondent writes:—A successful electrical exhibition, under the auspices of the Montreal Electrical Society, was held in the Arena, Montreal, from November 1st to 8th. The majority of the exhibits appealed more particularly to the housewife, but there were some that had a wider and more scientific interest. The Montreal Light, Heat and Power Co. occupied extensive space in the hall, and exhibited electric toasters, stoves, radiators, together with ornamental table lamps, house fittings, &c. The Montreal Electrical Society itself had an interesting booth where, amongst other things, was shown an electrical "museum," consisting of old-fashioned equipment of various kinds. They also showed a seven-roomed house to demonstrate how many economical uses may be found for electricity in the modern home. One of the most interesting stands was that of R. A. Lister & Co., Ltd., Toronto. This firm showed in operation a Lister-Bruston automatic electric lighting plant, designed for house lighting in rural districts. This exhibit attracted considerable attention and was in operation every day, its automatic features being fully demonstrated. Among other exhibitors may be mentioned:—Tate Electrics, Ltd., Walkerville, Ontario, electric motor trucks and automobiles; Eagle Sign Co., Montreal, electric signs; Sayer Electric Co., Montreal, lamps, shades, batteries, wireless telegraphy outfits, &c.; General Film Co., Montreal, motion picture projectors; Schuman Electric Co., lamps, radiators and electrical supplies. The Society for Prevention of Cruelty to Animals showed an automatic electric cage for the humane destruction of dogs. A large number of booths were devoted to the demonstration of vacuum cleaners washing machines and other household appliances

Book Notices.—*Central Battery Multiple Switchboards*, a bulletin recently issued by the Peel Conner Telephone Works, Ltd., is not a price list of the company's products but a handsome illustrated brochure containing a description of some of the exchange equipments which it has installed at home and abroad, with explanations of the mode of operation employed, and diagrams of the connections. The company prefers 40-volt to 22-volt working for many reasons, and first used it, we believe, at Glasgow. The arrangement of the frames and racks is standardised on improved lines, which enable extensions to be made at the minimum cost, and the innumerable details of the equipment are designed with a view to combining efficiency with long life. The illustrations are admirable.

Dynamo and Motor Attendants and their Machines. By F. Broadbent, M.I.E.E. Seventh edition. London: S. Rentell and Co., Ltd. Price 1s. 6d. net.—This work appears to have definitely taken its place in technical literature as a periodical, for new editions succeed one another at very short intervals. The present issue has been revised and brought up to date, and the title has been altered to include motor attendants, while the author even threatens to bring accumulator management "and other matters pertaining to installation work" within its covers. We should advise him not to spoil a good thing by overloading it. At present the book is unique of its kind, and it is hard to find food for criticism or scope for improvement; it admirably fulfils the purpose of a practical handbook for the guidance of the classes of readers indicated in the title.

"*Mechanical World* Electrical Pocket-Book for 1914." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Annual Report of the Royal Technical College, Glasgow." Glasgow: The College.

"*Engineering* Directory." October, 1913. London: *Engineering*, Ltd. Gratis.

"*Journal* of the Society of Engineers." Vol. IV, No. 11. November, 1913. London: The Society. Price 1s. 3d., post free.

"*Transactions* of the New York Electrical Society." June-October, 1913. New York: The Society.

"Manufacture of Lime." By W. E. Emley. Washington: Government Printing Office.

"Boletin de Ingenieros." Vol. IV, No. 2. October, 1913. Mexico: Departmento de Ingenieros de la Secretaria de Guerra

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 223 London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"Small Power Wireless Installations." By Maurice Child. Price 1s. net. "The Motor-Cyclist's Handbook." Price 2s. net. London: Percival Marshall & Co.

Liquidations.—The Electromobile Co., Ltd.—A petition for the winding-up of this company has been presented by Lawrence Fletcher, gas engineer, and will be heard on December 9th.

Sun Power Co. (Eastern Hemisphere), Ltd.—A meeting of creditors is called for to-day (December 5th), at Friars House, New Broad Street, London, E.C., at 12 o'clock noon, by the liquidator, Mr. F. S. Fitzer.

Warren Beattie & Co., Ltd.—This company is winding-up voluntarily with Mr. F. J. Forster, of Albert Chambers, Albert Road, Middlesbrough, as liquidator. A meeting of creditors is called for December 10th, at the liquidator's offices.

New York Belting and Packing Co., Ltd.—A meeting will be held at 91, Chambers Street, New York City, U.S.A., on January 15th, 1914, to hear an account of the winding-up from the liquidator, Mr. J. H. Cobb.

Safety Light, Ltd.—On November 24th voluntary liquidation was resolved upon. Mr. P. J. Goodchild, the liquidator, has issued a circular in which he says that there is no possibility of any return to unsecured creditors. A realisation of the whole assets will result in a considerable loss to the debenture-holders. A meeting of creditors is called for December 11th at Winchester House, E.C.

Advertising as a Career.—At the Kingsway Hall, Kingsway, on Monday evening, Lord Desborough presiding, Mr. Thomas Russell delivered an address on "Advertising and Selling as a Career." The meeting was held to inaugurate a "National Movement to Promote Efficiency in Advertising and Selling," conducted under the auspices of the International Correspondence Schools.

Electrical Competition in Australia.—The *Sydney Morning Herald* in October last published the following:—"Complaint is made that an unfair advantage against foreign electric firms is being taken of the tender system. It is stated that tenders are invited for the supply of electric material, and that German tenders are generally the lowest, but that they do not get the contract, which is given to an English competitor. Statements have even been made that English tenderers have been allowed to bring their prices down to the neighbourhood of the German quotation. If this be the case, then undoubtedly the German tenderers are being treated unfairly. Whatever be the practice, however, that practice is having its effect on German firms, who, in some instances, have refused to quote prices for business which would amount to thousands of pounds, as they considered that they were being made use of for the benefit of English manufacturers."

Catalogues and Lists.—Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Phœnix *Bulletin*, No. 8A, is a 12-page publication containing an illustrated description of a new type of machine for dealing with large currents for electrolytic purposes and for boosting. The theoretical principle upon which the machine is designed is considered, an explanation being given of the half-turn winding and of the special precautions adopted in order to deal efficiently with very large currents generated and carried off from the commutator. Illustrations are given of large electrolytic plants, including a dynamo for 7,000 amperes, also some large boosters. Copies of the *Bulletin* can be obtained on application.

Messrs. Isenthal & Co., Denzil Works, Neasden, London, N.W.—List No. 25AI is an excellent catalogue of 104 pages, in which is given fully-illustrated information, with prices, &c., of the firm's rheostats. The several sections deal respectively with (1) slate (single, twin and universal), (2) tubular and (3) cinema and arc lamp and sundry type rheostats. The illustrations include many explanatory diagrams of connections, and prices are set out in tabular form with great clearness. These resistances have now been thoroughly standardised, and the firm are keeping a large stock at Neasden where they are manufacturing every type of experimental and loading resistance, apart from those actually shown in the catalogue. We understand that the sales in this department have increased during the last three years in geometrical progression, and many new forms have been listed, while attention has also been paid to the ever-growing requirements of some of the more recent developments of the electrical industry, such as radio-telegraphy and high-frequency work generally.

Messrs. Major, Smith & Stevens, Ltd., Abbey Works, Northampton.—We have received a copy of the latest edition (the fourth) of the firm's illustrated brochure entitled "Notes on Electric Lifts." It contains a good deal of interesting material which should be of service to those interested in the installation and operation of lifts, and in addition to excellent half-tone illustrations of the electrical equipments themselves, it contains pictures of a number of important public buildings at home and abroad where the firm's electric lifts are in service. These premises include the British Electrical Federation Building and the Institution of Civil Engineers in London, also a theatre in Shanghai, while the H.M.S. *Orion* and her six engines and controllers are likewise pictured. Records of actual results showing economy in cost of power and repairs, methods of driving and control, the full automatic system, and accessibility, are all referred to, notes on the winding engine, position of worm, thrust bearings, wheel drive, automatic electric locks, safety gears and their position, and many other points, following. The publication (106 pages) winds up with an imposing selected list, extending over a number of pages, of purchasers and users.

Mr. O. N. Beck, 11, Queen Victoria Street, London, E.C.—Four-page list containing a full description, with illustrations, and a number of line diagrams, of the "Vapor" patent scale collector for use in boilers.

Messrs. John Spencer, Ltd., Globe Tube and Engineering Works, Wednesbury.—Trade price list of wrought-iron tubes and fittings, also iron and steel boiler tubes and accessories.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, London, W.C.—Leaflet No. 3,001 gives prices of double and triple-pole ironclad switches (house-service type) for from 15 to 100 amperes.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—The company has issued a new "Osram" lamp showcard, copies of which will be supplied free to all electricians, ironmongers, and stores on application.

Messrs. Isaria, Ltd., 208, Tower Bridge Road, London, S.E.—Illustrated lists with descriptive particulars, prices, weights, dimensions, &c., of Isaria A.C. watt-hour meters, and bell transformers.

Messrs. Woolnough, Lang, Ltd., London.—This firm has now shut down its Norwich premises and is fully established at Wales Farm Road, Acton, London, W. Two illustrated price lists have been issued dealing respectively with rotary transformers and motor-generators, and petrol and paraffin electric sets.

Bankruptcy Proceedings.—H. G. Prested, electrical engineer, Elthorne Road, Upper Holloway.—Under a receiving order made against this estate, the first meeting of creditors was held last week at the London Bankruptcy Court before Mr. Egerton S. Grey, Official Receiver. It appeared that the debtor was appointed in 1893, at a salary of £500 per annum, managing director of the company formed to develop a system of ignition for motor-cars. The undertaking was successful until 1908, when the system was superseded by a magneto ignition. Although other inventions had since been put on the market they were not successful, and in October, 1911, the assets of the company (Prested Miners' Gas Indicating Electric Light Co., Ltd.) fell into the hands of the debenture-holders, who appointed the debtor to the post of Receiver at a weekly salary of £7 7s. That appointment terminated in April, and the company had gone into liquidation. The debtor had held £8,000 shares, a large number of which were bought and paid for by himself. There was no prospect of any dividend being paid to the shareholders. Four years ago the debtor entered into an agreement to purchase a business in Windsor Road, Holloway, and paid £100 as a deposit; he failed to complete the purchase and judgment had been recovered against him for a balance of between £500 and £600. The debtor attributed his failure to the action of the debenture-holders and the collapse of the Prested Miners' Gas Indicating Electric Light Co., Ltd. He returned liabilities £170 and assets "nil." The case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

Frederick Wm. Chamier, mining and electrical engineer, 59, Fleet Street, E.C.—The adjourned first meeting of creditors was held on Monday, at the London Bankruptcy Court, under this failure. Mr. E. Leadham Hough, Senior Official Receiver, reported that a statement of affairs had been lodged showing assets to the value of £18,500, and liabilities only £511. The meeting had stood adjourned to enable the debtor to submit an offer for the consideration of the creditors, but none had been lodged. Asked if he thought the assets would realise the amount placed upon them the debtor said they ought to do so within 18 months. They included a claim of £76,000 against a foreign electrical company which was in course of liquidation, and from which he expected to receive a substantial dividend. In the absence of any definite proposal, Mr. E. H. Hawkins, I.A., was elected as trustee to administer the estate in bankruptcy.

Roger W. Wallace, K.C., Kensington.—The sitting of the Bankruptcy Court for the public examination in this matter has been further adjourned to December 16th, as a scheme of arrangement is being put before creditors.

J. D. Nixon (J. D. Nixon & Co.), electrical and mechanical engineer, Crewe.—December 18th is the last day for receipt of proofs for dividend by Mr. F. T. Halcomb, Official Receiver, King Street, Newcastle, Staffs.

W. Wadsworth, engineers' agent and dealer in electrical accessories, Chorlton-cum-Hardy, Manchester.—A first and final dividend of 1s. 4½d. in the £ is payable on December 9th at the Official Receiver's offices, Byrom Street, Manchester.

Australian Electrical Trade.—According to a Sydney newspaper a contract has been let for the erection of new large premises to be occupied by the Australian General Electric Co., at the corner of Goulburn Street and Wentworth Avenue, Sydney. The premises will consist of glass enclosed showrooms, storage floors, and office accommodation in a brick building having 120 ft. frontage to Goulburn Street, and a frontage to Wentworth Avenue of 76 ft. The floors are specially constructed to carry the heavy loads necessary for the storage of machinery. The building is to be completed in nine months.

Trade Announcements.—Messrs. Handley and Robinson, Ltd., have commenced business as electrical and general engineers at 27, South King Street, Dublin, and they will specialise in country house plants. Manufacturers are invited to forward lists, &c.

Messrs. Morris & Lister (London), Ltd., of Palace Chambers, Westminster, announce that their telephone exchange and number have been changed, and are now: "Victoria 7844."

Strike in America.—A daily paper states that between 5,000 and 7,000 employés of the General Electric Co. at Schenectady recently struck work owing to a dispute caused by the discharge of a Trade Unionist.

Canada.—H.M. Trade Commissioner for Canada (Mr. C. Hamilton Wickes) reports that a company in Montreal wishes to secure the agency of United Kingdom manufacturers of electrical supplies and fittings.—*Board of Trade Journal.*

LIGHTING and POWER NOTES.

Accrington.—Plant Extensions.—The Electricity Committee has considered the proposed extensions of plant at the electricity works, and has instructed the electrical engineer to get provisional tenders for additional gas plant. Ald. Higham (chairman) informed the Committee that during the next year there would be an additional consumption by new consumers to the extent of some 900 KW. The outside margin at present was only some 400 KW. with every particle of plant at extreme output, and it would be absolutely necessary to have additional plant installed by October next year. It is reported locally that the scheme for extensions which it is proposed to submit will involve an expenditure of from £40,000 to £50,000.

Australia.—Two more Victorian Shire Councils have decided upon electric lighting for their principal towns, viz., the Numurka Shire, to light Nathalia, at an estimated cost of £4,000; and the Warranga Shire, to light Rushworth. Messrs. McCarty, Underwood & Co., of Melbourne, have been appointed to carry out the work in each instance.—*Australian Mining Standard.*

Barnsley.—The T.C. is seeking powers to provide, purchase, sell, let for hire, fix, repair and remove electrical fittings and apparatus, and to enter into contracts with consumers.

Barrow.—The electrical engineer has reported that owing to the large increase in the number of consumers in the Abbey Road district, and the prospect of a still further increase due to the opening up of other land for building purposes, it would soon be necessary to consider some rearrangement and extension of mains in that neighbourhood. The electrical engineer further reported upon the terms which the chairman and himself had provisionally agreed to with the Walney Island Estates Co., with regard to the Corporation taking over the meters in their houses in North and South Vickerstown. This was approved.

Bacup.—Loans Sanctioned.—The L.G.B. has sanctioned the following loans in respect of the electricity undertaking:—£700 for station equipment and £2,100 for mains.

Bedford.—L.G.B. Inquiry.—On November 25th, Mr. T. C. Ekin held an inquiry into the application of the T.C. for sanction to borrow £10,000 for electrical extensions. According to the *Bedford Times* the latter include a turbine set, water-tube boiler, condensing plant, switchgear, air filter, &c. There was no opposition, and the inquiry was closed.

Bexley.—At a meeting of the U.D.C. on November 26th, it was reported that the Woolwich B.C. would be willing to consider any amended proposal which the Bexley Council might desire to place before it with reference to a bulk supply of electricity from Woolwich. The Bexley Council had previously intimated that no advantage would be gained by either Council from further consideration of the matter, and no further action was taken.

Bispham.—The U.D.C. has resolved that after the present quarter it will enforce the payment of the minimum charge of 3s. 6d. per quarter.

Bradford-on-Avon. — Prov. Order. — Mr. J. H. Edwards, electrical engineer, of Bristol, is applying for a prov. order for E.L. within the area of the U.D.C.

Brazil.—The new hydro-electric station of the Companhia Industrial de Electricidade at Parahybuna, has lately been completed. The plant comprises two Voith turbines, of respectively 3,300 H.P. and 1,200 H.P., coupled to three-phase generators working at 6 000 volts. The current generated is transmitted to a number of towns within a distance of 200 miles, transformer stations being located at Entre Rios, Avellar, Valenca, Ipiranza, and Palmeyras. The current is stepped up for transmission purposes to 30,000 volts, and then reduced to 6,000 volts, and, for distribution, to 200 and 120 volts.

Bristol.—The T.C. has reduced the price of electricity for heating purposes to 1d. per unit.

Brymbo. — Public Lighting. — The Denbighshire C.C. has granted a loan of £300 to the Brymbo P.C. for the purpose of a public lighting scheme. The Council has received a favourable offer for the supply of electricity from the Brymbo Steel Co.

Canada.—It is proposed to build at Vancouver a municipal electric lighting and power plant at a cost of $300,000. Current is to be generated by turbines driven with steam generated in boilers with oil-burning furnaces. A gas plant is also being considered.—*Canadian Engineer.*

According to the *Canadian Electrical News*, the following towns have passed by-laws to expend the sums mentioned on extensions to their electric light systems:—Fergus, Ont., $16,000; Outlook, Sask., $10,500; Brockville, Ont., $69,000. St. Catherines, Ont., has decided to expend $116,000 on a step-down transforming station and distributing system.

Power Developments in Montreal and District.—Hydro-electric development in the Montreal district has made rapid strides of late, and is on a scale that anticipates a large demand for power in the near future.

The Laurentide Co.'s new plant, which is expected to be completed by next spring, will increase the development at Grand-Mere to 80,000 H.P., which can be further brought up to 100,000 H.P. at comparatively low cost. A considerable portion of this power will be available for purposes outside of those of the company; the present development at Grand-Mere is 22,000 H.P.

The Cedar Rapids plant, with an initial capacity of 100,000 H.P., and 160,000 H.P. aimed at ultimately, will, according to the latest reports, be ready by the autumn of 1914, according to the original plans.

With both the Cedars and the new Laurentide plants in operation and the extension this summer completed at Shawinigan, the hydro-electric development in the district of which Montreal is the centre should be upwards of 400,000 H.P. by the end of 1914.

This is exclusive of the plans of the National Hydro-Electric Co. at Carillon, of which comparatively little has been heard recently, but which aim at a development of 160,000 H.P.

The Montreal Light, Heat and Power Co.'s water-powers at Chambly, Soulanges and Lachine, the Canadian Light and Power's plant at St. Timothee and smaller plants account for 100,000 H.P. in addition.

Chorley.—Prov. Order.—The T.C. has decided to consent to the proposed application by the Lancashire Electric Power Co. for a prov. order to supply electricity for lighting purposes within the borough, provided satisfactory clauses are embodied safeguarding the future interests of the Corporation.

Cleethorpes.—A recommendation to extend the electric light mains was severely criticised at the last meeting of the Council. Councillor Moody thought it was the height of folly to extend the mains when they were losing from £300 to £400 a year on the undertaking at present. Councillor Turner said they had this year nearly used half the amount they had agreed to take from the Grimsby Tramways Co. They were establishing a destructor and pumping station at Cleethorpes, and it would not be a difficult thing to make their own electricity. Eventually the Council adopted the recommendations.

Continental Notes.—Austria.—A big water-power installation in connection with a factory for the production of carbide of calcium and cyanide of potassium will shortly be in operation near Spalatro and Almissa, in Dalmatia. The installation, with that on the Kerka River, will have a joint output of 75,000 H.P.

The Electrotechnische Verein, of Vienna, has been agitating for relief from the restrictions imposed on electrical transmissions, and urges that legal powers should be given to use public and private lands and highways for electrical purposes, and to prevent obstruction by private individuals and others. The matter has been discussed for the last five years, and legislation has frequently been promised.

Germany.—To show the advantages of the use of electric motors, the Berlin Bureau for the Propaganda of Electricity publishes the following statistical figures: In 1895 there were in use in Berlin 1,010 gas engines and 250 electric motors; in 1911 the figures were 422 gas engines and 26,669 electric motors. According to the latest statistics only 317 gas engines are now in use.

Dartford.—The assistant district auditor states that there is a loss on the electricity undertaking for the year ended March 31st last of £1,290, as against a profit of £191 in the preceding year. This is attributed to an increase of 44 per cent. in the price of coal, to the cost of redemption of capital expended on plant unproductive until after the close of the year, and to a decrease in sales for power purposes. There remains invested and allocated to reserve a sum of £1,000, which does not leave a working balance on revenue account, the treasurer being overdrawn to the extent of £569.

Darwen.—Messrs. John Catlow & Sons, Ltd., are proposing to adopt electricity for motive purposes at Olive Mill.

Dublin.—Proposed Electric Cooking.—At a recent meeting of the North Dublin Union, a report was submitted which showed that for three years prior to the use of electricity, the cost of gas for lighting only was £956 per annum; the average cost of electric lighting over three years was £779, showing a saving of £177 per annum. It was suggested that electricity might also be used for cooking with advantage, and consideration of the matter was referred to the Ladies' Committee.

Dundee. — Broughty Ferry Supply. — Following upon a breakdown of the electricity supply on Monday, last week, in the recently annexed burgh of Broughty Ferry, a report has been prepared by Mr. Harry Richardson, the electrical engineer, which states that it would be opportune to mention generally the condition into which the plant had been allowed to deteriorate. The battery was absolutely useless; every pump in the place, without exception, was in a very inefficient state, and the condenser required immediate attention. There was hardly a valve in the place which would hold tight, and the condition of those taken out must be seen to be believed. The back of the switchboard was in a state of chaos, and as regards the cable and distribution things were little better.

Mr. Richardson reminded the Electricity Committee in his report, that it was his intention to make Broughty Ferry a sub-station, supplied with high-pressure current. It would, however, be March at the earliest before the necessary machinery could be delivered and the supply connection completed.

In his opinion the depreciated state of the Broughty Ferry station plant rendered a cessation of the electricity supply inevitable.

Exeter.—Proposed Refuse Destructor Plant.—The T.C. has decided to have a report prepared as to the power likely to be derived, and the use which might be made of such power, from a refuse destructor proposed to be erected at the St. Thomas Sewage Works.

Frensham.—Prov. Order.—The Farnham Gas and Electricity Co. is applying for a prov. order to supply electricity in the parish of Frensham, which is at present in the area of the Hindhead E.L. Co.

Gillingham (Kent).—L.G.B. Inquiry.—An inquiry was held on November 26th into the application of the T.C. for a loan of £7,000, of which £5,343 was for a second Diesel engine set the first one installed having proved very economical as compared with steam power. There was no opposition.

Hoyland.—The U.D.C. has decided on a scheme for lighting the town with electricity.

Ilford.—New Plant.—With reference to the proposed sub-station at Goodmayes, the electrical engineer has been authorised to inspect similar sub-stations recently erected at Southend, and proceed with the specification of the requisite battery and plant.

India.—It is notified in the *Punjab Gazette* that a licence for the supply of electrical energy in Lahore Municipal area, granted to the People's Bank of India, has been transferred to the Lahore Electric Supply Co., Ltd.—*Indian Engineering.*

Japan.—During the month of October last a total of £120,500 was invested in the electrical industry in Japan, £20,000 being in respect of new companies, and £100,500 for the extension of existing undertakings.

Kenmare (Co. Cork).—Owing to a breakdown in the cable supplying current to Kenmare, the town was in almost complete darkness for four days last week.

Limerick.—At a meeting of the Electric Light Committee on November 29th, the question of the loss in the working of the undertaking was under consideration, and it was decided to recommend the Corporation to increase the charge for lighting from 5d. to 6d. per unit, with certain discounts. No advance was recommended in the price for power purposes.

Liverpool.—New Loans.—Application is to be made to the L.G.B. for sanction to the borrowing of £10,000 for the provision of sub-station equipment.

London.—Bermondsey.—The B.C. is taking up a loan of £4 000 from the L.C.C. for mains and plant.

Marylebone.—The B.C. has received the approval of the B. of T. to supply electricity at extra-high-pressure.

L.C.C.—The Council has rescinded the resolution as to £4,230 for the electricity undertaking of the Woolwich B.C., the latter not desiring to take up the loan.

The Council, at its last meeting, sanctioned the following loans:—£15,500 for coal storage tanks and transporting plant, for the Hammersmith B.C. electricity undertaking; £17,226 for electricity purposes for the Shoreditch B.C., made up as follows:—Mains, £5,000; transformers, £10,000; switchgear, £1,800; and engineer's charges, &c., £500.

London's Electric Supply.—At the same meeting of the L.C.C., the chairman of the London Electricity Supply Committee (Mr. G. H. Hume) was asked whether he was aware that the County of London Electric Supply Co. had obtained a provisional order to acquire an option of a site comprising 23 acres of land between Barking Creek and the borders of Dagenham; whether he was aware that this site was the only one available for such a purpose; and whether this granting of a provisional order was likely to prejudice any scheme of the Council, and the interests of those boroughs that generate and supply their own electricity. Mr. Hume said, in reply, he was advised that the Council's only locus as regards the provisional order was in respect to its power of purchase, and that the Council had no locus in regard to the purchase of a site by the undertakers, and could not raise the question before a Committee of Parliament. So far as the Council's purchase powers were concerned, the question was dealt with, and the Council's interests were safeguarded. The valuer had stated that he was not aware that the scheduled site was the only land in the neighbourhood of London suitable for the purpose.

Maidenhead.—Workhouse Lighting.—The T.C. has decided to comply with the request of the B. of G. for a supply of electricity for lighting and power at the new workhouse laundry, and to extend the main at a cost of £150.

Minehead.—The local electric supply company has introduced a scheme for outside shop lighting, with metal lamps of not less than 200 c.p. Current will be supplied at 2d. per unit, plus a fixed charge varying from 21s. per annum for 200 c.p., to 60s. for 1,000 c.p.; two 100-c.p. units can be used together or in separate fittings for the lowest c.p.

Morocco.—A concession, it is stated, has lately been granted for the establishment and working of an electric lighting station in the town of Tetuan; the *Board of Trade Journal* says, it is understood that two syndicates have applied for concessions, one for an electric tramway for goods transport between Tetuan and Rio Martin.

Newcastle-on-Tyne. — Dunston Extensions. — In order to cope with the increased demand for power and the steadily increasing load, the Newcastle-on-Tyne Electric Supply Co., Ltd., has decided to extend the power station at Dunston-on-Tyne. This station generates three-phase current at 6,000 volts and 40 cycles. The steam pressure is 200 lb. per sq. in. superheated to 570° F. The main generating units at present consist of two A.E.G. sets, each of 10,500 h.p., and a Brown, Boveri set of 9,000 h.p., all three running at 1,200 r.p.m. The station was originally laid out to eventually accommodate six generating units, each of 10,000 h.p. continuous capacity, and 13,000 h.p. maximum capacity, or a total capacity of about 70,000 h.p. In connection with the present scheme an agreement has been entered into with the Teams By-Product Coke Co., Ltd., which is now engaged upon the installation of a large battery of Otto-Hilgenstock coke ovens on a site about 1½ miles distance from the Dunston power station, to purchase its available coke oven gas. This gas will be led along the N.E.R. Co.'s Dunston branch in a 16-in. welded steel pipe, which will be supplied by Messrs. Stewarts & Lloyds, Ltd.; the joints will be welded *in situ* by the acetylene process. The boiler house extensions comprise a steel frame building, sheeted in with corrugated iron, 114 ft. long × 75 ft. wide, and two steel chimneys. There will be two coal-fired water-tube boilers, each rated at 30,000 lb. of steam per hour, with the necessary furnace and flue fixtures, also stokers and superheaters. In addition, there will be four gas-fired water-tube boilers, each capable of dealing continuously with 57,000 cb. ft. of gas per hour, to be built in two batteries, with the necessary flue fixtures of same, inclusive of gas burners and superheaters. The fuel economisers, one for each boiler, will have automatic tube scrapers and flues and dampers, also soot cleaning gear. Induced draught fans will deal with the products of combustion from the boilers. There will be two feed pumps, each capable of dealing with 200,000 lb. of water per hour. The coal-handling plant will feed the overhead bunkers at the rate of 40 tons per hour, and will receive coal from two hoppers, each of 25 tons capacity, traversed by a railway track. The overhead bunkers will have a capacity of 950 tons. All the boiler house plant and buildings have been contracted for by Messrs. Babcock and Wilcox, Ltd., and the whole of these buildings will be placed on a 6 ft. 6 in. reinforced raft supported on pitch pine piles, which work has been executed by Messrs. Robert McAlpine and Sons, Ltd., of Glasgow. The engine room plant extensions consist of a 12,000-kw. turbo-alternator with direct-coupled exciter, the turbine being by Messrs. Richardsons, Westgarth & Co., Ltd., and the alternator by Messrs. Brown, Boveri & Co. The surface-condensing plant includes of a Contraflo condenser capable of dealing with 141,600 lb. of steam per hour.

New Southgate.—At a public meeting held under the auspices of the New Southgate Tradesmen's Association and the Friern Barnet Ratepayers' Association, it was resolved that, in view of the high price of gas in the district, the Ratepayers' Association should ascertain what support would be forthcoming from intending consumers, with a view to obtaining a supply of electricity from the North Metropolitan E.P.S. Co.

New Zealand.—The Manukau C.C. is applying to the Government for permission to harness the Hunua Falls for the supply of electricity.

Plymouth.—Year's Working.—The electrical engineer's annual report shows that for the year ended March 31st the gross profit was £15,560, an increase of £2,197 over the previous year; 152 additional consumers were connected during the year, and the number of motors had increased from 210 to 248; £1,542 was placed to the credit of the reserve fund, which now stands at £11,423.

The Electricity and Street Lighting Committee has decided to exercise the sanction of the L.G.B. to borrow £5,500 for extensions of plant.

Purley.—Owing to a fault in one of the cables, a failure of supply occurred on Tuesday evening, which affected Purley, Kenley, Woodcote, Coulsdon and Wallington.

Redditch.—A very lengthy discussion has taken place on certain recommendations of the Advisory Sub-Committee, which were deferred when a report was presented in March last. The debate centred largely round a proposal to increase the price to power consumers, which was strenuously resisted by the works manager, who pointed out that there were running agreements with several large firms, from whom the revenue amounted last year to £3,170 out of a total of £8,331. In the end an amendment was carried that the question of revision of power rates should stand over until next March.

Reigate.—L.G.B. Inquiry.—On November 27th an inquiry was held relative to the Corporation's application for a loan of £1,500 for electric light purposes, viz., transformers, mains, house services, £265 overspent on a loan to meet the cost of cable extensions on the Reigate Lodge Estate, which is being developed for building. There was no opposition.

Ripon.—Prov. Order.—The T.C. has decided to apply for a prov. order for electric light within the city. The compulsory area is to include 14 of the principal thoroughfares.

Rushden.—Electric Supply Inaugurated.—The formal opening of the works of the Rushden Electric Supply Co., Ltd., which is supplying energy in the Rushden and Higham Ferrers areas, took place last week. The new concern is an off-shoot of the Northampton E.L. Co., with Mr. G. H. Jackson as engineer, and the price charged for energy to local manufacturers for power purposes is within 5 per cent. of that charged at Northampton.

Generating Plant.—This consists of two four-cycle three-cylinder "Willans-Diesel" engines, each driving a 160-kw. E.C.C. dynamo; also a combined balancer booster, capable of dealing with 100 amperes out-of-balance current, and each booster to give 120 amperes at 90 volts. There is also a motor-driven auxiliary air compressor and battery milking booster. The main oil storage tanks are situated in the yard, and oil is pumped direct from the railway tank wagons in the goods yard adjoining the company's property. The three-wire switchboard is one step above the engine room floor level, all the rheostats being of the pedestal type, and arranged some 4 ft. away, along the front of the switchboard. The battery room contains two batteries, each of 120 cells, by the Tudor Accumulator Co. The present capacity is 340 ampere-hours, but the cells are large enough to allow for doubling the number of plates; they are operated by automatic charge and discharge battery switches on either side of the three-wire system, all the switchgear being by Messrs. Bertram Thomas. There is also a combined general office and showroom; and a private office and stores. All the distributing mains are vulcanised bitumen, laid solid, 2¾ miles having been already laid. All the feeders are drawn into stoneware ducts, ample provision being made for future developments.

Shipley.—Proposed Loans.—At a special meeting of the Council this week it was decided to apply for power to borrow £27,000 for the purposes of the electricity undertaking.

Stapleford (Notts.).—New Generating Station.—The Derbyshire and Notts. E.P. Co. has acquired a site in Nottingham Road, with a view to the erection of a power station for the supply of electric light to Stapleford and Sandiacre.

Sturry (Kent).—E.L. Scheme.—A meeting of the P.C. was held on November 25th to consider the electric light proposals put forward by a company for Sturry and adjoining parishes. It was stated that the company, which proposes to establish a generating station at a local water mill, offered to supply current

for lighting at 4½d. per unit, and for power at 1½d., by means of overhead wires. Houses would be wired free, and the cost would be 3d. per 15-c.p. lamp. The Council decided to support the scheme, and to make no objection to the use of overhead wires.

Swansea.—Asylum Lighting.—The Corporation has offered to supply current for lighting the new asylum at 2½d. per unit up to 100,000 units per annum, and the acceptance of this offer has been recommended to the Joint Asylum Committee for Swansea and Merthyr in preference to having an independent plant at the asylum. The whole matter has been referred to a committee, owing to diverse views on the subject.

Swindon.—L.G.B. Inquiry.—On Tuesday, last week, Mr. H. R. Hooper held an inquiry into the application of the T.C. for sanction to borrow £9,200 for the provision of a 500-kw. mixed-pressure turbine, surface-condensing plant, cooling tower, water softener, &c. There was no opposition.

Thurnscoe.—Prov. Order.—The U.D.C. has agreed to apply to the B. of T., in conjunction with the U.D.C.'s of Wath, Wombwell, and Bolton for a prov order. for electric lighting to be employed in connection with the light railway scheme for which powers are being sought from the Light Railway Commissioners.

Warrington. — Proposed Loans. — The electrical engineer has been requested to prepare a report on the lighting of the Aikin Street Hospital and a specification for its improvement. Application is to be made to the L.G.B. for sanction to borrow £14,550 for the extension of the electricity works and plant.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—At a meeting of the T.C. on Monday, the general manager of the tramways recommended the adoption of the P.A.Y.E. type of car over the whole system. As the result of his observation of the working of the experiment on the Woodside section during the past six months, he says he has no hesitation in recommending the new style of cars as an improved method of tramway operation by which greater public safety can be obtained. The prepayment of fares, he also says, has a direct influence on the finances. The total increase for the 21 weeks on the Woodside section, where the P.A.Y.E. cars have been on trial, is £487. A great deal of extra revenue, he says, is due to the prepayment of fares, and to the fact that the conductor is in a better position to see all intending passengers. The Council agreed that in the meantime the general manager should be authorised to invite tenders for bodies of the P.A.Y.E. type for six new cars recently sanctioned, and that the report by the manager should be forwarded to the B. of T., and application made for the sanction for permanent use of the P.A.Y.E. cars on the Corporation system.

Argentina.—According to the *Financier*, the underground line of the Anglo-Argentine Tramways Co. in the centre of Buenos Ayres, the first line of its kind in South America, was officially inaugurated on Tuesday by the President of the Republic.

Australia.—The N.S.W. railway and tramway power house at White Bay (Sydney) is designed to accommodate plant of 100,000-120,000 h.p. At the present time about half the buildings are erected; these will measure 465 ft. by 242 ft., and include turbine, boiler and switch-houses. Three 7,000-kw. Willans-Dick, Kerr turbo-alternators, 750 r.p.m. and a 7,500-kw. General Electric (U.S.A.) impulse turbine, 1,500 r.p.m.; condensing water is obtained from the bay through concrete tunnels fitted with revolving screens to catch the floating rubbish. Four Babock boilers each for 27,000 lb. per hour normal, or 37,000 lb. per hour forced rating, are being provided for each turbine. A chimney with the Prat system of induced draught will be provided for each pair of boilers, and as at present arranged there will be 16 chimneys. Among the districts to be supplied will be North Sydney, to which cables for 60,000 h.p. are to run through a tunnel between Long Nose Point, Balmain and Greenwich. The whole scheme has been designed in the office of the Electrical Engineer for Railways and Tramways.

Disagreement exists between the Railway Commissioners and Harbour Trust Commissioners as to the site for the power station for the Melbourne railways electrification; the Railway Commissioners, however, consider that there will be no delay in construction owing to this, as the plant will not arrive until next year. The Commissioners state that the contract with Messrs. C. A. Parsons & Co. contained a definite order for four 10,000-kw. generating sets complete, representing a total capacity of 40,000 kw., and included a provision that two additional 10,000-kw. sets, to make the station of the capacity of 60,000 kw., provided for in Mr. Merz's complete scheme, could be ordered by the Commissioners at any time within two years from the date of the contract, January 1st last. The contract which was entered into with Messrs. Babcock & Wilcox for the power station buildings and boiler equipment for one boiler house also included a similar provision in respect of the second boiler house required, to correspond with the increase in the generating plant. In view of the decision of the Government that all the power required for the railway electrification scheme should be generated at the railway power station, it became necessary for the options for the additional plant, &c., held under these contracts, to be exercised, and the cost involved, which is included in the estimates submitted by Mr. Merz, will be approximately £232 [illegible]. The additional plant will probably be erected in the early part of the year 1915.

Belfast.—The Bonus Scandal.—The Irish L.G.B. auditor some time ago disallowed a sum of £2,[illegible] distributed among the tramway employés under a "profit-sharing agreement" drawn up by the general manager. He accordingly surcharged the members of the Tramways Committee who signed the cheques. Strong representations were made to the L.G.B. and at a meeting of the Corporation on Monday it was announced that the surcharge had been remitted, on the ground that "the subject matter of the surcharge was made in such circumstances, as to make remission fair and equitable.

Bradford.—Half Year's Figures.—The tramways undertaking for the half-year ended September 30th shows a profit of £21,178, against £25,997 for the corresponding half of last year. The income was £153,259, an advance of £9,[illegible], but working costs had increased. The increase in the cost of electricity was £24,600, as against £22,500. This was due to an increase of 122,000 car-miles. The trading profit was £48,677, being £5,699 less than in the corresponding half-year of 1912.

Brighouse.—The Yorkshire (Heavy Woollen District) Tramways, Ltd., last week held an experimental run with a new motor-'bus at Brighouse. It is proposed to establish a service between Brighouse and the terminus of the Dewsbury tramways at Shepley Bridge, and, although arrangements for such are not yet completed, it is hoped that facilities will be made available for the residents of the Rastrick side of the borough of Brighouse.

Bury.—The Tramways Committee has decided that the Limefield section of tramways be extended to the New Inn at Walmersley, and the Jericho section to the borough boundary at Smethurst Hall Farm.

Carshalton. — Electric Vehicle Costs. — At the Queen Mary's Hospital a Cedes electric vehicle is in use for carrying food, milk, laundry baskets, &c., to and from the cottage blocks. The van has a carrying capacity of 30 cwt., and cost £499; the running expenses for one year amounted to £249, including £30 for energy, £28 for battery maker's charges, £3, acid, &c., engineer's services £17, tires £25, porter's services £146, these details being published in a recent issue of the *Hospital*. Unfortunately no details are given as to the method on which these figures have been computed, nor as to the car-miles run.

Continental Notes.—Austria.—In the Vienna municipal Council on November 11th, consideration was given to a scheme for building an electric railway from Vienna to Brünn, the provincial capital of Moravia, a distance of 70 miles, which is to be carried out by the Gemeinde, of Vienna. Current will be supplied as far as the Austrian border by the Vienna Electricity Works, and in Moravian territory beyond, by the Rossitzer Elektricitätswerke.

In recent times, says the *Zeitschrift für das Gesamte Turbinenwesen*, rumours have been current that the Austrian State Railways Administration had been surveying the water-powers of the Alpine lands, with a view to reserving them for the projected electrification of the railways. As a matter of fact, the introduction of electric traction is not an actual question, owing to the situation of the State's finances and the present high rate of interest. The studies with respect to single sections will, however, be continued, with a view to facilitating electrification at a more favourable period.

The Austrian State Railway authorities are at present engaged in installing plants for the better ventilation of the various long railway tunnels in the country. The plants are all electrically operated, among those lately completed being that in the Tauern tunnel, about 5 miles long, and another in the Dossen tunnel, about half-mile long, near Mallnitz, Carinthia. The necessary electrical energy for both tunnels is supplied by the power station at Lassach.

Russia.—A company has lately been formed in Moscow, with a capital of £84,300, to construct and work an electric railway, about 9 miles long, between that city and Odinzowo.

La Société des Tramways de Taschkent, which is at present electrifying its lines, is in negotiation with the municipal authorities at Taschkent in regard to a concession for the supply of electrical energy for public and private electric lighting and power purposes in the town.

Italy.—A decree ratifying the concession has been granted to the Società Tramviaria Valenzana for the construction and working of an electric tramway from Valenza Railway Station to the town of the same name.—*Board of Trade Journal.*

Spain.—The work of electrifying the horse tramway system in the town of La Coruna has lately been completed. The contract was carried through by the Sociedad Siemens-Schuckert Industria Electrica, the plant being constructed in the company's works at Cornella, Barcelona. The necessary current is supplied from the generating station of the Sociedad Electra Industria Corunesa.

Germany.—The plans for a tramway tunnel under the Rhine, connecting Düsseldorf with Obercassel, have now assumed definite shape. The tunnel will be driven below the Rhine Bridge, and in the middle of the river will sink 7·30 metres under the river bed. On the Düsseldorf side an entrance 17 metres deep is arranged for. On the Obercassel side an entrance 6 metres deep is to be made. The tunnel will be drained from a sump in the deepest part by electrically-driven pumps, and ventilated by electric fans. It will be lit by electric lamps disposed so as to facilitate safe

working. Only the tramways will use the tunnel, other kinds of traffic being relegated to the Rhine Bridge. The cost of the undertaking is put at £212,500.—*Zeit. fur Elektrotechnik und Maschinenbau.*

Edinburgh.—On November 26th the Tramways Committee decided to obtain tenders for six motor-'buses to run on the south side route, and to negotiate with the Tramway Co. with a view to an agreement for the running of the motor-'buses.

At the meeting of the Tramways Committee last week, a proposal, recommending the Corporation to promote a prov. order for the construction of a tramway from the existing car terminus in Corstorphine Road to the village of Corstorphine was remitted to the burgh engineer.

London.—Electric Ambulances.—Of the £18,680 proposed to be spent by the Metropolitan Asylums Board on the institution of an ambulance service, £14,480 is to go towards the cost of purchasing 25 electrically-driven ambulances and the apparatus for 18 charging depôts.

Morley.—Railless Traction Scheme.—It is anticipated that the construction of the overhead equipment for the railless traction system, powers for which were recently obtained, will be commenced at an early date by the Corporation. The route commences at the Leeds terminus of the railless system at Farnley, and runs to the Bradford terminus at Drighlington, and thence to the borough boundary at Tingley Common. From this point Ardsley East and West U.D.C. will carry the system to the Bay Horse Inn, East Ardsley. The Leeds Corporation will undertake the running powers and supply the cars for a term of years.

Newcastle-on-Tyne.—A Tramways Report.—Ald. J. H. Rodgers, speaking at the annual meeting of the Tramways Committee of the Corporation on November 27th, at which he was re-elected chairman, said that although there was a large increase in the volume of traffic during the half-year ended September 30th, the net profit was less. There was an increased income of £11,980, but an increased outlay of £11,970. There was a net surplus of £11,435, which was £1,200 less than in the corresponding half-year. Now that the system was getting older, the repairs were getting heavier, and coal had almost doubled in price. During the half-year they had spent £21,000 out of the reserve fund. This work would continue to go on each half-year, and the possibility was that during the next six months there would be anything from £10,000 to £20 000 spent out of the reserve fund, and it would be necessary to build up that fund again to the extent to which they had depleted it. Whilst the tramways were perfectly safe conducted as they had been during the past few years, they could not continue to grant concessions, spending money as they had been doing in the last six months. In the future the cost of maintenance would increase, and they could not expect good times and good trade to continue for ever, and if they continued to build up, as they unfortunately had been doing, permanently increased charges, they would find they could not curtail those expenses when they came to bad times.

New Zealand.—The report of the manager of the Dunedin Tramways on the question of a suitable type of omnibus for a service to be run in conjunction with the ordinary tramway service, recommends the adoption of the petrol-electric vehicle.—*Board of Trade Journal.*

Northampton.—Plant Extensions. — The engineer has been instructed to submit a competitive tender for the work of constructing the tramways to Far Cotton. The Tramways Committee reported that in consequence of the increase of traffic and the necessity for an increased service, it had obtained estimates for the following plant, and proposed at once to enter into formal contracts for the purchase of the plant, at a cost not exceeding £10,850 :—Engine and generator (400 to 450 kw.), £2 300 ; condenser, £1,250 ; battery (800 amps., one-hour rate), £2,100 ; switchboard extension (one panel), £100 ; steam pipe extension, £100 ; extension of car shed, £2,400 ; four new cars, £2,600.

Salford.—Subject to the confirmation of the Council, the Tramways Committee proposes early in the New Year to make various reductions of fares and to extend many stages. The scheme is estimated to cost £5,000 per annum, but the Committee hopes that an increase of passengers will help to make up for this diminution in the amount available for the relief of rates.

Sheffield.—The tramways department is experimenting with a device for showing the number of passengers seated on the top of a car.

Sunderland.—Improved Traffic Receipts.—At the annual meeting of the Tramways Committee, last week, the chairman stated that the traffic receipts up to the present were £5,000 in advance of those for the corresponding period last year, and £800 better than the takings in any previous year for a similar period.

Tunis.—An agreement has been entered into between the Director of Public Works and the President of the Tunisian Tramways Co., whereby the latter is empowered to construct an electric railway from Tunis to Hammam-Lif, *via* Djebel-Djelloud, Mégrine, Radès and St. Germain.—*Board of Trade Journal.*

U.S.A.—The City Council of Chicago has asked for bids on the construction of a system of comprehensive passenger railway subways. The Board of Harbour and Subway Commissioners has estimated the cost at about $130,000,000. According to the present plan, bids are to be received until January 5th, 1914, and then opened publicly. The comprehensive plan of subway construction, the Arnold plan of limited subway construction, and possibly others, will probably be submitted to the voters at the election in April, so that they may indicate their preference.—*Electrical World.*

TELEGRAPH and TELEPHONE NOTES.

Austria.—According to the Vienna *Elektrotechniker*, the negotiations for the organising of a great telephone-building programme against yearly annual payments by the Government (alluded to in our last issue), have made further progress lately, but the definitive settlement cannot be exactly foretold. Action in this matter started with the Siemens-Schuckert Werke, the firm of Felten und Guilleaume and the collective telephone and cable firms. Altogether, within three years, telephone installations to an amount of £2,500,000 will be carried out, while the doubling of this amount is in prospect. The manufacturers will hand over their claims on the State in their entirety to their bank connections, and the latter will make advances to the manufacturers on the strength of the yearly payments the Government will make. Under certain circumstances the banks may convert their claims on the State into the form of securities, the issue of which, however, cannot take place in the near future, owing to the unfavourable condition of the investment market.

Germany.—The four German telegraph bureaus—Louis Hirsch's Telegraphisches Bureau, Herold's Depeschen Bureau Gesellschaft m.b.H., Presscentrale Gesellschaft m.b.H., and the Deutsche Telegraph Gesellschaft m.b.H. have amalgamated, and become the Telegraphen Union. The object of the amalgamation is stated to be to extend and improve the International news service by the unification of the sources of news and of the numerous staffs of collaborators. The well-known German statesman, Von Podbrelski, is the president of the combined concern.—*Telegraphen und Fernsprech Technik.*

An underground telephone line has recently been completed between Berlin and Magdeburg. One is also being laid between the German capital and Hamburg.

Long-Range Wireless.—A message sent from Port Darwin, in Northern Australia, has been received and read distinctly at Lake Huron, Canada. The total distance is 9,000 miles, of which 3,000 are over land. No doubt this feat was merely a freak, caused by some unusually favourable condition of the atmosphere.

U.S.A. High-Frequency Patents.—Judge Rellstab, on November 17th, issued an order enjoining the Marconi Wireless Telegraph Co. of America against further infringement of the Fessenden high-frequency patents, but permitting the company to deliver apparatus to the United States Navy on giving suitable bonds, pending an appeal from the injunction. The Fessenden patents are owned by the National Electric Signalling Co.—*Electrical World.*

Russia.—The steamship company, "Aktiebolaget Bore," of Abo, is contemplating the installation of wireless telegraphy on its vessels plying between Abo and Stockholm.—*Board of Trade Journal.*

Hull.—The Finance Committee has adopted the report of the Telephone Committee, recommending the acceptance of the Postmaster-General's offer to sell the plant of the National Telephone Co. to the Corporation for £192,423.

Wireless in Fishing.—Wireless apparatus has been installed on several vessels engaged in fishing on the Dogger Bank, and is expected to prove of great service in guiding outward-bound vessels to the fleet, besides supplying the admiral of the fleet with information as to the state of the London market.

Dublin.—The hearing began in the Nisi Prius Court, Dublin, on Friday last, of an action by the Dublin County Council claiming a declaration that the Postmaster-General is bound to carry out an agreement entered into with the Council by the National Telephone Co. to supply telephone connections and apparatus to the offices of the Secretary of the Council, the County surveyor and the solicitor to the Council.

Postal Servants.—In spite of the concessions granted by the Postmaster-General, dissatisfaction is expressed by certain sections of the staff, and the possibility of a strike is being seriously considered. A conference of employés is to be held at Leicester to-morrow.

Swansea.—The Post Office Department proposes to construct a new central exchange, to complete the installation of underground cables, and to extend the latter to Llanelly, Neath, Port Talbot and Cardiff, at a cost of about £150,000.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—A new set of automatic signals for use on the Oswaldtwistle tram section is to be purchased.

The Electrical Engineer has been instructed to obtain provisional tenders for additional gas plant.

Argentina.—December 20th. The Municipality of La Paz, Entre Rios, is calling for tenders for installing electric light in that city. Specifications from the Municipality.—*Review of the River Plate.*

Ashton-under-Lyne.—December 19th. Motor for circular saw, and two press-button electric passenger lifts for the workhouse, Chamber Hills. Specifications, &c. (£2 2s.), from G. H. Partington, Clerk to B. of G., Poor Law Offices, Stamford Street.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

December 31st.—For the P.M.G. Insulators. See "Official Notices" October 31st.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" November 28th.

Victorian Railways Department.—January 28th, 1914. One three-phase alternator &c.—*Tenders.*

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" November 28th.

Brisbane.—January 7th, 1914. Switchboards, parts and accessories. Schedule No. 274. Telephone instruments, &c. Stores Schedule No. 275. Measuring instruments, &c. Stores Schedule No. 277. Telegraph instruments, &c. Stores Schedule No. 276. Protectors, parts, &c. Stores Schedule No. 278. See "Official Notices" to-day.

Belgium.—December 16th. The municipal authorities of Schaerbeek are inviting tenders for the supply of the electricity meters required in connection with the electricity supply undertaking. Copies of the specification can be obtained for 5d. from the Caisse Communale, 30, Rue de la Ruche, Schaerbeek, Brussels, while particulars can be secured from the Service de l'Electricité, at the same address.

December 20th.—The Belgian Post and Telegraph Authorities in Brussels (La Salle de la Madeleine) are inviting tenders for the supply and laying of a quantity of telephone cables in the Brussels district.

Bohemia.—Trubau.—December 15th. Supply of two electric running cranes, 25 and 3 tons lifting capacity respectively, for the boiler smithy at the railway works, Trübau. Particulars of the Abteilung IV/4, Fachabteilung für Zugförderungs und Werkstättendienst, 3, Schwarzenberg Platz, Vienna I (enclosing 1 krone).

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 kw.; storage batteries, boosters and switch and regulating gear; two 1,500-kw. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

Canada.—Yorkton (Sask.).—December 22nd. Tenders marked "Tenders for Diesel Electric Machinery" to be addressed to T. F. Acheson, Secretary-Treasurer, Town of Yorkton, for one 500-B H.P. combined unit. Specifications, &c., from M. M. Inglis, electrical engineer, Yorkton.—*Canadian Engineer.*

According to an announcement in the *Canadian Engineer*, the Bowness Improvement Co., 202, Eighth Avenue West, Calgary, Alta., is inviting tenders, until December 31st, for a 200-kw. traction motor generator, a four-panel switchboard, a 250-K.V.A. generator, and a vertical single-acting multi-cylinder gas engine. Specifications from Mr. T. L. Turnbull, consulting engineer at the above address. The date for sending in tenders for transforming machinery "to convert hydro-power into direct current" for the street railway, is extended from December 15th to February 15th.

Colchester.—December 9th. Electrical sundries for six months for County Asylum, Severalls. Mr. R. Overend, Clerk, the Asylum.

Darwen.—Tenders are to be invited for the supply of wind screens on tramcars.

Edinburgh.—The T.C. Tramways Committee is to invite tenders for six motor-'buses to run on the south side route.

France.—December 13th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of six lots of telephone exchange switchboards.

The Administration des Chemins de Fer de l'Etat is about to purchase:—Lot 5, electrical material needed for the local lighting and power sub-station at the Argenteuil-Triage railway station. Lot 6, 12 electric travelling lifts for the erection shop at Batignolles. Particulars, 43, Rue de Rome, Paris.

Leigh (Lancs.)—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" to-day.

London.—L.C.C.—December 10th. Installation, 2[illegible] lighting points, at Ocean Street Elementary School, Mile End, E. See "Official Notices" November 28th.

L.C.C. Fire Brigade Committee.—Installation of the electric light in the Cherry Garden Street Fire Station, and the supply of electric charging apparatus for installation at Clapham, Dulwich, Hackney, Holloway, Kensington, Lee Green and Streatham fire stations.

December 9th. Ten tons cotton covered copper wire for the Tramways Department. Also trolley wire. See "Official Notices" to-day.

December 23rd. Steam, exhaust, condenser feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" to-day.

Royal Mint.—December 15th. [illegible] tons of copper in ingots. See "Official Notices" to day.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follow:—Four 1,000/1,250-kw. sets; one 1,000-kw. set; and two 650/800-kw. sets. See "Official Notices" to-day.

New Zealand.—February 19th. The Christchurch City Council invites tenders for (1) underground and aerial cables; (2) testing instruments; (3) underground troughing and covering; (4) transformers; (5) meters and demand indicators; (6) marline, tape and rubber mats; (7) enamelled iron tablets; (8) insulators; (9) service fuse boxes. Specifications 10s. each, or £3 for complete set of nine.—*New Zealand Shipping and Commerce.*

Christchurch.—December 24th. Cable, testing instruments, transformers, meters, insulators, &c., for the City Council. High Commissioner for New Zealand in London.

Portugal.—December 12th. The municipal authorities of Serpa are inviting tenders for the establishment of a central station for the supply of electrical energy for public and private lighting and power purposes in the town.

Ramsbottom.—The U.D.C. has decided, in connection with the railless trolley system, to purchase two new cars, in which many improvements will be embodied.

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" November 28th.

Spain.—December 15th. Tenders are being invited by the municipal authorities of Belmez for the establishment of a central station in the town capable of supplying current for 2,000 10-C.P. metal filament lamps.

Stockton.—December 22nd. Construction of Stockton to Billingham Beck Branch Railway (about three miles in length), for the N.E. Railway Co. Mr. C. F. Bengough, Company's Engineer, York.

Sweden.—Stockholm.—Five sluice gates for tube inlet, also accessories. Weight of gates, about 85 tons. For Porjus Power Station.

Wakefield (Yorks.).—December 5th. Twelve months' supply of stores, for Yorkshire (West Riding) Electric Tramways Co., Ltd.

Wolverhampton.—December 16th. Supply and laying of cables, re-wiring lamp standards, &c., Heath Town Workhouse, for the B. of G. Mr. F. Harrison, Clerk.

Worksop.—December 15th. Electric light installation (123 lamps) for the B. of G. Mr. J. S. Whall, Clerk, 66, Bridge Street.

York.—Electricity and Tramways Committee. Tenders for the trucks, car bodies, and gear for four trailers.

December 22nd.—Corporation. Stores for electricity and tramways department. See "Official Notices" to-day.

CLOSED.

Accrington.—The Electricity Committee has recommended the acceptance of a tender by Leyland Motors, Ltd., for a 30-H.P. motor tower wagon costing £610.

Bacup.—The Electricity and Tramways Committee has ordered 12 three-ampere meters from the B.I. and Helsby Cables, Ltd.

Bedford.—The B.C. Electricity Committee recently invited tenders for (1) mixed pressure turbine, alternator, exciter, air filter and condensing plant; (2) water-tube boiler, mechanical stoker and coal-handling plant. Twenty tenders had been received for No. 1, and two for No. 2. These had been referred to a sub-Committee.

Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Pettit & Co. for 30 tons of Kent coal, at 19s. per ton, for the electricity works.

Australia. — Commonwealth. — P.M.G.'s Department :—

20 relay keys, £565.—Maritime Wireless Co.

The following contracts have been accepted by the Commonwealth :—

Melbourne.—

25 cable distributing boxes, five pairs, £12 : 50 ditto, 10 pairs, £31 ; 50 ditto, 31 pairs, £36 ; 25 ditto, 52 pairs, £47.—W. T. Henley's Telegraph Works Co., Ltd.

50 miles tinned rubber-insulated cotton-covered and braided copper wire, £172 ; 60 miles ditto, £177 ; 150 miles twisted pair, tinned annealed copper, vulcanised rubber-insulated, taped and braided, £2,062.—Armorduct Manufacturing Co , Ltd.

20,000 zincs, Leclanché, £149 —Lawrence & Hanson Electrical Co., Ltd.

800 steel battery brushes, £31 : 750 coppers, £21 ; 10,000 zincs, Meldinger, £307 800 zincs, for gravity cells, £575.—I.R., G.P. and Telegraph Works Co., Ltd.

1,500 G.I. suspended strand clamps, £112.—Western Electric Co. (Aus.), Ltd.

Sydney.—

12 miles switchboard cable, £89 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

4 miles switchboard cable, £124 per mile.—B.I. & Helsby Cables, Ltd.

2 miles switchboard cable, 21 conductors, £42 10s per mile ; 14 miles ditto, 104 conductors, £224 per mile.—Australian Metal Co.

—*Australasian Record.*

Messrs. Pope's Electric Lamp Co., Ltd., have received a further contract from the Melbourne City Council for 33,300 lamps.

N.S.W.—P.M.G.'s Department :—

440 lodge arresters, 17s. 6d each —E. H Kirkby.
Telephone material.—J. Bartram & Son Pty., Ltd.
15 miles paper-insulated, lead-covered cable, 416 pairs, 12½ lb., conductors not served, £1,100 per mile : 15 miles ditto, 26 pairs, conductors served, £166 per mile.—B.I. and Helsby Cables, Ltd.

—*Tenders.*

The Cock's Pioneer Sluicing Co., Eldorado, Vic., has placed an order with the Australian Metal Co. for the supply of a complete power house equipment.—*Tenders.*

The *Australian Mining Standard* for October 23rd says :—"When in London at the beginning of the year, Mr. Scaddan, Premier of Western Australia, arranged for a power house and plant for the Perth trams and lighting, and for the electrification of some of the railway sections. Four contracts have been let for a total of £188,521 with Babcock & Wilcox, Willans & Robinson and the British Westinghouse Co., and tenders have been called in London for three others, estimated at about £85,000. All works are to be completed by June, 1914. Last week an agreement was signed by the Premier and the Mayor of Perth respecting the lighting of the city. The engineer-in-chief, Mr Thomson, now in England, is reporting on the railways electrification scheme."

Shire of Nunawading —Aluminium cable, £1,420, B.I. and Helsby Cables, Ltd.—*Australian Mining Standard.*

Bolton.—The Corporation has accepted the following tenders in connection with the new generating station at Back-o'-th'-Bank :—

Erection of staircases and ladders.—Messrs. Grimshaw & Peers.
Iron fences.—Bolton Moor Foundry Co., Ltd.

Bury.—Electrical blowing apparatus for the Bank Street Chapel organ, Mr. Clarence A. Cass, Bury.

Canada.—Winnipeg.—Contract has been awarded the Inperial Wire and Cable Co. for 5,500 ft. of 2,200-volt, three-core, paper-insulated, lead-covered cable.

Hanley, Sask —A contract has been awarded to the British Canadian Engineer and Supply Co. for a producer gas electric plant. —*Canadian Electrical News.*

Hamilton. Ont.—The contract has been awarded the Hamilton Standard Underground Cable Co. for the cable on the hydro system, at a cost of $53,675

Toronto Ont —The Abitibi Pulp and Paper Co. has placed an order with the Canadian Allis Chalmers Co., Ltd , for a number of high-lift turbine pumps and centrifugal pumps all driven by Canadian General Electric motors.—*Canadian Engineer.*

Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for marine traction type tantalum lamps from the Canadian Northern Railway system, for use on their Atlantic Steamship service vessels.

Dartford.—The following tenders have been provisionally accepted by the U.D.C. for new plant :—

Babcock a Wilcox, Ltd., water-tube boilers, steel chimney, foundations, piping and accessories, £4 845.
Johnson & Phillips, Ltd., rotary converters, switchboard, cabling and accessories, £4,321.
B.I. and Helsby Cables, Ltd., £550 (estimated).

Darwen.—The Council has accepted the tender of Messrs. H. Baldwin & Co. for the supply of coal to the electricity works.

Eccles —The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., to supply consumers' electricity meters for 12 months.

Liverpool.—The City Council has accepted the tenders of W. A. Stevens, Ltd., the Brush Electrical Engineering Co., Ltd., and Straker & Squire, Ltd., for the supply of two motor-'buses each.

Grimsby.—The Education Committee has appointed Messrs J. D. Beckett & Co. as the electricians for districts Nos. 1 and 2 for the year ending December 31st, 1914.

The Public Lighting Committee has recommended the following tenders for acceptance to the Town Council :—

W. Lucy & Co., Ltd.—House service boxes, £171 ; fittings, £49 ; house fuse boxes, £158.
Cryselco, Ltd.- Metal-filament lamps, 75, 65, 50, 32 and 25 c.p., £46. The same firm has held the contract for the last four years. The majority of the lamps used will be of 65-c.p. size.
W. Browne & Co., Grimsby.—Coal, 7s. 8d. per ton, for three months.

London.— Shoreditch.—The following tenders have been received for the supply of lead-covered paper-insulated cable for house services for six months :—

	·0224.	·035.	·095.	
Siemens Bros, & Co., Ltd. (accepted)	£72 0	£91 0	£187	per mile.
W. T. Glover & Co.	73 10	92 10	190	,,
Western Electric Co., Ltd.	73 15	94 0	192	,,
W. T. Henley's Telegraph Works, Ltd.	74 0	93 0	191	,,
Helsby Cables, Ltd.	74 0	93 0	192	,,

Approximate quantity, three miles, ·0224 ; two miles, ·035 ; one mile, ·095.

L.C.C.—For the supply of electric cables, wires and flexible cords (Schedule No. 16), for 12 months from January 1st, 1914, the following have been accepted by the Stores and Contracts Committee :—Connolly Bros., Ltd., item 4 (*a*) and (*b*) ; W. T. Henley's Telegraph Works, Ltd., item 1 ; Hooper's Telegraph and India-Rubber Works, Ltd., items 2, 3, 6, 7 and 8 ; the Liverpool Electric Cable Co., item 5.

For electrical wiring and apparatus (excluding generating plant) at Maudsley Hospital, the following tenders have been received :—

Tyler & Freeman (accepted)	£1.485	Edmundson's Electricity Corporation, Ltd...	£1,705
G. E. Taylor & Co.	1,500	Donneson, Sillem & Co. ..	1,849
H. J. Cash & Co.	1,599	Foote & Milne	2 049
Drake & Gorham	1,640	Strode & Co.	2,117
Tredegar & Co.	1,640		
T. Clarke & Co.	1,704		

The Highways Committee recommends the acceptance of the tender of Rowley Bros. for the erection of the completion of Abbey Wood car shed, at £16,981.

The following tenders have been received for the supply of—(A) of 1 ton of T.C.C. copper wire, ·229 in. diam., and (B) 1½ tons of D.C.C. copper wire, ·229 in. × ·229 in., in connection with winding-car field coils :—

	A.	B.	Discount.
Siemens Bros. & Co.	£96 5 0	£80 6 8	—
B.I. & Helsby Cables .. (accepted)	93 6 8	91 0 0	2½
Midland Electric Wire Co., Ltd ..	93 6 8	93 6 8	2½
London Electric Wire Co. & Smiths ..	91 0 0	93 6 8	2½
I.R., G.P. and Tel. Works	99 17 6	100 17 6	2½
Johnson & Phillips	98 0 0	101 0 0	—
Henley's Telegraph Works Co. ..	105 0 0	101 10 0	2½
General Electric Co.	105 0 0	102 13 4	2½
Callender's Cable and Con. Co. ..	110 0 0	112 0 0	2½
Western Electric Co.	110 0 0	112 0 0	2½

Luton.—The following tenders have been accepted by the T.C. for the Electricity Department :—

E. Green & Son, Ltd., economiser and damper, £837.
Sturtevant Engineering Co., Ltd., air filter for turbines, £245.
W. H. Bowater, Ltd., annual supply of Ibstock coal, 13s. 9d. per ton.

Maidenhead.—The T.C. has accepted the tender of the Diesel Engine Co., Ltd., for a pump for the Electricity Works, at £29.

Plymouth.—The Electricity and Street Lighting Committee held a special meeting on Tuesday, at which 11 tenders were received for switchboard panels in connection with the electricity works extension. The lowest tender, that of Messrs. Johnson & Phillips, Ltd., at £581, was conditionally accepted.

Salford.—The T.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for welding about 600 tramway rail joints, at 30s. per joint.

Southampton.—The T.C. is to purchase from Pirelli, Ltd., the necessary quantity of cable required to supply the firm's works with energy. The approximate length required will be 600 yards, for which Messrs. Pirelli quoted £1,203 per mile for 1-in. cable, and £659 per mile for ½-in. cable.

Warrington.—The Electricity and Tramways Committee has accepted the following tenders for extensions at the electricity works :—

Boiler plant.—Babcock & Wilcox, Ltd., £2,362.
Turbo-alternator plant.—J. Howden & Co., Ltd , £5.843.
Condenser plant —Worthington Pump Co., Ltd., £3,344.
Economiser plant.—Goodbrand & Co., Ltd., £203.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, December 8th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, December 9th.—"B" Company. Ditto.

Wednesday, December 10th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, December 11th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, December 12th.—"D" Company. Special class on Crossley engine, 7 p.m. Technical instruction, 7.30 to 9.30 p.m.

Saturday, December 13th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

HIGH-SPEED TURBINES AT MARYLEBONE.

Through the courtesy of Mr. A. H. Seabrook, the manager of the Marylebone Council's electrical undertaking, we are able to illustrate and briefly describe the new high-speed turbine plant which has recently been brought into use at the Council's generating station.

It may be remembered that this station was equipped throughout in the first instance with Parsons direct-current turbo-generating plant which was, in fact, amongst the most modern and efficient plant available at that time.

A comparison between these 8-year old machines and the small and highly efficient turbo-alternators which have been installed, shows the unmistakable progress which the turbine builder has made during that period, and which is no less noteworthy than that shown when turbine machinery first supplanted reciprocating plant on a commercial scale.

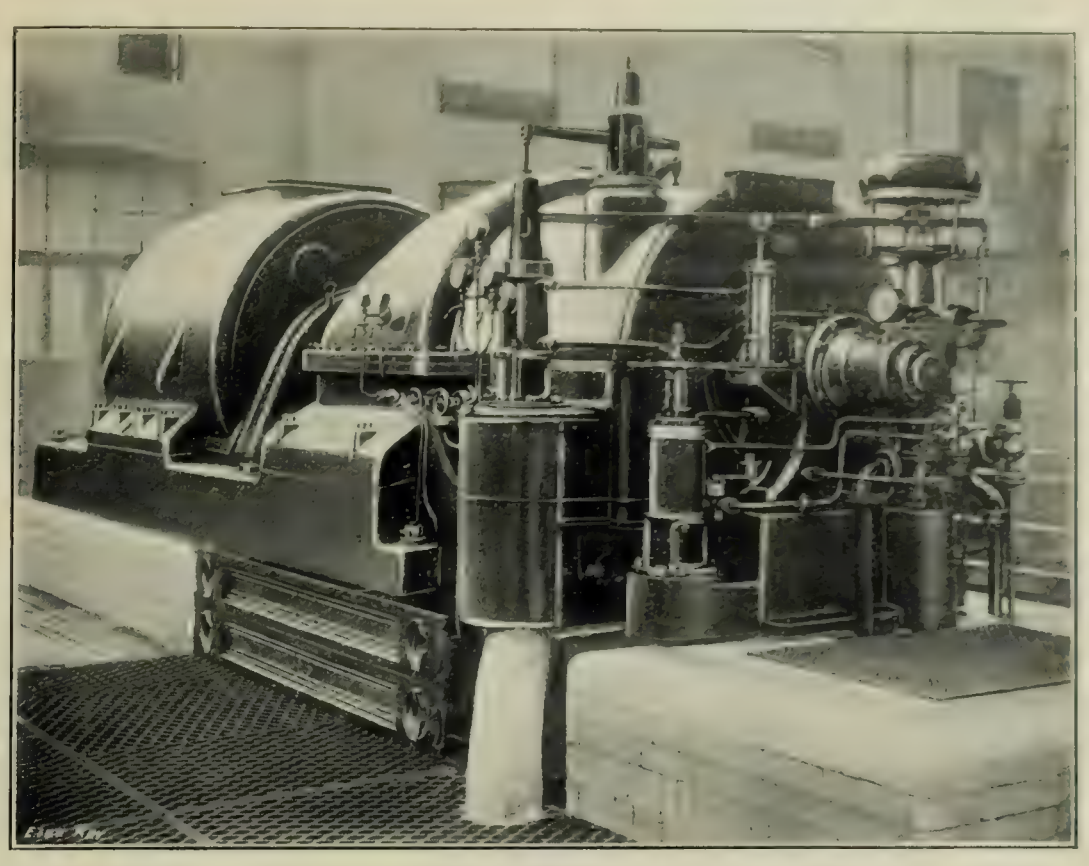


Fig. 1.—View of the Steam End, 3,000-4,200-kw. Oerlikon Turbine Set.

The new generating plant was supplied by the Maschinenfabrik Oerlikon, and consists of two sets, each consisting of a pure impulse type turbine coupled to a totally-enclosed three-phase alternator, generating current at 6,600 volts pressure and 50 cycles; an extension of the main-shaft carries the exciter, and the sets run at a speed of 3,000 r.p.m., each giving a normal output of 3,000 kw., and on a six-hour rating, 4,000 kw. We believe these are the first 3,000 r.p.m. turbine sets of this size to be brought into use in this country, and whatever may be the advantages of lower speeds, the low first cost, small space taken up, and high efficiency secured in the new Marylebone plant, are factors which cannot be ignored in connection with the general cheapening of electricity supply.

The new sets run on 190-lb. steam pressure, and 100° of superheat, and although greater pressure and superheat were desirable, the steam consumption on full load is guaranteed at 13·27 lb. per kw.-hour, and appears likely in practice to be 4 per cent. better; on ¾ load the consumption is 13·73 lb.

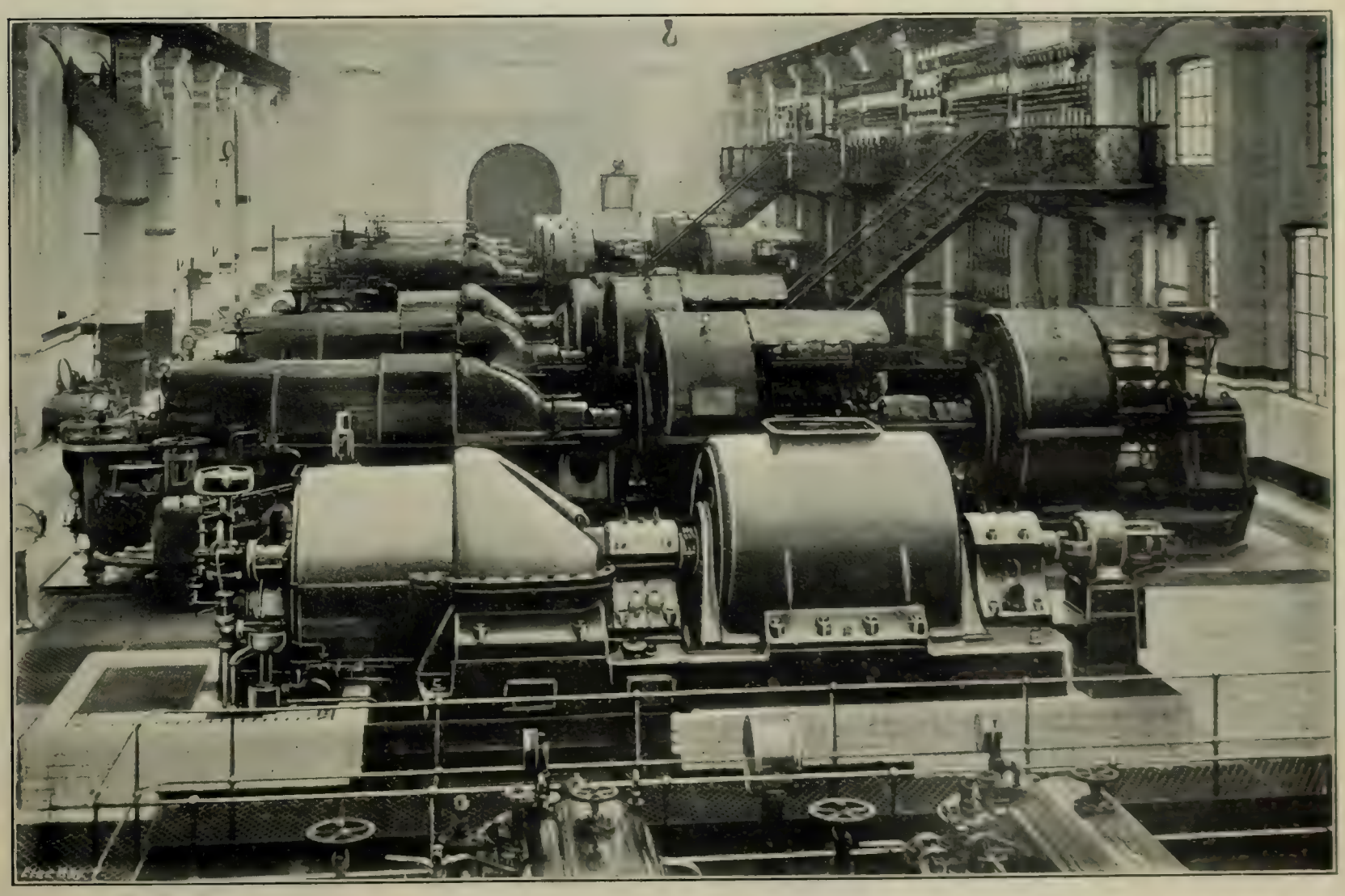


Fig. 2.—General View of the Marylebone Generating Station, showing a 3,000-4,200-kw. a.c. Turbine Set in the Foreground and the older 2,000-kw. d.c. Turbine Sets behind.

Fig. 2 shows one of the new sets in the foreground, with the older 2,000-kw. turbine units behind, and incidentally gives a good idea of the small space occupied by

the new plant as compared with the old; fig. 1 shows the steam end and governor gear of the same set, the governing being electrically controllable from the switchboard.

The turbine sets are being erected complete with Worthington condensing plants, each including a surface condenser of 10,500 sq. ft. cooling area to deal with 52,500 lb. steam per hour, coupled to the turbine above through a 52-in. diameter gate valve; a 22-in. motor-driven centrifugal circulating pump and electrically-driven three-throw air-pump. The first of the new turbines has been temporarily coupled to two old condensers which served four 500-KW. turbine sets, and due to the small steam consumption of the new plant, the latter has carried 3,800 KW. under these conditions.

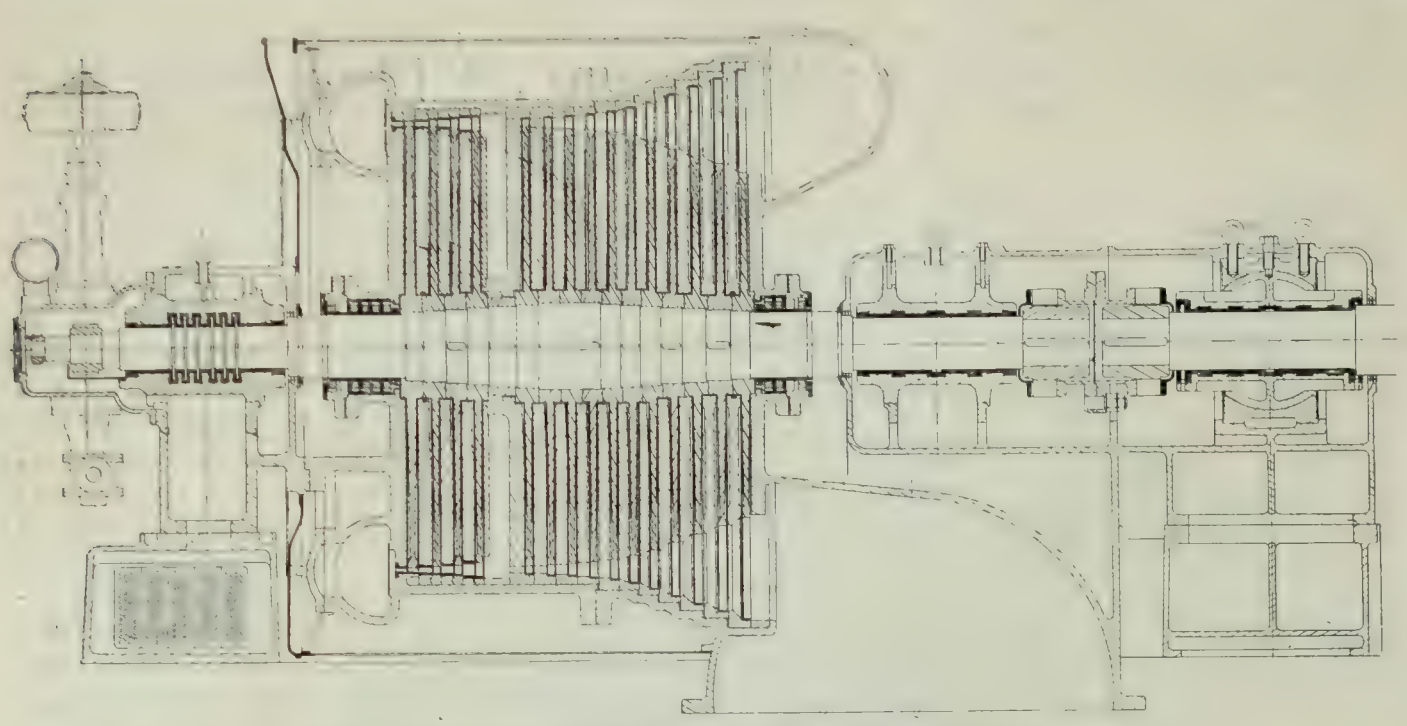


FIG. 3.—SECTIONAL VIEW, OERLIKON IMPULSE TURBINE.

Both the machines are arranged for forced ventilation, and the air is supplied from a Sturtevant wet-air filter plant, situated outside the engine room and shown in fig. 7; the air is passed into the cable race under the engine room —which it incidentally ventilates — then through ducts to the alternators, being discharged into the engine room.

Our illustration shows the comparatively small size of this wet-air plant which will deal with 8,000 KW. The new H.T. switchgear, supplied by Messrs. Ferranti, containing the control panels for the new machines and for the trunk feeders to Manchester Square and Rathbone Place sub-stations, and for a 1,000-KW. rotary converter installed in the generating station, has been erected on the main switch-gallery at one end of the direct-current switchboard.

Until recently the switchgear at this station was arranged on two galleries, one across each end of the generating station, which was originally illustrated and described in the ELECTRICAL REVIEW, Jan. 18th, 1907; in view of the growing output of the station, it was decided to rearrange and modernise the control of the plant, and with this object in view the old direct-current panels have been re-erected on the gallery shown in fig. 5, running down one side of the engine-room. This work was carried out between June and September last, and as now erected the field control of the machines with the necessary machine and pilot instruments are gathered together on the centre panels, with the

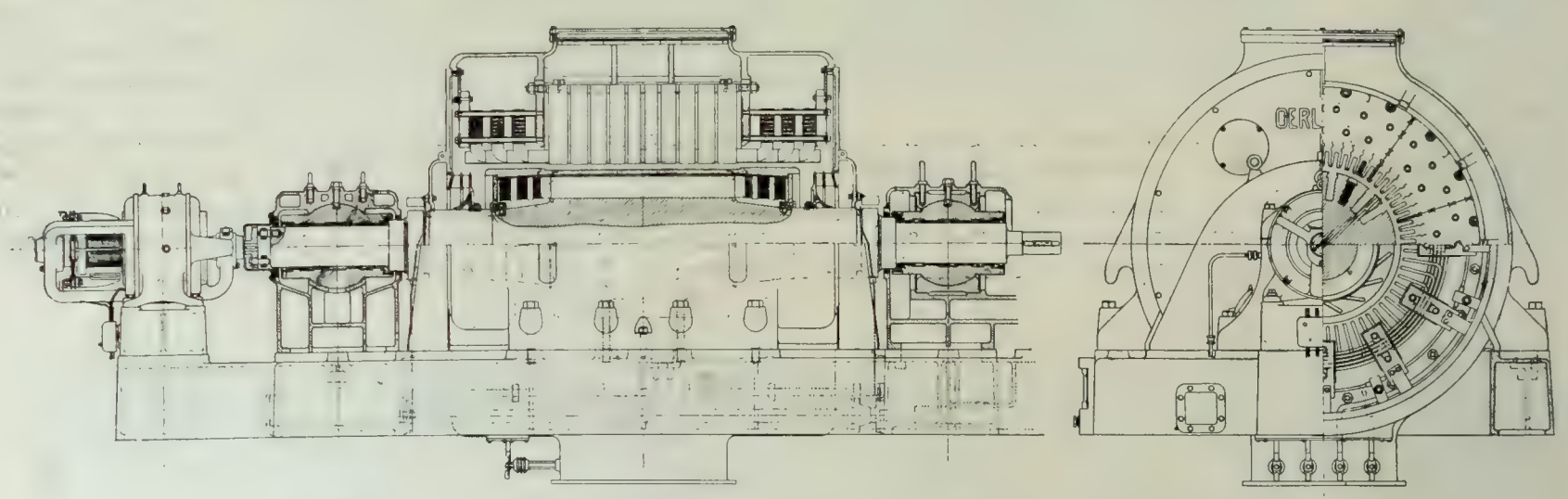


FIG. 4.—SECTION OF OERLIKON 3,000-4,200-KW. 3,000-R P.M. ALTERNATOR, &C.



FIG. 5.—NEW SWITCH GALLERY, MARYLEBONE GENERATING STATION; NEW H.T. SWITCHGEAR ON THE LEFT.

positive panels on the right, and the negative panels on the left, the new H.T. control panels being on the extreme left.

The whole of the field rheostats for the direct-current plant are installed in a centre chamber immediately behind the controlling panels; the feeder fuses which were originally under the switch galleries, are now fixed to brickwork partitions several feet behind their respective panels, while the H.T. oil switches and bus-bars are enclosed in brick cubicles, also some distance behind the control panels, to which they are connected by mechanical control.

Three H.T. trunk cables, supplied by the B.I. and Helsby Co., run to the Manchester Square sub-station, terminating in a special selector panel, which enables either of them to supply locally through two 1,000-KW. rotary converters, or to be connected to two further feeders which run to the Rathbone Place sub-station, where also a 1,000-KW. rotary has been installed for the supply of the local network.

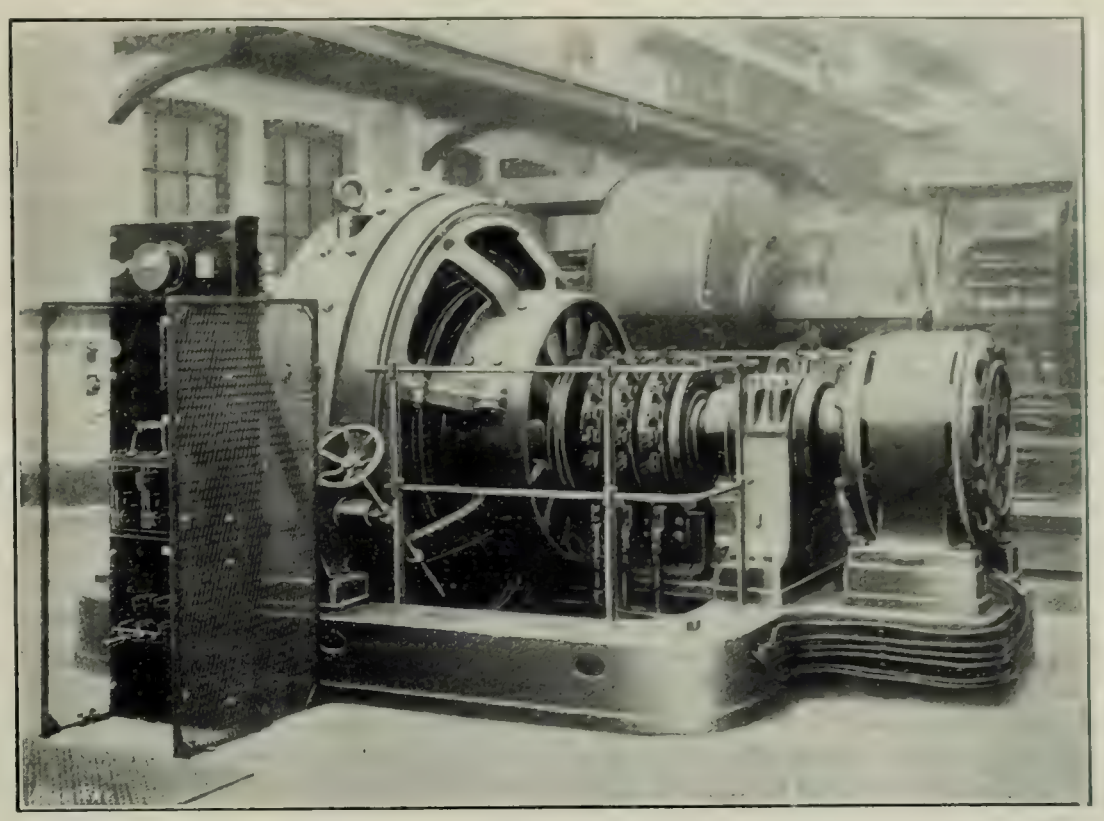


FIG. 6.—1,000-KW. WESTINGHOUSE SELF-SYNCHRONISING ROTARY, MARYLEBONE.

These rotaries are identical with that installed in the generating station and illustrated in fig. 6, and were supplied by the Westinghouse Co.

Each of them is provided with the Rosenberg self-synchronising apparatus and an alternating-current booster, the latter, on account of the wide variation in pressure, between 490 and 560 volts, required for the direct-current distribution.

We understand that the capital cost of the new H.T. scheme amounted to £42,000, and that, after allowing 10 per cent. per annum on this expenditure, direct current can be delivered to the sub-stations at about ·3d. per KW.-hour, at a 20 per cent. load factor. In effect, the saving arising from decreased steam consumption—the new plant requiring, roughly, 13 lb., as against 17 lb. per KW.-hour on full load with the old plant—amounts to more than the capital charges on the new plant, so that the department obtains the use of 6,000 to 8,000 KW. additional plant capacity at no cost.

It may be mentioned that various improvements have been effected in the boiler house, where originally each pair of Babcock boilers was provided with an independently-fired superheater.

In view of the additional space set at liberty, and the saving in running and maintenance cost, the independent superheaters with their machine stokers have given place to integral superheaters in each boiler, with, however, a modification in design, which provides for a connection to and from the superheater of the same size as the boiler stop valve, and a butterfly valve, by means of which the proportions of superheated and saturated steam passing to the top valve can be varied at will. The arrangement is found to give excellent control of the superheat.

The Marylebone boiler plant operates under induced draught, and as the boilers are not working at their full power, it will be possible by increasing the fan draught to obtain from 20 to 25 per cent. additional steam from them. This steam reserve and the low average steam consumption and compactness of modern turbine plant which may be

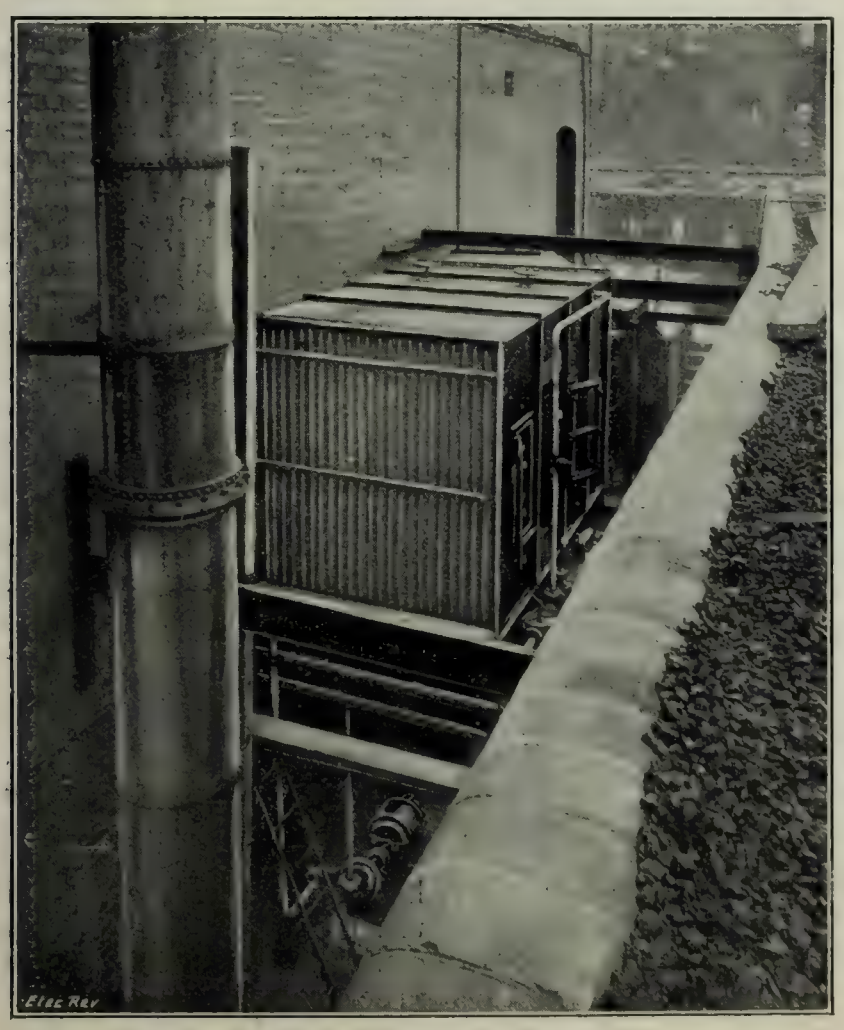


FIG. 7.—STURTEVANT WET AIR FILTER.



FIG. 8.—NEW STREET LIGHTING, MARYLEBONE.

installed, are such that the existing generating station will probably serve the Council's purpose for some years to come, despite the noteworthy increase in the sales of energy which is taking place in the area, and which, it is satisfactory to note, shows no signs of abatement.

Street Lighting.—An interesting departure in street lighting has been made at the new Baker Street Circus, by Baker Street Station, where four 5-lamp columns on the American ornamental street lighting system have been erected, each containing a total of 600 watts, made up of one 200 and

four 100-watt lamps. The fittings, fig. 8, were supplied by Mr. Haydn Harrison ; the columns are the standard Metropolitan Board of Works type, slightly extended ; the globes are Alba and Superlux and the lamps Osram and Mazda. On the refuge and sidewalk are 3-lamp fittings, 400 watts per post.

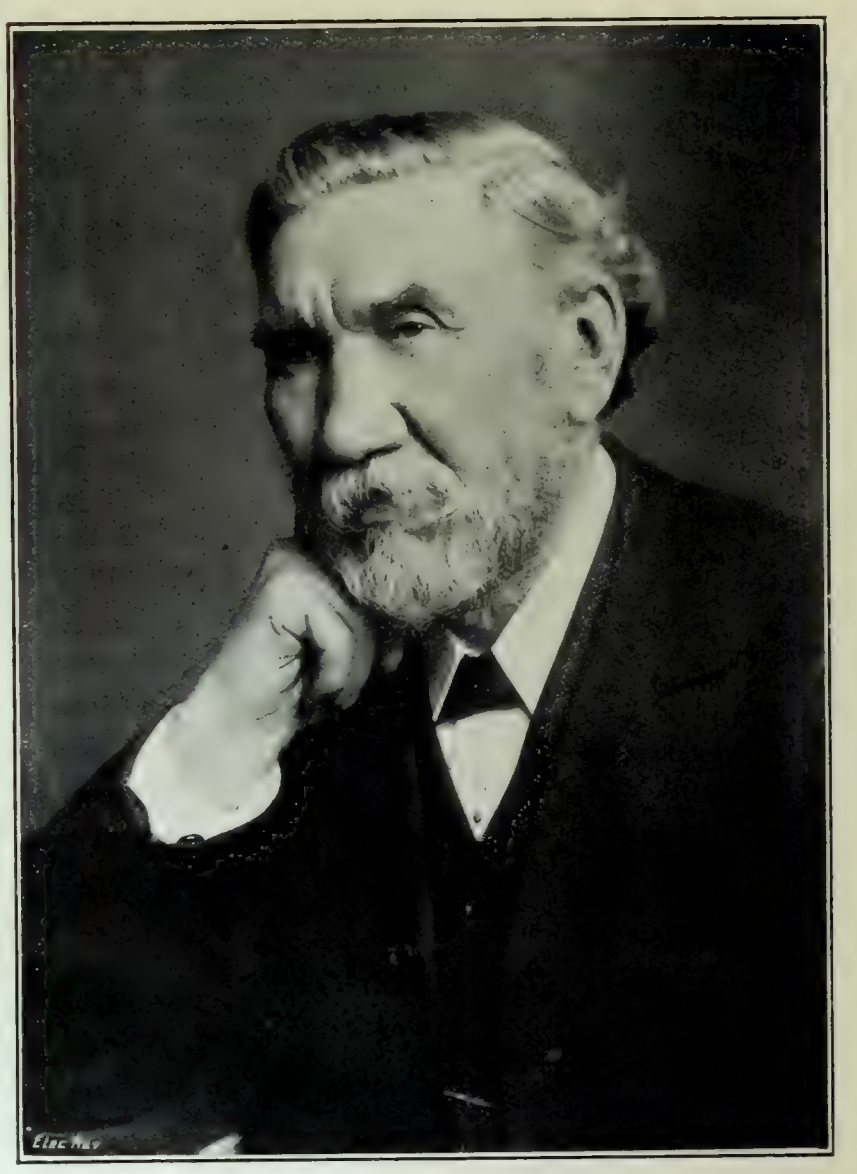
It is contended that this method of street lighting gives a most pleasing effect, and even if wasteful in current the effect is of more importance from an advertising point of view than a correct system of illumination, which may possibly not be pleasing in appearance. The posts previously erected on this site were two-light 160-watt, and three-light refuge-type of 240-watt capacity, for which £4 9s. 6d. and £6 14s. 6d. per post per annum, respectively, were charged.

The charge for the new 600-watt posts is £14, and for the 400-watt posts £10, per post per annum, so that over three times the light is being given for, approximately, twice the money. The final globes are not yet decided upon ; when this is done, all the posts will be of 600-watt capacity.

In conclusion, we are indebted to Mr. Seabrook and to his station engineer, Mr. Richardson, for their assistance in connection with the above article.

MR. JAMES HOWDEN.

As briefly stated in our last issue, Mr. James Howden, chairman of the firm of James Howden & Co., Ltd., engineers and boilers makers, Glasgow, passed away on November 21st, in his 82nd year. He was ill for only a short time, having been at business quite recently. He underwent an operation, and there were signs of his splendid constitution enabling him to make a good recovery notwithstanding his advanced age. A relapse came quite unexpectedly, however, to which he succumbed. Mr. Howden was born at Prestonpans and he went to Glasgow as a youth, beginning his career as an apprentice in 1847 with Messrs. James Gray & Co., makers of factory and blowing engines. Later, after a brief period in the offices of a Glasgow civil engineering firm, he took an appointment with Mr. Robt. Griffiths, where his work in connection with screw propellers laid the foundation for his subsequent chief engineering interest. He began business on his own account when only 22 years of age, designing rivet-making machinery, in which department he took out the first of a series of patents which ranged over the whole field of engineering, boiler - making and kindred subjects. He took his first contract for marine engines in 1859, putting in compound engines and water-tube boilers of his own design, using steam at 100 lb. pressure, a very decided advance in those days of single-cylinder engines using steam at from 20 to 25 lb. pressure. In 1862 Mr. Howden purchased ground in Scotland Street, and founded the firm of James Howden & Co., which prospered, necessitating larger works nine years later, and from that date onward he constructed engines and boilers for many leading steamship lines. In this connection the firm built up a world-wide reputation, but it is by reason of his system of hot-air forced draught that his name is best known. Early in 1882 he began a long series of experiments which eventuated in that system.



The late Mr. James Howden.

In a very few years the volume of business made it necessary for Mr. Howden to devote all his energies to the development of the forced-draught business, and to discontinue the manufacture of marine engines. This course was fully justified by the results, and in 1898 the business had increased to such an extent that extension was again necessary, and more land was acquired in the same street and new works were erected.

In 1900 he turned his attention to a special design of high-speed engine of the forced lubrication type, for driving electric generators. This engine embodies the accumulated experience of his earlier years, and is based on practically the same design as the marine engines built by him, one of the leading features being the method of conveying the steam from one cylinder to another without using outside pipes. The same success attended the production of these engines as had characterised his activities in the marine engineering world, large numbers of this type of engine in single units up to 2,000 H.P. having been constructed for installations at home and abroad, the principal clients being municipalities, colliery, factory and mill-owners, and steamship companies. Shortly thereafter Mr. Howden recognised that the steam turbine for electrical purposes would soon take the principal place for high powers, and would afford him a congenial field for his energies. He therefore commenced the manufacture of the Howden-Zoelly impulse steam turbine. This also has proved a great success, the company having supplied a large number to many of the leading city corporations and other power-users. It is interesting to record that the company are at this moment completing the fourth turbine order for the Corporation of Manchester, the capacity of the unit being 30,000 H.P. The latest development of Mr. Howden's Co. is the building in Govan of new works as a branch establishment for the manufacture of a special patented type of combination sectional water-tube boiler designed to embody the benefits of the cylindrical boiler with the good points of the water-tube boiler, but without any of the disadvantages of the latter. These boilers have also been designed to permit of the Howden system of hot-air forced draught being employed in a convenient form. We understand that already evidence is abundant that the boiler will be largely adopted both for marine and land installations, many contracts having been obtained. Mr. Howden had had his nephew, Mr. J. Howden Hume, associated with him in the active management of the business for over a quarter of a century ; during the latter half of the time he was managing partner, becoming managing director on the formation of the company in 1907. Mr. Howden's son, Mr. William H. Howden, has also been a director of the company since 1907, taking special control of the high-speed engine and turbine works. Mr. Howden was the last survivor of the original membership of the Institution of Engineers and Shipbuilders in Scotland, which was founded in 1857. He was also a member of the Institution of Civil Engineers, and a member of the Institution of Naval Architects. He contributed to the *Proceedings* many papers on important engineering and shipbuilding subjects.

He was a member of the advisory council of the International Engineering Congress in connection with the World's Columbian Exposition held in Chicago in 1893, and he received a remarkable ovation on his appearance at that Congress to read his paper on " Forced Combustion in Steam Boilers " at the request of his friend the late Admiral Melville, Engineer-in-Chief of the United States Navy.

FORTHCOMING EVENTS.

Faraday House Old Students' Association.—Friday, December 5th. At 7.30 p.m. At Holborn Restaurant. Annual smoking concert.

Institution of Mechanical Engineers.—Friday, December 5th. At 8 p.m. At Storey's Gate, S.W. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Junior Institution of Engineers.—Friday, December 5th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Presidential Address, by Sir Boverton Redwood, Bart.

Manchester Association of Engineers.—Friday, December 5th. At Whitworth Institute, Whitworth Park. Conversazione.

Northampton Polytechnic Institute.—Friday, December 5th. At 7.30. At the Institute, St. John Street, E.C. Annual Presentation of Prizes and Certificates by Mr. C. S. Cobb, Chairman of the L.C.C.
Saturday, December 6th. Conversazione.

Salford Technical and Engineering Association.—Saturday, December 6th. Visit to Salford Electricity Works. At 7 p.m. At Royal Technical Institute. Annual Meeting.

Institution of Post Office Electrical Engineers.—Monday, December 8th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "The Elimination of Waste in Telephone Plant and Operating," by Mr. B. O. Anson.

Institution of Electrical Engineers (Students' Section).—Monday, December 8th. At 7.0. At Trocadero. Annual Dinner.

Institute of Marine Engineers.—Monday, December 8th. At 8 p.m. Discussion on Fuel Test.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 8th. At 8 p.m. Paper on "Shipbuilding and Shipyard Practice," by Mr. W. J. Drummond.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, December 8th. At 7.30 p.m. At Armstrong College. Discussion on Dr. Klingenberg's Address.
Friday, December 12th. At 7 p.m. At Hugh Bell School, Middlesbrough. Discussion on Dr. Klingenberg's Address.

Royal Society of Arts.—Monday, December 8th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (II), on "The Measurement of Stresses in Materials and Structures."
December 10th. At 8 p.m. Paper on "Applications of Electricity to Agriculture and Life," by Mr. T. Thorne Baker.

Society of Engineers.—Monday, December 8th. At 7.30 p.m. At the offices, 17, Victoria Street, S.W. Annual general meeting.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, December 9th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Discussion on Dr. Klingenberg's Address.
Thursday, December 11th. At 6.30 p.m. At the Grosvenor, Gordon Street, Glasgow. Twelfth Annual Dinner.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, December 10th. At 7.15 p.m. At Philosophical Hall, Leeds. Paper on "The British Standard Specification for Consumers' Electric Supply Meters." By Mr. S. H. Holden.

Batti-Wallahs' Society.—Wednesday, December 10th. Informal Evening.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, December 10th. At 7.30. At the University, Edmund Street. Discussion on "The Rating of Electric Machinery," introduced by Mr. A. R. Everest.

Association of Engineers-in-Charge.—Wednesday, December 10th. At 8 p.m. At St. Bride Institute, Bride Lane, E.C. Paper on "Water Raising and Measuring," by Mr. W. H. Booth.

Electro-Harmonic Society.—Friday, December 12th. At Holborn Restaurant, smoking Concert.

Greenock Electrical Society.—Friday, December 12th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Primary Batteries," by Mr. A. Bucklitsch; "Secondary Batteries," by Mr. H. J. Roberts.

Junior Institution of Engineers.—Friday, December 12th. At 8 p.m. At 39, Victoria Street, Paper on "Efficiency of Production," by Mr. H. N. Munro.
Saturday, December 13th. At 7 p.m. Reception, Dance and Whist Drive, at Caxton Hall, Westminster.

Manchester Association of Engineers.—Saturday, December 13th. At Grand Hotel, Aytoun Street. Paper on "Commercial Motor Road Traffic," by Col. R. E. Crompton.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 13th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

NOTES.

Electric Blasting on the Rand.—The subject of electric blasting as a system for use in the Witwatersrand gold mines was exhaustively treated in a paper read at the monthly meeting of the Chemical, Metallurgical and Mining Society of South Africa. The authors of the paper were Messrs. William Cullen, Thomas Donaldson and W. Waters. The advantages claimed for electric blasting and the probable effects of the system were considered in detail under the headings:—Health conditions, safety, economy.

Under the first heading, the writers point out that electric blasting will remove the necessity for white miners and natives to rush around to light up at firing time, and then travel through dust and fume-laden drives, stopes, &c.; as, except in special circumstances, no charges should require to be exploded before all workers are out of the mine. The authors state that it must be better for a miner, when working in a shaft or winze, to be able to explode his charges from a place of safety than to be obliged to light up each individual shot and then either climb up ropes or ladders, or be hauled up by bucket or skip, with the ever-present risk that some mishap may occur to prevent his getting safely away before any explosions occur.

On the question of economy, which (the authors state) comes last in importance, and should also be considered as least, first considerations made it appear that blasting with electricity would prove more costly than with safety fuse. When "cuts" are fired with instantaneous electric detonators, all charges attain their maximum force at the same instant, and better results are consequently obtained, and the extra time afforded for actual work at the face would ensure greater footage being broken and thus compensate for the higher cost of actual materials used.—*South African Mining Journal.*

Electricity Supply Rifle League.—The following are the results of the November matches:—Brompton (Beale, 97), 565, *v.* Poplar (Randall, 89), 526; Brompton (Mogford, Furneaux 97), 573, *v.* Stepney (Heaveside, 93), 527. Central (Graze, Rhodes 98), 573, *v.* Poplar (Frost, Mogg, 93), 539; Central (Wells, 97), 561, *v.* Westminster (Lott, 99), 569; Hackney (Hilling, 97), 551, *v.* Westminster (Neville, 96), 550; Hackney (Turner, 98), 563, *v.* Shoreditch (Weekes, 97), 565); Ilford (R. Tuffnell, Wilde, 98), 574, *v.* St. James's (Cockburn, 97), 565; Ilford (R. Tuffnell, 98), 571, *v.* Shoreditch (Ridd, Thomas, 96), 565; St. James's (Cockburn, 97), 558, *v.* Stepney (Barber, 94), 557. The following are the positions to date:—

	Matches.					Scores.	
	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	14	12	2	0	24	7,963	7,662
Ilford ...	14	11	3	0	22	7,903	7,643
Shoreditch ...	14	10	3	1	21	7,946	7,694
Central ...	14	10	3	1	21	7,900	7,670
Brompton ...	14	8	6	0	16	7,850	7,656
St. James' ...	14	6	8	0	12	7,597	7,744
Hackney ...	14	3	11	0	6	7,636	7,690
Stepney ...	14	2	12	0	4	7,523	7,643
Poplar ...	14	0	14	0	0	6,930	7,847

The Electric Vehicle Committee.—The second meeting of this Committee was held at the I.E.E. on November 14th. The members of the Committee are as follows:—

I.M.E.A. Members of the Committee.

R. A. Chattock, City Electrical Engineer, Birmingham, Chairman.

F. Ayton, Borough Electrical Engineer and Tramways Manager, Ipswich, Hon. Secretary.

A. C. Cramb, Borough Electrical Engineer, Croydon.

J. Christie, Borough Electrical Engineer, Brighton.

J. E. Edgcome, Borough Electrical Engineer, Kingston-on-Thames.

H. Faraday Proctor, City Electrical Engineer, Bristol, Hon. Secretary of the I.M.E.A.

A. H. Seabrook, General Manager, St. Marylebone Council Electric Supply Department.

Co-opted Members of the Committee.

F. E. Gripper (Edmundson's Electricity Corporation), representing the provincial electric supply companies.

E. S. Jacob (Tudor Accumulator Co.) and W. S. Naylor (Chloride Electrical Storage Co.), representing the Accumulator Section, B.E.A.M.A.

J. F. Monnot (representing Arrol-Johnston, Ltd.) and R. E. Mossay (Lloyd Electric Cars), representing makers of electric vehicles.

W. H. L. Watson (Edison Accumulators, Ltd.).

At the request of one of the principal power companies, an invitation to nominate a representative to the Committee has been sent to the Association of Electric Power Companies; a similar invitation was sent to the Electrical Contractors' Association, which has appointed Mr. W. R. Rawlings for this purpose. It was felt desirable to have on the Committee a representative of the manufacturers of electric motors as well as one for the manufacturers of switchgear. Accordingly, the B.E.A.M.A. have been asked to appoint a member for each of these sections of the industry. When all these additional members have been appointed, every section of the industry will be represented on the Committee, with the exception of the London Electric Supply Companies who have declined the invitation which was sent to them. Replies declining the invitation were also received from the Royal Automobile Club, and the Automobile Association and Motor Union. As representing the F.R.A.M. Co., Mr. Conway Jenkins has been elected to the Committee. The present members of the Committee will hold office until December 31st, 1914.

Two Sub-Committees have been appointed, viz., the Technical Sub-Committee and the Commercial Sub-Committee. To the first has been referred the matter of the adoption of a standard plug; this matter will be taken in hand as soon as the drawings of the revised standard plug in use in America come to hand from the Electric Vehicle Association, with which the Committee is now affiliated through the membership of its hon. secretary. The matter of obtaining specially favourable rates for the insurance of electric vehicles has been taken in hand, and it is probable that some definite decision will be come to by the companies within the next six months or so. The question of tariffs for charging vehicle batteries is being considered by the Commercial Sub-Committee, and it is proposed to arrange, if possible, a conference between the Committee and the representatives of the London Electric Supply Companies. The Commercial Sub-Committee is also taking up the matter of publicity work.

Anglo-American Exposition, 1914.—In connection with this Exhibition, which is to be held at Shepherd's Bush, London, from May to October next year, an Electrical Committee has been appointed as follows, those marked with an asterisk being members of the Executive :—

W. M. Mordey, *Chairman.**
R. Hammond, *Vice-Chairman.**
H. R. Kempe, *Hon. Secretary.**

A. S. E. Ackerman	Dr. S. D. de Ferranti	S. L. Pearce
P. R. Allen	E. Garcke	H. Faraday Proctor
S. W. Baynes	Leon Gaster*	W. R. Rawlings*
W. Worby Beaumont*	T. E. Gatehouse*	Alexander Russell
Major G. Harland Bowden*	Albert Gay*	Capt. H. R. Sankey
	F. Gill	A. Hugh Seabrook
H. R. J. Burstall	Haydn T. Harrison*	Alex. Siemens
A. A. Campbell-Swinton*	Killingworth Hedges*	Roger T. Smith
	J. S. Highfield	C. P. Sparks*
C. S. Colton	Dr. E. Hopkinson	J. Swinburne
Col. R. E. Crompton	Dr. Gisbert Kapp	Reginald J. Wallis-Jones*
S. Cowper-Coles	J. E. Kingsbury	
S. T. Dobson*	Major W. A. J. O'Meara, C.M.G.	F. J. Warden-Stevens
Philip Dawson*		H. D. Wilkinson*

The electricity sections are as under :—

Class 24.—Plant (steam, gas, oil and water power).
„ 25.—Distribution of electrical energy (switchgear, transmission and transforming).
„ 26.—Utilisation of electrical energy (*a*) electric lighting ; (*b*) electric traction and propulsion—land, marine and aerial ; (*c*) continuous and alternating-current motors ; (*d*) heating, cooking and domestic appliances ; (*e*) electro-chemistry and metallurgy.
„ 27.—Telegraphy and telephony, land and submarine.
„ 28.—Miscellaneous applications of electricity.

The various classes of engineering exhibits are as follows :—

Class 20.—Steam engines.
„ 21.—Internal-combustion engines and other motors, other than steam.
„ 22.—General machinery.
„ 23.—Machinery tools.
„ 29.—Materials, equipment, and processes relating to civil engineering.
„ 30.—Models, plans and designs for public works.

"Snowed under by Black Soot."—Counsel raised a strong protest against the ventilating arrangements of the Extradition Court at Bow Street, on November 17th.

Mr. Bodkin, after being engaged for a couple of hours on a long case, rose and remarked to the magistrate : I positively cannot sit here all the morning and be snowed under by black soot. It is outrageous. There are heaps of carbon here.

Mr. Marshall Hall, K.C., said : When I go home and put my hand through my hair my hand becomes black.

Mr. Bodkin : It shows so on my friend's head. I do not think there is any remedy for it, for I think it comes in through what is called the gas ventilator.

A window in the glass roof was closed, and this brought about a reduction in the soot that was falling.

Copper.—Mid-monthly statistics bear witness once again to the weight of depression hanging over markets which can keep prices down under such circumstances. English stocks fell during the fortnight ending November 15th from 14,179 tons to 11,921 tons, or 2,258 tons reduction. What are usually termed European visible supplies dropped 1,418 tons, and European supplies, including Rotterdam, Hamburg and Bremen, and estimates for other ports, 1,464 tons. Supplies from North America were under the average, and those from Spain and Portugal were low. Chile shipments were over the average, and Australian just on. Total deliveries at 17,492 tons appeared to show an inactive month. Comparing these, however, with the figures for the whole month, we find that supplies from North America were about one-tenth lower than the average, while Spanish were 857 tons, against an average of 1,154. Chile shipments are a little above the average, and Australian considerably above. The total deliveries, at 40,519 tons, considerably more than double mid-monthly figures. Reductions in stocks for the whole month are : English, 1,285 tons ; European supplies increased 130 tons ; extended European supplies lost 410 tons.

American stocks increased in October 1,238 tons. The world's supply at the end of October had, however, lost 854 tons on the month.

The Physical Society's Exhibition.—This exhibition, which is to be held on Tuesday, the 16th inst., at the Imperial College of Science, South Kensington, will be open in both the afternoon (from 3 to 6 p.m.) and the evening (from 7 to 10 p.m.). Prof. the Hon. R. J. Strutt, F.R.S., will give a discourse at 4.30 on "Spiral Electric Discharges," and Mr. Louis Brennan, C.B., will show some experiments with soap films at 8.30 p.m. Some 30 firms will be exhibiting, and there will also be certain experimental demonstrations.

We understand that invitations have been given to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Faraday Society, the Optical Society and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the societies just mentioned (including also the Physical Society) desiring to attend the exhibition should apply to the secretary of the society to which they belong.

Transmission Lines Patrolled by Aeroplane.—From San Francisco comes an announcement that Robert Fowler, the aviator who recently completed a cross-Continental flight, has arranged with a California transmission company to patrol its high-tension lines leading out of Oakland in an aeroplane. A lineman, equipped with repair apparatus, will ride with the aviator, and the pair will take trips twice a week. The headquarters of this novel inspection crew are to be established at Sacramento.—*Electrical World.*

Electric Lighting on Motor-'Buses.—The London General Omnibus Co. is steadily replacing acetylene with electric lighting on its motor-'buses. A year ago the number of vehicles so equipped was only 226, while now 1,121 are lighted electrically. Following London's example, the Paris General Omnibus Co. is experimenting with electric lighting on its motor-'buses.

Moulders' Strike Ended.—According to a Northampton paper, the strike of moulders and foundrymen connected with two electrical engineering works at Rugby, which had been in progress for 11 weeks, was brought practically to a conclusion at the end of last week as a result of a conference in London between the National Executive of the Engineering Employers' Federation and the National Councils of Moulders and Coremakers' Societies. The basis of settlement recommended was :—"That the men withdraw their demand for the foundries to be strictly 'society' shops, and that an agreement be entered into between masters and men for the avoidance of disputes similar to that recently made at the conclusion of the Sheffield dispute, the Rugby employers undertaking to reinstate strikers now remaining in town as they may be able to take them back."

The I.E.E. "Journal" Criticised.—A correspondent writes, too late for our "Correspondence" columns :—"A few days ago we received a crumpled, flattened roll of printed matter by post. It is our practice to examine postal packets however cheap looking. On examination we found that the crumpled roll consisted of a sort of school magazine arrangement, but purported to be the proceedings of one of the professional institutions of the country, the Electrical Engineers to wit, priced, too, at 3s. 6d. No explanation is vouchsafed as to the alteration in get-up of the proceedings, and the ideas at the back of it can only be guessed. If financial, in view of the large increase demanded in subscriptions from members, they are mean. If the idea is facilitation of illustration, they are not tenable. The Civils can send out monthly parts and bound volumes. The American Institute can do the same. The latter can supply splendid paper, binding, and perfect diagrams on thin bank paper, folded neatly, for a smaller subscription than the English Institution demands. The new form is quarto, the most uncomfortable to handle and awkward to shelve of all book finishes. Why this procedure?"

The intention of the Institution to issue the *Journal* fortnightly, in quarto format, was announced a long time ago. Whether the new style pleases the members or not is for them to say.

Adjustable-Speed Single-Phase A.C. Motors.—Messrs. Greening's Engineering Co., of 15, Clifford's Inn, E.C., send us the following statement by the Wagner Electric Manufacturing Co., of St. Louis, U.S.A. (for which firm Messrs. Greening's are agents in this country) respecting their adjustable-speed self-starting unity power factor A.C. motors, which are being introduced into this country.

The Wagner Co. state that the machines are adjustable-speed single-phase motors, having several idle speeds, and a full-load speed which does not differ very materially from the idle speeds. For instance, the idle speed of a machine might be adjusted for 1,200 R.P.M., and the full-load speed will perhaps be 1,160 to 1,200 R.P.M. The firm are prepared to manufacture motors of ½, 1½, 2 and 3 H.P., at speeds of 900-1,800 R.P.M. ; and 5 H.P., speed 800-1,600 R.P.M. ; these ratings are supposed to be for constant H.P. over the speed range. The machine is designed to have six different operating speed steps and is supplied with a controller of the drum type, connected by a number of leads to different windings of the machine.

There is one starting step on the controller, and the machine will operate on the particular step with a performance similar to that of the firm's present B.A. self-starting single-phase motor.

The adjustment of the speed is obtained without the use of any resistance in the circuit, and, therefore, the efficiencies at all speeds are fairly good and remain constant for all speeds.

The machine has also windings to adjust the power factor.

Central-Station Fires in America.—Our contemporary, the American *Electrical Review and Western Electrician*, reports four central-station fires happening in 10 days as follows :—

On October 16th power plant No. 2, which was being constructed for the Pacific Light and Power Corporation on Big Creek, 75 miles back in the mountains from Los Angeles, Cal., was damaged by fire to the extent of nearly $10,000.

On October 19th, the power plant at Goliad, Tex., was completely destroyed by fire. The loss is estimated at about $25,000.

An explosion occurred in the plant of the Richmond Light and Railroad Co., at Livingston, Staten Island, on October 21st. Six men were killed and four injured, and a portion of the plant was wrecked. There were two separate explosions in the boiler room shortly after five o'clock in the morning. This plant supplied the electric car lines on the island, as well as current for lighting and power.

The Greenspring Electric Light and Power Co.'s plant at Greenspring, O., was almost completely destroyed by fire early on the morning of October 26th.

Institution and Lecture Notes.—Institution of Electrical Engineers.—As the discussion on Dr. Klingenberg's address on the "Electricity Supply of Large Cities" was to be concluded on December 4th, there will not be a meeting of the Institution on December 11th.

At the meeting of the Manchester Local Section on Tuesday last, the paper by Mr. S. Evershed on "The Characteristics of Insulation Resistance" was read and discussed.

Association of Mining Electrical Engineers.—The new Monkton Collieries, Royston, near Barnsley, were visited last Saturday by the members of the Yorkshire branch of the Association. Mr. John Bentham, of Sharlston Colliery, gave a lecture on "Electricity in Mines," in which he said that electric power in mines had come to stay, and it would eventually be applied to practically every mining operation.

A meeting of the Notts. and Derbyshire branch of the Association was held at Chesterfield on Saturday evening. A discussion took place on the paper on "Large Prime Movers and Boilers for Power Houses," read recently by Mr. E. K. Scott. A joint meeting of that branch and the Midland branch of the Association of Colliery Managers has been arranged to be held at Nottingham to discuss the section relating to electricity in the general mine regulations.

Association of Electrical Station Engineers (Manchester Section).—On November 27th a visit was arranged to view the cable works of Messrs. Glovers, Ltd., of Old Trafford. A large party of members assembled and were very cordially received by the officials of the company, and under the direction of Mr. Anderson and his colleagues a very interesting tour of the works was made.

The monthly meeting of the Bradford Branch of the Association was held at the Spotted House Hotel, Bradford, on Tuesday, November 25th, Mr. W. C. Eakin occupying the chair. A communication was read from Mr. C. H. Broadbent (hon. secretary) resigning his position, and this was accepted with regret. Mr. R. D. Spurr was unanimously elected to the vacant position. It was decided to hold a smoking concert some time in January next.

A meeting of the London Section was held at Chandos Hall, November 25th, for the purpose of transacting general business. The Hon. Secretary reported that he had been instructed by the Committee to obtain all information with regard to Lord Cavendish Bentinck's "Weekly Rest Day Bill," which may be presented to Parliament next session, so that the A.E.S.E. can support it if possible. General business meetings were also held last week at Grimsby and Newcastle-on-Tyne; at the latter place it has now been arranged to hold meetings the last Friday in every month at the Hotspur Hotel, Haymarket, at 7.30 p.m.

The Dewsbury Electricity and Tramways Committee consented to receive a representative of the Association of Electrical Station Engineers, on behalf of the charge engineers at the electricity works, at the meeting which was to have been held yesterday.

Greenock Electrical Society.—At the last meeting, Mr. P. Kerr read a paper on "The Entz Reversible Booster," and a lecture on "Steam Turbines," by Mr. J. H. Parker, was delivered. The author acknowledged his indebtedness for the use of slides, &c., to Messrs. The British Thomson-Houston Co., the Brush Engineering Co. and the British Westinghouse Co.

Society of Engineers (Incorporated).—A paper on the "Corrosion and Rusting of Iron," was read by Mr. Eric K. Rideal on Monday last, The author is a supporter of the electrolytic theory of corrosion, and discusses the matter in the light of that theory.

Royal Society.—The new President, Sir William Crookes, was elected and installed at the anniversary meeting of the Society on Monday last. A donation of £5,000 has been made by Sir Jas. Caird, of Dundee, for the furtherance of physical research.

Physical Society.—Prof. J. A. Fleming on Friday last performed a remarkable series of experiments, showing that it was possible to get a mechanical analogy for several of the problems of electrical oscillations that have proved hitherto so complex as almost to baffle mathematical investigation.

At the Mechanics' Institute, Bradford, last week, under the auspices of the Gilchrist Trust, Prof. John Cox lectured on "Lightning and Lightning Rods." The lecture was illustrated with lantern slides and electrical demonstrations.

A lecture on "The Electrification of Railways," was given on Monday night before the Leeds University Engineering Society, by Mr. H. E. O'Brien, who stated that by the development of electrification of railways the business man would be able to live further away from the town, because he could travel with greater speed. In a 40-minutes' journey the mileage could be increased by 25 per cent. Greater ease was another feature of the electric train. Mr. O'Brien spoke of the electric railway as the railway companies' resource to beat the tramway systems, and he instanced in this connection the result of the electrification of a short length of line at Southport, where the Corporation had been driven to such straits that it had stationed a man at the railway station entrance to advise people to patronise the tramway instead of the railway.

Boilers in Central Stations.—We have received the following communication from Mr. J. W. Jackson, of Philadelphia power station, too late for insertion in our "Correspondence" columns:—

"I notice you have generally discussed a paper I read before the Institution of Electrical Engineers, Newcastle Local Section, and am very glad to find that you are generally in agreement with the position taken up.

"I should, however, be glad if you would again refer to my paper on the section dealing with what might be termed 'High-speed Gases.' You will notice that this particular section is commenced by referring to the work done by the late Dr Nicholson and Prof. Bone in this direction. Both of these gentlemen have reduced the gas temperature at the back of their boilers to a very low figure, and in the case of Prof. Bone, boilers have been working for some time under these very low temperature conditions, and statements are made from time to time that no trace of corrosion is visible, either on the boiler or the economisers.

"From my experience I have no reason whatever to doubt these statements. I have had experience with a good many economisers; at one place there were 18 economisers some of them with [illegible] tubes, at other places economisers with 650 tubes, and so I have come across a good lot of corrosion internally and externally, but I am generally of the opinion that the greatest danger that an economiser runs is that due to the temperature of the feed water, and not that due to the gas temperature; but because so many economisers are abused by feeding them with low-temperature water, steps have been taken by various people to galvanise the economiser tubes, and again others by copper-plating them. I, therefore, cannot agree with the latter portion of your leader."

It will be seen that Mr. Jackson does not dispute the corrosion of cold tubes; external corrosion is necessarily due to deleterious constituents of the flue gases, and if the gases were not cooled below the dew point—whether by cold economiser tubes or by cold boiler tubes is immaterial—this corrosion would not take place. We doubt the efficacy of either copper or zinc as a protection against sulphurous compounds.

Pladuram Wire.—The manufacture of tungsten wire, which has done so much to facilitate the progress of the metal-filament lamp towards perfection, is surrounded with technical difficulties rendering the various processes of exceptional interest. We therefore with great pleasure seized an opportunity of visiting the works of Messrs. Duram, Ltd., at Hanwell, where considerable quantities of drawn tungsten wire are now being produced under the name "Pladuram" wire. The works have only been running a few months, the company having entered into occupation in January last; as most of the machines required for the company's special processes had to be made, and the workpeople trained to their operation, under the direct supervision of Mr. Charles Gladitz, the inventor and patentee of the apparatus employed, some months elapsed before work could be begun on a commercial scale; but when one considers that in the course of manufacture of the finest wires, about 0·015 mm. in diameter, the material has to pass through some 380 stages, the wonder is rather that it was possible to install the necessary plant and complete the organisation in a twelvemonth, let alone three months. This result, in fact, was only achieved by the untiring efforts of Mr. Gladitz, who is to be congratulated upon the successful outcome of his labours. We understand that the inventor has been at work on the subject unceasingly for four years, and has been successful in discovering many new facts and principles which play a predominant part in so difficult an undertaking as the production of tungsten wire; and not only is he able to manufacture the metal in a state of almost perfect purity, with certainty and freedom from flaws of any kind, but he can produce it in any form and for any purpose. We have had the pleasure of watching the whole cycle of operations, from the raw material to the ingot of pure metal, and onwards throughout the conversion of the ingot into thousands of yards of wire, which is measured in microns (thousandths of a millimetre), the unit of length hitherto employed mainly by physicists when speaking of the wave-length of light, even the mil being too large a unit for metal filaments. The tensile strength of the wire is astonishing; we saw a wire 20 microns (0·79 mil) in diameter tested, and it broke with a weight of 165 grammes. This corresponds with a tensile strength of no less than 334 tons per sq. in.; the breaking stress of extra plough steel is only 150 tons per sq. in.

All kinds of things can be made of tungsten, now that it is available "in bulk"; it is superior to platinum and iridium for many electrical purposes, such as contact pieces, heating wires for cooking apparatus and radiators, X-ray electrodes, &c., and costs only one-tenth as much; it can be used instead of platinum dishes in chemical laboratories, resisting all reagents except a very few, and being unoxidised by the air up to a temperature of 1,000° C. Its high melting point—3,540° C.—is double that of platinum. No doubt our readers will be able to suggest many other uses for the metal, for the manufacture of which much larger works are now about to be erected. We hope to be able, at no distant date, to give further particulars regarding this remarkable factory; for the present we must content ourselves with expressing our pleasure that a new industry, before which lie unbounded possibilities, has thus been inaugurated in this country, and is giving employment to a constantly increasing number of workpeople.

Electro-Harmonic Society.—The next smoking concert will be held at the Holborn Restaurant (King's Hall), on Friday evening, December 12th, 1913, commencing at 8 o'clock. Mr. Edward Manville will be in the chair. The preliminary programme is as follows:—Vocalists: Mr. Anderson Nicol (tenor); Mr. Humphrey Bishop (baritone); Mr. Denis O'Neill (Irish singer). Prestidigitateur, Mr. Leslie Lambert; Entertainer, Mr. Thornley Dodge; Humorous Sketches, Mr. George Blackmore; Entertainer, Mr. Lindon Wyatt; and a String Quartet (Messrs. Spencer Dyke, Edwin Quaife, James Lockyer and B. Patterson Parker). Accompanist, Mr. Bernard Flanders, A.R.A.M.

For Sale.—Norwich Electric Tramway Co. have for disposal 200-kw. d.c. steam generating set. Particulars are given in our advertisement pages to-day.

Inquiries.—Makers of "Excello" resistance wire are asked for.

London Electricians' Wages Movement.—A meeting of 80 electrical contracting firms was held on Wednesday afternoon, Mr. Bowden, of Poplar, in the chair, and a new Association named the London Electrical Masters' Association was formed, without incorporation; Mr. Bowden was appointed chairman, with Mr. L. G. Tate as secretary. A Committee was appointed to draw up articles, and to go into the questions raised by the Electrical Trades Union, and report to another meeting to be called by the Masters' Association. The first meeting of the Committee will be held on Monday next.

Electric Cable Explosions.—The Board of Trade has appointed Sir T. Edward Thorpe, C.B., F.R.S. (chairman), Mr. Robert Nelson (of the Home Office), Mr. W. Slingo (of the General Post Office), Mr. James Swinburne, F.R.S., and Mr. Alexander B. Trotter (of the Board of Trade), to be a committee to consider the causes of explosions which have occurred in connection with the use of bitumen in laying electric cables, and to report as to any steps which should be taken to prevent explosions in future from the use of bitumen or similar substances. Mr. M. J. Collins, of the Board of Trade, will act as secretary to the committee.

A Remarkable Proposition.—A correspondent wishes to be put in communication with a supply authority which can give a temporary supply of 50,000 amperes at 80-110 volts, D.C. He will bring his plant to the place where current is generated, and pay all expenses of connections, &c., besides paying liberally for the energy consumed. The demand would be made at the period most convenient to the engineer of the supply authority, and would not last more than two or three hours at a time.

There must be many authorities in a position to take up this unusual proposal without much inconvenience.

Appointments Vacant.—Mains assistant and a shift engineer, for Radcliffe U.D.C. (35s. each); assistant to central station engineer, for Sleaford U.D.C.; switchboard attendant for Middlesbrough Corporation (27s.); charge engineer for Paisley Corporation; jointer for Dundalk U.D.C. (37s. 6d.); lecturer in electrical engineering at South African College, Cape Town (£300 +). Particulars are given in our advt. pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Tuesday, the recommendation by the Blackpool Tramways and Electricity Committee to increase the salary of the electrical engineer (MR. C. FURNESS) from £700 to £900 a year, was before the Council. Ald. Brodie, chairman of the Committee, said Mr. Furness was appointed electrical engineer 12 years ago, at a salary of £520. It was subsequently increased to £600, and, on the death of the tramways manager, four years ago, he was appointed to the position, largely as an experiment, his salary being raised to £700. At that time profits on the tramways were £8,425, and they had since increased to £10,053 and £18,331, while for the year ending March next they were estimated at £25,000. Mr. Bamber, in moving an amendment that the recommendation be referred to the General Purposes Committee, said an increase of £200 was a big pill for the ratepayers to swallow, and it would create an undesirable impression among other officials of the Corporation. Mr. Cartledge seconded. He argued that they ought to be more considerate towards the workmen. The amendment was defeated, and the minutes of the Committee were adopted by 22 to 20.

MR. W. T. HELLABY, who has been for the past 7½ years in the West Ham Corporation electricity department, has recently been appointed to a position of assistant sales manager to the County Borough of Sunderland electricity department.

MR. G. MIDDLECOAT, of the Southampton Corporation Electricity Works, is resigning his position with the Corporation and joining the staff of the Edison & Swan United Electric Light Co., Ltd., Ponder's End.

Tramway Officials.—Last Friday, MR. H. KING, traffic manager of the Aberdare Council's tramways undertaking, was presented with a box of cutlery and a silver teapot on the occasion of his marriage. Mr. A. J. Abraham, tramway manager, presided, and made the presentation.

MR. G. PHILLIPSON, overhead lines superintendent at Rochdale, has been presented with a case of pipes and a tobacco pouch by the members of the Corporation Tramwaymen's Club, in recognition of his services in wiring the club premises for the electric light installation.

General.—ALDERMAN H. W. PEAL has been unanimously elected chairman of the Ealing Electricity Supply Committee for the twelfth year in succession.

MR. M. BARRINGTON BAKER has accepted an appointment under the Crown Agents for the Colonies, as Director of Wireless Telegraphs in Zanzibar, and he is sailing this week.

The York Electricity and Tramways Committee has reappointed ALDERMAN MEYER as its chairman and COUNCILLOR DAVIES as its vice-chairman.

COUNCILLOR BONALLACH and COUNCILLOR CARR-SAUNDERS have been elected chairman and vice-chairman respectively of the Stepney B.C. Electricity Supply Committee.

ALDERMAN SMITH and COUNCILLOR WADHAM have been re-elected chairman and vice-chairman respectively of the Barrow Electricity Committee.

COUNCILLOR F. MOSS has been unanimously re-elected chairman of the Public Lighting Committee of the Grimsby T.C., and ALDERMAN T. KING vice-chairman.

Obituary.—MR. S. FALK.—We regret to learn of the death, which occurred on November 29th, at the age of 59 years, of Mr. Salomon Falk, managing director of the well-known firm of Falk, Stadelmann & Co. Mr. Falk was born in Hochberg Wurtemberg, and he came to England in 1876, becoming associated in business with the firm of Julius Ungar, at Commercial Street, London, E.C., who were manufacturers of gas fittings and street lamps. He foresaw that there was a great future before the gas industry, and began business on his own account at 36, Basinghall Street, in 1882, acting as agent for the United Kingdom and Colonies, for Jean Stadelmann and Co., of Nurnberg, manufacturers of gas burners, &c. In addition to this, he established a very considerable business in glassware in connection with the lighting trade. It is interesting to note that at about this time, his invoice journals record the supply of glass shades to Mr. Swan, of York, the pioneer of the incandescent electric lamp. From Basinghall Street, he removed to Colonial Building, Hatton Garden, where the business developed into a more general one of lighting fittings and accessories for oil, gas and electricity. Here he was joined by his two brothers, Victor and Max, and a year or two later by Mr. Louis Thurnauer, of Jean, Stadelmann & Co., and so successful were affairs, that in 1887 he formed a limited liability company, with which Jean, Stadelmann & Co. were incorporated, and removed to more pretentious premises at 43, Farringdon Road, where the business was carried on as Falk, Stadelmann & Co., Ltd. These premises, however, were soon found inadequate for the proper conduct of the increasing business, and in 1889 the firm removed to 83, 85 and 87, Farringdon Road, where the surrounding property offered the opportunity of such further extension as the rapidly-increasing business warranted. This foresight of Mr. Falk has since received ample justification by the acquisition by the firm of additional ground space, on which were erected buildings which, probably, in extent exceed that of any other firm engaged in the lighting trade. In the course of time a branch was opened at Glasgow, for the convenience of customers in the North, and later at Manchester. With the advent of the metal-filament lamp, Mr. Falk added to his extensive business of manufacturer and supplier of electrical accessories generally, an electric metal-filament lamp department, which controlled the "Efesca" lamp. Whilst still exercising control as managing director of the firm of Falk, Stadelmann & Co., Ltd., Mr. Falk had of late years taken a measure of relaxation which was justly due to him after his strenuous early business career, and built a residence at Sunningdale, where during the summer months he was devoted to golf, and it was whilst horse-riding to the Esher golf course that he was seized with the heart failure which proved fatal.



MR. S. FALK.

MR. W. W. COULSON.—The death is announced, after a few days' illness, of Mr. W. Watson Coulson, secretary to the Oswestry Electric Light Co., Ltd.

ALUMINIUM INSULATION FOR MAGNET COILS.*

THE organic insulating materials commonly used for covering wire only permit a moderate temperature to be attained, if damage is to be avoided. Cotton or silk coverings begin to carbonise at about 80° C., and even the enamel-covered wires cannot stand more than 120° C. When higher temperatures have to be withstood, asbestos coverings have sometimes been adopted, but only at great sacrifice of space, for even a small wire requires a radial thickness of asbestos of about ·35 mm., while the corresponding thickness in double cotton covering is only ·1 mm., in single cotton covering ·05 mm., in double silk ·035 mm., in single silk ·025 mm., and in enamel only ·01 to ·02 mm.

As early as 1883 a patent was taken out by A. Chertemps and Co., of Paris, for a method of insulating unaffected by heat, in which solutions of various inorganic salts were applied to the wire, and after driving off the water of crystallisation, the solid substance remained on the wire as the insulating covering. Mineral oxides, such as clay and magnesia, were found especially suitable for the purpose, and will remain undamaged even up to red heat.

In 1900 Dr. W. Reissig, of Munich, introduced a modification of the above, in which a coating of acid aluminium oxide or clay, dissolved in benzol, turpentine or carbon bisulphide, is used. He found that a coating ·005 mm. thick on a 2-mm. copper wire of a certain length showed an insulation resistance of 102,000 megohms when measured at 122 volts, 25,000 megohms at 245 volts

* B. Duschitz, in *E.T.Z.* November 20th, 1918.

and 8 200 to 9,000 megohms at 365 volts. The coating is said to be impervious to water, and to stand temperatures up to 250° C.

In 1905 R. Hopfelt employed the well-known fact that aluminium, if exposed to the air, even at ordinary room temperatures, becomes covered with an exceedingly thin, transparent and invisible coating of oxide, which protects the underlying aluminium from further attack from the atmosphere, and which, if removed by scratching or otherwise, soon replaces itself automatically. At higher temperatures the covering becomes denser, but without becoming brittle and flaking off, as is the case with the oxide formed on the surface of heated copper.

Hopfelt found that the natural aluminium oxide coating could safely withstand as much as half a volt. It was, therefore, possible to wind magnet coils with bare aluminium wire provided that some additional insulation was introduced between the layers, where the voltage difference usually exceeds half a volt.

In practice it was found necessary to employ rather special winding machines for this aluminium wire, so as to avoid scraping off the oxide during the process of winding.

The wire is guided into the wooden former between leather pads carried on a screw-driven traveller moving to and fro in front of the former. The rate of traverse of this guide is variable to suit the wire being dealt with. The operator inserts a sheet of pressspahn, paper, asbestos paper, or mica between each layer and the next. The finished coils are then generally taped over, impregnated and dried ready for use. Besides the greatly improved heat-resisting power of such aluminium coils, they show a great saving in weight. Thus a coil which in ordinary copper wire would weigh 27 kg., weighs only 10·7 kg. in aluminium, whilst having the same power. Such coils have proved so satisfactory that they have been largely adopted for lifting-magnet windings, brake magnets, blow-out magnets on controllers, and, especially, for the field windings of traction motors.

Various methods have been suggested for the strengthening of the oxide coating on the wire. One of these consists in winding the coils as described above, and then heating the whole and plunging it into a suitable cold oxidising liquid. The heating of the coil causes the air inside it to expand, and when cooled this draws the liquid into intimate contact with the whole winding. The same result can be attained more simply by plunging the coil, without heating, into a hot liquid bath and then allowing the whole to cool down. Sometimes the oxidised aluminium wire is run through a bath of grease or oil or insulating paint, and is wound into the coil whilst wet. This gives additional mechanical and electrical protection. A specially well oxidised aluminium wire produced by a secret process is on the market under the name of "Aldradraht." The covering is from ·005 to ·02 mm. thick, and is mechanically strong, so that no special care in handling it is required. It stands pressures of several hundred volts, and is not damaged by temperatures of 350°-400° C.

Attempts have been made to obtain the same advantages for copper-wire coils, since this would considerably reduce the dimensions of a coil for a given duty, the resistance of aluminium being about 1·7 times that of copper. Direct oxidisation of copper wire is impracticable, but a method has been patented for use with single layer windings of the edge-wound spiral type. Here the main winding is of copper strip and the various turns of this are separated by a thin aluminium foil spiral about ·025 mm. thick and covered with its insulating oxide coating.

In order to strengthen this coating, the aluminium is preferably run through a bath of ammonium borate or similar liquid, whilst a current is at the same time passed through the strip and the bath. The insulation of the exposed edges of the copper strip is carried out by a transverse winding of the same oxidised aluminium foil. This gives a good heat-conducting covering, which at the same time can safely withstand high temperatures. This process is the property of the British Westinghouse Co.

Another process for obtaining heat-resisting copper coils consists in employing the ordinary cotton or silk-covered wire, but drawing it through a both of plastic inorganic insulating material before winding it into a coil. When complete, the coil is raised to a high temperature, either in an oven or by means of a current, until the cotton or other organic part of the covering is wholly or partly charred, so that the wire remains loosely embedded in a tunnel of the hardened inorganic material. The free space available inside the tunnels is sufficient for all necessary expansion of the copper without damage to the insulation. Such a covering occupies less room than an asbestos covering, but more than the aluminium oxide covering.

NEW COMPANIES REGISTERED.

Electrical Works (Miller), Ltd. (132,404)—This company was registered on November 26 h, with a capital of £25,000 in 5,000 shares of £1 each and 5,000 shares of £4 each, to found electrical manufactories in Germany or elsewhere, to light factories and buildings, to provide motive force to electrical machines and movers, to carry on any commercial, financial or other enterprises, &c., to acquire any freehold, leasehold or other property in any part of Europe, &c. The subscribers (with one share each) are:—J Briggs, 16, John Street, Bedford Row, W.C., solicitor; R. A. Briggs, 15, Dickenson Road, Crouch Hill, N., bank clerk; A. Müller, Weissenburgerstrasse 48 I, Bavaria, electrical engineer; E. F. H. Briggs, 16, John Street, W.C., solicitor; F. J. Stevens, 69, South Norwood Hill, S.E., managing clerk; H. S. Briggs, 8, Frederick's Place, E.C., chartered accountant; W. F. Chifferell, 84 7, Cursitor Street, E.C., printer. Minimum cash subscription, £2,000; the number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £100 shares; remuneration of directors £40 each per annum; of managing director £240 per annum. Registered office, 16, John Street, Bedford Row, W.C.

Northern General Transport Co., Ltd: (132,492)—Registered on November 29 h, by S. Morse, 1, Kingsway, W.C. Capital £400,000 in £1 shares (150,000 6 per cent preference). Objects: To carry on in the United Kingdom, Europe and elsewhere the business of tramway, light railway, motor car omnibus, van, wagon, cab and carriage proprietors, engineers, store and garage keepers, carriers of passengers and goods, manufacturers of and dealers in motors, motor cars, omnibuses, cycles, carriages, trucks, locomotives and other vehicles with either steam, electric power, oil, gas or other power, electrical and mechanical engineers, electricians, manufacturers of electrical apparatus, &c. The signatories (with one share each) are—H. S. Day, 1, Kingsway, W.C., director; T. Bower, jr., Victoria Road, Alexandra Park, N., secretary. W. A. Godfrey, 1, Kingsway, W.C., secretary; F. C. Cocking, 103, Woodvale, Forest Hill, S.E., registrar; S. J. Clements 11, Dacecroft Road, Herne Hill, S.E., secretary; J. M. Gray, Gravesacre, Gravesend, tramway manager; C. H. Gilliams, 72, Eastbourne Avenue, Eastbourne, S.W., secretary. Minimum cash subscription seven shares. The first directors (to number not less than two or more than six) are C. S. B. Hilton, 1, Kingsway, W.C.; C. R. Greene, 6, West Street, Gateshead (chairman, Gateshead and District Tramways Co.); R. J. Howley, 1, Kingsway, W.C.; L. A. Atherley-Jones, K.C., M.P., 4, Paper Buildings, E.C.; and H. S. Day, 1, Kingsway, W.C.; qualification, one share; remuneration, £125 each per annum (chairman, £300). Solicitor, F. A. V. Morse, 1, Kingsway, W.C.

Balm Mills Estate Co., Ltd. (132,478)—This company was registered on November 25th, with a capital of £3 000 in £1 shares, to acquire the Balm Mills Estate, Robertstown, York, together with the property connected with the business of a producer and supplier of steam power carried on by J. J. Jubb, to manufacture and generate gas, steam and electricity for lighting, motive power or otherwise, to carry on business as cotton, woollen and worsted cloth manufacturers, &c. The subscribers (with one share each) are:—J. J. Jubb, Bienheim House, Batley, gentleman. F. A. Jubb, Carlinghow, Batley, clerk; G. H. S. Johnson, Trinity Mount, Dewsbury, warehouseman; J. S. Jubb, Bienheim House, Batley, architect. Private company. The number of directors is not to be less than three or more than five, the first are J. J. Jubb, F. A. Jubb, G. H. S. Johnson and J. S. Jubb; qualification, £50 shares, debentures or debenture stock. Solicitors: Schofield, Taylor & Maggs, Batley. Registered by Jordan and Sons, Ltd., 116-7, Chancery Lane, W.C.

Norton Griffiths & Co., Ltd. (132,382)—This company was registered on November 25th, with a capital of £100 000 in 50 000 participating preference, and 49 500 ordinary shares of £1 each, and 10 000 shares of 1s. each, to construct, manage, work and control public works and conveniences of all kinds, including railways, tramways, docks, harbours, piers, canals, reservoirs, embankments, irrigations, reclamation, improvements, tunnel, sewage, drainage, sanitary, water, gas, electric light, power supply, &c., in any part of the world. The signatories (with one share each) are:—W. W. Mitchell, 59A, London Wall, E.C., secretary; H. L. Griffiths, 59A, London Wall, E.C., chartered accountant. Private company. The first directors (to number not less than two or more than 12) are J. Norton Griffiths, M.P., and others to be appointed by the signatories. W. W. Mitchell is first secretary.

D. P. Anderson & Co., Ltd. (132,463).—This company was registered on November 28th, with a capital of £1,000 in £1 shares, to take over the business carried on by Isabella V. Anderson, as "D. P. Anderson and Co.," to carry on the business of telegraphic cable and other code compilers, printers, publishers, &c. The subscribers (with one share each) are:—Isabella V. Anderson, Avoca, Orpington, Kent, telegraphic code compiler; L. Worral, West Dene, Beaconsfield Road, Clacton-on-Sea, telegraphic code compiler; H. V. Robinson, Priory Lodge, Tonbridge, Kent, director. Private company. The number of directors is not to be less than two or more than five; the first are Isabella V. Anderson, L. Worrall and H. V. Robinson; Isabella V. Anderson is permanent. Registered office, 10, Philpot Lane, E.C.

Universal Electric Contracts, Ltd. (132,417)—This company was registered on November 26 h, with a capital of £1,000 in 100 founders' shares of £1 each and 1 800 ordinary shares of 10s. each, to carry on the business of electricians, electrical and mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—H. Pinder-Brown, 240, High Holborn, W.C., solicitor; E. V. Allen, Sunby Cottage, Cookham, Berks., company director. Private company. The number of directors is not to be less than three or more than five: the first are J. C. Akerman, R. A. Chambers, E. V. Allen and H. Pinder-Brown; qualification, 100 ordinary shares. Registered office, 240, High Holborn, W.C.

Napier-Kimber, Ltd. (132,381).—This company was registered on November 25th, with a capital of £1,000, in £1 shares, to take over the business of general electrical contractors carried on at 3, Wellington Terrace, Bayswater Road, W., by Cunningham, Ltd. The subscribers (with one share each) are:—R. N. Cunningham, 171, Edgware Road, W., electrical engineer; A. W. Kimber, 14, Belsize Grove, Hampstead, N.W., electrical engineer. Private company. The number of directors is not to be less than two or more than four; the first are R. N. Cunningham and A. W. Kimber (both permanent); qualification £1. Registered office, 3, Wellington Terrace, Bayswater Road, W.

Harraway Bros., Ltd. (132,372)—This company was registered on November 25th, with a capital of £3,000 in £1 shares, to take over the business carried on at 45, King's Road, Chelsea, and 146, High Street, Kensington, as "Harraway Bros.," and to carry on the business of electricians, engineers, suppliers of electricity for light, heat, power, or other purposes, &c. The subscribers (with one share each) are:—H. V. Harraway, 12, South Square, Gray's Inn, W.C., solicitor; J. M. Hawkins, 26, Huddlestone Road, Willesden Green, N.W., secretary. Private company. The number of directors is not to be less than two or more than five; the first are H. V. Harraway and J. M. Hawkins; remuneration, five guineas each per annum; secretary, J. M. Hawkins. Registered by H. V. Harraway, 12, South Square, Gray's Inn, W.C.

Holborn Electric Fires, Ltd. (132,434).—This company was registered on November 27th, with a capital of £3 000 in £1 shares, to take over the business carried on at 2, Devonshire Square, E.C., as the "Holborn Electric Fires," together with certain inventions relating to improvements in electric heating, and to adopt an agreement with A. J. H. Andrews. The subscribers (with one share each) are: A. J. H. Andrews, 2, Devonshire Square, E.C., electrical engineer; Dr. D. H. Jackson, 95, Abbey Road, N.W., consulting chemist. Private company. The number of directors is not to be less than two or more than four; the first are A. J. H. Andrews and Dr. D. H. Jackson qualification, £50. remuneration as fixed by the company. Registered office, 2, Devonshire Square, Bishopsgate, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £2 300 of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Rawlings Bros., Ltd. (67,908)—Capital, £100,000 in £1 shares (30,000 pref. and 70,000 ord.) Return dated November 4th, 1913. 20 685 pref. and 38,169 ord. shares taken up. £58 854 paid. Mortgages and charges: £17,935.

New Phonopore Telephone Co., Ltd.—Mortgage dated November 19th, 1913, to secure £500 and further advances not exceeding £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. Haes, 24, Bishopsgate, E.C., and E. Medinger, 27A, Worcester Street, Wolverhampton.

Northwood Electric Light and Power Co., Ltd.—Issue on November 7th, 1913, of £750 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

THE directors' report for the year ended August 31st, 1913, states that the directors have continued their policy of active development during the year, and have expended a further sum of £121,691 on capital account in the provision of additional land, buildings, plant and mains. The area of the districts covered by the company's statutory powers is approximately 155 square miles, and a supply is now available in 302 miles of streets, being an increase of 60 miles during the year. 3,486 new consumers were connected to the mains during the year, bringing up the total number connected to 11,354, being an increase of 44 per cent. as compared with the previous year. The power supply has increased by 22 per cent., the motors now connected being equivalent to 6,270 H.P., while the total connections, including lamps, motors, heating and other apparatus, have increased by 29 per cent., the total units sold by 20 per cent., and the gross revenue by 23 per cent. Important modifications have been made in the scale of charges for electricity for power purposes, which the directors anticipate will lead to a greatly increased demand from manufacturers and others. For the purpose of providing the capital necessary to keep pace with the continued growth of the company's undertaking, a further £25,000 5 per cent. debenture stock was issued during the year at a premium. For the same purpose a further 10,000 ordinary shares were offered to the ordinary shareholders in July last at a premium of £3 per share, ranking for dividend as from September 1st, 1913. The directors are pleased to report that 9,821 of such shares were allotted, and have been paid for in full. To provide for future expansion, a resolution will be submitted at the forthcoming meeting for the increase of the capital by the company by the creation of a further 20,000 6 per cent. cumulative preference shares of £5 each, to rank *pari passu* in all respects with the existing preference shares, and for the issue of such shares as and when the directors think proper for the purposes of the company. The profit and loss account shows a credit balance for the year of £37,857, as compared with £27,623 for the previous year, being an increase of 37 per cent. After payment of the dividend on the preference shares for the half-year ended February 28th, 1913, and of an interim dividend of 5 per cent. on the ordinary shares, there remains, including the amount carried forward from the previous year, an available balance of £28,365, which the directors recommend should be applied as follows:—Dividend on 30,000 6 per cent. preference shares for the half-year ended August 31st, 1913 (paid on September 1st, 1913), £4,500; final dividend of 5 per cent., free of income-tax, on 40,000 ordinary shares, making 10 per cent. for the year, £10,000; 2 per cent. bonus, free of income-tax, £4,000; leaving a balance to carry forward of £9,865. The directors recommend that out of the net premiums received on the above-mentioned issues of debenture stock and ordinary shares, £20,670 be added to general reserve, raising it to £58,000; and that the balance of £9,631 be carried to a suspense account to meet the cost of writing off sundry items of plant which are being removed to make room for new and larger machinery, and also to meet certain contingent liabilities, the amount of which has not yet been ascertained.

Date.	Number of consumers.	Lighting in KW.	Motors in rated H.P.	Total connections.	Total units sold.
Aug. 31, 1911 ..	4,810	4,411	3 986 H P.	8,238 KW.	3,390,530
Aug. 31, 1912 ..	7,868	5,724	5,137 H P.	10,861 KW.	4,516,398
Aug. 31, 1913 ..	11,354	7,7o2	6,270 H P.	14,022 KW.	5,446,488

Mr. George Bookman, chairman of the local board in Adelaide, paid a visit to England recently, and the directors had the advantage of personally conferring with him in regard to the affairs of the company. The directors record with regret the death, in June last, of Mr. W. E. Dalton, one of the company's local auditors. On the recommendation of the local board, Mr. James Counsell was appointed to fill the vacancy.

The meeting is called for Monday next, at Finsbury Pavement House, E.C.

Barbados Electric Supply Corporation, Ltd.

THE annual meeting was held at Basildon House, E.C., on Monday. Mr. A. W. Tait, who presided, said, in proposing the adoption of the report (see ELECTRICAL REVIEW, p. 885), that the results for the year showed a profit of £395, compared with a loss of £467 last year. Although the results were again disappointing, considerable progress had been made. The number of lamps and motors connected of an equivalent of 25 C.P. was 9,430 at June 30th, 1913, which was an increase of 4,020; and the number of consumers connected to the mains was 456, as compared with 247. The growth of revenue had been steady, but the number of units consumed per lamp was still unsatisfactory, and much below European experience. The costs of generation were high, due to the high cost of oil fuel which prevailed during the whole year, and also to the low load factor. They were doing all they could to cultivate the day load, and as they knew, a certain number of small motors had been connected and they were hopeful that that might increase, although the field in that direction was not large. They had, however, for some time been negotiating with the Tramway Co. for the supply of power to them when they converted the line to electric traction. Their general manager, Mr. Shettle, went to the United States to have meetings with the chief parties interested in the Tramway Co., and discussed with them the basis of an agreement for supply. The terms of that agreement had been carefully considered by the directors, and also by their consulting engineers, and they had intimated to the tramway company that, subject to certain modifications which they considered necessary for the safeguarding of their interests, they were prepared to enter into a contract for supply. They had hoped to be able to intimate at the meeting that the alterations which they had suggested had been accepted by the tramway company, but they had not yet received their reply. Even if the contract was signed within the next few weeks, the supply would not be available for a year, because the tramway company had first of all to reconstruct their system, and that company would have to install additional plant and machinery in order properly to fulfil the contract. That would involve the raising of further capital, and he presumed it would only be possible to do that by means of creating further debentures. When the business was definitely concluded, the directors would inform the shareholders as to the arrangements which were suggested in that connection. Since the close of the year the revenue showed a satisfactory increase. For the four months to October 31st it had increased over that for the same period of the previous year by £545, which was equal to an increase of over 90 per cent. As he mentioned last year, the company was still feeling the active competition of the gas company, and the progress which they were making must be considered satisfactory when that was borne in mind. It was somewhat difficult to persuade prospective customers to incur the necessary expense of wiring and fitting their houses for electric light, when the gas company would do that for nothing, charging only an infinitesimal monthly rental. It was also difficult to maintain a proper wiring and fitting staff. The general manager was still endeavouring to persuade some of the local men to take up business as wiring contractors, and he had at last succeeded in inducing one man who had had electrical training to go into the business, and he hoped, therefore, that that would mean an increase in the number of consumers that could be connected. With regard to street lighting, 66 lamps, of an equivalent of 7,200 C.P., were erected during the year under review, and since the close of the year a further contract for 20 lamps, of an equivalent of 2,000 C.P., had been obtained for lighting the road to St. Lawrence, and those had now been erected. A contract had also been secured for 23 lamps, of an equivalent of 2,500 C.P., from the Government, for lighting the wharves and inner basin, and that work was now in hand. As he had already mentioned, they had been compelled to pay a very high price for oil fuel. As they knew, oil everywhere had gone up in price, and at present they were under the disadvantage of having to ship practically the whole of the oil required from the United States. They were only able to obtain a small supply locally in the island, and although they had experimented with the Trinidad oil, they had not been able to use it with any success, because it contained so much tarry matter. It might be, however, that when refineries were established there, they might be able to produce an oil suitable to their requirements. They understood, also, that the Mexican Eagle Oil Co. had recently obtained powers to erect an oil storage station near their works for supplying shipping, and if such station was established, there might be a chance of obtaining cheaper fuel, as the oil would then be shipped to the island in bulk in large quantities. The chairman proceeded to refer to the accounts. The capital expenditure during the year amounted to £2,484. That represented expenditure on extensions to mains for public lighting and general service, and for house connections with consumers. In addition to public lighting, the principal extension carried out during the year was that to the suburbs of St. Lawrence. Although the results up to date were considerably behind what was expected, the progress had been steady and encouraging. It took some time to overcome the overhead charges, but when the load reached a certain point, the percentage of costs rapidly decreased with any increase of supply. They believed this point had now been reached, and he hoped that next year they would be able to submit a more satisfactory account. If a contract could be arranged with the tramway company, the progress of their undertaking should be all the more rapid, not only because of the decrease in the total costs of generating, but also because of the increase of activity which it was bound to create among the people.

COLONEL W. F. LEESE seconded the motion, and the report was adopted.

Reduction of Capital.—Brotherton Tubes and Conduits, Ltd., and reduced.—A petition for the confirmation of the reduction of capital from £65,000 to £13,000 has been presented and will be heard on December 9th.

THE TRACTION AND POWER SECURITIES CO., LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital from £2,000,000 to £1,829,180, is to be heard on December 9th.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—A quarterly dividend of 1½ per cent. is announced.

Consolidated Diesel Engine Manufacturers, Ltd.

The directors' report expresses regret that during the period from March 27th, 1912, to October 31st, 1913, the profits anticipated in the prospectus were not realised. The unstable market for fuel oil and the consequent high prices had adversely affected the profits. The general expenses for the 19 months, therefore, exceeded the revenue by £9,600. The new works at Ipswich, in connection with which part of these expenses had been incurred, had only just been completed. It had, therefore, not been possible to obtain any revenue from this source, but the works were now actively engaged in the building of engines, and the first of these was expected to be ready for running by the beginning of the year. In the meantime, orders for engines were being executed at the Ghent works. A number of orders had already been booked for the foundry at remunerative prices, and work was energetically progressing. No dividend for the past year had been received from the investment in Usines Carels Frères, although the balance-sheet of that company, before providing for depreciation on buildings, plant and machinery, showed the profit for the period ending July 15th, 1913, as 724,993.07 fr. (£29,000). This profit was less than was anticipated, and the directors of Usines Carels Frères attributed this falling off to the following reasons:—(1) The war in the Balkans. Messrs. Carels have in the past done a large trade in these countries, and the war has seriously affected this business. (2) The national strike which took place in Belgium in the early part of the year. (3) The high prices which had been ruling for fuel oil and the consequent effect upon the obtaining of orders. And (4) considerable expenses had been incurred in connection with the extensions of the works. These expenses had been met out of revenue, although no benefit from the extensions was derived during the period covered by the accounts. Owing to these special circumstances, the directors of Usines Carels Frères had decided, after writing off depreciation, to apply the balance of profits to writing off expenses incurred in connection with the exhibition at Ghent and in reduction of other charges. Messrs. Usines Carels Frères had now on their books orders totalling over £120,000, including an order of two marine engines of 1,500 B.H.P. each for the British Admiralty, and they were using every effort to keep the figures of the order book as high as the actual conditions of trade will permit.

The adjourned ordinary general meeting of the shareholders was held on Tuesday, at Salisbury House, London Wall, E.C. Mr. J. M. Fells, the chairman, presided, and there was a crowded attendance. The proceedings, which lasted upwards of two hours, were at times very lively, but in the end the appointment of a Committee was agreed to with practical unanimity.

The Chairman said that as he had only quite recently been elected a director he desired to emphasise as clearly as possible the fact that he was presiding at that meeting in a representative capacity. His election as chairman was due to the fact that a number of independent and influential shareholders suggested to the directors that it was desirable that there should be on the board a director who had no responsibility whatever for the past. In what he was about to say he should not attempt to excuse the directors, for they had, in his opinion, been guilty of some grave errors of judgment, and the company should not have been allowed to drift into its present position, matters should have been taken in hand some time ago. Whether those errors of judgment carried any legal responsibilities, he (the chairman), as a layman, could not express any authoritative opinion. His sole duty as regarded the past was to report to them, as fully and frankly as he could without detriment to the permanent interests of the company, what led to the present position. Having referred to the early history of the Diesel engine and its patents, he said that the Diesel Engine Co., of which the Consolidated Co. held some 90 per cent. of the shares, was formed some few years after the date of Dr. Diesel's patents. The first-named company was only a royalty receiving and merchanting company, and its principal contractor was Messrs. Carels Frères. In 1903 the Diesel Engine Co. and Messrs. Carels Frères entered into an agreement of a close and business character, which, with certain modifications, existed until the Spring of last year, when the Consolidated Co. was formed and acquired some 99 per cent. of the shares of the Engine Co. 595,959 shares of £1 each had been issued. From these had to be deducted 172,149 shares, of which 72,149 were issued to the Diesel Engine Co., and 100,000 to Carels Frères, which left 423,810 subscribed in £1 shares. Of that money, £150,000 was paid to Carels Frères in accordance with the terms of the prospectus. £8,500 was paid for preliminary expenses, and £31,716 for underwriting commission and share brokerage. Those three items amounted to £190,000, leaving £233,810 available for the cost of building and equipping works in England, for the manufacture of Diesel engines and for additional working capital to meet the demands of an increasing business. On October 31st last out of that £233,810, £136,560 had been spent on the new works at Ipswich. Altogether, £143,357 had been advanced to and invested in the Diesel Engine Co., and the auditors had drawn attention to the fact that, in their opinion, owing to trading losses incurred by that company, which were not provided for in the accounts, that figure was not of the value stated. He (the chairman) was advised that at least £35,000 out of the amount which the company had advanced to the engine company would be irrecoverable. Having dealt with the company's investment in the Usines Carels Frères, the chairman said that the present financial position of the undertaking was such that they must have fresh capital, and their suggestion was that it should be raised on what was known as the assessment principle rather than by the issue of debentures. The commercial record of the associated companies showed that they had business connections in all parts of the world, and that the present volume of business, which was large, was capable of considerable expansion, and he believed that given an efficient board of directors and staff, there was no reason why the company should not earn satisfactory profits. In conclusion, he said that the board had a large majority of proxies which would enable them to carry their report if they so wished, but feeling that the company had a great future, instead of using those proxies and passing the report that day, it was their desire to see a small committee of shareholders appointed to go into the whole history of the company and to report at a subsequent meeting.

Sir William Peat then addressed the shareholders at great length on the position, and gave it as his opinion that it would be necessary to write a very substantial sum off the assets of the Diesel Engine Co. as lost. He pointed out that last year there was a loss of £49,000 in that company due to the fact that the directors had paid that amount of money to persons who had bought Diesel engines which had not come up to the specifications. With regard to the Usines Carels Frères, 50 per cent. of the capital of which belonged to the Consolidated Co., he pointed out that they had paid a quarter of a million for a half interest in that concern although the total capital was only £400,000. Although they got no dividend from that company this year, he was confident, as a result of his investigations, that the business was a good one, and that fine profits ought to be made under proper management. Altogether he estimated that it would be necessary for the directors to write off something like £135,000 to clean up the balance-sheet, and if the proposed scheme of reconstruction went through, the 5s. a share by which the capital was to be written down should be adequate to write off that loss. The scheme further provided for an assessment of 5s. a share, which would produce £150,000. The manager had given him an estimate that when the Ipswich works were in full swing they ought to make £26,000 a year profit, after providing for depreciation. It was evident that the company had got valuable patents and a business worth conserving, and the only course open to the shareholders, short of liquidation, was reconstruction. In his opinion, it was important that they should face the situation boldly and at once, and not allow matters to drift on in the hope that things would improve.

The Chairman then proposed a resolution, to the effect that a Committee of seven shareholders, with power to add to their number, be appointed to inquire into the causes of the present position of the company, to advise as to remedies, and to deal with the question of the new board and the reconstruction scheme; the Committee to report to a further meeting to be held in a fortnight's time, their report being first circulated among the shareholders.

Mr. Davidson, who said he had come prepared to very strongly criticise the action of the board, remarked that, under the circumstances, he would second the chairman's resolution, and would content himself with saying that he hoped nothing would be done to prevent the committee trying to find out who was responsible for the present position, and whether they could not fix pecuniary responsibility upon someone.

Mr. Peddie, chairman of the Shareholders' Committee, and Mr. Lawson having addressed the meeting at some length, the resolution for the appointment of a committee was agreed to, and the meeting proceeded to nominate gentlemen to act on this body.

Burmah Electric Tramways and Lighting Co., Ltd.—The directors announce a dividend of 3 per cent. (3s. per share) on the preference shares, placing £5,000 to reserve for depreciation and carrying £908 forward. According to the *Financial Times*, the directors announce that if proper provision for the upkeep and for depreciation of the system is to be provided, it will be impossible to rely upon paying the full dividend on the preference shares, and consequently there is no reasonable prospect of paying anything on account of the arrears. The directors have formulated a scheme which will be submitted at meetings on December 5th and 22nd.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Stolz Electrophone Co. (1913), Ltd.—60,000 shares of £1 each fully paid, Nos. 1 to 60,000.

And to allow the following securities to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 162,000 preference shares of £1 each fully paid, Nos. 1,838,001 to 2,000,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended October 31st, 1913, amounted to 1,426,639, compared with 1,386,195 units in the corresponding five weeks of 1912.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. for the three months to December 31st on the 6 per cent. cumulative preference shares.

Mackay Companies.—The usual quarterly dividend of 1¼ per cent. on the common shares is announced.

Power Gas Corporation, Ltd.—The directors recommend a dividend of 5 per cent. per annum on the ordinary shares.

Continental.—Germany.—A new company has been formed by the Rheinische Credit Bank, at Mannheim, entitled the Elektrische Kraftversorgung Aktien Gesellschaft, whose objects are for the erection, purchase, promotion, mortgage or working or all kinds of electric installations. The capital is fixed at £400,000. The company is associated with the Brown-Boveri concern, and takes over a series of undertakings from that firm, so that it starts with a prepared portfolio. Eng. Prof. Marguerre is the president.

France.—The report of the Société Electro-Metallurgie de Dives, for the year ending on June 30th last, shows a net profit of £60,616. Of this sum £2,972 is being placed to legal reserve, £1,642 paid to the directors and management, £14,281 to a special reserve fund to provide for fluctuations in the prices of metals, and £40,000 to the payment of a 5 per cent. dividend to the shareholders, leaving a small balance to be carried forward.

Russia.—The report of the Société Russe de l'Electricité Westinghouse, for the last financial year, shows a loss of £72,115, bringing the total loss appearing in the balance-sheet up to £230,652.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors report (according to the *Financier*) that the accounts for the year to September 30th show a balance, being profit, of £21,635, compared with £19,769 for the previous year. Owing to the more favourable weather during the past season, the traffic receipts show an increase of £2,291 compared with the previous 12 months. The sale of electricity also increased by £1,399, or nearly 16 per cent. The balance of the revenue account at the disposal of the company, including £2,581 brought forward, is £16,607. The directors propose to pay a dividend of 3 per cent. on the preference shares, which will absorb £4,500, leaving a balance of £12,107. It is proposed to place £2,000 to rolling stock reserve account, to appropriate £6,000 towards future maintenance of permanent way, to add to third-party insurance reserve £1,000, and to carry forward £3,107.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend at the rate of 1¾ per cent. for the three months to December 31st, plus a bonus of 1 per cent., making a total of 8 per cent. for the year, on the common stock.

R. Waygood & Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum (6d. per share), less income-tax, on the ordinary shares for the past half-year is announced.

Electric and General Investment Co., Ltd.—The directors have declared the interim dividend on the preference shares and 1s. per share on the ordinary shares, being at the maximum rate of 10 per cent. per annum for six months ended November 30th, 1913.

STOCKS AND SHARES.

Tuesday Evening.

It has been a case of the Home Railway market first, and the rest nowhere. Investment securities picked up under the leadership of Consols, but the buoyancy was damped by a heavy and unexpected issue of Canadian Government stock. With speculation in American Rails and mining shares shrunk to a minimum, the Home Railway market has matters all to itself, and is attracting a fair amount of business; much of it, however, is of the semi-professional type, and a smart fall on Tuesday, to-day, reflected the ways of profit-scalpers.

The firmness of Home Rails is due mainly to the consideration of the dividend outlook, combined with a reaction in public feeling against foreign gambles which have involved the operator too often in severe and sometimes total loss. The North-Eastern has just arrived happily at a new three years' agreement between itself and its men, and although the railwaymen have given notice to terminate the conciliation boards, this is understood to be a step not entirely distasteful to the companies themselves, inasmuch as it will permit of new arrangements being made likely to be more agreeable to everyone concerned.

Fresh rises occurred in Districts and Metropolitans. The latter have been especially prominent, partly because of the bear account in the stock, partly because of the Great Northern's overtures to the City tube that is now owned by the Metropolitan Railway. But in the reaction the price gave way to 43. Districts shot up on the opening of the new tube to Paddington. East Londons rose to 8 but came back to 7. London and South-Western Deferred stock is coming to the fore in connection with the scheme for electrifying a part of its suburban system. Probably the stock will receive such a dividend at the end of the current year as will give a return of 5½ to 6 per cent. on the money, and it is argued that with electrification of the Thames Valley lines this should be capable of substantial expansion. But, at the same time, it is well to remember that there may also be involved the possibility of a fresh issue of capital to undertake the work.

The Electric Lighting market is very steady, with quiet rises in several issues. Beyond that there is not much to say. People are not selling their shares, but, on the other hand, there has been little fresh demand, and consequently dealings are comparatively few and far between. This, in a negative way, is a good thing, since it shows that the public are not going to be led away into thinking that the County of London Electric Company's Bill will pave the way to a complete metamorphosis of the industry in London. That industry is doing very well, and while the amalgamation of interests would make a considerable difference to profits, its consummation is still a long way off.

Various shares have gained ⅛ on the week, amongst them being Bromptons, Chelseas, Kensingtons and South Londons. Debenture stocks are also on the rise, the advances being a point each in several cases.

The market in Mexicans is better for the time being. Well-informed people in London look upon the withdrawal of Huerta—at least temporarily—as already certain, thanks to the fatuous policy of the United States, or, rather, of President Wilson. The present position, in a nutshell, is that the country wants money, that it is not likely to get cash upon reasonable terms until the internal struggles are settled, and that everyone who has a stake in Mexico is eager to see things cleared up as quickly as possible. Mexican Light and Power issues are a little lower, but Mexico Trams have improved, the Common shares rising 2 points and the bonds 1. The group, as a whole, is better. Rio bonds picked up, and there are substantial recoveries in British Columbia Electric Railway issues. Brazilian Tractions went up 2, in sympathy with smart rises in the Government bonds.

Some of the American power and other utility companies' shares—which for a long time past had been almost unsaleable—suddenly came to the front at the end of last week, the prices putting on several points in a day. As may be well supposed, the market in them is an exceedingly tender one. Shawinigan Water Common shares rallied 3 to 138½ upon the steady advance in the company's earnings for this year, and the bonds are ½ higher. Montreal Common went up 4 to 219; and a demand for Electric Development of Ontario bonds carried the price to 96½. Canadian General Issues have risen, the dividend of 7 per cent. being supplemented by a bonus of 1 per cent. There is a wide-spread impression that the new Canadian Government and municipal loans just floated in London will tend to ease the money stringency in Canada very considerably, and therefore advantage, not only the railroads, but the industrial corporations and commerce generally. Lisbon Trams are better at 1¼.

The Telegraph and Telephone list is steady, with no particular alterations worth mentioning. West India and Panama Telegraphs put on 5s., thanks to a little speculative demand at the end of last week, and this had the effect of improving the price of the First Preference also. Marconis slipped back into dulness, both classes of shares showing a slight reaction, although Canadians are well maintained at 9s., and Americans at 16s. 9d. Reuters recovered the dividend of 6s. per share deducted on the Stock Exchange pay-day.

In the Manufacturing group, Castner-Kellners rallied 1/32 upon the statements at the meeting. Small falls occurred in British Aluminium Ordinary and Babcock & Wilcox shares. Consolidated Diesel Engines at 2s. 6d. were unchanged as the result of this week's meeting. Crompton Debenture rose 3; and Willans and Robinson Preference after its 7 points rise, is another 1 to the good at 22½. Rubber shares have gone back, because of the failure of the raw produce to rise to regain the half-a-crown per lb, which it touched a little while ago. Business has fallen again upon quietude, and further developments are wanted to revive renewed interest.

Within a day or two, there will probably appear the prospectus of £175,000 7 per cent. cumulative participating preferred stock, to be offered at par, in the Province of Buenos Ayres Electric Supply Company.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Nov. 26	3,084	+ 293	48	46,240	+ 3,704	..	..
Blackpool-Fleetw'd	„ 29	1,161	+ 114	21	29,0 3	+ 2,790	8	..
Bristol	„ 28	29,447	+ 3,257	..	88.,056	+ 51,291	30·5	..
*Brit. Elec. Trac. Co.	„ 21	01,401	+ 9,980	..	..	..	4:9·8	1·25
Chatham and Dist.	„ 20	3,585	+ 315	46	4,911	+ 2,818	14·98	..
Cork	„ 27	1,8[illegible]3	+ 85	47	28,726	+ 685	·89	..
Dublin	„ 28	19,154	—2,167	..	2[illegible]0,257	—15,[illegible]64	54·25	..
Hastings	„ 27	3,1[illegible]7	+ 244	..	..	+ 3,698	19·3	..
Lancashire United	„ 26	6,26[illegible]	+ 1,033	47	78,641	+ 9,084	42	3
Llandudno-Col. Bay	„ 2	648	+ 47	61	17,[illegible]19	+ 1,480	6·5	..
London United	„ 21	28,2[illegible]7	+ 1,515	..	296,054	+ 6,086	..	..
Tyneside	„ 19	1,9[illegible]3	..	21	11,060	721	11	..
Anglo-Argentine	„ 25	2[illegible]8,018	+ 17,[illegible]70	47	3,605,049	+189,803	..	..
Auckland	„ 21	10,497	—8,677	21	92,254	— 4,949	25·42	1·31
Brisbane	Sept.	25,[illegible]90	2,890	..	23[illegible],7[illegible]8	+ 51 674	..	..
Calcutta	Nov. 19	17,939	+ 991	..	..	+ 9,840	..	..
Kalgoorlie, W.A.	Oct.	2,652	..	44	29,099	..	20·5	..
‡Madras	Nov. 15	1,[illegible]03	— 14	46	37,3[illegible]4	+ 2,527	15·25	1
Montevideo	Oct.	29,224	+ 7[illegible]6	52	5[illegible]78,5[illegible]5	+ 27,219	..	..
Cen. London Rly.	Nov. 29	21,060	—1,461	48	239,400	5,322	6·78	·4
City & S. Lon. Rly.	„ 29	11,091	—1 075	48	13 ,480	—12,712	7·26	..
Dublin-Lucan Rly.	„ 28	44[illegible]	1	1[illegible]	3,294	— 22	7	..
L'pool Overh'd Rly.	„ 23	6,7[illegible]2	+ 472	47	80,5[illegible]6	+ 6,0[illegible]6	6·6	..
London Elec. Ry. Co.	„ 29	[illegible]8,160	— 85	48	653,545	+ 725	21·25	..
Mersey Railway	„ 2[illegible]	[illegible],667	— 186	48	1[illegible]7,1[illegible]8	+ 4,702	4·5	..
Metropolitan Rly.	„ 2	72,2[illegible]9	+ 6,015	47	[illegible]09,[illegible]78	28,289	29·25	8·5
Met. District Rly.	„ 29	5[illegible],771	+ 141	48	[illegible]28,[illegible]8	+ 17,743	25	..

* Includes railways and tramways. ‡ Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅛	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	+ ⅛	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94 xd	..	4 5 1
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16 — 17	..	5 6 0
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord.	10	5	5†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	103 —105	+ ½	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	+1	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 3/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅛	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	5	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hov	5	9	8†	7⅞ — 8⅛	..	5 10 9
Kensington & Knightsbridge, Ord.	5	8	8†	7½ — 8½	+ ⅛	4 17 6
Do. 4 % Deb.	Stock	4	4	— 92	+ 1/16	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	90 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	— 92	..	4 7 0
Metropolitan	5	4	4†	8⅜ — 8⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	3⅜ — 4⅝	..	4 12 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	4⅜ — 100	+ 1	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	97 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	79 — 100	+ 1	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10½	..	5 11 7
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8⅝ — 9	— ⅛	5 11 1
Do. 7 % Pref	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82⅝ — 85¼	..	4 1 10
South London, Ord.	4	5½	..	2¼ — 3½	+ ⅛	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	97 — 100	+1	5 0 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	5/16 — 7/16	..	..
Do. 5 % Cum Pref.	5	5	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4¼ — 6⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4 7/16 — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5½	— ⅛	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	107 —118	+1½	7 1 7
Do. 7 % Pref.	$100	7	7	119 —124	+1	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	½ — 11/16	— ⅛	7 5 6
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	+1	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/32 — 7/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 13/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —106	..	4 14 4
Mexican El. Lt, 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	47 — 51	—1	7 16 10
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	..	8 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 82	— ½	6 1 11
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	— 2	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 222	+ 4	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	5	5	99 —104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	137 —140	+4	4 5 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107	+ ⅛	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	97½ — 99½	..	4 9 6
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	27/32 — 29/32	..	6 12 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6¾ xd	— ⅛	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	122 —124	..	6 9 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	104½ —105½	..	5 13 9
Do. Def.	Do.	30/-	..	23⅞ — 24⅛	..	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	5	..	7 5/16 — 7 3/16	..	5 5 7
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	+1	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9⅛	+ ⅛	6 6 4
Do. 10 % Pref.	10	10	10	14½ — 15½	+ ½	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8⅛ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7⅛	..	6 12 0
Direct United States Cable ..	10	4	4†	6⅞ — 6⅞	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	126 —129	..	5 8 6
Do. 3½ % Pref. Stock	Do.	3½	3½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97 xd	..	4 2 6
Eastern Extension	10	7	7	12⅛ — 12⅜	..	5 11 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅜ — 12⅜	..	4 19 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	..	6 2 8
Indo European Telegraph ..	25	15	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	78 — 82	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	..	3⅜ — 3¼	— ⅛	5 14 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅜ — 2⅝	— ⅛	6 3 8
Monte Video Telephone, Ord. ..	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/16	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97 — 98	+ ½	4 11 10
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9⅛ xd	+ ½	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6½ — 6¾	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅛ — 2⅜	+ ⅛	4 10 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅜ — 10¼	+ ¼	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9⅜	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 18½	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	31/32 — 33/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	..	..
Do. Do. Deferred	100	..	..	4 — 5½	+ ¼	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90		6 13 4
Do. 7 % Non-Cum. Pr'f.	100	3	..	50 — 53	+2	5 13 2
Do. 5 % Perp. Deb.	100	5	5	91 — 94	+1	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66		4 11 0
Do. Gtd. Assented	100	..	4	79 — 81	+1	4 18 9
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	—1	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅛ — 2⅝	+1/16	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	5/16 — 7/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ⅞	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	..	6 11 2
Metropolitan Railway Consol.	100	1⅝	1⅝†	43¾ — 43¼	— ¼	3 15 2
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30½ — 31	+ ¾	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	+4	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅝ — 3⅞	..	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 — 113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding). Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	3½ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 8/16 — 4 13/16	..	5 14 3
Do. 2nd Pref.	5	5½	5½	4 6/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89½ — 91⅝	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Do 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Auckland Trams, 5 % Deb.	100	5	5	101½ - 103½	+ ½	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	+2	6 13 4
Brisbane Trams Invt., Ord.	5	8	8	7¼ — 7⅜	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	115 — 120	+1	6 13 4
Do Pref. Ord.	100	6	6	103 — 107	+ 1½	5 12 2
Do. 5 % Pref	100	5	5	102 — 105	+2	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	+1	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 — 104	..	4 6 7
Do. 4¼ % Con. Deb.	100	4¼	4¼	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5 7/16 — 6 3/16	..	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5⅜	+1/16	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4⅜d.	6	⅝ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	+ ⅛	4 7 3
Do. 6 % Pref.	1	6	6	1 2/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
„ Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	78 — 81	+2	8 12 10
Do. Gen. Con. 5 % Bonds	..	..	5	80 — 85	..	5 17 8
Do. 6 % Bonds	100	6	6	83 — 86	+1	6 19 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5¾ — 6¼	..	8 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96 xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 6 % Bonds	..	5	5	99 — 101	+ ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91	+1	5 9 11
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5¼	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

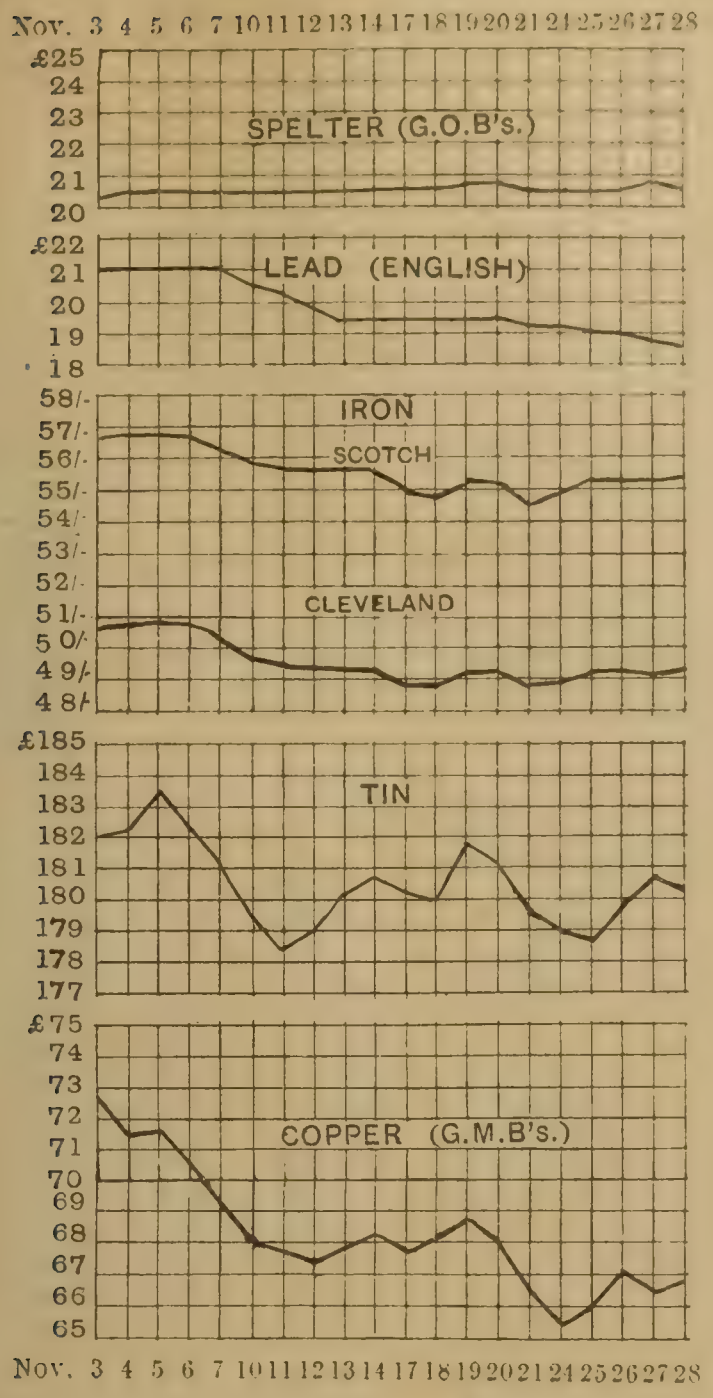
Aron, Ord.	1	7	..	2/16 — 3/16	..	8 12 4
Do. 6 % Pref.	1	6	6	21/32 — 25/32	..	7 13 4
Babcock & Wilcox	1	16	..	2 13/16 — 2 15/16	—1/16	5 8 11
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 1/16 — 1 3/16	—1/32	..
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	..	8 — 8½	..	5 17 8
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1 5/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 6¼	..	4 15 3
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	33 7/32 — 33 9/32	+1/32	5 3 5
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	67 — 72	+3	6 18 11
Dick, Kerr	1	Nil	..	9/16 — 11/16	..	..
Do. Pref.	1	6	6	27/32 — 29/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 1⅜	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 1/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15
Do. Deb.	100	4	4	88 — 93	..	4 6
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 1
Do. Deb.	100	4½	4½	100½ —102½ xd	+1½	4 17 1
India-Rubber, G. & T.	10	7½	5	13 — 14	..	5 7
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	54 — 59 xd	..	6 15 7
Do. B 4 % Cum. Pref.	100	..	..	20 — 25	+1	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd 1913.

METAL MARKET.

Fluctuations in November.



New London Showroom for Electric Vehicles.—On Thursday, last week, the new showrooms of Edison Accumulators, Ltd., in Duke Street, W., were opened, Lord Montagu of Beaulieu presiding at an inaugural luncheon held on the occasion.

Mr. W. R. Cooper, in proposing "Prosperity to Edison Accumulators, Ltd.," referred to the earlier failures in accumulator traction due to the defective batteries then employed, and to the advance made in the modern steel-alkali cell, largely used in American electrical vehicles, of which there were 37,000 employed in the States, including 12,000 commercial vehicles. Lord Montagu, in replying, expressed his belief in the favourable prospects before them, and in the merits of the Edison accumulator. He was much impressed by the success of the electric vehicle in the States, for both pleasure and business purposes; the electric runabout could be driven by women and professional men on account of its ease of handling. Reliable test figures showed that the commercial "electric," using charging energy at ½d. per unit, was much cheaper to run than the petrol vehicle, and the prospects for its adoption were very promising. Mr. Bernard Drake, who also replied, referred to his recent American visit, when he found that about 2½d. per car-mile covered all expenses in running an electric vehicle. It rested with the supply authorities to offer a suitable tariff for charging batteries—say, ½d. per unit.

In replying to the toast of "The Guests," Mr. A. H. Seabrook said that greater stress ought to be laid on the use of the electric vehicle for reasons of health. Chicago did not permit steam-hauled trains on its railroads within ten miles of the centre, and he understood that the licensing authorities in Berlin had refused to license any more petrol cabs in the city, although they welcomed electric cabs. The *Lancet* had recently drawn attention to the danger of "petrol haze" in the streets, and such things as these ought to be duly emphasised when the electric vehicle was being considered.

Mr. J. E. Edgcome, who also spoke, said the low tariffs for battery charging had possibly been exaggerated, but the supply engineers would do what they could, and the rates would probably be between 1d. and ½d. per unit.

LISTS OF CONSUMERS.

Every supply company has, needless to say, its list of consumers. But the accessibility of these lists varies very considerably, as was discovered recently by a large manufacturing firm, desirous of circularising all the consumers in the kingdom.

Their experiences were interesting. Some municipalities and companies refused flatly to give any information whatever. Others did no more than give a schedule of the streets in which their mains were laid, leaving the advertisers the option of circularising every house therein, or none at all. One ingenious chief of a large metropolitan concern wrote that non-consumers were the people he wanted to see circularised, and offered to send a list of all non-consumers in the streets served by his mains. His offer was promptly accepted, doubtless to his surprise.

Some undertakings, while not objecting to their consumers being circularised, evidently considered their names and addresses delicate secrets to be locked up in the official breast; for they would do no more than undertake to post and distribute the circulars, sent them in bulk in blank envelopes.

The majority, however, were willing to furnish the information desired—for a consideration. It was obvious, from the diversity of the methods by which the information was imparted, that requests for these lists were infrequent. Some asked for a copy of the local directory, which they then marked. Others sent written or typed lists, to be either kept or copied by the advertisers. Only one, a very large provincial town, sent a printed list. Some allowed a representative of the firm to make a copy at their offices; others, while officially refusing to supply a list, would allow one of their own employés to accept a fee for making a copy in his own time.

The fees charged varied widely, averaging from 10s. to 20s. a thousand names. A large Scottish municipality, with 20,000 or more consumers, had so many packets of envelopes sent to them, and presently returned them, mechanically addressed, at 5s. a thousand. At the other extreme, a company owning several small undertakings asked—in vain—for £5 5s. for allowing their list of not more than 1,000 names, all told, to be copied.

Altogether, the firm in question was successful in obtaining the names of some 200,000 consumers, at a total cost of some £150. Whether a smaller firm, or the same firm in other circumstances, would have been equally successful is questionable; but in this instance the majority of the municipalities and companies approached recognised that the current-consuming devices that were to be advertised could do them no manner of harm.

Indeed, it is difficult to see how it can be to their disadvantage to give a list of their consumers to any responsible electrical firm applying for it. Apart from the modest guineas they can charge for the information, the benefit resulting from the use of it would be as much theirs as the advertisers'. There need be no fear of their consumers being annoyed by persistent circularising. The number of firms which can afford to circularise a quarter of a million consumers is strictly limited.—H.R.T.

Electrical Vehicles in Germany.—Just as in England, increasing attention would seem to be now given to the electric vehicle in Germany. The electric tramway authorities of Düsseldorf, for example, have lately put in service an electric motor-tower wagon for use in the maintenance of the tramway overhead conductors. The vehicle, which was built by Messrs. Heinrich Scheele & Co., of Cologne, has a total weight of 3 tons 12 cwt., and can attain a maximum speed of about 17 miles per hour. The machine is equipped with two 6-H P. electric motors, the necessary current for which is supplied by a battery of Hagen accumulators, capable of running the wagon a distance of 60 miles on one charge. A feature of the machine is that it is designed to be controlled not only from the driver's seat, but also from the top of the platform, so that in carrying out repairs the wagon can be slowly moved along without its being necessary for any of the men to descend. An electric stores wagon, built by the same firm, has also been put in service by the tramway authorities in Dusseldorf. This is capable of attaining a speed of 22 M.P.H., and of running a distance of 50 miles on one charge of the battery.

TRADE STATISTICS OF AUSTRALIA.

The following figures showing the imports of electrical and similar goods into Australia during the year 1912 are taken from the recently issued official trade statistics; the figures for 1911 have been given for purposes of comparison and notes of increases or decreases have been added:

	1911. £	1912. £	Inc. or dec. £
Gas and oil engines.—			
From United Kingdom	114,000	127,000	+ 13,000
,, United States ...	41,000	37,000	— 4,000
,, Germany ...	4,000	3,000	— 1,000
,, Other countries...	9,000	8,000	— 1,000
Total ...	168,000	175,000	+ 7,000
Portable and traction engines.—			
From United Kingdom	120,000	121,000	+ 1,000
,, United States ...	61,000	50,000	— 11,000
,, Other countries...	2,000	—	— 2,000
Total ...	183,000	171,000	— 12,000
Other.—			
From United Kingdom	73,000	380,000	+ 307,000
,, United States ...	10,000	84,000	+ 74,000
,, Other countries...	5,000	5,000	—
Total ...	88,000	469,000	+ 381,000
Dynamo electric machines up to 200-h.p. static transformers, coils, etc.—			
From United Kingdom	141,000	186,000	+ 45,000
,, Germany ...	36,000	50,000	+ 14,000
,, Italy	4,000	10,000	+ 6,000
,, Sweden	6,000	4,000	— 2,000
,, United States ...	90,000	113,000	+ 23,000
,, Other countries...	7,000	8,000	+ 1,000
Total ...	284,000	371,000	+ 87,000
Dynamo electric machines over 200-h.p. and parts.—			
From United Kingdom	17,000	30,000	+ 13,000
,, Germany ...	2,000	2,000	—
,, United States ...	9,000	18,000	+ 9,000
,, Other countries...	1,000	—	— 1,000
Total ...	29,000	50,000	+ 21,000
Regulating, starting and controlling apparatus.—			
From United Kingdom	20,000	26,000	+ 6,000
,, Germany ...	7,000	8,000	+ 1,000
,, United States ...	23,000	50,000	+ 27,000
,, Other countries...	2,000	1,000	— 1,000
Total ...	52,000	85,000	+ 33,000
Coal cutting machines.—			
From United Kingdom	3,000	2,000	— 1,000
,, United States ...	17,000	13,000	— 4,000
,, Other countries...	2,000	1,000	— 1,000
Total ...	22,000	16,000	— 6,000
Earth and rock cutting, excavating, etc., machines.—			
From United Kingdom	34,000	35,000	+ 1,000
,, Germany ...	8,000	6,000	— 2,000
,, United States ...	8,000	8,000	—
,, Other countries...	2,000	1,000	— 1,000
Total ...	52,000	50,000	— 2,000
Rotary and percussive rock drills.—			
From United Kingdom	7,000	5,000	— 2,000
,, United States ...	25,000	23,000	— 2,000
,, Other countries...	—	2,000	+ 2,000
Total ...	32,000	30,000	— 2,000
Machine tools.—			
From United Kingdom	66,000	81,000	+ 15,000
,, Germany ...	11,000	17,000	+ 6,000
,, United States ...	46,000	55,000	+ 9,000
,, Other countries...	4,000	5,000	+ 1,000
Total ...	127,000	158,000	+ 31,000
Electric turbines, economisers, superheaters, etc.—			
From United Kingdom	82,000	61,000	— 21,000
,, Germany ...	1,000	4,000	+ 3,000
,, United States ...	—	5,000	+ 5,000
,, Other countries...	—	—	—
Total ...	83,000	70,000	— 13,000
High speed reciprocating steam engines for coupling or coupled to electric generators or pumps.—			
From United Kingdom	38,000	21,000	— 17,000
Motive power machinery not elsewhere included.—			
From United Kingdom	214,000	260,000	+ 46,000
,, France	11,000	10,000	— 1,000
,, Germany ...	9,000	22,000	+ 13,000
,, Sweden	2,000	6,000	+ 4,000
,, Switzerland ...	3,000	13,000	+ 10,000
,, United States ...	91,000	103,000	+ 12,000
,, Other countries...	3,000	6,000	+ 3,000
Total ...	333,000	420,000	+ 87,000
Electroliers, gasoliers, etc.—			
From United Kingdom	26,000	37,000	+ 11,000
,, Germany ...	1,000	2,000	+ 1,000
,, United States ...	1,000	2,000	+ 1,000
Total ...	28,000	41,000	+ 13,000
Electric fittings, switches, fuses, and lightning arresters.—			
From United Kingdom	29,000	45,000	+ 16,000
,, Germany ...	8,000	10,000	+ 2,000
,, United States ...	9,000	19,000	+ 10,000
,, Other countries...	1,000	4,000	+ 3,000
Total ...	47,000	78,000	+ 31,000
Electric heating and cooking appliances.—			
From United Kingdom	2,000	3,000	+ 1,000
,, United States ...	1,000	1,000	—
,, Other countries...	—	1,000	+ 1,000
Total ...	3,000	5,000	+ 2,000
Electrical and gas appliances not elsewhere included.—			
From United Kingdom	88,000	130,000	+ 42,000
,, Denmark ...	6,000	8,000	+ 2,000
,, Germany ...	47,000	47,000	—
,, Holland	4,000	8,000	+ 4,000
,, United States ...	22,000	45,000	+ 23,000
,, Other countries...	4,000	8,000	+ 4,000
Total ...	171,000	246,000	+ 75,000
Lamps and lampware, and incandescent mantles.—			
From United Kingdom	57,000	84,000	+ 27,000
,, Germany ...	60,000	49,000	— 11,000
,, United States ...	50,000	53,000	+ 3,000
,, Other countries...	13,000	13,000	—
Total ...	180,000	199,000	+ 19,000
Rails, fishplates, etc.—			
From United Kingdom	500,000	845,000	+ 345,000
,, Belgium ...	43,000	125,000	+ 82,000
,, Germany ...	211,000	90,000	— 121,000
,, United States ...	310,000	215,000	— 95,000
,, Other countries...	16,000	25,000	+ 9,000
Total ...	1,080,000	1,300,000	+ 220,000
Telephones, switchboards, and appliances.—			
From United Kingdom	69,000	58,000	— 11,000
,, Belgium ...	18,000	19,000	+ 1,000
,, Germany ...	7,000	6,000	— 1,000
,, Holland	1,000	3,000	+ 2,000
,, Sweden	32,000	44,000	+ 12,000
,, United States ...	10,000	30,000	+ 20,000
,, Other countries...	—	5,000	+ 5,000
Total ...	137,000	165,000	+ 28,000
Wire, iron, and steel.—			
From United Kingdom	111,000	113,000	+ 2,000
,, Germany ...	320,000	299,000	— 21,000
,, United States ...	266,000	304,000	+ 38,000
,, Other countries...	49,000	8,000	— 41,000
Total ...	746,000	724,000	— 22,000
Accumulators, cable and wire (covered), carbon, measuring and recording instruments, arc lamps, etc.—			
From United Kingdom	430,000	587,000	+ 157,000
,, Germany ...	105,000	59,000	— 46,000
,, United States ...	18,000	14,000	— 4,000
,, Italy	10,000	9,000	— 1,000
,, Other countries...	10,000	8,000	— 2,000
Total ...	573,000	677,000	+ 104,000
Arc lamp carbons.—			
From United Kingdom	Included in above.	1,000	—
,, Germany ...		18,000	—
,, Other countries		1,000	—
Total ...		20,000	—

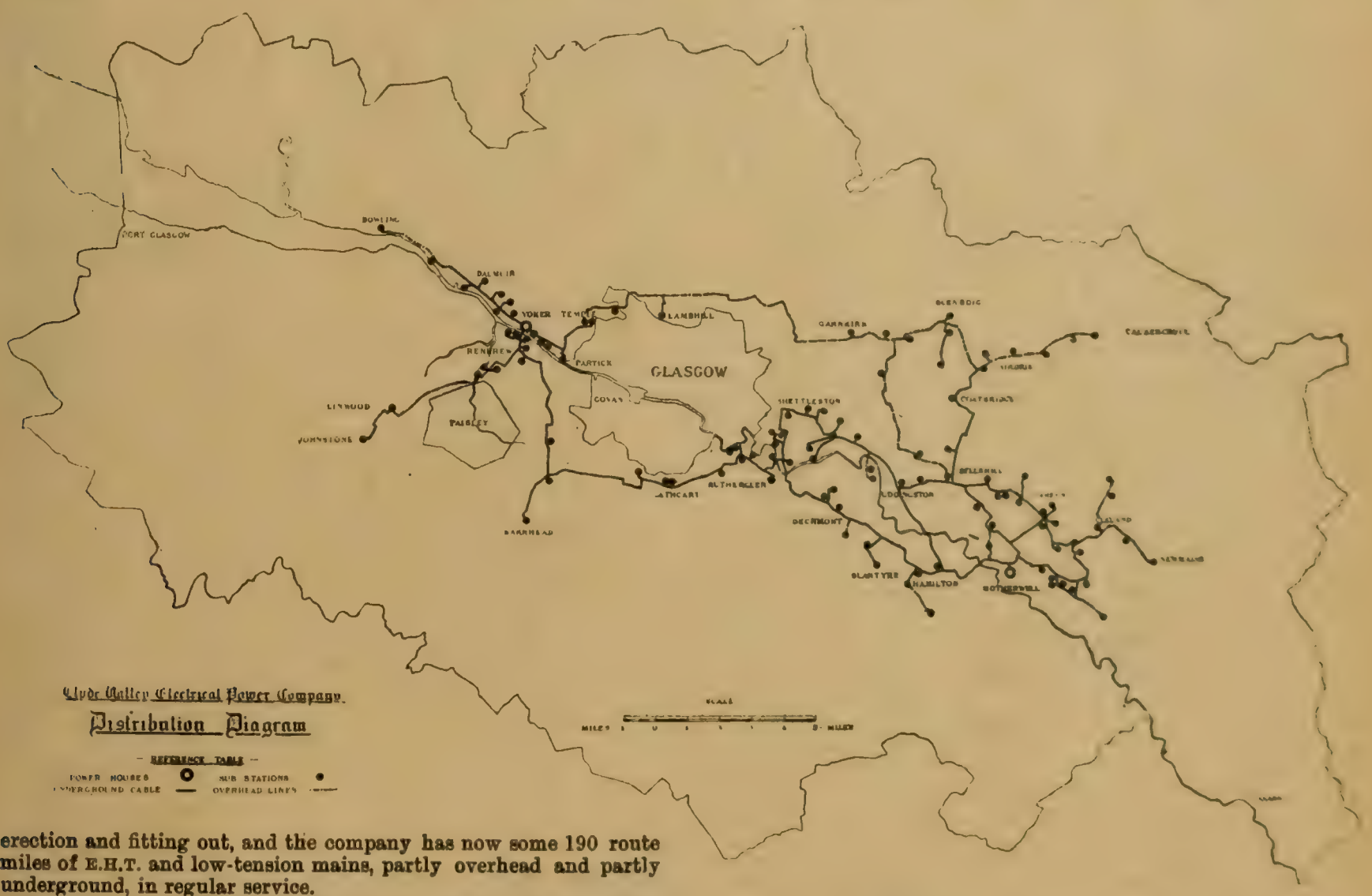
THE CLYDE VALLEY POWER CO.'S UNDERTAKING.

The business of electricity supply for industrial purposes from large central stations is, at the present time, developing rapidly in this country, and there are now numerous industries, both in England and Scotland, which depend on electricity supplied from economically situated generating stations for their power.

We have reviewed from time to time in our columns the various economic advantages accruing to industries through such power facilities, and it may be of interest to our readers to give a few particulars of the scope of operations of the Clyde Valley Electrical Power Co., the largest electricity supply company operating in Scotland, and, indeed, one of the most important now in the United Kingdom.

The Clyde Valley Co. commenced supply late in 1905 from its two generating stations of Motherwell and Yoker, with some 12 sub or distributing stations, an 11,000-volt ring-main system from Motherwell power station, a ring-main from Yoker power station, and four-core distributor cables, aggregating some 56 miles. The business of the company has rapidly extended since then, and its cables cover a very wide area of Lanarkshire, Renfrewshire and Dumbartonshire, as will be seen from the attached plan of the network, which shows the E.H.T. mains, power stations and transforming sub-stations.

The capacity of the generating stations is as follows:—The Motherwell generating station now contains three 5,000-KW. and two 2,500-KW. turbo-generators, while the Yoker plant consists of two 5,000-KW. and two 2,500-KW. turbine sets, a total of 35,000 KW. of generating plant, together with the necessary boilers, condensers, &c.; the transforming sub-stations have increased in number to 113, with some six more in course of erection and fitting out, and the company has now some 190 route miles of E.H.T. and low-tension mains, partly overhead and partly underground, in regular service.



The H.P. of motors connected to the system amounts at the present time to 53,767, with lighting connections equal to 93,126 33-watt lamps, and the company numbers among its customers the best industrial firms in the West of Scotland. Some idea of the diversity of the industries supplied can be gathered from the fact that among the company's customers are collieries, engineers, paper mills, wire rope works, distilleries, soap factories, docks, textile works, bakeries, shipbuilders, bridge builders, tube works, brick works, colour works, ordnance factories, saw mills, printers, iron and steel works, motor-car works, rope works, quarries, chemical works, tramways, dye works, laundries, building contractors, &c., and that supplies in bulk are given to the Burgh of Wishaw, the Coatbridge and Airdrie Electric Supply Co., Ltd., and the Strathclyde Electricity Supply Co., Ltd.

The company has a large amount of mains and construction work on hand in connection with new contracts for supply, the latter having amounted to 8,781 H.P. since the beginning of this year. Prospects for the coming year are exceedingly good, and although the country's volume of trade may be showing a slackening off in certain directions, electricity supply should not be affected to a great extent, as economies must of necessity be introduced in many ways to make up for diminished margins of profit, and one of the most important ways of doing this has been found to be the adoption of electrical driving in place of older and less efficient methods.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We give below, as usual, a list of the proposals that will come forward in the next Session of Parliament. Readers who are desirous of obtaining further information will find the applications published in detail in the last few numbers of the *London Gazette*:—

(*a*) Electric Light and Power.

Ely.—Ely Gas and Electricity Co., Ltd., is applying for prov. order for electric lighting.

Barnsley.—Corporation, power to supply, hire, &c., electrical fittings and apparatus, and other electrical powers.

South Suburban Gas Co.—Powers to generate electricity an enter into contracts and agreements for sale of the same.

Yorkshire.—Further powers and removal of existing restrictions are sought by the Yorkshire Electric Power Co.

Leyland.—Leyland Gas Co. is seeking authority to generate and supply electricity; power to make agreements with the Lancashire Electric Power Co. or other authority.

Brentford.—Brentford Gas Co, power to take over powers of Egham and District Electric Light Co., Ltd.; also to apply for prov. E.L. orders.

North Met. Electric Power Supply Co.—Power to generate electricity at St. Albans, Hertford; power to various railway companies to give supply of energy in bulk to company, &c.

Kenilworth.—Midland E.L. and Power Co., Ltd., is applying for a prov. order.

Hinckley and District.—Midland E.L. and Heat Co. is applying for prov. order.

Beeston and District.—Derbyshire and Notts. Electric Power Co. is seeking a prov. order.

Ripon.—Corporation prov. electric light order.

Bedworth and Bulkington.—Midland Electric Light and Power Co., Ltd., is applying for prov. order.

Hawarden.—R.D.C. is applying for prov. order.

Heanor, Eastwood and District.—Derbyshire and Notts. Electric Power Co. is applying for prov. order.

Merthyr Tydfil.—Merthyr E.T. and L. Co. is applying for amendment of 1899 order as to terms of purchase by local authority.

London.—County of London Electric Supply Co. Application for power to make agreements with L.C.C. for postponement of purchase dates. (See p. 882 of our issue of last week.)

Hightown.—New company to supply gas and electricity in Little Crosby.

Knottingley.—U.D.C., prov. E.L. order.

Bispham with Norbreck.—U.D.C., prov. E.L. order.

Brighton.—Powers to supply electricity in Portslade-by-Sea, Southwick and Shoreham-by-Sea.

Weymouth and Melcombe Regis.—Corporation, sundry further powers relating to the working of the electricity undertaking.

Deal and Walmer.—D. and W. Gas Co. is seeking electricity supply powers for Sandwich and Deal, Walmer, &c.
Worthing.—Corporation, extension of limits of electric supply, &c.
Maidenhead.—Corporation, sundry further powers relating to the electricity undertaking.
St. Annes-on-Sea.—U.D.C., authority for showrooms, house-wiring, &c. Also confirmation of agreement with Blackpool, St. Annes and Lytham Tramways Co. as to supply of energy.
Stone.—Application by Stone Gas Light and Coke Co., Ltd., for various powers, including electricity supply.
Wimbledon.—Corporation, sundry provisions relating to working of electricity supply undertaking.
Chiswick.—U.D.C., purchase of undertaking of Chiswick Electricity Supply Corporation, Ltd., and further powers.
Thornton.—U.D.C., prov. E.L. order.
Midhurst and District.—Application for prov. order by B. E. G. Bailey, the Hon. Weetman Pearson and T. Stallibrass.
West Bridgeford.—U.D.C., prov. order.
Llanfairfechan.—U.D.C., prov. order.
Gellygaer (Bedlinog and Fochriw).—U.D.C., prov. order.
Oulton Broad.—Oulton Broad Electricity Co., Ltd., prov. order.
Chorley.—Lancashire Electric Power Co., prov. order.
Banstead.—Walton-on-the Hill, Kingswood and District, application by G. Allom, 15, George Street, Hanover Square, London, for prov. order.
Tenby.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Warminster.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Ruthin.—Application by J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.
Ledbury.—Ledbury Electric Supply Co., Ltd., 127, Victoria Street, Bristol, prov. order.
Bradford-on-Avon.—Application by J. H. Edwards, Bristol, for prov. order.
Rickmansworth and Chorley Wood.—Colne Valley E.S. Co., Ltd., prov. order.
Kingston-upon-Hull.—Corporation, extension of area, to include Sutton.
Leeds.—Corporation, extension of area and acquisition of undertaking of Roundhay and District E.L. Co., Ltd.
Ystradgynlais.—R.D.C., prov. order.
York.—Corporation, extension of area.
Newton-in-Makerfield.—U.D.C., prov. order.
Cowbridge and Penybont.—South Wales Electric Power Distribution Co., prov. order.
Yeovil.—Petters, Ltd., Yeovil, prov. order.
Abercarn.—South Wales Electric Power Distribution Co., prov. order.
Skegness.—U.D.C., power to supply gas and electricity and to acquire undertaking of Gas Co., also motor-omnibus powers.
Llanidloes.—Llanidloes E.L. Co., Ltd., prov. order.
Dearne Valley.—Constitution of joint board to exercise electric lighting powers in the U.D.C.'s of Wombwell, Wath-upon-Dearne, Bolton-upon-Dearne and Thurnscoe.
Farnham.—Farnham Gas and Electricity Co., extension of supply area.
Feltham and District.—Application by F. H. Edwards, Mandeville, Platt's Lane, Hampstead, for prov. order.
Harwich.—Corporation, prov. E.L. order.
Reading.—Reading E.S. Co., Ltd., supply in bulk to York Town and Blackwater Gas Co.
Slaithwaite.—U.D.C., prov. E.L. order.
Watford.—U.D.C., extension of area to include Bushey Urban District and Aldenham parish.
Whitstable.—Whitstable Electric Co., Ltd., 94, High Street, Whitstable, prov. order.

(*b*) Electric Tramway and Railless Trolley Vehicles.

Birmingham.—Corporation, further tramway and motor-omnibus powers.
Birkenhead.—Corporation, power to run motor-omnibuses in various districts as part of tramways undertaking.
Bolton.—Corporation, new tramways, trailer cars, motor-omnibuses, further electrical supply provisions.
Bournemouth.—Proposed new company to run railless trolley vehicles in the County Borough.
Bristol.—Corporation, powers to work tramways to be purchased, or leased, from the Bristol Tramways and Carriage Co.
Chesterfield.—Corporation, further tramway powers; extension of area for supply of electricity in Brampton, Walton and Tapton Parishes.
Leeds.—Corporation, tramway and trolley vehicle routes within and without the city; motor-omnibuses.
London.—L.C.C., construction of tramways, street widenings, and various incidental powers.
London United Tramways.—Various powers.
Manchester.—Corporation, extension of time for tramways construction, running of omnibuses, generating station, &c., in Davyhulme, extension of area to include Davyhulme and parts of Stretford and Salford; also purchase of undertaking of Trafford Power and Light Supply (1902), Ltd.
Newcastle-on-Tyne.—Corporation, powers to construct tramways in Longbenton and Weetslade.
Newport.—Corporation, tramway and motor-omnibus powers, also extension of electricity supply limits to include parishes outside borough.
N.E.R.—Power to construct and use trackless trolley system along a specified route in Newcastle-on-Tyne and Gateshead.
Norwich.—Additional tramway powers are sought by the Norwich E.T. Co.
Oxford and District.—City of Oxford E.T., Ltd., powers relating to sale of undertaking to Corporation, removal of same and the running of motor-omnibuses.
Poole, Sandbanks and Westbourne.—Sandbanks Railless Electric Car Co., Ltd., seeks powers to run railless trolley vehicles in the borough of Poole. Agreement with Bournemouth and Poole Electric Supply Co. for supply of electricity.
Preston.—Corporation, tramway and motor-omnibus powers.
Reading.—Corporation, additional tramways; trolley vehicles and omnibuses.
Rotherham.—Corporation, electric tramway powers.
Sheffield.—Corporation, new tramway and motor-omnibus powers.
Walsall.—Corporation, trolley vehicle powers, also motor-omnibus and trailer car provisions.
York.—Corporation, powers to run electric trolley vehicles along routes within the city; further powers to supply electricity, &c.
Western Valleys, Monmouthshire.—Western Valleys (Mon.) Railless Electric Traction Co. is applying for extension of authorised routes, and other powers.

(*c*) Railways, &c.

L.B. and S.C. Railway.—Widening and other powers, including provisions as to agreements relating to the supply of electricity.
Midland Railway.—Powers to extend time limited by Sec. 21 of the Midland Railway (L.T. and S.R. Purchase) Act, 1912; agreements with Metropolitan District, London Electric and Whitechapel and Bow Railway Companies, and Underground Electric Railways of London, Ltd.
Met. and G.N. Railway Companies.—Joint Committee, to lease and work G.N. and City Railway; construct new railways in the City of London, Finsbury and Islington; sundry incidental powers.
London Electric Railway Co.—New subways and works making connections with the Central London Railway, &c.
Central London Railway.—Enlargement of portion of tunnels, new subways and works, additional capital, &c.
N. and S. Shields.—New company, to construct underground railway between N. and S. Shields, generating station, payment of interest out of capital, agreements with municipalities, and light and power companies as to purchase of electricity.
London.—City of London, various powers to Corporation, including regulation of premises on which celluloid is manufactured or stored.

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. Evershed, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, November 26th, London, November 27th, and Cardiff, Dec. 1st*, 1913.)

(*Continued from page* 895.)

It has been the custom ever since the early days of submarine telegraphy to observe the total current at the end of the first minute, and to call the ratio of the charging voltage to that current "the insulation resistance after one minute's electrification," a custom which is still adhered to by cable-makers. Inspection of the curve in fig. 6 shows that at one minute 86 per cent. of the total current was charging current, only 14 per cent. being true leakage current. Hence when a cable-maker specifies the resistance of cable similar to this as so many megohms, his statement only contains 14 per cent. of the whole truth. Economy of truth, however, is on the side of honesty in this instance, and the buyer is doubtless aware of the customary method and sometimes understands what it implies.

In this paper we are more concerned with fact than custom Fig. 6 shows that at one minute the total current was 0·0051 micro-ampere at 525 volts, hence the value of what may be called the "customary resistance" was 525/0·0051 = 103,000 "megohms" for $\frac{1}{16}$th of a mile of cable: and the customary resistance of one mile of similar cable would be 103,000/16, or roughly 6,000 "megohms." The final value of the current being 0·00072 micro-ampere, the real dielectric resistance was 525/0·00072 = 730,000 megohms for $\frac{1}{16}$th of a mile, equivalent to a dielectric resistance of 45,000 megohms for one mile of similar cable.

With these figures as a guide, let us ascertain the relative importance of dielectric leakage and moisture leakage in some installation of interior wiring in which rubber-insulated wires are used. The circuits which gave the characteristic curve shown in fig. 5 afford a good example, being carried out with rubber-covered wire insulated to the same standard as the flexible we have just examined. The conductors also are of the same diameter in the two cases. The installation contains 380 yd. of wire, coupled up in the usual way to a number of fittings in which porcelain is used exclusively as the insulator. Assuming the covering of the wires to be undamaged, the dielectric resistance of 380 yards of wire to earth will be about 45,000 × 1,760/380 = 200,000 megohms, and the customary resistance would be about 6,000 × 1,760/380 = 28,000 "megohms." We need not attempt to decide which of these values

is to be taken, because it is only necessary to look at fig. 5 to find that the resistance of the installation as a whole was but a paltry six megohms, even when tested in dry weather. The relative importance is now obvious ; leakage through the dielectric rubber is nothing, leakage at the fittings is everything.*

What has been demonstrated in the case of rubber must be equally true with regard to any insulator which has a resistance in any degree comparable with that of good rubber. The resistance of such materials as ebonite, sulphur, glass, mica, gutta-percha, shellac, dry paper, and dry cotton, is in every case enormous ; like rubber, their specific resistance is measured by millions of megohms, and in most cases by thousands of millions. Hence dielectric leakage will be ignored in what follows.

Moisture Curves.

Cotton.—Although this material is so largely used as an insulator for wires the opportunity for observing its resistance seldom or never arises in practice. Several test-pieces were therefore made up for the purpose, each consisting of two cotton-covered wires wound side by side in a single layer on a well glazed porcelain bobbin so that leakage from one wire to the other could only take place through the cotton coverings. One of these cotton test-pieces when tested for insulation resistance from one wire to the other gave the curve shown in fig. 8. After being dried in an

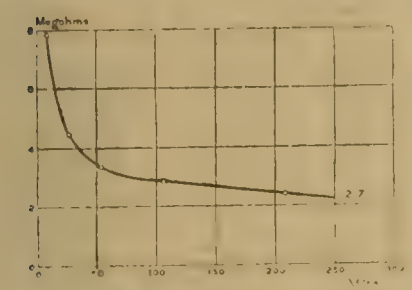


Fig. 8.—Insulation Resistance of Cotton which contained a Normal Quantity of Moisture.

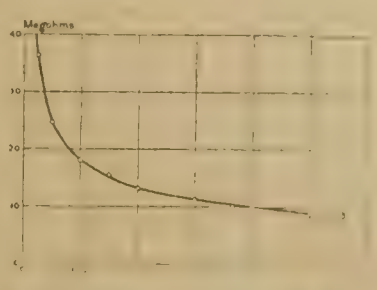


Fig. 9.—Insulation Resistance of Cotton after Drying.

oven at 150° C. for a couple of hours, and then allowed to cool, this test-piece gave the curve shown in fig. 9. The resistance is now five or six times greater as the result of the partial evaporation of the moisture originally contained in the cotton, but the general character of the voltage-resistance curve is unaltered. It will be noticed that at 500 volts the resistance has fallen to about one-third the value it had at 50 volts, or $R_{50}/R_{500} = 2{\cdot}8$. In the diagrams the value of the ratio R_v/R_{10v} is marked at the end of each characteristic curve, so that different curves may be readily compared ; in the case of absorbent materials this ratio is more commonly nearer two than three. After further drying at 150° C. for some hours, this same test-piece gave the curve shown in fig. 10. The effect of the drying process has been to increase the resistance to something like 80 times the initial value, but notwithstanding the great diminution in the quantity of water in the cotton, the curve retains the characteristic shape.

Various kinds of paper, under a variety of conditions as regards moisture, compression, length and area, were exhaustively tested.

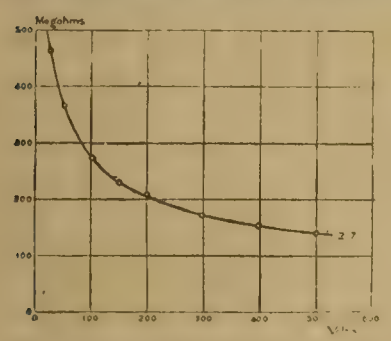


Fig. 10.—Insulation Resistance of Cotton ; the same Test-piece as in Figs. 8 and 9, after further Baking.

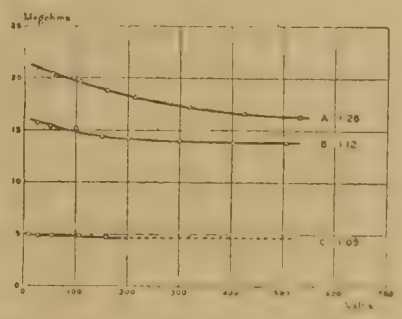


Fig. 11.—Moisture Curves of damp Paper, showing Gradual Change from Moisture Condition to Ohm's Law as the Paper becomes sodden with Water.

As might be expected, paper behaves in much the same way as cotton.

The law of the characteristic curve is considerably affected by the degree of compression to which the absorbent material is subjected.

The degree of moisture in an absorbent material like paper may be varied within wide limits without much affecting the law of the moisture curve, although the corresponding variations in the resistance will be enormous. But when the material contains a considerable excess of moisture, so that it is sensibly damp the law begins to change, the ratio R_v/R_{10v} gradually approaching unity as a limit and the curve subsiding into a horizontal straight line. In other words, when an absorbent insulator is sodden with water its resistance follows Ohm's law. This gradual change from a moisture curve is illustrated in fig. 11, the curves being obtained from paper in which increasing quantities of water had been absorbed. Owing to the very low resistance of the wet paper curve C could not be continued beyond about 160 volts.

The test-pieces for examining micanite cloth were made up by wrapping a single thickness of the cloth round a piece of smooth iron pipe, and then winding a single layer of cotton-covered wire tightly over it. The cloth was therefore tested under much the same conditions as are commonly met with in practice, micanite cloth being largely used as an insulator for windings.

The test-piece was baked for about four hours at 150° C. In one hour after removal from the oven the test-piece was cold and its resistance was then about 1,300,000 megohms when tested at 500 volts. It was then left exposed to the air of the experimental room in order to find out to what extent micanite cloth acted as an absorbent of atmospheric moisture. The two curves given in fig. 12 were obtained after exposure to the air for five days and 90 days respectively.

In these curves the ratio R_{10}/R_{500} is much less than 2 ; the average value deduced from seven curves obtained from micanite cloth test-pieces is 1·47.

The three examples which have just been examined are typical of the whole. The composition of the insulating substance seems to be of little importance. So long as the structure of the

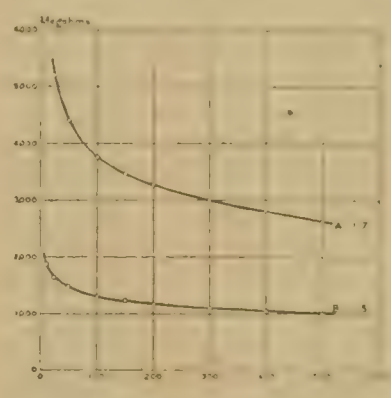


Fig. 12. — Micanite Cloth Tested after Exposure to the Air for (A) Five Days and (B) 90 Days.

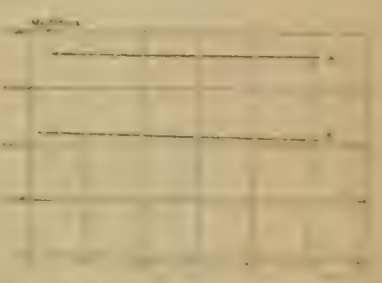


Fig. 13. — Resistance of Cylinder Oil : (A) when dry ; (B) containing a Trace of Absorbed Water.

material is such as to provide capillary spaces to harbour moisture, leakage will take place in the characteristic manner. In the following sections the effect of filling up the pores of absorbent materials is dealt with in connection with oiled paper and varnished windings.

Oils are good insulators in themselves, but they are capable of absorbing traces of water. An investigation was therefore made to ascertain whether water when absorbed in oil behaved in the same way as moisture in an absorbent solid. Several different kinds of oils and varnishes (and also liquids which are used as solvents in varnishes) were tested in this apparatus, and in every case Ohm's law was followed, the resistance proving to be a constant quantity not varying with the potential difference between the electrodes. The result of a test with oil containing absorbed water is shown in fig. 13, the upper curve being obtained from cylinder oil freshly drawn from the storage tank and the lower curve from the same oil after absorbing water. The effect of the absorbed water is evident in the marked lowering of the resistance. But of any effect like that due to moisture in absorbent solids there is no trace. In both curves the resistance is practically constant, Ohm's law being followed well enough.

Paper containing moisture may be saturated with an insulating oil without producing any effect on the leakage paths formed by the water. The curve shown in fig. 14 was obtained from drawing paper which, while in a normal state as regards moisture, was immersed in dry cylinder oil and left to soak for a week before being taken out and tested. The resulting curve does not differ in any way from an ordinary moisture curve, the ratio R_{50}/R_{500} being 2·1 for the oiled paper. It is evident that the oil does not displace the water, or break up the conducting paths, or interfere in any material way with the characteristic conduction due to the moisture which was present in the paper before the entrance of the oil.

The converse, however, does not hold good. Water will not only find its way into paper which has been dried and soaked in oil, but will so far displace the oil as to form leakage paths. As is well known, paper impregnated with oil easily absorbs water from the air. Hence the necessity for the lead covering and soldered joints of an impregnated paper cable.

Although water ultimately finds its way into impregnated paper, the process of absorption is extraordinarily slow.

The experiments on oiled paper lead irresistibly to the conclusion that the mode in which absorbed water forms conducting

* It may be remarked in passing that the average resistance per leakage point is a useful criterion for the insulation of wiring. In the case of the resistance from wires to earth, the switches, fuse-blocks, ceiling roses, lampholders (if they can leak to earth), and other places where the conductors are fastened to leaky insulators, constitute the leakage points. For resistance between the wires with the switches closed and the lamps removed, the lampholders alone are to be counted ; and for resistance between the wires with the lamps in place and the switches open, the switches are the only leakage points that count.

In the example considered in the text the resistance to earth was about 6 megohms, and there were 62 leakage points, hence the average resistance per leakage point was $6 \times 62 = 372$ megohms. Remembering that one switch base of good quality may have a resistance as low as 100 megohms, it is evident that the installation as a whole was in excellent condition as regards insulation.

Rules based solely upon the number of lamps are frequently too remote from the facts to afford much guidance.

paths is substantially the same whether the insulator is saturated with oil or not. The water may be in the insulator before impregnation with oil or it may be very slowly absorbed afterwards, but once inside it will conduct electricity just as though the oil was not there.

Varnish is intended to prevent water from forming leakage paths. To do this it must either keep out water by closing all the pores at the external surface of the insulator, or it must interpose a solid and impervious layer of the body of the varnish between the conductors and the porous insulator. Applying varnish by a brush aims at the first alternative, vacuum methods aim at the second. It need hardly be pointed out that when a porous body is saturated with a liquid varnish, and the solvent is then dried out, the solid body of the varnish remaining in the insulator is necessarily insufficient in quantity to fill up the pores. They can only be entirely filled up by soaking the insulator in oil, or in a melted wax or in some equivalent solid insulator which can be liquefied by heat. Hence a porous insulator, even when varnished, is likely to have many channels available for the reception of water. Whether water can find its way into them depends on how far the varnish has been able to stop up the pores on the outside of the insulator.

Experiments on varnished windings occupied many months. Their outcome can be summed up in a sentence. Varnish reduces the extent to which moisture is absorbed, but it seems powerless to stop absorption altogether if the windings are subjected to the temperature variations which occur in ordinary use. This failure to exclude moisture was exhibited in every trial, both by test-pieces varnished by a vacuum method and by those which had received coats of varnish applied by a brush. A couple of tests will illustrate the whole series.

One of the test-pieces, composed of two cotton-covered wires wound on a porcelain bobbin, had an initial resistance of 34,000 megohms after being varnished by the vacuum method with a black plastic varnish of good quality. The resistance followed Ohm's law, being constant at all pressures up to 500 volts, thus indicating conduction by the varnish and the absence of moisture conduction. Yet after exposure to the air of the experimental

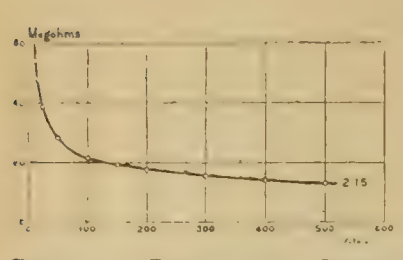


Fig. 14.—Insulation Resistance of Paper which had been Soaked in Dry Cylinder Oil for a Week.

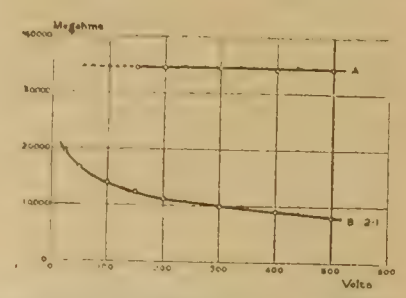


Fig. 15.—Insulation Resistance of Varnished Cotton: (A) 12 Hours and (B) Nine Days after Baking. Showing the Change from Ohm's Law to Moisture Conduction.

room for nine days this test-piece gave a perfectly normal moisture curve with a ratio R_{50}/R_{500} equal to 2·1, and the resistance had already fallen to less than one-fourth of the initial value. The fall in resistance and change in the law of conduction are shown in the two curves in fig. 15. The resistance continued falling for several months and ultimately settled down round about 2 or 3 megohms, rising and falling with the changes in the humidity of the air.

Another test was made on one of the windings used for testing micanite cloth. Two coats of the plastic varnish were applied by a brush to the outside of the winding, and the test-piece was then baked at 150° C. for 32 hours, by which time the varnish was quite dry. After allowing the test-piece to cool, the resistance from the winding through the micanite cloth to the iron core was about a million megohms. This high value was not maintained for long. Within 20 days after removal from the oven a decrease was noticeable, and by the seventy-fourth day the resistance had fallen to 33,000 megohms. The curve obtained on that day is given in fig. 16. It should be compared with the curves given

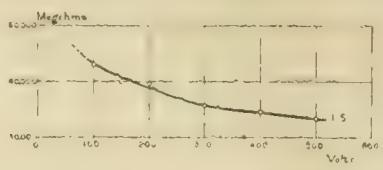


Fig. 16.—Insulation Resistance of Varnished Micanite Cloth (compare with Fig. 12).

in fig. 12 for a similar micanite cloth test-piece which had not been varnished. Both curves indicate leakage through moisture, but the varnish has in this case greatly reduced the amount of moisture which the insulation can absorb.

There can be little doubt that the failure to exclude moisture altogether is due to insufficient elasticity in the body of the varnish. Unless this is a highly elastic substance it is unable to follow the expansions and contractions of the windings, and ultimately the continuity of the coat of varnish is broken up, leaving numerous crevices by which moisture can enter.

Questions naturally arise as to the volume of water which is utilised in forming leakage paths, and what sort of relation that volume bears to the total volume of water in the absorbent insulator.

To find some answer to these questions experiments were made on the resistance of an absorbent insulator containing known quantities of water of a measured specific resistance. The insulator was composed of a number of circular disks of chemically pure filter paper, 12·5 cm. in diameter, piled up into a pad and moderately compressed between two flat metal electrodes. The pad of paper had an area of 122 sq. cm., and its thickness (under the compression) was 0·53 cm., so that the pad occupied a volume of 64·8 cubic centimetres. The specific resistance of the water used in this experiment was 2,500 ohms.

To begin with, a quantity of the water was put into the paper and left to distribute itself uniformly. The method of experiment was to measure the resistance of the pad and weigh it immediately afterwards. Next, to allow some of the water to evaporate and then to repeat the resistance test and the weighing. Proceeding slowly step by step, the water was finally dried out and the net weight of the dry paper ascertained. In this way a number of corresponding values were obtained for weight of water in the paper and resistance of the pad. The figures are given in Table I, the volume of water in cubic centimetres being taken as equal to the weight in grammes.

TABLE I.

Test-point.	Volume of water in the pad of paper. c.c.	Resistance of the pad at 500 volts (megohms).	Estimated volume of resistance water. c.c.	Ratio of resistance water to total water, expressed in parts per million.	Percentage volume of water in the pad of paper.
A	1·68	93	188×10^{-6}	112	2·59
B	1·55	131	134 „	87	2·39
C	1·48	179	98 „	66	2·28
D	1·43	226	78 „	54	2·20
E	1·29	369	48 „	37	1·99
F	1·14	845	21 „	18	1·75
G	1·08	1,280	14 „	13	1·66
H	1·00	1,870	9·4 „	9·4	1·54
I	0·59	23,600	0·74 „	1·3	0·91
J	A trace	$11·7 \times 10^6$	—	—	0

Remembering that the resistance of a centimetre-cube of the water was only 2,500 ohms, it is obvious by inspection of the figures in the second and third columns that the resistance of the pad is out of all proportion to the volume of water it contains.

Under the conditions at Test H the proportion of resistance water to total water was only 9·4 parts in a million. In the table certain assumptions have been made. Thus, the average length of the leakage paths has been assumed to be five times the distance between the electrodes; the dormant water has been assumed to occupy blind alleys entirely off the paths of the leakage current; and the conductivity of the water in the pad of paper has been assumed to remain constant notwithstanding evaporation.

Taking all these matters into consideration, the figures given in Table I seem more likely to be over-estimates of volume than under-estimates. At all events, they may be accepted as of the right order of magnitude, and the significance of the experiment stands out clearly in spite of some unavoidable guesswork. A vast proportion of the whole volume of water in an absorbent insulator is dormant in the sense that it does not form an appreciable part of the observed resistance. The resistance of the leakage paths through the insulator is determined by an exceedingly small fraction of the absorbed water.

The relation between the volume of resistance water and the total volume is shown as a curve in fig. 17. The total volume of

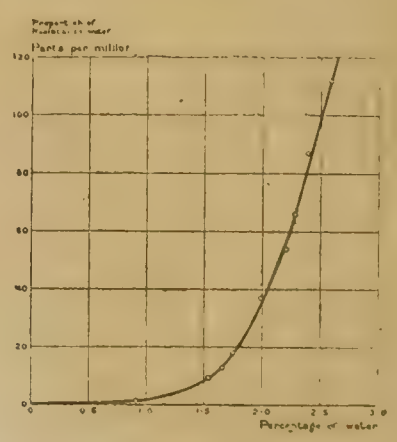


Fig. 17.—Proportion of Resistance Water to the Total Quantity of Water in a Pad of Paper (see Table I.)

absorbed water in the paper is here reckoned as a percentage of the volume occupied by the pad of paper.

Incidentally, the weighing experiment affords another example of the relative importance of moisture conduction and dielectric conduction. Referring once more to Table I, we see that when the absorbed water was reduced to a mere unweighable trace, the resistance of the pad of filter paper rose to nearly 12 million megohms, corresponding to a specific resistance of about 2,700

million megohms (cm. cube). This is far below the specific resistance of more thoroughly dried paper, which is certainly not less than 26,000 million megohms, a value obtained by the British Insulated and Helsby Cables in their test room with carefully dried paper. It is evident that in Test I moisture conduction was at least 5,000 times greater than dielectric conduction, and in Test A, when the pad of paper was much nearer a normal state as regards the quantity of absorbed water, moisture conduction outweighed dielectric conduction more than a million times.

The fact that it has been possible to compare one curve with another without taking potential *gradient* in the insulator into account is sufficient proof that the curves have some simple property in common. In every case in which moisture conduction alone controls the resistance curve, it is found that over a considerable length along the curve the ratio $R_v/R_{10\,v}$ is fairly constant, whatever may be the value of v in volts. Hence, although the insulators have varied widely in thickness, the ratio R_{50}/R_{500} has served quite well as a rough guide for comparing the different curves. A good example of this property is afforded by the moisture curve for cotton given in fig. 9. Half a dozen ratios of $R_v/R_{10\,v}$ read off from this curve are remarkably constant, and point to a definite law, expressed empirically by the formula—

$$R = k \sqrt[x]{1/v}$$

and since in this particular curve the ratio $R_v/R_{10\,v}$ is only a little less than $\sqrt{10}$, the exponent x must be a number not much greater than 2. The formula is only useful as an indication of the general character of the moisture curve. In 47 curves obtained from insulation, composed entirely of absorbent materials, such as cotton, paper, cardboard, fibre, and other things, both varnished and unvarnished, and including oil-impregnated paper, the average value of the ratio R_{50}/R_{500} was 2·20.

This figure is confirmed by the results of a number of insulation tests on absorbent materials carried out by Mr. E. H. Rayner at the National Physical Laboratory. In Mr. Rayner's 17 tests the average value of the ratio $R_v/R_{10\,v}$ was 2·15. The figure 2·2 may, therefore, be regarded as a good average value for the ratio $R_v/R_{10\,v}$ for insulation which is wholly composed of absorbent materials, used under a moderate degree of compression.

But in the case of 12 curves obtained from compound insulation, in which dielectrics, like mica or ebonite, were used in series with an absorbent material, the same ratio had an average value of a little less than 1·4. The difference is easily accounted for. The law of moisture conduction in any given absorbent material must be the same, whether there is a dielectric insulator in series with it or not, and, assuming the dielectric has a constant resistance, the absorbent insulator alone is responsible for the curvature of the resistance line. For an example, turn to fig. 4, which is the characteristic curve obtained from a supply meter in which the absorbent insulation of the windings is in series with the ebonite that serves to insulate the working parts from the case of the instrument. As it stands, the ratio is only 1·35, but suppose we draw a new horizontal line at such a distance below the curve as will make the ratio R_{50}/R_{500} as deduced from measurements from this line to the curve, equal to the average for absorbent materials, namely, 2·2. Then ordinates measured from the new datum up to the curve will represent the resistance of the absorbent insulation of the windings, and the distance from the new datum line down to the original base line will represent the resistance of the ebonite.*

The resistance of the ebonite alone is found to be 810 megohms, and a datum line has been drawn in fig. 4 to represent this value. In general, if the curve of a compound insulation of the kind we are considering shows a ratio as high as 2, we may be sure that the resistance of the dielectric component has fallen to something approaching zero, either because it has broken down in itself, or because it has been shunted by some kind of absorbent dirt.

A non-absorbent dielectric in series is not the only cause of a low ratio value. We have already seen in fig. 11 how the curve flattens out when there is enough absorbed water to form paths of constant resistance in parallel with those which give a typical moisture curve. But under such circumstances the resistance curve will be so very far below the average level which it occupies under more normal conditions that there is no likelihood of the low ratio that is associated with wet insulation being attributed to the presence of a non-absorbent dielectric in series with the absorbent materials.

When condensation takes place on the surface of a solid body it first makes its appearance to us in small detached drops clinging to every roughness on the surface. If we suppose the solid body to be an insulator of immeasurable resistance, the presence of detached drops of water will not make any appreciable change in that resistance, and the same holds good for the maze of internal surfaces inside a porous insulator when moisture condenses there. But, as we have seen, the absorption of a mere trace of water brings about a vast decrease in resistance. We cannot suppose the drops to coalesce in order to form a continuous leakage path, because in that case the conduction would be simply that of an electrolyte and would follow Ohm's law, leaving the moisture curve unexplained. We must therefore look for connecting links between the drops to establish a complete conducting chain. It would be natural to suppose the links to be films of some kind condensed on the surfaces of the capillary passages in the insulator, and to account for the characteristic curve the films would have to be endowed with a property analogous to that of the electric arc; with increasing electric pressure they must increase their sectional area either by reason of the leakage current they carry or in consequence of some effect which, like endosmose, depends on the potential gradient. This hypothesis was put to the test of experiment, and has proved itself capable of accounting for the facts.

(To be concluded.)

* It may be the resistance of a conducting film on the surface of the ebonite, for external films have in several cases been found to follow Ohm's law. The point requires further investigation.

The paper was discussed at Birmingham on November 26th. Dr. Garrard said that he would like to ask whether the phenomena could be explained on the basis that the conduction of the moisture within the insulator was electrolytic in character. If two electrodes were placed in a vessel of water, and a gradually increasing voltage were applied, it was found at first that the current flowing was very small, but that after a critical value had been reached the current very rapidly increased—that is to say the electric resistance rapidly decreased. This phenomenon, with a single cell, only occurred between zero and, say, two or three volts, but in a porous insulator one could regard the moisture as being split up into a large number of cells in series, so that the voltage over which the action would be shown might be several hundred volts, as in Mr. Evershed's experiments. On this basis could also be explained the fact found by Mr. Evershed, that when the insulator was very wet the conductivity followed Ohm's law, for with a very wet substance, instead of a number of electrolytic cells in series, there was only one, and variation in resistance over the first volt or two was of no effect when working with several hundreds of volts. The electrolytic action might also account for another phenomenon which he had often observed when testing the insulation resistance of apparatus, and that was that it improved if the testing voltage were applied for a long period. One outstanding feature of the paper was the impossibility of using porous insulating materials in electrical machinery. These nowadays were not used by up-to-date manufacturers. The fibrous materials such as cotton, paper, and the like, were used simply as mechanical carriers for the insulating compound. The experiments showing that even impregnated windings absorbed moisture were remarkable; they did not, however, bring out the important point that although qualitatively a certain amount of moisture might be absorbed, yet quantitatively the amount was too small to do any harm. Tobey had shown that five or six drops of water per quart of oil reduced the dielectric strength by 25 per cent. The dielectric strength was, however, not proportional to the insulation resistance; in fact, the latter was of very little use in the investigation of the electrical properties of oil. He was not able to agree with Mr. Evershed's statement that on evaporation the electrolytic ions generally remained behind.

Dr. Guy Barlow suggested another model of absorbent insulator consisting of closely packed granules of a non-absorbent and highly insulating material (*e.g.*, sand). The leakage paths in this case might be expected to represent the conditions in a porous material much more nearly than the parallel tube model used by the author. Measurements of the resistance of porous materials at temperatures low enough to freeze the condensed moisture might be of interest. In order to produce such solidification within the pores one would probably have to lower the temperature a long way below normal freezing point.

Mr. E. O. Turner said there seemed to be great difficulty in judging the relative merits of similar pieces of insulating material tested by different experimenters. Apparently the puncture test was the only one at all consistent. The author pointed out that if a test-piece was carried though a standard course of vacuum baking and varnishing, its insulation resistance after some time settled down round about a fairly steady value. He would like to ask whether the succeeding variation of resistance could be represented as at all a definite function of the wetness of the air. Were this the case the insulation resistance, dew-point, and temperature might be measured simultaneously at a fixed voltage. Correction could be made subsequently to a chosen standard of humidity. It would be of interest to know if the author could hold out any hope of forming a basis for comparison of results obtained in this way for test pieces of uniform size. Referring to fig. 1, it seemed possible that at the final part of the curve, near the breakdown point, there might be an appreciable rise of temperature in the moisture channels—if these still persisted—due to the concentration of the energy loss in a minute volume. In this case the extremely high negative temperature coefficient of water might account for the rapid drop in the curve.

Mr. Forrest said the effect of temperature upon the insulation resistance of non-absorbent insulators, such as rubber and gutta-percha, was very pronounced, and with both materials a rise in temperature was immediately accompanied by a serious fall in the insulation resistance. The author did not deal with this important point in his paper, and it would be interesting to have his views on this matter. Gutta-percha cable, when submitted to an external pressure (as occurred when it was laid at the bottom of the sea), showed a marked increase in insulation resistance, whereas the samples of paper tested by the author showed an equally marked decrease with an increase of pressure. Could the author explain this difference in behaviour? The only really satisfactory method of testing the insulation to earth of an electrical machine was by means of a flash test carefully carried out at a voltage several times greater than the normal working voltage to earth. This flash test would bring to light weaknesses in the insulation to earth, which could not be discovered by any other method.

Dr. Kahn thought there were two conclusions which might be drawn from the investigations Mr. Evershed had made. The first was the fact that it was absolutely useless to specify any insulation resistance unless the voltage was stated at which it should be

measured. Although this had been recognised by many engineers, the bulk of the specifications issued still omitted to state the voltage. As the instruments by which the insulation resistance was measured were usually made to give 500 volts, and as it appeared from Mr. Evershed's paper that near this particular voltage the insulation resistance was comparatively constant, he proposed that this should be adopted as a standard voltage for testing the insulation resistance. The second point which was clearly brought out by the paper (although it had, of course, been well known to most electrical engineers), was that the insulation resistance of electrical apparatus was by no means a constant figure even if taken at a given voltage. The insulation resistance of such apparatus could sometimes be increased 10 times or more by a simple drying process. As the paper clearly showed that the insulation resistance entirely depended on the amount of moisture suspended in the insulation material, and as this was something foreign to the actual apparatus, and could be altered without altering the apparatus in any other respect, it was quite clear that the insulation resistance was not an intrinsic feature of the apparatus, and it should, therefore, be entirely abolished from all specifications. The insulation properties of such apparatus could always be clearly proved by the usual pressure tests.

Mr. W. C. S. Phillips asked if the author had conducted any experiments on paraffin wax, as he considered it desirable that his theory should be tested on substances which could be melted *in vacuo*. Swann had worked at a potential gradient of 50,000 volts per cm. The method adopted by him was to enclose the paraffin wax between two metal plates surrounded by guard rings. A third plate was completely immersed in the paraffin wax, which was heated for some time to 120° C. *in vacuo*, and then allowed to cool. If the substance between the plates obeyed Ohm's law, there should be no change in potential of either of the plates. This was shown to be the case when the wax was replaced by paraffin oil. Thus, the electrometer only showed that portion of the current which did not obey Ohm's law, and in some of his experiments Swann calculated that the current so observed was about 60 times the Ohm's law current.

Mr. A. R. Everest said a paper was read before the American Institution several years ago, describing a research upon the variation in insulation resistance of fibrous materials with varying temperatures. The suggestion was made that the entrapped moisture existed at the lower temperatures largely in the form of disconnected particles, and that as the temperature was increased, these particles split up into smaller particles, increasing the number of continuous chains through the thickness of the material, and causing greater leakage, and accounting for the lower insulation resistance. Other investigations had shown that when a material of this class was subjected to a high potential stress heating was produced, and this, by lowering the insulation resistance increased the leakage losses, and caused still further heating. Disruptive breakdowns occurred if the temperature was allowed to exceed a critical value. If the material was kept cool by artificial means, higher pressures were endured without breakdown. A slot tube of fibrous material would have a higher breakdown value when tested on a solid steel mandrel than on a tinfoil-covered wooden mandrel. If a mica barrier were placed so as to interrupt the leakage losses which caused the cumulative heating, much higher potentials could be endured without breakdown. Insulations made up with Bakelite showed much less drop in insulation resistance with increase in temperature.

At the meeting of the Western Local Section of the Institution of Electrical Engineers, held at Cardiff on Monday, Mr. Faraday Proctor, chairman of the Section, presided, and Mr. Evershed's paper was read by his partner, Mr. Vignoles, in the absence of the author.

In the course of the discussion which followed, the Chairman asked whether any experiments had been tried to ascertain the results of tests carried out with alternating currents.

Prof. David Robinson (communicated) thought that attention might be called to the fact that the value of 2·15, which was given as the average deduced from Mr. Rayner's tests, corresponded very exactly to the simple law that the insulation resistance varied inversely as the cube root of the testing voltage in connection with figs. 6 and 7. It did not seem quite justifiable to term the whole of the variable part of the current "charging current." If the properties of the material did not vary with time there would be of course a charging current in addition to the leakage current at the moment of switching on, but even with a battery and a resistance of several megohms, a few seconds would suffice to reduce this to a negligible amount. The author's explanation of the action of his model was beautifully simple but almost too good to be true. The action of potential gradient on the positively charged water would be to exert a force on the whole length of the film, and it was not evident whether that should produce any effects, such as those indicated in fig. 18.

Mr. Sydney F. Walker (communicated) said he was in hearty agreement with the author of the paper in condemning what he termed "the blind tests of breakdown voltage."

Mr. W. A. Chamen said it was difficult to know how to discuss this most valuable and interesting paper. One naturally thought of the effect of moisture in such ticklish machines as their alternators. He supposed the idea that they had all held hitherto was that porous insulators were perfectly safe for them. He supposed they were quite right in assuming that while the temperature of the porous insulator was kept well up, say, up to 200°, they had nothing to fear from the absorption of moisture in such a way as to reduce their insulation within dangerous limits.

Mr. J. Lang Wilson and others also briefly discussed the paper, and the consensus of opinion was that the subject was an extremely difficult one, and required very great study before members could venture to criticise the conclusions the author of the paper had come to.

NOTES ON INCANDESCENT LAMP MANUFACTURE.

In the course of an article in the *Elektrot. Anzeiger*, H. T. Erb comments upon the very small margin of profit which can accrue to manufacturers of metal-filament lamps in view of the low level to which retail prices have now been reduced. The manufacture of low-voltage lamps is still much simpler than the manufacture of high-voltage types, and in view of the increasing demand for 14-volt (or other low-pressure) metal lamps for advertising and decorating work, it would probably pay some firms to specialise on low-voltage lamp manufacture. The problem of grading lamps for series running has been solved well enough to permit of sign and other low-voltage lamps being run in series, but there is yet room for further improvement in this direction. The figures below summarise the manufacturing cost per thousand 220-volt 25-watt lamps, as given by the author. These data are said to be drawn from actual works records, and their arrangement shows how the value of the lamp increases as its manufacture proceeds; at what stage of its manufacture the greatest outlay in material and wages is required; the percentage of breakages in each stage, and the value of the pieces broken.

Item.	Brought forward.* Shgs.	Materials. Shgs.	Wages. Shgs.	Breakages. Per cent.	Breakages. Value. Shgs.
Bulb	—	37·1	4·5	1·5	0·63
Crown	—	4·9	1·52	5·0	0·32
Electrodes ...	—	28·0	2·25	1·0	0·29
Stem	—	41·3	7·2	1·0	0·49
Star	48·5	26 3	13·15	—	—
Attachment ...	88·0	133·0	32·10	2·0	5·04
Melting on ...	253·0	37·1	9 7	5·3	15·85
Pumping	300·0	—	11·8	6·0	18·70
Flashing	312·0	0·6	1·96	1·5	4·70
Adjustment and completion	314·0	21·8	9·35	2·0	6·90
	345·0	261·0	85·0	—	53·0

* Cross total cols. 2, 3 and 4 of previous line.

Up to a certain stage in manufacture, pieces are prepared which may subsequently be used in any one of a number of types of lamp, but beyond this stage parts are selected and assembled and the true lamp manufacture commences. In the above table, no allowance is made for the cost of gas, current, standing charges and unproductive labour; in practice, these items should be reduced to a minimum. The figures in column 2 of the table show the value per thousand lamps of the materials in and wages spent on the lamps at various stages of their manufacture. As manufacture proceeds, the value of the piece handled during any particular operation increases rapidly since it becomes a complex structure, damage to which involves a greater wastage of time and material than is accounted for by the member actually broken. The total cost per thousand lamps for wages (productive labour) and materials appears to be 345 shillings, and the value of the pieces broken is 53 shillings.

Electrical Driving in Cotton Mills.—Mr. J. W. Crowley, textile expert of Messrs. Siemens Bros., Ltd., gave a lecture on the electrical driving of looms, ring-spinning and doubling frames, at Haslingden Technical School, on Nov. 19th, the lecture having been arranged by the Cotton Sub-Committee of the Education Committee. Mr. Crowley did not recommend individual driving in every case. He said that in the Little Harwood Shed, Blackburn, there were 1,140 looms, each driven by its own motor. So far as ring-spinning and doubling frames were concerned, he thought there was now no question of the advantages of individual driving over group driving, but in respect of other machinery in many cases the question was still an open one. It was of the utmost importance to the textile manufacturer about to introduce electrical driving that he should have expert advice as to what system to adopt.

THE STAFF ENGINEERS' ASSOCIATION.

This, the latest Engineering Association, is being established mainly for economic purposes, by professional engineers, for their mutual protection and support. It embraces civil, electrical and mechanical engineers, and is intended to work on lines similar to those adopted by the Law Society and the British Medical Association, with a view to furthering the interests of its members, promoting a higher public sense of the rank of the engineering profession, and elevating the status of engineers. It is proposed to attain these objects by the following means :—

(*a*) By the study of economic and social questions, and by the development of the spirit of unity ; (*b*) through the medium of statistical information and extensive inquiries into existing conditions of employment, with a view to their regulation if desirable ; (*c*) by the systematic airing of grievances in the Press ; (*d*) by means of monetary assistance to members ; (*e*) by the aid of vacancy lists and an information bureau ; (*f*) by means of free advice in law cases of professional interest, with partial or total assistance in defence ; (*g*) by free advice in connection with patents ; (*h*) by means of local branches of the Association ; (*i*) by provision for intercourse amongst members, and by the acquisition and dissemination of special information of mutual interest and assistance ; (*j*) by influencing the framing of laws, in so far as they concern members of the Association ; and (*k*) by all other methods conducive to the attainment of the objects of the Association.

The members of the Association (other than honorary members) will consist of two classes, viz., Members and Associates. Each applicant for election as member must be at least 24 years of age, and must produce evidence that he has been regularly trained as an engineer, or that he has attained to a position of eminence in the profession. Each applicant for election as Associate Member must be at least 18 years of age, and must produce evidence that he is undergoing an engineering training. The subscription will range from 10s. to 30s. per annum.

The general assistance to members will comprise free advice concerning all patent questions, legal advice and protection in disputes regarding conditions of employment and remuneration, &c. Information will be supplied to members regarding vacant posts, firms and working conditions at home and abroad, as well as technical and practical information of use to members in their various occupations.

Members may receive assistance in case of unemployment, or if they lose their employment by promoting the objects of the Association, and each member may apply for special monetary assistance in case of necessity. Names of members will only be disclosed with the consent of a general meeting.

The inception of the S.E.A. was first suggested by a small body of engineers attached to the staffs of one or two representative firms ; the enthusiasm of this small band of reformers—each member of which holds a good appointment—has spread to such an extent that their tentative proposals, we are told, are being supported with a zeal which equals their best expectations.

In the early days it was alleged that a combination of employers had been formed with objects adverse to the interests of their employés, and if this charge could be substantiated, the necessity for a protective association would be obvious. There is nothing undesirable about the formation of the Association as long as it adheres to its legitimate objects, and is conducted by honourable men. The organisation of the S.E.A. will be protective, and not aggressive. Technical lectures or papers will form merely an adjunct of its general work ; it is solely because other engineering associations are so purely technical that the S.E.A.—the business association—has been designed.

The contention in support of the S.E.A. is that when a large body of co-workers pull together, their general agreement and insistence will go far to remove adverse conditions of working and contract, which obviously means that economically the sphere of engineering employment will be improved.

That the staff engineer is largely responsible for our remarkable technical and scientific development—which is changing completely the conditions of every country—does not seem to be appreciated by the public in any way. For this reason alone, therefore, it is patent that engineers are justified in combining for better status and conditions, since, in common with the world's chief workers, they deserve both.

The main object of the S.E.A. will be to do for engineers what the B.M.A. has done for the doctors and the Law Society for the lawyers. Both these institutions protect only the economic interests of their respective members, and they have not only raised and ensured the status of the professions they protect, but they have even influenced potently the framing of Parliamentary and ocal laws.

The address of the hon. secretary of the Staff Engineers' Association is 31, Queen Victoria Street, London, E.C.

New Radium Supply.—By a new process, which has just been discovered by Prof. Rudolf Sommer, of Germany, it is possible to extract pure radium salts from carnotite ore, both quickly and economically.

NEW PATENTS APPLIED FOR. 1913.

NOT YET PUBLISHED

Complete specifications for the patents by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 6/8, High Holborn, London, W.C., and at Liverpool and Dundee, in which all enquiries should be addressed.

26,329. "[illegible]" A. T. Dodge. November 17th.

26,340. "Spring motor and magnetic attachment." A. H. Tarrant. November 17th.

26,349. "[illegible]" E. Rowland. November 17th. (Complete.)

26,340. "[illegible]" Westinghouse Cooper Hewitt Co. November 17th. [illegible] (Complete.)

26,351. "[illegible]" A. G. [illegible]. November 17th.

26,361. "[illegible]" W. [illegible] and H. [illegible]. November 17th.

26,364. "Magnetic circuits." A. F. Jones. November 17th. (Complete.)

26,367. "Holders for electrodes of [illegible]." H. Aitken. November 17th.

26,374. "Ignition systems for internal combustion engines." W. R. Priestland and A. Sargent. November 17th.

26,388. "Electrically-actuated musical [illegible]." R. Pfeffermann. November 17th. (Convention date, November 18th, 1912, Germany.) (Complete.)

26,398. "Electric telegraphy." H. W. Malcolm. November 18th.

26,400. "Compass corrector." E. A. Suter. November 18th.

26,402. "Radio-telephony." W. T. Ditcham. November 18th.

26,415. "Alternating current dynamo-electric machines." L. J. Hunt and Sandycroft, Ltd. November 18th.

26,419. "High-duty electric lamps." C. V. Boys. November 18th.

26,426. "Ignition devices for internal-combustion engines." B. J. Shorter. November 18th.

26,462. "Electric hot-plates and other heating-appliances." W. A. S. Benson & Co., Ltd., and W. J. Sims. November 18th. (Complete.)

26,469. "Electrical fuse lighting devices." J. F. Williams. November 18th.

26,479. "Telegraph or like systems and apparatus therefor." H. H. Harrison and Automatic Telephone Manufacturing Co., Ltd. November 19th. (Complete.)

26,494. "Supply of electricity for heating, lighting, and other purposes." A. F. Berry. November 18th.

26,495. "Supply of electricity." A. F. Berry. November 18th.

26,496. "Supply of electric current or gas and meters therefor." A. F. Berry. November 18th.

26,497. "Electrically and gas heated cooking-ovens. A. F. Berry. November 18th.

26,502 "Dynamo-electrical means for starting internal-combustion engines and lighting systems in connection therewith." L. J. Wolf. November 19th. (Complete.)

26,511. "Electric heating elements used in connection with electric heating-apparatus." G. H. Clarkson. November 19th.

26,525. "Insulating cover for domestic utensils." W. A. S. Benson & Co., Ltd., and C. J. Scott. November 19th.

26,546. "Electrical resistances, particularly applicable to electric heating elements adapted to be immersed in liquids." F. B. Cox. November 19th.

26,570. "Telegraphic transmitters." G. Visca. November 19th. (Complete.)

26,575. "Electro-magnetic switches." A. H. Curtis, F. N. Pickett, V. M. Colton, and Igranic Electric Co., Ltd. November 19th.

26,582. "Electrical welding-machines." Western Electric Co., Ltd. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,592. "Electric hand-lamps." A. Schrader. November 19th. (Complete.)

26,600. "Devices for attaching electric telegraphic and telephonic cables or wires to insulators." H. Parra. November 20th. (Convention date, November 25th, 1912, France.) (Complete.)

26,602. "Method of and means for use in connecting an automatic telephone sub-section system to an automatic central station." H. C. Steidle. November 19th. (Complete.)

26,608. "Selective signalling-devices." Western Electric Co., Ltd. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,609. "Electric welding-machines." Western Electric Co., Ltd. November 19th. (F. T. Woodward, Belgium.) (Complete.)

26,623. "Voltage regulators for electric generators." A. H. Gilsted. November 19th.

26,631. "Electric clocks." H. Aron Elektrizitatszahlenfabrik G.m.b.H. November 19th. (Convention date, February 26th, 1913, Germany.) (Complete.)

26,635. "Electric switches." A. Bonnella and G. J. Bonnella. November 19th.

26,646. "Voltage and output regulators for dynamo-electric machines." T. Ferguson and J. R. Johnstone. November 20th.

26,657. "Shade-holder for incandescent electric lamps. T. McClelland, Junior. November 20th.

26,684. "Insulated electric conductors." Western Electric Co., Ltd. November 20th. (F. T. Woodward, Belgium.) (Complete.)

26,687. "Electro-magnetic relays." O. D. Lucas. November 20th.

26,688. "Electrically-controlled starters for internal-combustion engines." O. D. Lucas. November 20th.

26,695. "X-ray apparatus." E. R. Morton and Newton & Wright, Ltd. November 20th.

26,700. "Electro-pneumatic continuous brake for vehicles." F. V. le Manquais and J. W. Sims. November 20th.

26,702. "Excess voltage safety devices for high-tension circuits." D. Samali. November 20th.

26,704. "Means for supporting resistance wires and the like." Credenda Conduits Co., Ltd., and V. Summerhayes. November 20th.

26,708. "Water-tight, telephonic, telegraphic, and the like electrical apparatus." E. A. Graham. November 20th. (Complete.)

26,713. "Metal filament lamps." B. Gnann. November 20th. (Convention date, September 1st, 1913, Germany.) (Complete.)

26,733. "Electric controlling mechanism for marine and like engines." S. Rumolino. November 20th. (Addition to 29,754/09.) (Complete.)

26,763. "Arms for telegraph poles and telephone poles." A. L. Bayley. November 21st.

26,764. "Fittings for electrical conduits and method of manufacturing same." J. R. A. Hemming. November 21st.

26,802. "Electrostatic separators for treating inflammable or explosive materials." J. Fraus. November 21st. (Convention date, October 27th, 1913, Germany.) (Complete.)

26,817. "Dynamo-electric machinery, more particularly dynamo-electric machinery used for starting and lighting purposes." C. A. Vandervell and A. H. Midgley. November 21st.

26,827. "High-frequency electric-current generator." E. C. Hoegerstaedt and H. S. Wescott. November 21st.

26,831. Means for use in controlling the temperature of electrically-heated cooking and sterilizing apparatus and the like." C. E. Hearson. November 21st.

26,834. "Multiple arrangements of high-frequency electric-current generators." P. O. Pedersen and V. Poulsen. November 21st. (Convention date, December 12th, 1912, Denmark.) (Complete.)

26,835. "Electrically-heated cooking and sterilizing apparatus." C. E. Hearson. November 21st.

26,855. "Electrically-controlled railway block-signalling and apparatus therefor." P. Browne. November 22nd. (Complete.)

26,899. "Electrolytic measuring-instruments." H. S. Hatfield and Chamberlain & Hookham, Ltd. November 22nd. (Complete.)

26,905. "Circuit arrangements for telephone or other systems." Siemens Bros. & Co., Ltd., E. A. Laidlaw, and W. H. Grinsted. November 22nd. (Complete.)

26,906. "Automatic regulating-devices for dynamo or other electric machines." R. Bosch (Firm of.) November 22nd. (Convention date, November 1st, 1913, Germany.) (Complete.)

26,913. "Arc lamps." A. W. Penrose & Co., Ltd., and M. Owen. November 22nd.

26,929. "Method and means for comparing electrical quantities." C. G. E. Milne, H. T. George, P. M. Levy, and J. Tucker. November 22nd.

26,934. "Transformation of the frequency of high-frequency alternating-currents for wireless telegraphy and telephony." Soc. Marius Latour et Cie. November 22nd. (Convention date, November 22nd, 1912, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Electric Heating Apparatus. G. Wilkinson. 19,543. August 27th. (February 18th, 1913.)

Waterproof Covering of Electric Cables. C. J. Beaver and E. A. Claremont. 22,355. October 1st.

Circles for Magnetic Compasses, Surveying, and Levelling Instruments. J. C. Fergusson. 22,568. October 4th.

Fittings for Electric Lighting Purposes. F. A. Wilkinson. 24,953. October 31st.

Advertising Lamps. B. Ahner. 25,153. November 2nd.

Magnetic Separators. J. T. Pollard and R. Emmott. 25,195. November 4th.

Automatic Regulating Devices for Electric Distribution Systems. British Thomson-Houston Co. and C. McCarthy-Jones. 25,286. November 4th.

Refractory and Heat-Insulating Material. British Thomson-Houston Co. (General Electric Co.). 25,370. November 5th.

Printing Telegraph Systems. Western Electric Co. (Western Electric Co.). 25,382. November 5th.

Telephone Instrument Set Adapted for Two Lines. Siemens Bros. & Co., and E. A. Laidlaw. 25,673. November 8th.

Striking Mechanism for Electric Clocks. L. Asprey and E. Farrow. 26,194. November 14th.

Electricity Meters of the Mercury-motor Type. W. Hamilton & Ferranti, Ltd. 26,359. November 16th.

Process and Means for the Production of Electrotypes for Letterpress Printing. I. T. Nelson and J. Murray. 27,911. December 4th.

Construction of Electric Irons. H. Hirst and G. Maurice. 29,350. December 20th.

Electricity Multicore Cable Dividing Boxes or Apparatus. British Insulated and Helsby Cables, Ltd., and R. W. Blades. 29,783. December 27th.

1913.

Manufacture of Electric Incandescent Lamps. Naamlooze Vennootschap Philips' Metal Gloeilampenfabriek. 1,340. January 16th. (December 6th, 1912.)

Production of Hydrogen and Oxygen by Electrolytic Processes. Knowles Oxygen Co., and R. W. Grant. 1,812. January 22nd.

Electric Quick-make and Quick-break Vibration Proof Switch-fuses. R. C. Perfect. 1,984. January 24th.

Means for Effecting Ignition in Internal-combustion Engines. G. E. Heyl and T. T. Baker. 3,057. February 5th. (July 29th, 1912.)

Ignition Apparatus of Gas-engines. C. S. Sydenham. 4,965. February 27th.

Conductors for Electrical Machines. Akt. Ges. Brown, Boveri et Cie. 6,036. March 11th. (March 18th, 1912.)

Sockets and Terminals for Electric Leads. A. G. Bloxham. (Robert Bosch, Firm of.) 6,551. March 17th.

Transmitting Apparatus for Electric Selecting Systems. Western Electric Co. (Western Electric Co.). 6,767. March 19th. (Divided Application on 25,382/12. November 5th.)

Paper Feed-mechanisms for Printing Telegraph and Similar Apparatus. Western Electric Co. (Western Electric Co.). 6,768. March 19th. (Divided Application on 25,382/12. November 5th.)

Electric Signalling. J. C. Thomson. 9,632. April 24th.

Alarm Device for Money Safes. P. Pelli. 10,087. April 29th. (September 3rd, 1912).

Apparatus for Heating Water and Other Liquids by Electricity, Particularly Applicable as a Bath Heater. C. Arpin. 10,403. May 2nd. (May 3rd, 1912.)

Means for Regulating Machines for Multiple Wire Drawing or for Continuous Rolling. Soc. Anon des Forges et Acieries de Huta Bankowa, 10,901. May 8th. (May 11th, 1912.)

Means for Operating Direction Switches and Resistance in Electric Motor-driven Controllers. Electromotor Equipment Co., and A. J. Barlow. 11,069. May 10th.

Electric Telegraph Stations. M. C. Dos Santos. 11,243. May 14th. (May 14th, 1912.)

Suspension of Overhead Line Wires for Electric Traction. Soc. Vedovelli, Priestley et Cie. 11,310. May 14th. (November 26th, 1912.)

Electric Furnaces. Compagnie pour le Traitement des Metaux et des Minerais par Electricite. 12,444. May 28th. (Jan 10th, 1913.)

Electrical Mine-igniting Machines. Elektrotechnische Fabrik Schaffler & Co. 12,813. June 2nd. (February 5th, 1913.)

Method of Construction of Electrical Heating Resistances Particularly Applicable to Electrical Furnaces. Soc. Generale des Nitrures. 12,837. June 2nd. (July 26th, 1912.)

Systems Employing Electric Motors Controlled Synchronously from a Distance. J. L. Routin. 13,084. June 5th. (Divided Application on 735/13, January 9th.)

Timing Devices for Electric Ignition in Internal Combustion Engines. W. C. Kitchell. 13,241. June 7th.

Alternating Current Electro-Magnets. Otis Elevator Co.. (Otis Elevator Ges. 13315. June 9th.

Dynamo-electric Machines. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 13,435. June 10th.

Vapour Electric Apparatus. M. Von Recklinghausen, A. Helbronner, and V. Henri. 13,490. June 11th. (June 11th, 1913.)

Apparatus for Causing Electrical Impulses for Transmission to a Distance. J. A. Gardner and A. Ferguson. 13793. June 14th. (Addition to 27223/10.)

Electric Incandescent Lamps. H. Cheron, H. Dominici and R. Biquard. 13822. June 14th. (June 15th, 1912.)

Combined Switching and Plug Contacts. J. P. Jakobsen and H. F. Jensen. 14,330. June 20th. (June 21st, 1912.)

Electrostatic Apparatus for Separating and Cleaning Grits, Grain or the Like. J. Kraus. 14587. June 24th. (May 9th, 1913.)

Mine-igniting Machine. Cahücitwerke Nürenberg. 14,870. June 27th. (July 1st, 1912.)

Push-button Switches for Electric Horns Used on Motor-cars and the Like. A. Goodwin and C. A. Vandervell. 14,942. June 28th.

Change-over Arrangements for Electric Supply or Control Systems. Siemens Bros. Dynamo Works, F. Lydall and C. E. Fairburn. 15,149. July 1st.

Dynamo-electric Machines. Brolt Ltd., Brooks and W. Holt. 15,585. July 7th.

Electrical Devices for Operating Door Sashes of Automobiles and other Carriages. J. F. P. de la Riboisiere. 15,648. July 7th. (July 9th, 1912.)

Wireless Telegraph Receivers. J. G. Balsillie. 15,674. July 7th. September 23rd, 1912.)

Safety Devices for Electric Conductors. G. Giles. 15,951. July 10th. (July 20th, 1912. Addition to 4,997/09.)

Electrolytic Diaphragms. H. A. Wagner. 16048. July 11th.

Device for Transferring Pressure from Rigid Bodies to Electric Insulators. M. Hedlund. 16,262. July 15th.

Cooling of Dynamo-electric Machines. Allgemeine Elektricitats Ges. 16,391. July 15th. (July 16th, 1912.)

Dynamo-electric Machinery. Siemens Bros. Dynamo Works, Ltd., and G. H. Taylor. 16,526. July 18th.

Commutators for Electric Meters. H. Aron Elektricitatszahlerfabrik Ges. 16,753. July 21st. (March 10th, 1913.)

Electric Relay. Siemens & Halske Akt. Ges. 17,879. August 5th. (November 18th, 1912. Addition to 17,137/13.)

Means for Regulating the Efficiency of Electric Current Generators Working at Variable Speed. F. Eichert. 17922. August 6th. (April 4th, 1913.)

Electro-magnetic Device for Adjusting Valves from a Distance. B. Bruns. 18,526. August 14th. (August 14th, 1912.)

Sparking Plugs. Soc. Générale des Huiles et Fournitures Industrielles l'Oleo. 18753. August 18th. (June 6th, 1913.)

Electric Insulators. A. Orinschnig. 18755. August 18th. (May 5th, 1913.)

Re-inking Mechanism for Use in Printing Telegraphs. Western Electric Co. (Western Electric Co.). 19,124. August 22nd. (Divided Application on 25,382/12. November 5th.)

Telephone Exchange Systems. F. R. McBerty. 19,421. August 27th. (November 3rd, 1911. Divided Application on 25,174/12. November 2nd.)

Electric Rat-traps. B. F. Ash. 19,496. August 28th. (August 28th, 1912.)

Pedal-driven Electric Generators for Use in Connection with Projecting Apparatus and the Like. Soc. Internationale de Lumiere Froide. (Procedes Dussaud.) 20,288. September 8th. (September 7th, 1912.)

Switches for Opening and Closing Electric Circuits. H. Leitner. 21,751. September 26th (Addition to 2,747/12.)

Metal-working Machines with Work-holding Magnets. Magnet Werk Ges. Eisenach Spezialfabrik für Elektromagnet-Apparate. 22,706. October 8th. (October 25th, 1912.)

School Lighting.—In the course of a paper recently read by Mr. Daniel H. Ogley, M.Eng., of the Royal Technical Institute, Salford, the author points out that school lighting, since it is in their school days that children are in the most easily influenced stage of their development, needs special attention. The medical man examines the eyesight of a child, finds that it is defective, gives an order for certain kinds of glasses, and proceeds with the examination of the next child. The cause is hardly ever inquired into, though in many cases it would be found that incorrect illumination of the premises was in great part to blame. He quotes Dr. Kerr, Medical Officer to the L.C.C., as saying in a recent report that a child requires a better light to read by than does an adult, to whom reading is second nature, and disagrees with Dr. Kerr's statement that the least illumination permissible on the school desk of a child has been found to equal 1 ft.-candle. A minimum of 2 ft.-candles for reading and writing is, in his opinion, required, while for drawing and distinguishing fine detail, from 2 to 5 ft.-candles are necessary, according to conditions. It cannot be too strongly emphasised that exposed light sources of great intrinsic brilliancy constitute a severe source of eye trouble when placed directly in the field of view, and should be avoided under all circumstances. If the direct illumination system is in use, the best plan is to insist on adequate shading, and if the lamps are not entirely surrounded by the shades, the lower part should be frosted to avoid even a momentary direct view of the filament. The inverted system has much to recommend it, but the absence of shadows is rather wearisome, and objects appear flat, tiring the eye in the effort to perceive them correctly. The inverted system, with a certain amount of direct lighting to produce shadows, is perhaps better. Reflection should be avoided from desks and matter placed thereon. Too much stress cannot be laid upon the steadiness of the light supply. Flickering gas jets are sources of much trouble, and metal-filament lamps, owing to the low specific heat of the metal, respond much more readily to changes in pressure than do carbon ones. Direct measurement of illumination should be insisted upon, remembering that for most purposes an illumination of 2 ft.-candles is sufficient.

THE

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INDUSTRIAL RESEARCH.

"Where ignorance is profitable 'tis folly to be wise."

Prof. Thos. Marshall.

IN man's struggle with Nature it is well that his vanguard should be amply provided with scouts to report the features and character of the scattered outposts they establish in the vast territory of the unknown.

It is an established dogma of scientific belief that knowledge should be pursued for its own sake and that the quest for truth should be untrammelled by any specifically utilitarian aim. But just as an army moves upon its belly so does human progress depend upon industry as its commissariat, and it is becoming evident to some thinkers that the time has now come when the "scouting" can no longer remain sporadic but must be organised, and in certain domains must be definitely industrial in its aim.

As a nation of shopkeepers we are doubtless alive to the importance of these issues, for our State at the present time devotes no less than £180,000 per annum to University education in England and Wales, and if we include such Institutions as the National Physical Laboratory, and the grant of £4,000 to the Royal Society, we may say that our country is expending about £200,000 per annum on the highest education and the promotion of research. This total sum, Principal Griffiths assures us in his recent address to the British Association, is slightly in excess of that devoted to *one* of the Universities of Germany.

In his recent Presidential address to the American Chemical Society, Mr. A. D. Little dealt with the question of Industrial Research in America, and it may not be without interest briefly to review the steps taken in the United States for winning new knowledge to aid their industries in keeping abreast of our own in the race for commercial supremacy.

First, as to some examples of individual achievements:—With their agricultural machinery, the Americans have reduced the labour cost of seven crops by £116,000,000, as measured by the methods of only 50 years ago.

Aluminium discovered in Germany by Wöhler in 1828 cost £18 per lb. in 1855; in 1911 the Pittsburg Reduction Co. produced 40 million pounds of the metal at 11d. per lb.

The development of the motor-car, and especially of the low-priced American car, is a thing of yesterday; to-day a single manufacturer turns out two cars a minute, while another is expanding his output to 500 cars a day.

The invention by Gayley of the dry-air blast in the manufacture of iron involves a saving to the American people of from three to five millions sterling per annum.

The Americans appear to be under the impression that efficiency of production is a sounder basis for prosperity than mere volume of produce, however great, and they have instituted long-continued and highly-organised researches with this end in view.

There are in the States at least 50 notable laboratories engaged in industrial research. The expenditure of several

of these laboratories is over £60,000 each per annum. The United States Steel Corporation has not hesitated to spend £60,000 upon a single research, and the annual expenses of a dozen or more of the laboratories referred to probably exceed £20,000 for each laboratory.

The State participates directly in the work of industrial research; the Department of Agriculture includes within its organisation 10 scientific bureaus, and its printing bill for the past year was £10,000. The research work of this department receives local application through the agency of 64 State experimental stations, the present income of which exceeds £600,000 per annum.

The Bureau of Fisheries devotes £8,000 to a single study, and the Geological Survey gives £20,000 to investigating the mineral resources of Alaska.

The Bureau of Mines conducts fundamental inquiries and investigations in the mining and mineral industries; its appropriation for the current year is £132,000, of which £70,000 is to be devoted to technical research.

The Bureau of Standards of the Department of Commerce devotes about £140,000 per annum to the testing of standards and the investigation of the properties of materials.

Most of the American universities are actively engaged in industrial research, and Kansas and Pittsburg have recently established Industrial Research Fellowships, which are supported by the special interests directly concerned.

To return to our own position—are we satisfied with it? Are we attaching sufficient importance to this matter of industrial research, and are we approaching it in a corporate and national spirit?

Michael Sadler has shown us that modern Syndicalism springs from several sources besides mere discontent with Parliamentary institutions. It is part of a great return of the modern mind to the mediæval model. In every calling we see signs of a new professional consciousness. What the Middle Ages (very imperfectly and with ultimate failure) tried to accomplish through the Guild system, the modern mind hopes to attain through a stronger sense of professional solidarity and corporate life.

The electrical industry of to-day has its own guilds, and the I.E.E., at any rate, has shown that it is alive to the need of organised industrial research; and it is up to all of us to lend it our interest and support and to strengthen its hands in this corporate endeavour to win new knowledge for the electrical industry. But it ought not to be left entirely to such organisations to promote research for the benefit of the nation; that this is being realised by Parliament is evidenced by the formation of the Development Fund, part of which ought certainly to be allocated to industrial research. Has our Institution applied for a grant from the Fund? If not, why does it not do so?

Copartnery or Co-partnership?

A few years ago, with a great flourish of trumpets and beating of drums, the Furness scheme of "Copartnery," as its author styled it, was propounded. After considerable discussion, and against the advice of Trade Union officials, it was given a 12 months' trial, at the end of which it was abandoned, although it was claimed to have worked very well, and to have been profitable alike to masters and men. Now, however, we are told that the Furness scheme was not copartnership at all!

In the December number of *Co-partnership* the scheme is referred to as follows:—

> So often is the failure of the Furness scheme referred to in discussions on industrial matters that we cannot too frequently point out that the method so greatly heralded from Hartlepool a few years ago was never regarded in the town or by advocates of or movement as having anything of a copartnership hue. And w would advise readers to carefully follow the report of the Labou Copartnership Association meetings at Leeds, and to observe th speech of Mr. T. C. Taylor, M.P. As an employer who practise what he preaches, he was able to declare that the Furness plan wa not only innocent of all suspicion of copartnership, but could no even claim to be profit-sharing. It simply made provision for th purchase of shares by contributions from the men's wages—with n addition from the employer. To regard it as copartnership erroneous; to describe it as a profit-sharing failure is unfair to th movement with which it had no association.

On turning up the report of Mr. T. C. Taylor's speech we find the following expression:—

"With reference to the Furness scheme, he would sa that it was neither copartnership nor profit-sharing in th least degree. According to that, out of the workmen's wage something was to be stopped to pay for a share upon whic they were to have dividend just like any ordinary share holder. They were to have interests in the profits only a capitalists, and to pay for their own shares. Was tha profit-sharing? Not a bit of it."

Surely, if the workmen were to have an interest in th profits as capitalists, they *shared* in the profits with th other capitalists. At the time the Furness scheme wa formulated we, in company with a large number of journal technical and otherwise, considered it to be a *bona fid* attempt to start a profit-sharing or copartnership arrange ment. Was there, after all, a subtle difference betwee "copartnership" and "copartnery," and is it not time w had a working definition of "copartnership"?

Copper.

The position of copper has visibl deteriorated, and that to a distinct extent and in place of the confident feeling, which was so apparen a few weeks ago, the market has settled down into a fit o gloom and pessimism in the strongest contrast with wha had been the current course of sentiment for several months The actual position of the metal has worsened largel because of the increase in production which is in progres in many of the chief centres of output, which increas synchronises with a slackening of trade all over the world It is a singular fact that while the leading American pro ducers seem able enough to manage the market when it ha everything in its favour, they are all at sea when thing turn in the opposite direction. With any little adverse feature developing, they invariably adopt an attitude which has a very unfortunate effect upon the market in the long run. This year, again, a position has arisen in which the leading interests could have sold all their accumulations at pounds above the rates current to-day, if only they had been reasonable, but instead, they chose the niggardly and cheese-paring policy of lowering their prices by shillings instead of by pounds, and the result was that, whereas they could have sold heavily at £72, or at any rate at £71, they are now looking for buyers at pounds below this level, and are send-ing copper to Europe on consignment to find a market. This is a pretty pass after the wholly exceptional strength of the market only a few weeks ago.

Of course, much of the excellence of the position arose from the development of unforeseen circumstances, such as strikes in producing centres and at refineries, and to this extent a return to more normal conditions as regards prices was inevitable sooner or later, but what upsets people is the way in which the leading interests fail to grasp what are regarded as trade essentials. At times, indeed, they seem to be quite out of touch with the market. This is, of course, all to the good for consumers, who to-day are undoubtedly paying a good deal less for copper than they would have been doing had the course of events been directed by a knowing hand, but the bulls of copper who got badly left

are not able to look upon the records of the last few weeks with anything approaching sangfroid at present.

There is considerable interference now with consumption in the United States by serious strikes which have broken out, but it is curious how little is heard of these impediments. When a mine shuts down, or a smelter has to blow out for flue cleaning, all the world and his wife are advised of the news, but the facts that one of the leading copper consumers has 12,000 men out on strike, and that other consumers are also having trouble with their employés, have hardly been considered as of any account. This is a feather showing the direction of the wind. The outlook is certainly not for permanently higher prices yet awhile, though possibly there may be a reaction.

The anxiously-awaited American returns have now appeared, and the market has taken them very philosophically. As a matter of fact they were about as the majority of people expected. The best feature was the absence of increase in the production, which, indeed, was slightly smaller than during October, while the total deliveries were about 8,000 tons less. This was accounted for entirely, however, by the lessened home trade takings, these showing a falling-off of about that amount, from 30,434 tons to 21,722 tons, arising in the greater measure from strikes at the works of the largest United States consumers, causing the postponement of deliveries. The export movement was large, at a little over 31,000 tons, while there was an increase in the stocks at American refineries during November of nearly 7,000 tons. The returns were, on the whole, a trifle better than had been expected, the most favourable item, as stated, being the production returns.

The Chief Engineer's Department of the L.C.C.

The fact that the position of Deputy Chief Engineer is vacant has given the London County Council a good opportunity to consider the organisation of the higher posts in the Chief Engineer's Department. Acting on the advice of the Establishment Committee, a number of changes have been made.

The office of deputy chief engineer has been abolished, and the old practice reverted to by which the officer in charge of one of the branches of the department is designated chief assistant engineer. This gentleman under the new plan will receive a salary of £800 per year, rising by increments of £50 to £1,000 a year.

The staff of the department is to be divided into six principal branches :—(*a*) Parliamentary and improvements; (*b*) bridges and tunnels; (*c*) mechanical; (*d*) tramways; (*e*) electrical; (*f*) main drainage. This last department is at present divided into two parts, one for the system north of the Thames, and the other for the system south of the river. At present the principal post in each part is held by an engineer; one of these receives £800 a year, and the other £750. It is proposed eventually to appoint an assistant engineer in charge of both divisions, add the designing of new works to his duties, and pay him a salary commencing at £700, and rising by annual increments of £50 to £1,000 a year. Immediate effect cannot be given to this arrangement, and for the time being there will be two assistant engineers.

For two of the remaining branches, the salary of the assistant engineer-in-charge will be £600 a year, rising by annual increments of £50 to £800, and for the other two £500 a year, rising by annual increments of £50 to £700 a year. The second officer in each section except the main drainage branch, an extra assistant in the tramways branch, and two additional assistants in the main drainage branch, are to receive salaries commencing at £400 per year, and rising by either £50 or £25 per annum to maxima varying from £450 to £600 per year.

In the main drainage branch there will be two principal assistants, one for the north and the other for the south of the river. These will each commence at £500 a year, and rise by annual increments of £50 to £700. The chief clerk of the department will receive £400 a year, rising by six annual increments of £25 to £550.

In addition to the foregoing, there will also be fifteen senior assistants, each with a salary of £300 a year, rising by annual increments of £25, 11 to £400, and four to £350 a year; 35 first-class assistants, 18 second-class; seven minor establishment assistants, and 10 non-classified assistants at weekly wages varying from 42s. to 63s. per week.

It appears from the above that an attempt has been made to organise the department in such a way as to secure thorough efficiency. We have given the detailed proposals, as we are sure they will prove of interest in informing our readers as to the annual values of positions which for importance and prestige may be looked upon as prizes worth aiming for and winning.

When the scheme is completed the extra cost to the Council will be about £280 a year more than at present, including the salary attached to the position of deputy chief engineer.

London's Electricity Supply.

The comparison instituted between London, Berlin and Chicago with regard to their electricity supply by Prof. G. Klingenberg, at the meeting of the Institution of Electrical Engineers in London last week, while interesting in itself, gains added interest from the fact that it represents the views of an impartial and disinterested observer, who is in a position to take a bird's-eye view of the great problem of supplying London with electrical energy on the soundest lines. That this will shortly become the question of the hour in electrical circles is certain; the "appointed day" is approaching when, unless new arrangements are made, the London County Council will have to tackle the purchase of the undertakings which at present supply the bulk of the electricity consumed in the Metropolis, and to consider how best to deal with a position of extreme difficulty and complexity. It is not likely that the matter will be allowed to drift to its climax as in the case of the transfer of the telephone service to the State; the public interests involved are far too important to be dealt with in a manner so clumsy and unstatesmanlike. Long before 1931 arrangements must be made to ensure that capital shall continue to flow into the undertakings, and that their plant and equipment shall be kept up to the highest standard of efficiency; and to this end it is essential that the situation be analysed and studied in all its bearings at no distant date. Already signs and portents of the coming change have begun to show themselves. The County Council has taken practical steps to reconnoitre the field, the County of London Co. is seeking powers to purchase land and to effect combinations which are clearly not unconnected with the matter, and various engineers, including Dr. Klingenberg, are turning their attention to the subject.

The paper is, therefore, well timed, and will do good service by showing how far the existing chaos—due to political influences, and not to engineering incapacity, as Dr. Ferranti pointed out in the discussion—has kept London behind other great capitals by indicating the directions in which improvement may be sought, and by affording comparisons which will provide ideals at which to aim.

Whether Dr. Klingenberg's suggestions for the future conduct of the supply are applicable to the special conditions which obtain in this land of vested interests and statutory restrictions cannot be discussed here, but it was interesting to observe in the discussion at the Institution how widely the speakers differed in their points of view. Mr. Snell advocated a curious combination of the theoretically desirable with the actually existing in the form of bulk supply from outside and distribution by the present authorities; Dr. Ferranti emphasised the importance of cheapening the supply of electricity, and the dire results of political meddling with engineering problems; Mr. Seabrook claimed the author as a supporter of his views on tariffs, and Mr. Tapper differed from them both. It is evident that the address affords scope for discussion, and we trust that it will be productive of valuable results.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Concluded from page* 901.)

The Lodge.—The machine made by Messrs. Lodge Bros. and Co. is of the permanent-magnet type, and is designed to give an output of 120 watts at 6 volts. The regulation of the current output is automatically controlled by the armature re-action, which occurs at high speeds. In addition to an electro-magnetic cut out, fitted on the swichboard, a free wheel clutch is mounted on the armature spindle to prevent the battery discharging through the dynamo when the latter is stopped or only running slowly.

The T. and M.—The feature of the dynamo made by Messrs. Trier and Martin, Ltd., of Camberwell, is the means adopted for maintaining a steady output. The machine is of the two-pole shunt-wound type with a special inter-connection arrangement of the brushes. Four brushes—two main and two auxiliary—are employed, these being equally disposed round the commutator; the main brushes are fixed in the ordinary or neutral position, and the auxiliary brushes half a pole pitch in advance, being connected to their respective main brushes through a suitable external resistance. The field magnet windings are connected direct to the main brushes, the regulation of the output being mainly effected by the auxiliary brushes and resistance.

In order to clearly follow the action of the machine the various connections and arrangements of pole-pieces and brushes are shown diagrammatically in Fig. 18. The main brushes are shown in the neutral position at A and B, each being connected respectively to an auxiliary brush half a pole

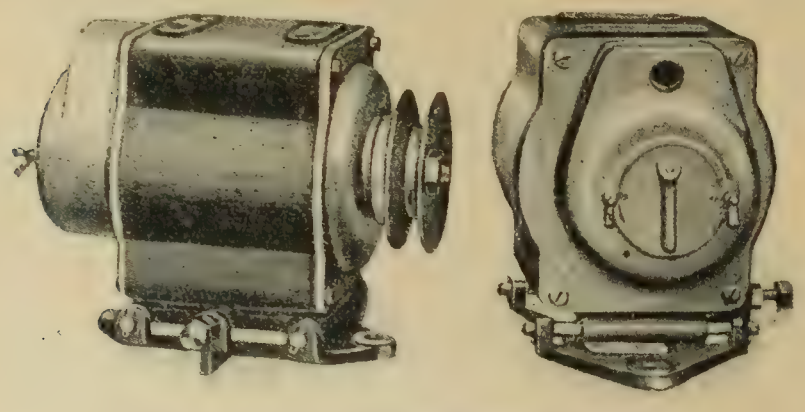


Fig. 17.—T. and M. Car-Lighting Dynamo.

pitch or 90° in advance, i.e., at A^1 and B^1, by means of resistances R and R^1. As the armature C begins to revolve between the poles D and D^1, due to residual magnetism, an E.M.F. is set up between the brushes A and B; which has the effect of sending a current through the shunt winding S S^1, thus building up the shunt field, and it also causes currents to flow in the resistances between the main and the auxiliary brushes and in the armature conductors lying between the brushes A A^1 and B B^1. These currents produce a magnetic flux in the armature parallel to a line connecting a main and auxiliary brush, and its effect is to strengthen the main field. This state of affairs continues until the armature is revolving at a sufficiently high speed to generate the line voltage between the main brushes, which represents the cutting-in speed of the generator. As the speed increases the machine begins to

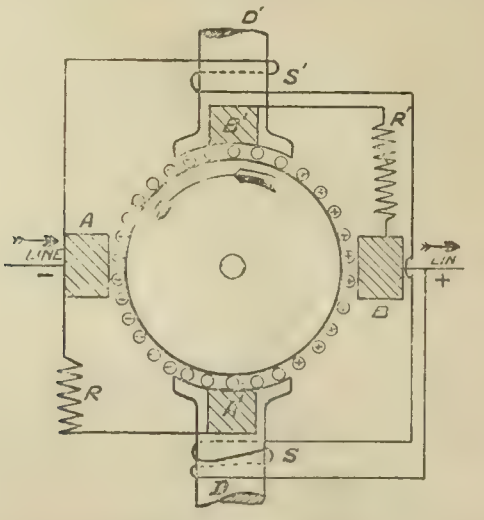


Fig. 18.—Pole and Brush Connections, T. and M. Dynamo.

supply current to the line, and an armature reaction is set up which displaces the axis of the field forward, this having the effect of reducing the current in the resistances R and R^1. When the axis of the magnetic field is displaced by 45° there is no current between the main and auxiliary brushes, as they are then at equal potentials. As the load and speed increases the further displacement of the magnetic field causes a current to again flow in a reverse direction, with the result that the magnetic field is weakened and the machine becomes self-regulating.

It will be noticed that the currents which now flow in the resistances are in the same direction as the main current, so that the auxiliary brushes at high speeds supply part of the main current, and by suitably designing the machine about half of the full load current is supplied by the auxiliary brushes. At full load the armature coils between the main and auxiliary brushes are practically idle and the watts' loss in the armature is stated to be then only half of that of an ordinary dynamo. In other words, given two machines, it is claimed that the T. and M. will not only supply approximately double the current for the same temperature rise, but will also be, other conditions being equal, the smaller machine. The dynamo, battery and lamps are all connected in parallel, and the usual automatic magnetic cut-out is provided to disconnect the generator, as soon as its speed drops below the cutting-in speed, predetermined for the particular voltage of the machine. The dynamo is being made in various sizes, viz., 8 volts and 8-10 amps., and 12 volts 7-8 amps., 10-12 amps. and 20 amps. Curves obtained by practical tests show that once the normal speed—about 1,600-1,700 r.p.m.—is attained, the output of the machines remains constant even up to a rate of 4,000 r.p.m., the fluctuations being only about ½ amp.

The Ducellier.—Although still supplying a permanent magnet machine, Messrs. A. A. Godin have introduced a new 12-volt 200 watt direct-current dynamo. The current output is maintained constant entirely by electrical means, the

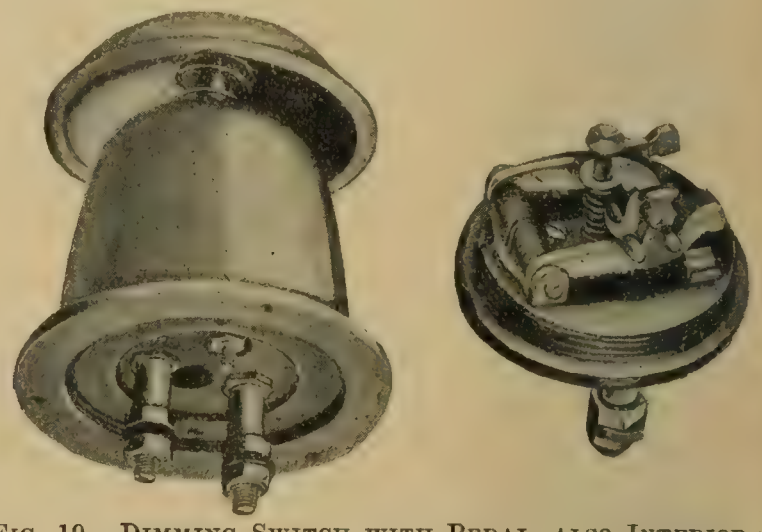


Fig. 19.—Dimming Switch with Pedal, also Interior; Ducellier System.

generator losing its excitation in direct ratio to the intensity of the current, which it is producing and to the increase of its own speed. The minimum dynamo speed cut-out device, which functions at about 400 r.p.m., is of the electro-magnetic variety, with a positive make and break. Mounted on the same base as the automatic switch is another device, which distinguishes the Ducellier dynamo. This is what is termed a security apparatus, it being provided to protect the whole of the installation—lamps, dynamo and automatic switch—

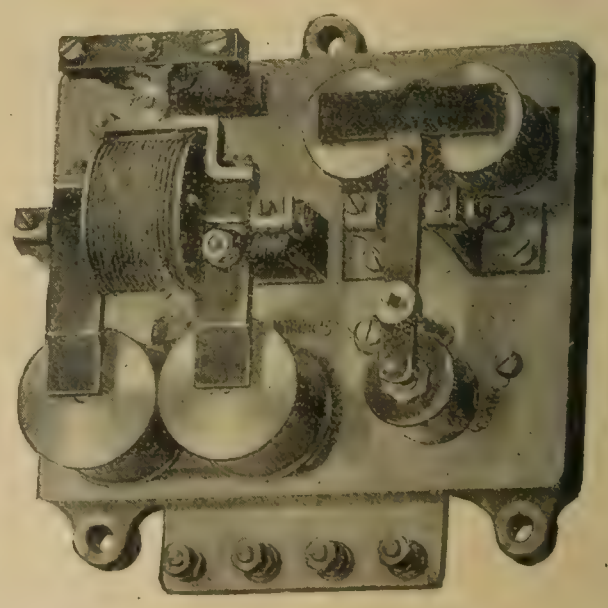


Fig. 20.—Automatic and Excess Voltage Cut-outs; Ducellier System.

against any accidental excess of voltage of the machine. It is composed of a group of shunt windings, which can attract an iron armature, which breaks the excitation circuit of the dynamo. Still another feature of the Ducellier system is the provision of what is termed a dimming switch, by means of which the intensity of the light emitted by the head lights can be reduced when driving through towns or villages at night, or when meeting other cars. It simply consists of a pedal-controlled switch which brings a resistance in circuit with the head lamps.

The S.E.V.—A French machine which has lately come into great prominence is that known both as the S.E.V. and the B.R.C., it being handled in this country under the latter name by Messrs. Fenestre, Cadisch and Co. The feature of the machine is that it is designed to give a constant voltage—6 volts—rather than a constant output, notwithstanding the varying speeds at which it is driven. The controller is mounted on one end of the machine and acts by short circuiting, on a special resistance provided in the shunt excitation. The device consists of a vibrator working in conjunction with a small electro-magnet having two windings—a fine one in shunt with the two poles of the generator and the other a thick one in series with the circuit; the object of the latter being to limit the current output of the dynamo. The arrangement is such that when the voltage obtained is equal to that for which the vibrator has been adjusted, the vibrating blade is attracted to the electro-magnet, and the additional excitation resistance is thrown in circuit. The effect is to immediately produce a drop in the voltage, and the blade resumes its position, short-circuiting the resistance. In practice a nearly constant average voltage is said to be secured. An electro-magnetic switch is provided to cut the dynamo in and out with the battery, as the speed increases or falls, this being mounted on the machine, in conjunction with the voltage regulator, a feature of both being that the moving parts are so arranged that they can be quickly detached and replaced.

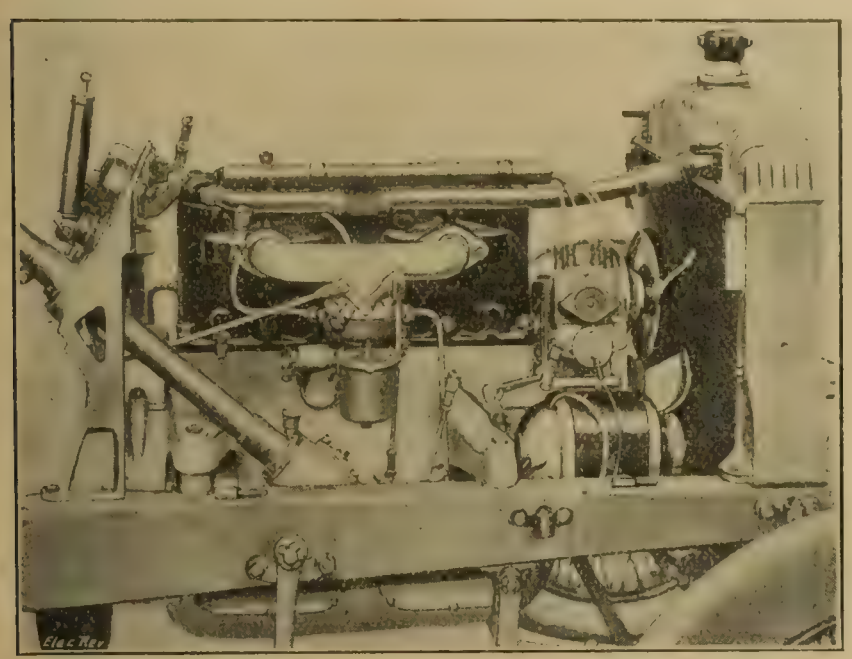


Fig. 21.—Diamler Engine, with Magneto and Dynamo.

The Magician.—This is another French design of machine, handled in this country by the United Motor Industries, Ltd. It is at present made in one size only, 180 watts at 12 volts, the interest centring in the simple yet ingenious means adopted not only to maintain a constant output at varying driving speeds, but also to mechanically close the circuit between the dynamo and the battery when the speed of the former reaches about 800 r.p.m. and to break it when it falls below that rate. This is done by supporting the dynamo in a cradle in such a way that it is free to rock or oscillate in the same. Thus, as soon as the speed of the dynamo reaches a certain limit, the distortion of the magnetic field within the machine causes the shell of the dynamo to rotate on its own axis through a greater or less arc. The cut-in and cut-out switch is mounted directly on the generator, and is provided with a forked trip gear,

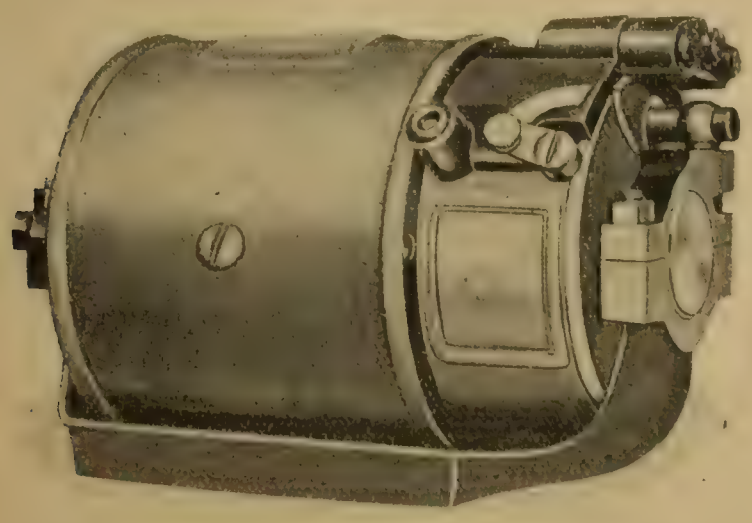


Fig. 22.—Magician Car-Lighting Dynamo.

one or other of the two arms of the latter coming into contact with an arm rigidly fixed on the supports so that as the dynamo moves through its arc, the gear, and through it the switch, is automatically pushed over in the desired direction. The current output is also maintained constant by the same ingenious means, for, by making use of the principle of torque reaction, or the tendency of the magnets to revolve in the direction of the armature rotation, the brushes are automatically placed in a less favourable position as the speed increases, consequently lowering the excitation current, and preventing an increase of output. The United Motor Industries, Ltd., are also supplying a Magician electric engine starting motor, which is provided with an epicyclic reduction gear of the epicyclic type.

The Bleriot.—In addition to their series of 6, 12 and 24 volt machines giving outputs up to 250 watts, and which run at a relatively high speed, Messrs. Bleriot, Ltd., have now introduced what they term a slow-running type, designed to give 150 watts at 12 volts. Contrary to the older pattern, in which a constant output is electrically maintained, the regulation in the new dynamo is effected by a centrifugally-controlled slipping clutch forming part of the driving pulley. The machine is of the four pole type with only one pair of brushes. The cut-out device for making and breaking the connection between the dynamo and the battery is mounted on the switchboard.

The Stereos.—The feature of this French-built machine is that to maintain a constant output at different driving speeds, the armature is so mounted on its spindle that while it must rotate with it, its position relative to the field coils is varied as the speed increases. The machine was fully described and illustrated in the issue of the *Review* for the 29th August last.

The Bosch.—At present only a single size of machine is being made by the Bosch Magneto Co., Ltd., this having a normal output of 100 watts at 12 volts, but capable of giving a much higher production without danger of over-heating. Regulation is effected by an external automatic device, which is stated to control a variable resistance in the excitation circuit. A feature of the machine is that the spindle is not located centrally in the casing, as is usual, but is below the centre, this having been done so that it is at the same height from the base as that of the Bosch magneto, it being thus possible, whenever there is room on the engine, to drive the dynamo in tandem with the oil pump, the water-circulating pump, or even with the magneto.

The Gray and Davis.—One of the most interesting of the American dynamos seen at the Exhibition was that of Messrs. Gray and Davis, of Boston, Mass., the feature being the provision for the separate regulation of the voltage and amperage. The machine is compound-wound, but unlike most compound-wound machines used for electric lighting, the two field windings assist instead of oppose each other, it being for this reason called a cumulative-compound instead of a differential-compound machine. The purpose of the additional field is to increase the output of the generator as the lamps are switched on, without increasing the speed of the dynamo. In order to obtain constant armature speed—about 1,200 r.p.m.—two

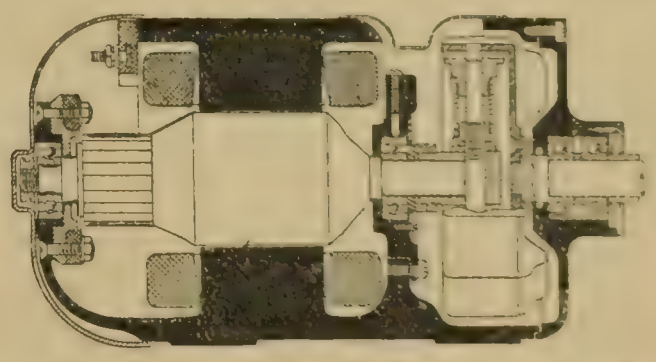


Fig. 23.—Sectional View of Gray & Davis Dynamo.

methods are used in the two different types of dynamo produced, both acting on the centrifugal system. Under normal conditions, with the car engine alternately accelerated and retarded, the dynamo clutch will slip almost continuously,

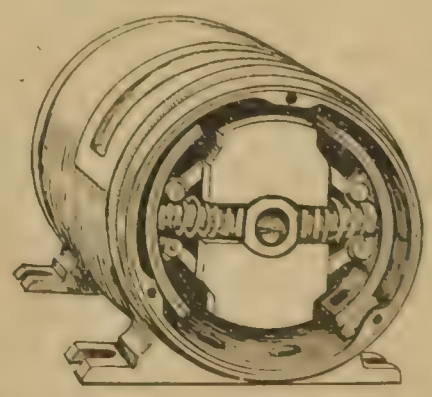


Fig. 24.—Expanding Clutch, Gray & Davis Dynamo.

and, in order to dissipate the heat which is generated, a forced draught through the dynamo is provided by fan-shaped wings cast on the plates of the clutch. In the alternative arrangement, the slipping clutch is of the internal expanding variety. The machine gives current at 6 volts, two sizes being made, in one of which the automatic cut-in switch operates at 750 revolutions, and the other at 1,000 revolutions.

D

The Radios.—This is another new French machine introduced into this country by Nilmelior (England) Ltd. It is made for both 6 and 12 volt circuits, the feature being the provision of a separate current output regulator which acts on the field windings. The dynamo itself is of the usual two-pole shunt-wound variety, provided with an electro-magnetic cut-out.

The Eisemann.—Since the Eisemann dynamo, made by the Eisemann Magneto Co., was described a year ago its design has been somewhat modified. In its latest form it has an output of 180 watts at 12 volts. The feature of the machine is that the control is entirely external, yet built up complete with the generator. Owing to questions concerned with securing the patents, it is not yet permissible to fully explain the electro-magnetic control system. It may be stated, however, that there are three magnetic switches, which act automatically and in sequence, these being mounted on the side

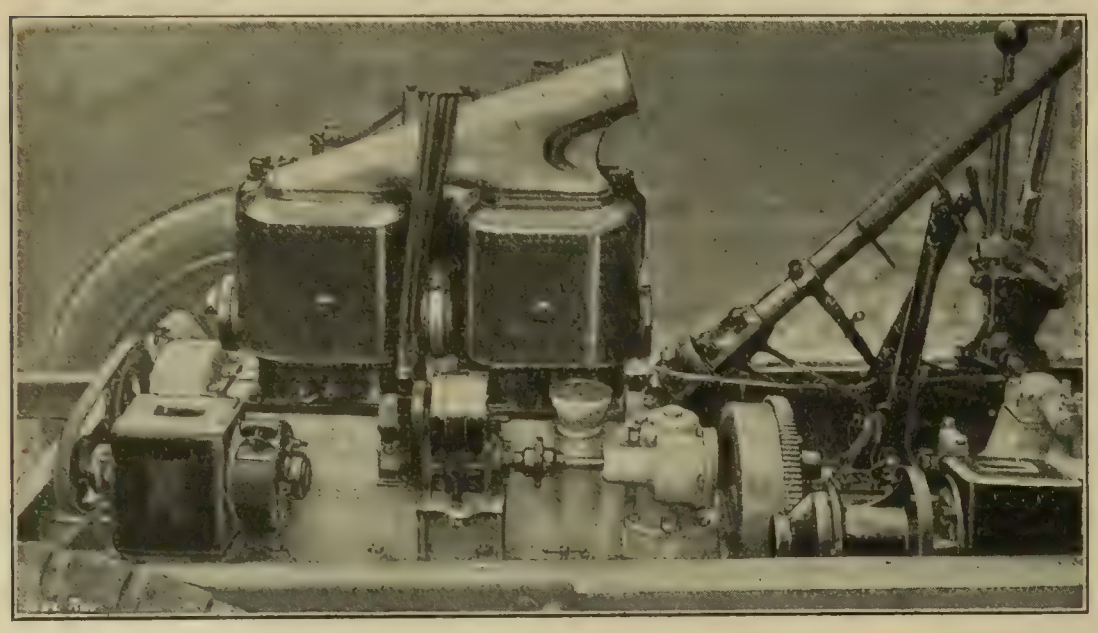


Fig. 25.—Arrol-Johnston Engine, with Dynamo, Magneto and Starting Motor (left to right).

of the machine. The first switch cuts in the circuit between the dynamo and the battery when the armature has attained the necessary speed—about 500 r.p.m.—for the charging rate to exceed the normal or battery rate; the second cuts the circuit when the amperage rate is being exceeded, while the third switch acts as a governor on the circuit, and enables the machine to light the lamps without the intervention of the battery.

The Rushmore.—The feature of the 6-volt dynamo set introduced by Rushmore Lamps, Ltd., is the ballast coil which secures automatic regulation of the current output. The field magnets are provided with a shunt winding, which opposes the main coils, between the dynamo and the battery. The effect of the increasing resistance of this iron coil is to divert current to the shunt field windings, and these being in opposition to the main field coils, the net effect is that the current output is prevented from rising.

The Westinghouse.—The American Westinghouse Co. have recently entered the field with a dynamo for car-lighting purposes. It is of the 6-volt type, and arranged to give a different current output when the dynamo is merely charging the battery and when the lamps are switched on, this being effected by a reversed compound field winding. The capacity of the generator is sufficient to not only run the lamps, but, also to always have a small reserve for accumulator charging. Thus when the lamps are switched on, the battery current to the lamps passes through the series winding and so assists the shunt field. As the output of the dynamo increases, the balance of current not required for the lamps, passes to the battery through the series winding in the reverse direction, causing it, in this case, to oppose the shunt field. The usual automatic electro-magnetic cut-in and cut-out device is provided, one of its features being that while it is designed to cut in at a speed of 325 revolutions, the cut out only works when the speed drops to 225 r.p.m., an arrangement which prevents the switch from repeatedly cutting in and out, when the car is travelling at a fairly steady slow speed.

The Bijur.—This machine is made by the Bijur Motor and Lighting Co., who, in developing the same, have worked on the hypothesis that the brushes and the commutator are the only parts which are likely to give trouble, or to require the care that can be given by other than an expert. Consequently all the other parts have been enclosed in a tight casing which cannot be opened except by special tools. The brushes and commutator can be got at by removing small brass plates on either side of the machine. In order to permit the dynamo, which gives current at 6 volts pressure, to be used direct for the lighting circuit, the current regulation is obtained by varying the strength of the shunt-winding by means of a magnetic device which inserts a single step of resistance in the field immediately the output exceeds a certain predetermined limit; when the output drops the resistance is automatically removed. The mechanism by which this action is obtained is enclosed within the dynamo casing, as is also the automatic electro-magnetic cut-out.

The Remy.—Another American machine is the Remy, made by the Remy Electric Co., of Anderson, Ind., U.S.A. It is a 12-volt machine with inherent current-output regulator; the dynamo is of the differentially compound-wound type, the series winding opposing the shunt winding through a third brush so as to produce a characteristic curve, in which the maximum voltage is reached at a moderate speed, and above which no increase of output is produced, irrespective of the speed at which it is driven. A feature of the armature is that the slots of the drum are not of the usual parallel type, but are set at an angle to the spindle, it being claimed that the arrangement adds to the silent operation of the machine. There are two poles, the compound winding being located on the upper part of the field casting. The cut-out device, or reverse current relay—as the makers term it—is designed to function at the relatively low speed of 250 r.p.m.

Other lighting dynamos on exhibition at Olympia which call for no special mention on this occasion—some having already been described in these columns—included the Disco, made by the Disco Co., of Detroit, U.S.A.; the Fulmen or "Orno," of Messrs. G. T. Riches and Co., Ltd.; the Tonelyte, of Messrs. Steiner and Co.; the En Route of the Motor Accessories Co.; the V.R. of Messrs. Van Raden and Co., Ltd.—which is practically identical with that of Messrs. Vandervell and Co.; and the Brolt of Messrs. Brown Bros., Ltd.

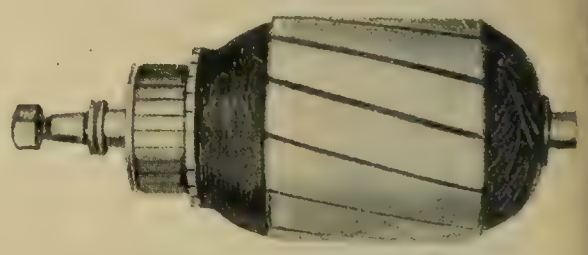


Fig. 26.—Skew Slotted Armature, Remy Dynamo.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Code Books for Engineers.

It appears to us to be somewhat remarkable that in these days of literary and commercial enterprise someone has not published ere now a comprehensive code book containing code words such as would cover the usual phraseology and requirements of engineers engaged in electrical and electro-mechanical undertakings.

For years we have been patiently hoping that a code book of this description would soon be published, but alas, no, or if so, then we have not yet seen it. We feel convinced that a really good code book, with wide-embracing scope and full provision for condensing the matter into the shortest possible number of words, would amply compensate the publishers by the large demand for copies from all the leading and up-to-date traders and engineers outside the British Isles.

Some of the private code books of manufacturers are most excellently compiled and thought out, and save considerable expense when cabling ; but though private code books may be necessary or advisable, they are certainly of no value in the majority of cable communications between oversea importers and their buyers in England.

It frequently happens, too, that details have to be cabled to sundry firms with whom there may have been little or no previous business, or who possess no private codes.

It is hardly possible to conceive that any other branch of commerce is so badly catered for in this direction, and surely the time arrived long ago when engineering requirements

justified a specially compiled book. The average popularly used codes of to-day containing practically commercial phrases only are certainly of no value for transmitting details such as voltage, phase, cycles, speed, candle-power, type of motor, method of coupling, efficiencies, and the hundred and one other important detail matters daily dealt with.

Take an example. A quotation is required from a definitely specified manufacturer, with whom no previous business has been done, and who has no oversea local representative, the inquiry being for a direct-current motor-generator with common bedplate, rigid or other coupling, motor three-phase, 400 volts 100 cycles, suitable starting gear, generator direct current, 100 volts 180 amps., over-compounded 5 per cent., with shunt regulator, machines to be totally-enclosed type, speed not exceeding 900 R.P.M.

Are there any public code books now on the market which could condense the above cablegram to a reasonable number of words—say even six words?

For **Newton, McLaren, Ltd.**
D. Eardley McLaren, *Managing Director.*

Adelaide, South Australia,
November 5th, 1913.

Electric Clocks.

Your correspondent says it would interest your readers to know the principles of electric time service which distinguish fundamentally between the two systems named. If you agree with him and can spare the space, I will express them as concisely as possible.

The energy devoted to making contact should not be taken from the pendulum, which ought to be left undisturbed in performing its only true function — time measurement.

The electromagnet used to maintain its oscillations may provide unlimited energy to perform a powerful switching operation, but that energy should not be first put into the pendulum and then taken out of it. A Foucault-Hipp driven pendulum is the worst for such treatment, because the amplitude of its oscillations is perpetually varying in irregular frequency, which has no relation to the half-minute function of making contacts to operate dials.

It is undesirable and inefficient to have to arbitrarily adjust the duration of the contact to the supposed requirements of the dials; on the other hand, their self-induction should dictate the duration necessary.

The contact should not pass what current is available regardless of its sufficiency or insufficiency; on the other hand, it should be compensatory in its action, passing enough current to operate all dials under varying conditions of battery, &c., or else ceasing work altogether, after giving due warning of impending failure.

I have enunciated these principles fearlessly as a fundamental statement of right and wrong, and they have never been called in question. There is only room for difference of opinion as to their importance in practice.

The oscillographs in my I.E.E. paper laid the "short-contact" bogey in 1910.

F. Hope-Jones, M.I.E.E.

Clerkenwell, E.C., *December 8th*, 1913.

My original letter in your issue of November 14th was penned with no other motive than that of asking for public recognition for Mr. G. B. Bowell's 20 years' work in electric clocks; and as my letter was in no way intended to draw any comparisons between rival trading firms, nor did I even mention any electric clock system by name, I did not propose to make any reply to Mr. Hope-Jones's letter—although I could not help smiling at the idea of my brother's "habitually transgressing the principles of electric time service."

Mr. Bousfield's letter is most interesting, since it voices what I believe to be the opinion of most experienced users of electric clocks.

H. T. W. Bowell.

London, E.C., *December 5th*, 1913.

The New "Journal" of the I.E.E.

Not so long ago we heard a great deal about the "dignity" of the Institution of Electrical Engineers: does this account for raising the Institution *Journal* to the dignity (?) of a penny magazine? Those who, like myself, keep their *Journals* in a book-case, will not welcome the change in the size of the volume; moreover, the penny magazine edition is very difficult to keep in good order for binding, as it gets inadvertently doubled over, and the corners get turned up; in short, being now a magazine, it is difficult to avoid its being treated as such rather than as a book. I shall be glad to hear for what reason the change has been made.

J. W. Record.

Manchester, *December 3rd*, 1913.

Electric Vehicles.

Referring to the remarks at the inaugural luncheon last week, on the occasion of the opening of new showrooms by Edison Accumulators, Ltd., it would be a pity at the present stage of electric vehicle development in this country, if the general public interested in commercial trucks formed the opinion that the success of these is dependent on the supply undertakings being able to furnish energy at a halfpenny per unit for charging purposes. As a matter of fact, even at the price of one penny per unit for vehicle charging, at the off-peak load, the cost is 33⅓ per cent. lower than in America, where this industry has assumed very large proportions, and the rates charged vary from 3 cents to 5 and 6 cents per KW.-hour. The cost of power for operating a self-propelled vehicle is only a small proportion of the total cost, as the per cent. cost figures given below will show. The horse has had a time-honoured monopoly of the goods-carrying industry, and is still an institution in this country for city haulage work, as the invasion of his territory at the present time by commercial petrol trucks does not amount to much. A very different state of affairs exists to-day in America, where this field has now been highly developed and specialised, with the result that the horse is rapidly disappearing from the city streets, and delivery work is being speeded up and carried out either by electric or petrol trucks, each type in its own special field of application, the electric being used for short-haul, frequent-stop delivery, and the petrol for long hauls. In its proper field, up to 30 to 40 miles per day on one charge, the electric truck has proved itself to be the cheapest goods carrier, and its popularity and success are proved by the number of vehicles of this type in daily use in all the large cities. The last three years have witnessed the real development of this industry over there, and the success of the modern electric is due to advances in design and construction and improvements in batteries, which give the present type an increased range of operation on a charge of from 30 to 40 per cent. The Electric Vehicle Association of America has played an important part in this development, and the formation of a Committee of the I.M.E.A. in this country on the same lines and the work now being taken in hand are of great importance at this juncture, as the question of charging arrangements and facilities presents considerable difficulty to prospective users of this type of truck at the moment.

Trucking data costs on 1,000-lb., 2-ton, 3½-ton and 5-ton trucks for electric, petrol and horse vehicles have been worked out by the Mass. Institute of Technology, based on operating cost figures taken over a large number of observations, and the average results on all four sizes of vehicles give the following per cent. items of operating cost per mile:—

	Electric.	*Petrol.*	*Horse.*
Storage, drivers and help...	46 %	41 %	54 %
Maintenance	30 %	28 %	11 %
Standing charges	17 %	22 %	11 %
Electricity, petrol or feed	7 %	9 %	24 %

These figures are interesting, as showing the relative proportion of each item of cost for each type. The electric and horse trucks were in use for 285 days out of 300 days per annum, and the petrol trucks for 270 days, the average mileage per annum being 9,137, 9,200 and 6,525 for electric, petrol and horse truck respectively.

The higher depreciation and insurance rates on petrol trucks are shown in the high per cent. cost, as against

electric, and on the other hand, the per cent. maintenance cost on electric, as against petrol, is slightly higher, but the maintenance figure covers a replace battery each year for the electric.

As petrol costs 1s. 6d. a gallon here to-day, as against 16 cents or 8 pence in America, the equivalent English figure to take for comparison is 1s. 3d. per gallon, which for the same consumption and mileage would bring up the per cent. cost of petrol to nearly double the American figure, and the per cent. cost for electricity here for electrics would be reduced by 33 per cent. on the basis of a 1d. per unit rate.

G. E. Clarke, M.I.M.F.

Birmingham, *December 8th*, 1913.

Electrical Acciden s in Mines.

Your correspondent "Armour" has drawn attention to a subject that is well worth discussion, in his advocacy of the armouring of all cables used underground. There are, however, several points in his letter that are not accurate, which detract from the strength of his arguments, and we think it necessary to draw attention to these.

In the first place, armoured trailing cables have been well tried (as seemingly evident to others besides "Armour," as the most suitable to resist falls and abrasion), but there are few mines which have not dropped them, for the following defects: —Weight, inflexibility, "kinkability," and permanent flattening by concussion.

Secondly, jute, leather and whipcord, though stated to be insufficient protection, have all been largely used and have generally been found more satisfactory than armour.

Thirdly, lead covering (said not to "suffer greatly") is absolutely useless for trailing cable work, and it is *not* "the toughest covering short of armouring."

Fourthly, the solid rubber sheathed cable originally introduced by us as cab-tire sheathed cable is stated to be "the most expensive form of protection." It may be, in first cost, up to twice that of most types of trailing cables. It is remarkable, however, that this "most expensive" type is probably now more in demand than any of the others, seeing that mining men are not in the habit of paying more for an equally good (or poor) article.

Fifthly, as to armouring being necessary on repaired cables. Repairs on C.T.S. cables are now made with our patented vulcaniser by colliery electricians in such a neat and efficient manner, that it is almost impossible to discern the repaired place, and it is practically as good as new. (We send the Editor a joint to examine, to prove this.) An armoured cable could not be anything like so simply and effectively repaired at the colliery.

Sixthly, the coincidence mentioned as to Scotland being most immune, and that it used the best trailing cables, is quite correct. There is a greater percentage of C.T.S. trailing cables in Scotland than in any other mining district in the United Kingdom, and probably more of them are now in use there than all the other types combined.

Briefly, the advantages of the C.T. sheathed cables over, at least, any armoured cable, have now been well proved for most situations where trailing cables are used, and to argue this point further seems to be a waste of time, as well as little-needed advertisement for that type of cable.

St. Helens Cable and Rubber Co., Ltd.,
J. H. C. Brooking, *Manager.*

Warrington, *December 8th*, 1913.

The Association of Mining Electrical Engineers.

I am glad to see in your issue of the 5th inst., the publication of a letter from Mr. W. Baxter (of the North of England Branch) referring to the assertions respecting the above Association contained in a leading article in your paper of the 21st ult.

Will you please allow me to say that I quite agree with Mr. Baxter's letter, and that I could go much further did I think it either necessary or desirable.

Assertions such as you made in your article—unbacked as they were by any statement of proof—are not, I think, likely to have much weight with your average reader, and none so far as the members of the A.M.E.E. are concerned, any one of whom could easily prove a direct negative to some of your remarks anent the Association.

In the same issue in which this leader appeared (on page 816, middle of second column), in the conclusion of an article on "Electrical Accidents in Mines," an accident which took place at a South Staffordshire colliery is referred to, and you make three queries, as follows :—

1. Who was the competent electrician? and what training had he?

2. Was he a member of the A.M.E.E.?

3. Did he hold a certificate granted by this Association?

As president of the Warwickshire and South Staffordshire Branch, I can definitely state that he was not a member of the A.M.E.E. and, therefore, the third question does not require an answer, and, moreover, would never have been asked had the writer read the rules of the Association. As regards the first question, I would refer you to the writer mentioned in your editorial comment on Mr. Baxter's letter, "who is familiar with almost every colliery in the country." He should assuredly be able to impart to you the precise information.

With Mr. Baxter, I much regret that you should, seemingly, be so averse to this Association, and that only on apparently a very slight insight as to its inner workings, and the class of its members. I can only think of one possible "grievance" (as Mr. Baxter puts it) that you might have—and that will be fairly obvious to our members. If there is really anything in such surmise, then your antagonism is all the more regrettable.

I trust you will give this letter the same publicity as your articles.

Arthur Hall.

Nuneaton, *December 8th*, 1913.

[We wish to do full justice to the Association, and should be only too glad to publish proofs that we had been misled as to the nature of the membership of the Society—if they were forthcoming. As stated in our note, our view has been privately supported by a leading official of one branch of the Association, and therefore is not unbacked.

If we criticise the Government of our country, are we necessarily unpatriotic? It is not the Association that we find fault with, as an Association, but its composition, which, we maintain, is not what the founders intended it to be. We welcomed their proposals, and supported their aims; but the Association has been captured by those whose interests are not in harmony with the interests of the real colliery electricians, and who are not likely to place the latter before the former, lest they should weaken their own monopoly of power and responsibility. Mr. Hall's last paragraph appears to suggest that we have some personal "grievance" against the Association; nothing could be further from the truth. On the contrary, we wish to see it prosperous and strong to carry out the main object for which it was established—namely, in the words of the first president, to establish a professional class of mining electrical engineers. We have consistently adhered to this view from the formation of the Association, which derived its origin from our own suggestion in December, 1908—a fact which in some measure entitles us to criticise its doings.—Eds. Elec. Rev.]

Canadian Electrical Trade.

In response to Mr. Herbert H. Berry's invitation in his latest letter to you on the above subject, I would say that in my own British experience I have not known the presence or absence of a fibre lining to a 3-ampere switch to have had any observed effect upon the electrical fire risk during, say, the last 25 years.

Upon these grounds, I do not examine or inquire as to whether such linings are or are not used, the point having been shown to be without interest from my own standpoint.

A. Lester Taylor.

Liverpool, *December 9th*, 1913.

Graphs in a Cable-Ship Drum Room.—We have received a long letter from Mr. E. Raymond-Barker, dated December 8th, in reply to the review on the book named above, but unfortunately we are compelled to hold it over on account of pressure on our space.—Eds. Elec. Rev.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Electric Comb.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W., are introducing a seasonable device in the shape of the electric comb and hair dryer, illustrated in fig. 1. Reasonable in price, easily adapted to the home and inexpensive in use, it is claimed that the Plexsim comb dries the hair quickly and in a natural manner, producing a soft and silky appearance.

The comb, which has a power consumption of 40 watts, is supplied with flex and adaptor for an ordinary lamp socket, and a neat attachment can also be supplied where single lamps are in use, by which the latter can be kept lighted while an extra socket, suspended underneath, is available for the adaptor. The company holds large stocks, and will supply suitable literature to those desiring it.



Fig. 1.—Electric Comb and Hair Dryer.

Domestic Wall Plugs.

One of the requirements of a wall plug for safety in domestic service is that it must not be possible to make contact with the terminal pins when the pins are alive. In order to effect this, the cover of the plug should project over the terminal pins, so that no portion of the pins is visible when the plug enters the socket.

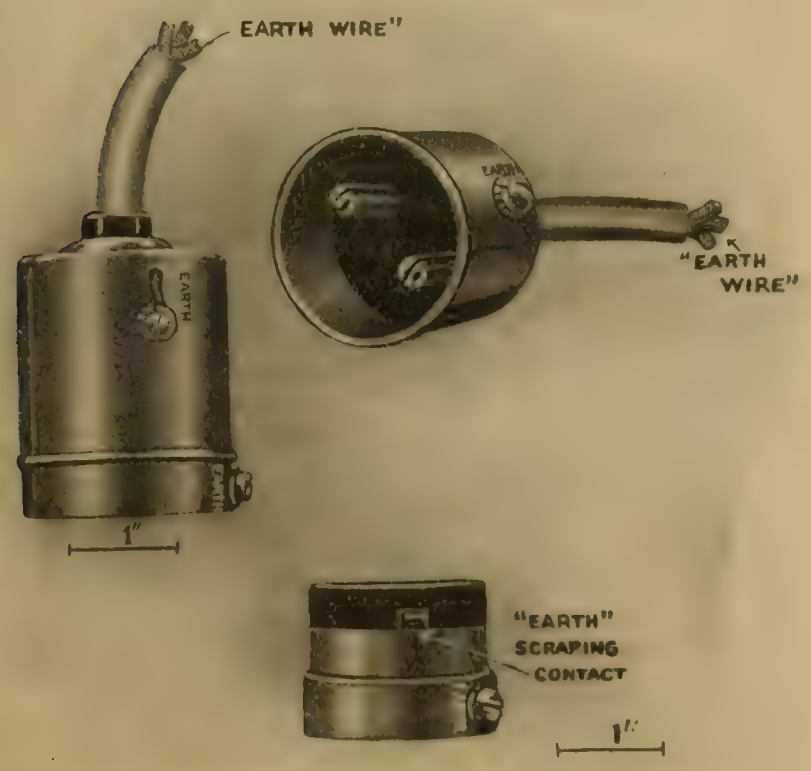


Fig. 2.—Reyrolle Wall Plug, showing interior.

This method is sometimes adopted on kettles and other domestic apparatus, but there is room for a much wider application of it.

The earthing arrangements which for years have been applied to flexible conductors in use in factories serve also a good purpose in the home, particularly where any form of portable electrical apparatus is used near to water-pipes, gas-pipes or other metalwork at earth potential. It may be argued that it is unnecessary to earth the cases of electrical appliances which are used in a drawing room or dining room, where, thanks to the insulation of carpets, floors, &c., there is no danger of shock. This is true to some extent but there are a number of cases where one unexpectedly finds "earth" in a room—for instance, disused gas-pipes, fireplaces, sometimes with an old connection to a gas-stove, bell wires, &c. It is a simple matter to make a metallic earth connection to the plug socket wherever an electrical apparatus is used near to water-pipes or taps, because the earth wire need only be run to the pipes. Then, in those rooms which are perfectly insulated it is agreed that there would be no danger in omitting the earth wire from the socket; indeed, under some conditions, it might be safer to do so. But to make all heaters in the household interchangeable the same form of plug and socket must be used throughout.

The accompanying illustrations, fig. 2 show a plug made by Messrs. A. Reyrolle & Co., Ltd., of Hebburn, which was originally developed for use in factories, and has now found a further field in domestic work.

Electrical Floor Polisher.

We illustrate in fig. 3 a new machine for surfacing, polishing, cleaning, or renewing all classes of floors, either wood, composition, rubber or stone.

Such work has hitherto been an expensive process, entailing highly-skilled labour at the outset, and a continuous after expense for maintenance.

The machine is self-contained, with a small motor, and is operated from the ordinary lampholder or wall plug by a flexible cable; it is easy to handle, and the attachments, which include various brushes, polishing pads, sandpaper disks, carborundum stones, &c., are interchangable.



Fig. 3.—Electrical Floor Polisher.

The makers, Messrs. Surfacing Machinery, Ltd., of 118 City Road, E.C., are prepared to give estimates for high-class floor finishing polishing, or resurfacing, and to contract for periodical polishing in hospitals, ballrooms and public buildings, in connection with which the machine has met with considerable success.

Auto-Transformer Starters.

The increasing use of squirrel-cage motors of comparatively large power has led the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, London, to develop an auto-transformer suitable for these. As may be seen from the accompanying illustration, fig. 4, the switch is of the drum type the live parts being clamped on steel bars with substantial moulded mica insulation, and is fitted with E.A.C. self-aligning finger contacts. The whole is very easily accessible, and the drum may be removed without disturbing any other part, or undoing any connections. The switch is arranged with four positions:—

(*a*) Off—Completely disconnecting the motor from the mains.

(*b*) Starting—Connecting the transformer, giving 40 per cent., 60 per cent., 75 per cent., or 85 per cent. of line voltage, according to the tapping selected.

(*c*) Transition—Making connections as in (*b*), and also connecting the motor direct to the mains through a buffer resistance.

(*d*) On—Connecting the motor to the mains direct, the transformer being no longer alive.

The E.A.C. slow-motion device is fitted, allowing rapid motion from step to step and through the transition connection, but

ensuring a definite stop in the starting position. The positions are consecutive, and the handle will not remain in either the starting or transition position, so that the starters are fool-proof,

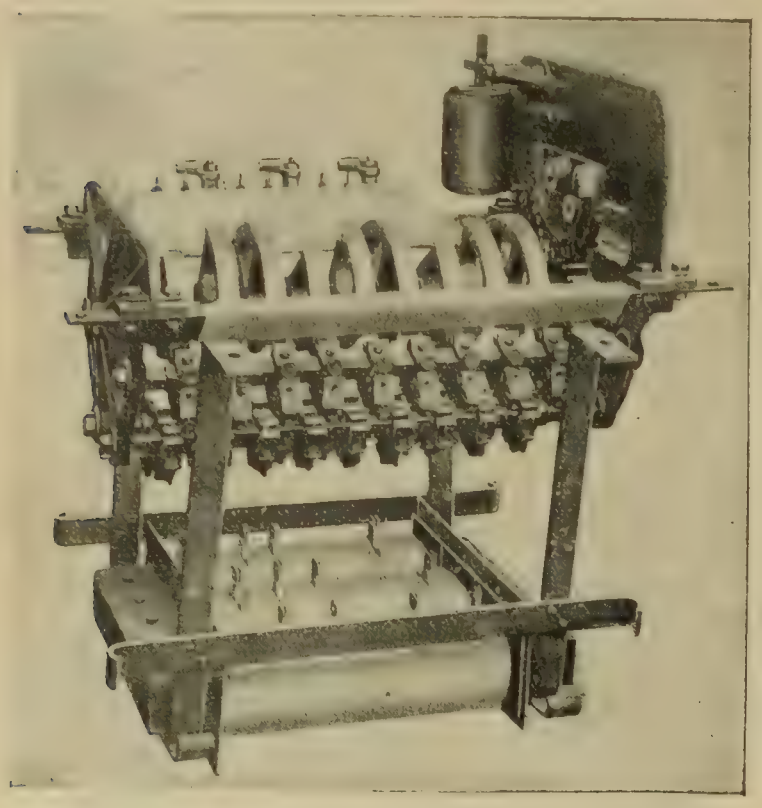


Fig. 4.—Auto-Transformer Starter, with Outer Case Removed.

while the provision, if desired, of no-volt and overload releases completely protects the starter and the motor.

Laminated Gears.

A remarkable step forward in the design of gears was recently put before us by Mr. A. F. Evans, the invention of Mr. A. E. Terry, of Messrs. Herbert Terry & Sons, Redditch. The object specially aimed at is silent running, but other important advantages are gained which should ensure the immediate popularity of the new gear. The accompanying illustrations show the construction of the gear-wheels, which are made of thin plates of steel, with the teeth not machine-cut, but notched out like armature core plates. The alternate plates are staggered half a tooth, as shown, and riveted together to the required total thickness. Any metal can be used, and any pitch or shape of tooth, and the disks can be punched with key or spline ways to fit on a spindle or arranged to be carried on a spider. The disks are accurately set on the tooth-notching machine by the bore and keyway, so that when cut they are all identical in all respects except that already mentioned, namely, that alternate plates have their teeth phased half a tooth from the teeth of the adjoining plates, thereby halving the virtual pitch and doubling the number of contacts. Large wheels

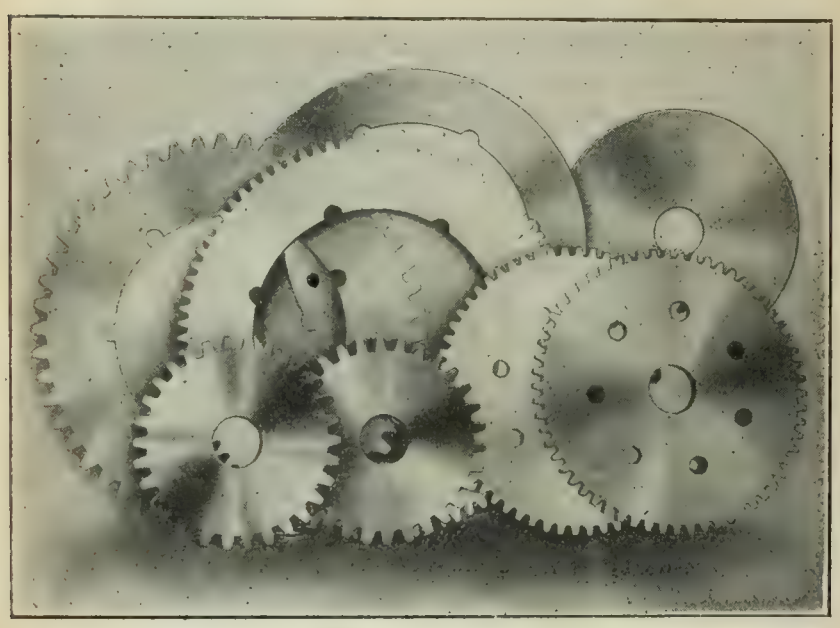


Fig. 5.—Laminated Gear Wheels.

are built up of rings or segments, carried on spiders, and their size is limited only by the latter. The teeth may be hardened without fear of distortion, and the whole process of manufacture is extremely simple and economical, the tools required being also much cheaper than the milling cutters used for milling gears out of the solid. Any width of face can be supplied. Between adjoining plates a very thin washer is inserted, to provide clearance for the teeth to pass without friction. It is claimed that these laminated wheels run together as silently as raw hide or silent-chain gear; the wheels cannot ring or hum, owing to their construction, which makes them as free from resonance as if they were made of lead. A special factory has been built for the manufacture of the gear wheels at Owlerton, Sheffield, and a private company has been formed to carry on the business.

The wide range of applications for the new wheels hardly needs emphasising; it includes practically all the purposes for which spur gearing is employed. A special advantage is the reliability of the built-up wheel, as the breakage of a tooth does not interfere with the continued use of the gear. Electric motor drives in particular, which are so often used where noisy gearing is a serious

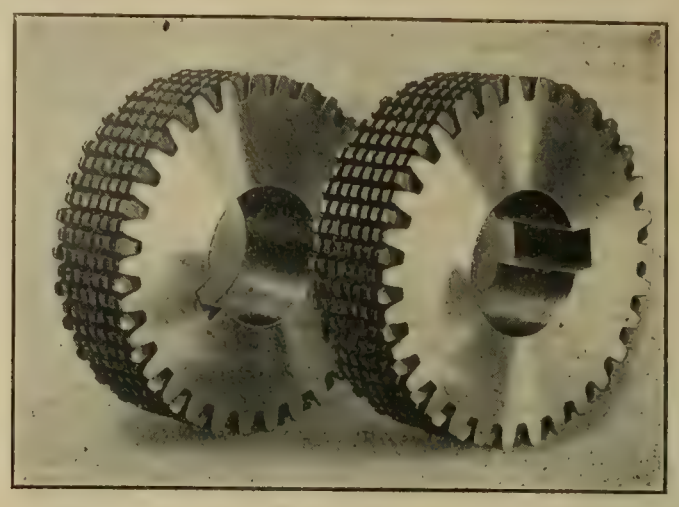


Fig. 6.—Disks for Laminated Wheels.

nuisance, will benefit greatly by employing these wheels, which, moreover, can be made of smaller dimensions for the same ratio of reduction. In the case of large gears only a small stock of spiders need be carried, the laminations being chosen to suit requirements. Automobile and tramway engineers will find the laminated gears especially useful.

LEGAL.

P.M.G. *v.* Hendon U.D.C.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Swinfen Eady and Phillimore, on Monday, upon the appeal of the Postmaster-General from a decision of the Railway and Canal Commissioners, consisting of Mr. Justice Bankes, the Hon. A. E. Gathorne-Hardy, and Sir James Woodhouse, in relation to differences which had arisen between the Post Office and the Hendon Urban Council as to placing telegraph poles and wires in certain roads within the jurisdiction of the Council. It appeared that there were three roads within the Council's jurisdiction which had been laid out, but none of which, at the date of the action, had been taken over by the Council. The Postal Authorities desired to place telegraph wires and poles along those roads, and made the usual application for authority, which the Council declined to give. The case then went before the County Court Judge, when the Council raised the point that the roads had never been dedicated to the public, and the County Court Judge having decided in favour of the Council, the Postmaster-General appealed. The Council admitted that the three streets were public roads, and that, as regards one of them, notices had been served upon the frontage owners requiring them to make up the roads. The only point which the Court had to decide was whether the roads were under the control of the Council. Sec. 13 of the Act provided that where anyone was responsible for the repair of the road, the consent of such person must be obtained before any poles or wires could be placed over or along same. It had been contended that the roads, not having been taken over by the local authority, were not under the Council's control, but on the other hand, it was contended by the Postmaster-General that the obligation to repair the road was not necessary in deciding whether the road was under their control.

Mr. Justice Bankes and the Commissioners held that the present case could not be distinguished from that of the Reigate Rural Council case, in which the Divisional Court had held that a street did not come under the control of a local authority until it was taken over, and they entered judgment in favour of the Hendon Council, but, in the circumstances, without costs.

The Attorney-General, the Solicitor-General, and Mr. Bremner appeared in support of the appeal, and Mr. Foote, K.C., and Mr. Goddard for the District Council.

The Attorney-General having dealt exhaustively with the statutes bearing on the subject, contended that the "body having the control of the streets," was an expression as used in the statutes which covered the Highway Authorities, and that local authorities had within the meaning of the Telegraph Acts the control of the street, whether it was a street vested in them, or whether it was a highway not vested in them, and therefore that the decision of the Commissioners was wrong.

Mr. Foote, on behalf of the Council, contended that the Council was not a body having the control of the streets in question, and he said he did not raise any question as to the nature of the streets and highway. He submitted that in the circumstances the decision of the Commissioners was right upon the various statutes governing the subject, and that the appeal ought to be dismissed.

Their Lordships held that the Urban District Council had not, within the meaning of the statute bearing on the question in dispute, control of the streets or roads in question. The judgment of the Railway and Canal Commissioners was therefore right, and the appeal must be dismissed with costs.

The National Telephone Co.'s Assets.

Mr. Percy Wheeler, on December 5th, applied to Mr. Justice Sargant with reference to a summons relating to the distribution of the above assets.

A summons, he said, was taken out before the Long Vacation, and was before Mr. Justice Astbury, but that learned Judge said he felt a difficulty in dealing with it, as he, as counsel, had been concerned in the matter. The liquidator now found himself with £60,000 in his hands undisposed of, and he desired the direction of the Court as to its disposal. Mr. Justice Astbury, to whom he had applied, did not desire to deal with the summons, and he accordingly applied to his Lordship to hear it.

His Lordship asked whether it was necessary to dispose of it before Christmas.

Counsel said it was very desirable that it should be determined speedily and it would not take long.

His Lordship said then the summons might be in the paper for hearing in the afternoon of Monday, December 15th.

Wolfram Lampen Atkien-Gesellschaft *v.* Burns, Harris and Werth.

In the King's Bench Division, on December 3rd, this pending action was mentioned to Mr. Justice Channell. Mr. Compton Smith (for the defendants) said the hearing was at present fixed for December 15th and the case was in the non-jury list. He asked that it should be made a jury case because of the issues involved. The action was brought by the plaintiffs for the price of electric lamps supplied, and, among various defences, it was alleged that the plaintiffs represented that the lamps would not be an infringement of the Osram patents. Defendants alleged that the lamps did infringe those patents, and Mr. Justice Lush had made an order that that question should be deferred until the trial of the other issues.

The Hon. M. Macnaghten (for the plaintiffs) resisted the application, and said there was no allegation of infringement when the case was ordered to be put in the non-jury list. There was a question as to whether there was a warranty attached to the sale of the goods, and that was eminently a matter for a Judge sitting without a jury.

His Lordship refused the application.

The British Vacuum Cleaner Co., Ltd., *v.* James Robertshaw & Son, Ltd.

In the Court of Appeal, the Master of the Rolls and Lords Justices Eady and Phillimore delivered, on December 9th, their reserved judgment on the appeal of the defendants in this action from a judgment of Mr. Justice Sargant. The plaintiffs brought the action for an injunction to restrain an alleged infringement of Letters Patent No. 17,433, of 1901, granted to Mr. Hubert Cecil Booth for improvements relating to an appliance for the extraction of dust from carpets and other materials.

The Master of the Rolls was of opinion that though the patent could be supported on the construction put upon it by the House of Lords limiting the specification by that construction, the defendants had not infringed.

Lord Justice Phillimore, however, was of opinion that the judgment of Mr. Justice Sargant was right, and the defendants had infringed the patent.

By a majority of the Court the appeal was allowed, and judgment entered for the defendants with costs.

Hutchins *v.* L.C.C.

In the King's Bench Division on Thursday, December 4th, Mr. Justice Ridley, with a common jury, heard an action against the London County Council, as owners of the electric tramway system, in which was involved a novel claim for compensation.

On March 4th last Henry Hutchins, an engineer's fitter, at 12.30 (midnight) hailed a tramcar near the Angel at Islington, and as it failed to stop he ran after it to the next stopping place in the City Road, and was out of breath when he reached it. He alleged that directly he was seated the conductor came to him and demanded his fare. He protested that he first desired to recover his breath, upon which the conductor took him by the coat-collar and flung him from the car injuring his knee, for which injury he claimed compensation. He had not been able to trace the conductor.

Mr. Cecil Walsh, K.C., appearing for the defendants, offered to bring 22 conductors into court, 11 who might have been on the route that night, and 11 who undoubtedly were not there, in order to give the plaintiff a wide field for identification.

The 22 conductors were accordingly paraded, wearing their hats, before the plaintiff, but he was unable to identify the man by whom he said he had been assaulted. He stated that he had his ideas, but would not like to swear as the men were so much alike.

His Lordship said that if a conductor had flung the plaintiff out of the car, as he said, the man had exceeded his duty, and the defendants could not, therefore, be held responsible for the act. According to the Council's Tramway Rules, if a man refuses to pay his fare, the conductor has only the power to take his name and address. He held that there was no case to go to the jury. He believed that the man had met with a serious accident, but as the conductor had acted outside the scope of his employment the Council was not responsible.

Judgment was therefore entered for the defendants.

Dublin County Council *v.* Postmaster-General.

In the Nisi Prius Court, on the 1st inst., before Mr. Justice Dodd, the hearing of this action was resumed. According to the *Freeman's Journal*, the plaintiffs claim a declaration from the Court that the Postmaster-General is bound to carry out the agreement entered into by the National Telephone Co. to supply telephone communication and apparatus to the offices of the Secretary of the Council, the County Surveyor, and the solicitor to the Council. The Council's contention is that the Postmaster-General in taking over the business of the Telephone Co. also took over its agreements with, and liabilities to, the plaintiffs. This the Postmaster-General denies. In the statement of claim it was set out that the company agreed to pay the Council 1s. for each pole erected or to be erected in the County Dublin, and also to pay an annual rent of 1s. for each wayleave granted by the plaintiffs between December, 1903, and December, 1911. It was also set out that the poles remained, and that they were subject to all the wayleaves and other rentals, and that they were now being used by the Post Office.

The defence set out three main objections to the claims:—First, that the plaintiffs' course was to proceed by petition of right; second, that the questions should be settled by the Recorder of Dublin or some tribunal other than the High Court; and third, that the contracts could not for various reasons be carried out.

The arguments having concluded, judgment was reserved.

Edwards *v.* Brixham Gas Co.

In the Chancery Division on December 9th Mr. Justice Neville had opened before him this action, by which the plaintiff sought an injunction and other relief in respect to an alleged nuisance caused to his property by the working of the defendants' electric light plant.

Mr. Peterson, K.C., and Mr. Maugham were counsel for the plaintiff, and the defendants were represented by Mr. McCall, K.C., and Mr. Palmer.

In opening the case Mr. Peterson said that it was brought to restrain a nuisance which was caused by the working of the gas engines for the defendants' electric lighting undertaking at Brixham. The plaintiff was a tailor carrying on business at 50, Fore Street, Brixham, where he resided. Besides owning that house, he had some cottages at the rear, abutting on Gas Lane and Angel Lane, one of which was connected with his Fore Street premises by a bridge, and was used as a store room or workroom. Fore Street, counsel understood, was the chief street in Brixham. It was in Commercial Street, with shops on each side. The tenants of three of the plaintiff's cottages had left owing to the nuisance that was caused by the defendants' works, the vibration being such that it was impossible for them to remain. Under the Electric Lighting Act of 1906, the defendants were authorised to extend their works, and to supply both gas and electricity. Taking advantage of that authorisation, they had greatly extended their works, and the electric lighting engines had been placed immediately opposite one of the plaintiff's cottages. The result of the vibration had been that the plaintiff's wife had suffered from headaches and nervous excitability verging on to a nervous breakdown, the plaintiff's son Douglas, aged seven, had had his recovery from an illness retarded, cracks had appeared in the chimneys and ceilings of the plaintiff's house, plaster was continually falling down, and the hinges of the front doors of the cottages had been broken off.

His Lordship asked when this state of things first started.

Counsel said that it had been going on from December, 1911, when the plant for this electric supply was increased. The defendants denied the nuisance, and said that these works were of the very best design and were worked with skill and care. He, however, should call evidence to show that the nuisance was such that the tenants had found it impossible to remain in the cottages.

Evidence was given as to the effect of the vibration, and the hearing was adjourned.

Alker *v.* St. Helens Corporation.

At Liverpool County Court, on the 8th inst., before Judge Thomas, an action was brought by Wm. Alker, farmer, Haydock, against the St. Helens Corporation, to recover damages for the loss of two horses, alleged by plaintiff to have been killed by a "live" tramway wire belonging to the defendant Corporation. It was stated by counsel, and given in evidence, that, following upon stormy weather, a telephone wire in the neighbourhood of Haydock House Farm, St. Helens, farmed by plaintiff, on May 9th last came into contact with an electric tramway wire in connection with defendants' tramway system, and becoming thereby charged with electricity, fell upon and killed two of the plaintiff's horses. He claimed for the loss of the animals, damage to harness alleged to have been caused by the electric wire, and the cost of the hire of two horses pending the purchase of two others.

Mr. Kennedy, for the Corporation, submitted, and called evidence to the effect, that the contact between the telephone wire and the electric tramway wire did not take place at the point

where the plaintiff alleged, and that defendants had been in no way negligent; also that the guard of the tramway wire was kept in good repair and regularly inspected.

His Honour, in the result, said he had come to the conclusion that contact did take place between the telephone wire and the feeder wire of the tramway system between the posts mentioned, and he gave judgment for plaintiff for £81, and costs.

Grant Finance Co., Ltd., *v.* Victoria Falls and Transvaal Power Co., Ltd.

On Tuesday Mr. Justice Pickford gave his reserved judgment in this action, to which we referred briefly in our issue of November 28th. The result was that the defendants substantially succeeded in the action, his Lordship's decision being in their favour except as to the commission upon the continuous or discontinuous supply under Clause 11.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Erg" writes:—"Sec. 15 of the 1909 Electric Lighting Act provides for a minimum annual sum to be paid by the consumer to the authority for a stand-by supply. In the event of the consumer deciding to take his lighting and power supply from the authority, and to put down a gas-driven generator for plating, arc lamp, or furnace work, would the authority be entitled to raise its charges for lighting and power above those current in the district or alternatively to make a fixed annual charge (under this section) based on the capacity of the gas-driven generator, for which no s and-by supply is connected?

*** Sec. 15 of the Act in question provides that "Notwithstanding anything in the Electric Lighting Act or in any Act of Parliament or provisional order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises; the sum to be paid shall be determined in default of agreement by arbitration." It is conceived that the real meaning of this clause is that the undertakers are only entitled to insist upon payment in respect of a stand-by when the current used from the mains is to perform the work of the stand-by plant. Upon the facts stated it does not appear that the plating, arc lamp, and furnace work are ever to be done by current supplied from the mains.

It would, of course, be possible to argue that the words "possible supply" which appear in the section include every source of electricity on the premises. Thus the undertakers may contend that some day the gas-driven generator will break down and that the consumer will then be compelled to fall back on the mains. If the definition of "separate supply" is the same as it is in the London Electric Supply Act, 1908 (8 Edw. VII, Ch. clxvii), this would certainly be correct, as "separate supply" is there defined as "either electrical energy produced on such premises or a supply from any other source"; and "Erg's" works may be within the district of one of the companies scheduled to that Act, which includes the Charing Cross, West End and City Co. If "Erg" disputes the charge he is entitled to have the question settled by arbitration.

BUSINESS NOTES.

Private Arrangements.—Jackman & Marchant, electrical engineers, 81, Sandgate Road, Folkestone.—The creditors interested herein were called together last week, when a statement of affairs was presented showing the position as at December 1st last, which had been prepared by Mr. H. H. Barton, I.A., 69, Sandgate Road, Folkestone. The statement disclosed ranking liabilities of £1,875, of which £1 281 was due to trade creditors and £490 to cash creditors, while the bank was also set down for £104. The assets were estimated to realise £630, from which had to be deducted £108 for preferential claims, leaving net assets of £522, or a deficiency of £1,353. The business was acquired by the debtors in May, 1906, the purchase price being £400. The debtors had a small capital of their own, and in order to enable them to complete the purchase price they borrowed £390, which was still owing. They had since borrowed a further £100, which made the £490 shown on the statement owing to cash creditors. The greater part of the borrowed money was obtained from the respective wives of the debtors, and it was intimated that they would defer their claims if a composition was accepted by the creditors. The present deficiency was attributed to losses by bad debts and in trading prior to 1911, together with the depreciation written off the assets and the drawings. In 1911 the business was carried on at a net profit of £320, while the drawings were £360. The following year the net profit rose to £470, while the drawings were £390. During the past 12 months the trading resulted in a net profit of £380, the drawings being £350. In answer to questions, it was stated that the debtors had recently been pressed by creditors. In order to protect the assets from a suing creditor a deed of assignment had already been executed. On behalf of the debtors an offer was made of a cash composition of 5s. in the £. An increased composition was pressed for, and the offer was amended to one of 6s. 8d. in the £, payable in cash. That offer was decided to accept, and it was also resolved that the deed already executed should be confirmed. The following are creditors:—

Pope & Co., Ltd.	£166	Durnier & Co.	£46
Electrical Co., Ltd.	101	New Ever-Ready Co., Ltd.	67
Henley's Co.	82	Pilkington Tile and Pottery Co.	35
Chapman & Co.	21	Sonter & Co.	33
Clark, Hunt & Co.	34	Smith & Co.	20
Camburn, Folkestone	42	Veritys, Ltd.	52
Colpeck, Folkestone	23	Wandsworth Manufacturing Co.	25
Evered & Co., Ltd.	20	Falk, Stadelmann & Co., Ltd.	56
Emanuel & Son	56	Ruskin Pottery Co.	36
Ellis, Simpson & Co.	32		

Belgium.—A new company has lately been formed at Anderlecht (45, Rue Limnander), with a capital of £4,000 and the title La Compagnie des Compteurs Aron.

Stoker Contracts.—Among electrical orders recently booked by The Underfeed Stoker Co., Ltd., are the following:—

Brisbane Trams.—Two Class "E" stokers.
Met. Borough of Stepney.—Eight travelling grate stokers, air heaters, chimneys, &c.
Hanschin Electric Railway.—Eight Class "E" stokers.
Norwich Electric Tramways.—Two Class "E" stokers.
Folkestone Electric Supply Co.—Two Class "E" stokers.

Catalogues and Lists.—Messrs. H. A. Jackson & Co., Caxton Works, Salford.—12-page pamphlet, containing excellent art-printed illustrations, and stating prices, of a number of designs of luminous radiators in hand-beaten art metal. A second pamphlet of 36 pages contains equally good pictures of electric light fittings of fine designs, these including Corona fittings, ceiling plaques, centre fittings, electroliers, pendants, dressing-table fittings, lanterns, &c., in brass and in oxidised, antique or polished copper. Prices are clearly set out.

The Electrical and Engineering Supplies Co., Harold Wood, Essex.—Illustrated and priced leaflet of decorative outfits for Christmas-tree and shop-window decoration and illumination.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Catalogue No. 654 (96 pages), containing detailed descriptive matter, with numerous illustrations, curves and clearly tabulated price information relating to the firm's recording instruments. The list is in three sections, as follow:—(1) Ink recording instruments, with roll chart of $2\frac{3}{4}$ in. (70 mm.), useful width; (2) ditto. with chart of $4\frac{3}{4}$ in. (120 mm.), useful width, time recorders; (3) quick-acting recorders, spark recorder and oscillograph, dimension sketches, and general index.

The Electric Battery Co., 62, Eagle Street, High Holborn, London, W.C.—New eight-page list containing a description with illustrations and prices of the "E.B.C." dynamo car-lighting system (S. L. Price's patent).

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—We have been favoured by this firm with a copy of their desk companion for next year. As before, it takes the form of a blotting pad with a reference book at the right-hand side, a calendar for the whole year in monthly squares being arranged along the top of the entire production. Users of previous editions will, in the present instance, find that the squared paper has this time given place to a diary arranged with three days to a page. As before, there are abridged specifications and approximate price lists of the firm's manufactures, together with a number of half-tone illustrations of the works and of the different types of plant made therein. Calendars for both 1914 and 1915 are also given. Nothing more need be added to show the useful nature of this desk companion.

The Electrical Co., 122 and 124, Charing Cross Road, W.C.—Twelve-page price list of novelties in electric signs and illuminations for Christmas. Kaleidoscopic novelties for shop windows, flexible illumination chain for indoor and Christmas tree use, as well as a number of lamps, &c., are listed. Also net price lists of rubber cables, flexible cords and bell wire, and steel conduits and fittings.

The Wagner Electric Manufacturing Co., 15, Clifford's Inn, Temple Bar, London, E.C.—Illustrated and priced leaflet describing the Wagner starter-generator for starting motor-car engines from the driver's seat, and for electrically lighting the car.

The Westinghouse Cooper Hewitt Co., Ltd, 80, York Road, King's Cross, London, N.—List No. 67 describes Cooper Hewitt lamps for the textile trade. A separate pocket booklet of 20 pages gives a lengthy list of shops, works, offices and other premises, &c., where these lamps have been applied, together with extracts from testimonials.

Messrs. Herbert Morris, Ltd., Empress Works, Loughborough.—Bound catalogue, No. 50, of close upon 500 pages entitled "Modern Lifting." The front cover bears a coloured picture of one of their 50-ton, seven-motor electric cranes at work. The book abounds in illustrations, together with brief notes and lists of users, of harbour cranes, electric and hand overhead travelling cranes, electric travelling crabs, crane motors, winches, portable electric haulage gears, jib cranes, conveyors, electric runways, pulley blocks, and so forth.

A series of interesting posters have been issued by the Underground Electric Railway Co. for the month of December which concentrate attention on the Christmas festivities.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Bloomfield Street, London Wall, London, E.C.—New 24-page two-colour brochure dealing with the Henley wiring system. It is arranged more particularly for the non-technical man, and to assist contractors in securing customers. It contains a very large number of interesting pictures of premises which have been fitted out on the system. In these illustrations practically every type of property is represented, from Messrs. Brunner, Mond's workmen's dwellings and the small colliery inns of the Newcastle Brewery Co. to fine buildings, such as cathedrals and churches, at home and abroad; St. Wilfrid's College, Oakamoor; Craigdunn Castle, Cullybacky; the Dormy House Club, Brancaster; the Royal Hotel, Whitby; and Halsway Manor, North Devon. Since this booklet was completed, it has been decided to install the Henley system in the workmen's model dwellings now being built on the Duchy of Cornwall Estate, and the work is now in progress.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Folder announcing reduced prices of "Royal Ediswan" drawn-wire lamps.

Norway.—The A/S Elektrokemisk-Industri at Christiania, which company was formed in 1904 for the purpose of promoting electro-chemical, metallurgical and mining enterprises in Norway, at a recent general meeting decided to increase its capital by £111,100 to £333,300. Originally the capital was £111,100, but it has already been increased by a similar amount. During its short existence the company has developed great activity, and already many large electrical concerns have been formed as the result of its operations.

Dinner.—The Western Electric Co.'s inspection department held their fifth annual dinner on Saturday, December 6th, at the Royal Oak Hotel, North Woolwich, close upon 80 of the works inspectors were present. A suitable programme was afterwards rendered. Mr. G. Emes acted as chairman, Mr. R. A. Miles as vice-chairman, and Mr. Charles Read as M.C. The toasts were "The King," "The Company," "The Chairman," and "The Vice-Chairman," all of which were suitably responded to.

A Disclaimer.—Mr. J. MacConnell, director of Premier Electric and Hardware Co., Ltd., 9-10, Cheapside, Golder's Green, N.W., writes as follows:—"My attention has been drawn to the publication in various trade journals of certain legal proceedings affecting a business entitled 'The Premier Electric and Hardware Co.,' of Golder's Green, which may injuriously affect the Premier Electric and Hardware Co., Ltd., of which I am a director. This latter company purchased the goodwill and assets of the Premier Electric and Hardware Co., which was a private business trading under that title, but the limited company has no relationship whatever with that concern; on the contrary, it is a limited liability company registered under the Companies' Acts."

Book Notices.—"The Colliery Manager's Pocket Book, Almanac and Diary." 1914. London: *Colliery Guardian* Co., Ltd. Price 2s. net.

"Rays of Positive Electricity and their Application to Chemical Analyses." By Sir J. J. Thomson. Price 5s. net.

"Photo Electricity." By H. Stanley Allen. Price 7s. 6d. net. 1913. London: Longmans, Green & Co.

"Electrical Engineering." By Clarence V. Christie. 1913. London: Hill Publishing Co. Price 17s. net.

"Science Abstracts." Vol. 16, Part II. Sections A and B. November 27th, 1913. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 8, October, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the American Institute of Architects." Vol. 1, No. 2. November, 1913. Washington: The Institute. Price 20 cents.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, No. 10. October, 1913. Liége: The Association. Price 5 fr.

Brazilian Patents.—Messrs. Leclerc & Co., of Rio de Janeiro, send us a translation of an ordinance of the Minister of Agriculture, Industry and Commerce, published in the *Diario Official* of October 23rd, 1913, viz.:—"By order of His Excellency the Minister, be it known that, within six months, reckoned from this date, it is exacted that documents, proving the working of the inventions from 1898 to 1911, be filed at this General Direction, in order to be recorded at the respective records, failure to this formality patents will be declared void in pursuance of Article 5, Sec. 2, Nos. 1 and 2 of the Law N 3,129 of October 14th, 1882, in combination with Article 59 of the Regulation approved by Decree N. 8,820 of December 30th, of said year." By what is above stated, say Messrs. Leclerc, it is understood that Brazilian patents not worked in accordance with the law and regulation, will be declared void if the above requirements are not fulfilled.

Dissolutions and Liquidations.—Magneto Exchange and Repairing Co., magneto repairers, 45, Broad Street, Bloomsbury, London, W.C.—Messrs. C. Godfree & O'Bartschi have dissolved partnership. Debts will be attended to by Mr. Godfree.

Prested Miners' Gas-Indicating Electric Lamp Co., Ltd., 101A, Elthorne Road, London, N. First meetings of creditors and contributories, December 16th, at 33, Carey Street, W.C.

Bankruptcy Proceedings.—John Samuel Richards, electrician, 29, Fredsham Street, Market Kingston-upon-Hull.—The public examination of this debtor was held at the Guildhall, Hull, last Monday, when the statement of affairs showed liabilities amounting to £93 and assets estimated to produce £12, leaving a deficiency of £81. The failure was attributed to the law costs of an action brought by him for damages for personal injuries sustained by him in an accident which action proved unsuccessful. Debtor stated that he was a journeyman electrician, earning 37s. a week. The examination was closed.

W. H. Davis (lately trading as the General Investment Fittings Co.), dealer in gas and electric light accessories, 71, Ralph Road, Saltley, Birmingham.—The public examination of the above debtor was held last week at Birmingham. The case was declared closed.

Trade Announcements.—We understand that Messrs. Williams & Bach, of 9, Hanover Street, London, W., have acquired the services of Mr. William E. Gallier, and he has resigned his position with Messrs. Jackson & Boyce, of Berners Street.

The business of the United Lamp Co. was, on November 30th, transferred to the Imperial United Lamp Co., Ltd., of Caxton House, Westminster, S.W.

Mr. R. C. Baines, who has held several important positions in India, amongst others that of electrical engineer to the East India Railway, and latterly with the General Electric Co., of England, has joined Messrs. Lester B. Betts & Co., Ltd., of 9, London Street, E.C., as a director. Messrs. Lester B. Betts & Co., Ltd., represent, amongst others, a large number of electrical manufacturers for export.

Messrs. Krupka & Jacoby, Ltd., announce that they have appointed Messrs. Andrews & Co., of 198A, St. Vincent Street, Glasgow, as their agents in Scotland.

Showroom premises and offices have been opened at 11, Queen Street, Exeter, by Messrs. Brooking & Co., electrical engineers, which firm has been joined by Mr. W. Bird, of Dawlish.

Electric Signs.—The Sun Electrical Co., Ltd., of Charing Cross Road, W.C., have sent us a night view showing a Sun electric sign which has recently been erected on the Elephant and Castle Hotel. This is one of two recently erected for Sandow's Cocoa Co., the other being fixed on the top of the dome of the Angel at Islington. It goes without saying that both signs are excellent advertisements for this particular cocoa, and it is interesting to note that, though so far apart, either sign is visible from the other. Each of the signs contains just over 300 lamps, and the letters are 2 ft. 9 in. high.

Christmas Publicity.—The Electric Supply Publicity Committee, of 20A, Tudor Street, London, E.C., have issued a booklet of 16 pages, containing some notes on, and small illustrations of, electrical apparatus suitable for Christmas presents. The pamphlet has been issued for the use of the supply companies and local authorities.

For Sale.—York Corporation has for sale four 75-kw. compound Willans-Crompton sets, and three 27-h.p. electric capstans, &c. By tender, the whole business of Messrs. Warren, Beattie & Co., Ltd., Electrical Engineering Works and Stores, Middlesbrough. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Abercarn.—The B. of T. has revoked the 1906 E.L. order.

Accrington.—It was announced at the T.C. meeting last week that if Great Harwood decided to take electricity from Accrington, as far as could be seen, it would not add to the plant required, as the demand would come on at half-past five, and could then be satisfied very easily.

Arder (Co. Louth).—E.L. Scheme.—A special meeting of the Town Commissioners has been summoned to consider a proposal made by Messrs. Cooke & Byrne that in the event of the Commissioners obtaining sanction for the electric lighting of the town, the firm will be prepared to find the capital for carrying out the scheme.

Argentina.—At a public meeting of the inhabitants of Tres Arroyos a co-operative association was formed for the installation of electric light in that town.

The Cordoba Government has granted a concession to Sr. D. Baravalle to establish an electric light station in Las Varillas department of San Justo.—*Review of the River Plate.*

E

Australia.—The Treasurer of the South Australian Government recently announced that a Royal Commission to inquire into the gas and electric supply services would be appointed at the end of the present session of Parliament.

The Newcastle (N.S.W.) Municipal Council has obtained a loan of £5,000 for the purpose of extending the electric lighting scheme.

THE PERTH (W.A.) MUDDLE.—A late issue of the *Commonwealth Engineer* discloses a strange position of affairs in connection with the Perth electricity supply, which, to put it mildly, reflects little credit on the municipal and other authorities concerned. It will be remembered that the city bought out the Gas and Electric Co some time ago; before its new owners took possession, the State Government decided to resume certain land on which stood the electricity works, and consequently the city called in its expert, Mr. Edmiston, who advised the building of a new A.C. station, and abandonment of the existing D.C. distribution system. The Council was divided on the proposal, and subsequently a report was obtained from Mr. Broadbent, the company's engineer, which emphatically opposed the supersession of the D.C. distribution, while agreeing to the necessity of a new power station. This idea found favour, but in order to decide the matter, Mr. Forbes Mackay was called in, and he pronounced in favour of the first proposal.

In the meantime the city was negotiating for the purchase of the Perth tramways, but a favourable offer was, due to the indecision of the Council, allowed to pass, and as there seemed no prospect of finality, the State Government stepped in and purchased the concern at a much higher price. In planning improvements to the system, the Government came to the conclusion that as a new tramway power house would be required, this might also serve for the city supply.

Other matters had arisen also in connection with the appointment of city engineer, which had been given to Mr. Broadbent, and an appeal to Mr. Forbes Mackay resulted in that gentlemen recommending that the matter be placed in the hands of Messrs. Merz & McLellan.

In meantime nothing definite appears to have been done, but the services of three more local experts were obtained to report jointly on the position and apparently favoured the original Edmiston proposals.

At this time the Government, after conferring with Mr. Merz, decided to undertake the whole electric supply to Perth and suburbs from its power station, offering a supply to the city at ¾d. per unit, and leaving the city to distribute the energy.

An agreement appeared to have been reached, but legal difficulties occurred relating to the right of the city to supply in the suburbs, which delayed matters another five months. Now the suburbs claim the privilege of dealing direct with the Government. Under these conditions the city engineer considers that the old plant will suffice for its needs.

The net result, according to our contemporary, is that the city has lost the electricity supply, and finds itself saddled with a debt of nearly half a million, and, by its stupidity in handling the matter, has its source of revenue very much curtailed. A further trouble is that Messrs. Mertz & McLellan have ordered the new Government plant for a 40-cycle frequency, while that in use at the railway workshops, at the Fremantle Harbour works and at the town of Fremantle is of 50 cycles. This will result in loss in conversion either of energy or plant, and, moreover, it appears that the Fremantle Tramway Board can supply itself at a less cost than the new Government supply.

THE SHOALHAVEN SCHEME.—The report of the chief electrical engineer of Goulburn on the practicability of obtaining power from the Shoalhaven River states that a dam immediately below Warri Bridge appears the most suitable. Pipes would be led a distance of 35 chains to the power station, giving a total head of 1,010 ft. This would supply 10,000 H.P., and if necessary 30,000 H.P. Including a transmission line to the proposed State power scheme at Kiama, the cost is estimated at £526,000. The report states that the tin manufactures alone would justify the scheme. The charge per unit is estimated at an average of 0·43d.

Batley.—NEW TURBINE PLANT.—At the last meeting of the T.C. consideration was given to a recommendation of the Electricity Committee that the Committee should be authorised to enter into a contract for the installation of a 1,200-KW. Ljungstrom turbo-generator (or in the alternative a 1,000-KW. "disc and drum" turbo-generator) with other plant and auxiliaries. It was explained by Mr. J. W. Turner that the additional plant was required owing to the increased demand for current. The recommendation of the Committee was approved unanimously

The tradesmen have decided to adopt a scheme of electrical illumination in Commercial Street for Christmas.

The Yorkshire Electric Power Co., which has the right to supply electricity for power purposes in Soothill Upper, is seeking powers to supply current there for lighting also.

Battle.—WORKHOUSE INSTALLATION.—The B. of G. last week inaugurated the E.L. installation at the Workhouse. The installation has been carried out by Messrs. J. L. French & Co., of Bexhill, at a cost of £319, and replaces oil lamps. There are nearly 140 lights, and current at 50 volts is supplied by a dynamo, driven by an Aster engine. The storage battery, having a capacity of 300 ampere-hours, is by the Chloride Co., Ltd. Mr. A. C. Vicehurst, of the Bexhill E.L. Works, acted as consulting engineer to the board.

Bawtry (near Doncaster).—E.L. PROPOSAL.—The P.C. has passed a resolution in favour of the scheme submitted by Messrs. Best & Pullan for supplying electric light to the town. It is intended to hold a parish meeting, and Messrs. Best & Pullen are to be requested to attend and explain their proposals.

Bitterne.—PROPOSED E.L. SCHEME.—The Southampton T.C. has offered to extend the E.L. mains to the parish at an estimated cost of £681, to charge the P.C. £2 9s. 6d. per lamp per annum for public lighting with a minimum of 35 lamps, and to supply current for private lighting at 4d. per unit.

Beckenham.—Having made arrangements to supply electricity to the factories of Messrs. Muirhead and the British Radium Corporation, at Elmers End, the U.D.C. has decided, with a view to other consumers being connected later on, to lay high and low-tension cables and erect sub-stations at an estimated cost of £1,200.

Blackrock (Co. Dublin).—The U.D.C. has adopted the report of the Electric Lighting Committee on the negotiations conducted by the Council with regard to the various lighting projects before the Council. It was stated that the Alliance Gas Co. had failed to obtain a prov. order, and had published notice of its intention to promote a Bill in the next session for powers to supply electricity to Kingstown, Blackrock and Dalky, and the Committee recommended that in the meantime no action should be taken beyond getting the Council's electric lighting order renewed.

Bradford-on-Avon.— PROPOSED E.L. SCHEME.—Mr. J. H. Edwards, of Bristol, who is applying for a prov. order for E.L. within the urban area, has informed the R.D.C. that it is proposed to include certain rural parishes in the area of supply, and asking if the Council has any objection to the proposal. The Council has requested full details of the proposals for consideration.

Bocking (Essex).—PROPOSED E.L. SCHEME.—The P.C. on December 1st, discussed the E.L. question, and had before it two schemes, one requiring a capital expenditure of £2,700, and an annual cost of £200, and the other a capital outlay of £2,000, and a yearly cost of £175. It was decided to invite electrical companies to consider the possibility of electric lighting in the parish.

Braintree.—PROPOSED E.L. SCHEME.— With a view to carrying out an E.L. scheme for the town, the U.D.C. has appointed a deputation to visit the works of the Grays U.D.C. and obtain information of the undertaking there.

Bridlington.—PUBLIC LIGHTING.—The T.C. has instructed the borough electrical engineer to report upon the cost of laying cable for the full length of the Sewerby sea defence road and in the streets on the Lamplugh Estate, and also on the cost of erecting public lamps at those places.

Canada.—Electric cooking is finding much favour in Victoria, B.C., and at the present time some 300 installations are in operation, giving entire satisfaction. The B. C. Electric Co. gives a special rate of 5 cents per KW.-hour for heating and cooking business, subject to a monthly minimum charge of 75 cents per connected KW.; with this rate there has been no complaint, and this end of the company's business is steadily increasing, the average connections during the past six months being three ranges per week. One installation, which has proved to be of more than ordinary advertising worth, was a complete electrical installation in one of the local schools, in the Household Science Department. Parents of the girls have an opportunity to visit the classes at any time to note progress made, and the electrical equipment has invariably come in for special attention. Ninety-eight per cent. of the residences in Victoria are connected to the electric system; 10,000 lighting meters are in use, with a population of 60,000.—*Journal of Electricity, Power and Gas.*

Our Ottawa correspondent says the chances are in favour of the Toronto Hydro-electric Commissioners purchasing the Toronto Electric Light Co., while the purchase of the Toronto Electric Railway is also urged.

It is proposed by the Ottawa municipal electrical authorities to reduce the present rate of 3 cents per KW.-hour for heating to 2 cents; also, in the case of the "house-area" rate (consisting of a fixed rate plus 3 cents per KW.-hour for current), a discount of rather less than 50 per cent. is proposed on the metered supply. This, it is considered, will greatly assist in developing electric cooking and heating. The proposed reduction will also affect the rates of the Ottawa Electric Co.

The Ottawa municipal electricity department has been notified by the Ontario Hydro-Electric Commission that a reduction of its light and power rates by 10 and 15 per cent. respectively is authorised. This is practically an order from the Commission, which the municipal department is prepared to agree to. A similar reduction is authorised for Toronto and London.

Everyone of the 46 municipalities in Ontario using hydro-electric energy, earned a surplus for the last nine months. These surpluses varied from 56 to 10 per cent.

Carlisle.—NEW LOANS FOR PLANT.—The Electricity Committee has agreed to apply to the L.G.B. for sanction to borrow £23,440 for extensions and the provision of new plant at the electricity works.

Chesterfield.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for a loan of £7,000 for electricity purposes, £4,000 being for mains, £2,500 for high-tension transforming and transmission lines, and £500 for spares. There was no opposition.

Connah's Quay.—E.L. Report.—The U.D.C. has had prepared, by Mr. A. Leigh, a report on the question of electric lighting, and this is being considered by a Special Committee, which will report later on.

Coniston.—E.L. Scheme.—At a meeting of the P.C. it was reported that the proposed electric lighting scheme for the district had been favourably considered by the Divisional Committee and the R.D.C.

Continental Notes.—Norway.—At one of the last meetings of the Municipality of Hangesumd, it was unanimously decided to acquire the Rödne Waterfall. The Rödnefos is situated 30 miles from the town, and it is estimated that the whole scheme, including the erection of a secondary power station and the transmissions, will involve a capital expenditure of about £72,300.

Austria.—A generating station for the supply of current for lighting and power purposes in connection with its various collieries has just been completed near the Franz Colliery by the Kaiser Ferdinand's Nord Railway. The plant comprises four 3,000-H.P. steam turbines and generators.

Italy.—It is reported from Rome that a German company has applied for a concession to utilise the water power of the River Piave, near Soccher, in the generation of electricity for lighting and power purposes. The plant, &c., is estimated to cost about £2,800,000, and 165,000 H.P. is available.

Portugal.—A concession has been granted to the Serra da Estrela Hydro-Electric Co. for the supply of electric power for the public and private requirements of the Town of Mangualde. The concession is for a term of 20 years.—*Board of Trade Journal.*

Dewsbury.—School Lighting.—At the last meeting of the B.C., it was reported that the Electricity and Tramways Committee had been in communication with the Education Committee, with regard to the lighting of various elementary schools with electricity. The Education Committee thought that the charges proposed were excessive and asked for more favourable terms, the Electricity Committee replying that it was prepared to lay cables to all the Council schools within the borough, with the exception of the Knowles Hill Road School, without the usual guarantee. This offer is being considered by the Education Committee.

Dublin.—At the quarterly meeting of the Retail Traders' Protection Association a resolution was adopted urging consideration of the advisability of removing the increase of 10 per cent. made on electric light charges in the city some years ago.

Dundee.—The Broughty Ferry Report.—The electrical engineer's report upon the condition of the plant in the Broughty Ferry power station, was under discussion at the last Council meeting, and provided the recently-elected Ferry members with an opportunity for some plain speaking.

Mr. W. Anderson moved that the report be not adopted, and that it be sent back to the engineer with a request that he furnish a report upon the actual cause of the breakdown. He also suggested that a committee be appointed to invite the criticisms of the late manager at Broughty Ferry, or those who were associated with him prior to Dundee taking over the working of the station, in order that the whole facts of the case might be elucidated.

Another member stated that the storage battery mentioned by the engineer had been examined four months ago in Mr. Richardson's presence, when he was told it was useless, and that upon their proposing to spend £200 upon it, Mr. Richardson had advised them not to spend anything.

Against this, however, it was stated that Mr. Richardson had reported to the Broughty Ferry T.C. that unless it carried out certain repairs, estimated to cost £500, he would not be responsible for any breakdown that would occur.

The Council replied that there was no use spending the money seeing that Dundee was to take it over. The convener mentioned that the actual cause of the stoppage was a failure of the feed pump, when it was found that a reserve pump was also useless.

After further discussion, it was moved as an amendment that the report be approved, and this became the finding of the meeting by 24 votes to 7.

In connection with the foregoing, a lengthy letter has been addressed to the late convener of the Electricity Committee of the Broughty Ferry T.C. by Mr. James L. Turnbull, the late engineer and manager of the power station. Mr. Turnbull takes up the Dundee electrical engineer's report piecemeal, seeking to show that at the time the station was handed over, the plant was in as good a state of efficiency as was possible for plant of its age to be. He also pointed out that Mr. Richardson had been informed in September that certain renewals and repairs were necessary, but that he objected as the whole place was to be scrapped.

In conclusion, Mr. Turnbull said the breakdown would not have occurred if the Broughty Ferry staff alone had been in charge of the plant.

Easingwold.—Proposed E.L. Scheme.—The R.D.C. has informed Mr. Chas. H. Best, of Bradford, that it views with satisfaction the proposed formation of a company to provide electricity for the parish, and would confer with the representatives of the company on the matter.

East Ham.—The Electric Lighting Committee recommends that as from April last the price of electricity supplied to the tramways be reduced from 1·125d. to 1·0625d. per unit. The engineer and manager has suggested that the current for power and heating, now charged at the rate of 2d. per unit, should be reduced to 1½d., subject, in the case of power, to a minimum account of £— per quarter, and in the case of electric radiators to a minimum account of 12s. per annum. The Council has accepted a tender for the supply and fixing of two automatic stokers at the generating station.

Eastleigh.—The U.D.C. has decided not to agree to the terms of the Southampton Corporation for a supply of electricity.

German East Africa.—A concession has recently been granted to put down a plant to utilise the water power of the Pangani waterfall at Usambaraj for the generation of electrical energy.

Grantham.—Workhouse Lighting.—The B. of G. has decided to have the question of lighting the workhouse inquired into, and to have terms for electric lighting submitted.

Hastings.—Public Lighting, &c.—The T.C. on December 5th decided to extend the mains, at a cost of £500, to supply current to "Beaulieu," Ore, and advantage will be taken of the service to convert the street gas lamps *en route* to electricity.

Hazel Grove-cum-Bramhall.—The U.D.C., which is applying for a prov. order for E.L., has retained Mr. H. C. Crews as consulting engineer.

Hereford.—The T.C. has sealed an agreement for the supply of electricity for lighting and power to the premises of the Hereford Society for Aiding the Industrious.

Hindley.—L.G.B. Inquiry.—Mr. H. R. Hooper conducted an inquiry on December 3rd into the application of the U.D.C. for sanction to borrow £2,500 for the purpose of electric lighting. There was no opposition. Mr. T. Robey said the Council made an agreement with the Lanca. E.P. Co. in 1907 for a supply of electricity in bulk, and it was now in the position that if it did not carry out the order, the B. of T. would revoke the order. Applications kept coming in, and the Council had great hopes that within a very short time the demand would be very satisfactory. Upon the suggestion of the Inspector, who pointed out that the £2,500 asked for allowed nothing for small extensions, it was agreed to consider the raising of the sum from £2,500 to £3,100.

Holmfirth.—New Loans.—The D.C. has decided to apply to the L.G.B., for sanction to borrow £7,500 for the purpose of the electricity undertaking, the money being required for generating plant, &c. The extensions will, it is believed, necessitate the erection of additions to the electricity works.

Huddersfield.—L.G.B. Inquiry.—An inquiry was held last week by Mr. H. R. Hooper into the application of the Corporation for powers to borrow £60,000 for the electricity undertaking. The town clerk said the money was required for generating plant, additional boilers, additions to switchboard, and extension of mains to enable the Corporation to meet the increasing demands for current, both for power and lighting purposes. He pointed out that the capital expenditure on the undertaking in 1912 was £240,155; the number of consumers was 4,705; the units sold in 1912 were 7,129,987, and the revenue had increased to £45,078 last year. The borough electrical engineer said that the Corporation proposed to install at once a 4,000-KW. three-phase set, and to add, two years hence, a 2,000-KW. single-phase set. After that it would gradually convert the single-phase system into a three-phase installation. The estimated cost of the new plant was £35,500; new mains £21,500; total £52,000, leaving £8,000 for future use. There was no opposition.

Hyde.—Public Lighting.—The Hyde Tradesmen's Association has decided to approach the Corporation with a request that it should light the principal thoroughfares with electricity, and thus encourage its own undertaking.

Irvine.—Proposed E.L. Scheme.—The T.C. has appointed a Committee to negotiate for a supply of electricity from Kilmarnock.

Japan.—According to a report recently issued by the Japanese Ministry of Finance, there were 155 electric light undertakings in Japan at the end of 1911, supplying current to an equivalent of 2,761,000 lamps, as against 122 undertakings and 1,902,000 lamps respectively at the end of 1910.

According to the *Financial Times*, the proposed Tokyo loan for £1,600,000 for electrical works has been officially sanctioned, and it is considered probable, therefore, that a foreign loan will be floated in the coming spring.

Keighley.—Loans for Plant Extensions.—The Electricity Committee of the T.C. has decided to apply to the L.G.B. for the following loans:—£1,200 for building extensions; £400 for a 25-ton crane and extension of gantry; £2,500 for 800-KW. converting plant and switchgear; £6,000 for two water-tube boilers, with chain grate stokers, ash handling plant, and economiser tubes and flues; and £6,000 for mains.

Kirkburton (near Huddersfield).—Prov. Order.—The U.D.C. has agreed to support the application of the Yorkshire Electric Power Co. for powers to supply electricity for lighting purposes within its district.

Knaresborough.—The E.L. Scheme.—A special meeting of the U.D.C. is to be held at an early date to consider the report of Mr. Wilkinson upon the possibilities of an electric lighting scheme, estimated to cost £4,000.

Knottingley.—E.L. Scheme Approved.—At a special meeting of the U.D.C. last week, the scheme submitted by Mr. J. W. Speight for the lighting of the town by electricity was approved. The Committee which had had the matter under consideration had come to the conclusion that by the adoption of electricity better light would be given than at present, and it would be more economical to install electrical plant than to replace the present pumps at the sewage works.

Littleborough.—L.G.B. Inquiry.—An inquiry was held last week into the Council's application for sanction to loans of £4,000 for electrical purposes. Energy is purchased from the Rochdale T.C. at 10 per cent. additional to its works costs. There was no opposition to the proposal.

Llanfairfechan.—E.L. Scheme.—At a meeting of the local Council, last week, a communication was read from a Manchester firm of electrical engineers, in which they guaranteed, for an outlay of £3,500, to install plant to supply 100,000 units per annum, at a cost of 3·8d. per unit; and that for an outlay of £5,250 they would guarantee a supply of 250,000 units annually, at a lower cost still. They would prepare full details of the scheme proposed for a fee of 10 guineas, and in the event of it not being proved to be practicable, would waive their charge. The matter is under consideration.

London.—Marylebone.—The B. of G., at its last meeting, considered recommendations that information be obtained from the Notting Hill E.S. Co. as to the cost of a supply of current for lighting and other purposes to the infirmary at Notting Hill; and that the Finance Committee be requested to advise the Board whether current should be generated at the infirmary. Dealing with the first recommendation, Mr. Dennis proposed that the B.C. should be asked to allow its electrical engineer to give expert advice, and assist the Guardians in carrying out the scheme. This was agreed to. In the discussion which ensued on the second recommendation, Mr. Elmer said that if private companies could generate current and make profits, the B. of G. could make it cheaper for its own institutions. At present the cost of gas at the infirmary was enormous, and if, by installing electricity, the lighting bill could be reduced by £750 per annum, the matter should be seriously considered. It was decided to approve the recommendations. At the same meeting it was stated that owing to the installation of metallic-filament lamps and certain alterations in the lighting arrangements at the workhouse, the lighting bill had, in six weeks, been reduced £20.

L.C.C. Loans.—The Finance Committee has recommended the Council to sanction the borrowing by the Battersea B.C. of £4,500 for the electricity undertaking—£3,250 for mains, £480 for services, and £770 for meters.

Manchester.—The seal of the Council has been placed to an agreement with the Trafford Power and Light Supply (1902), Ltd., for the purchase and transfer of that undertaking to the Corporation.

The Electricity Committee has approved a report of the engineer, recommending the adoption of an inclusive charge per annum for providing and maintaining arc lamps for outside shop-front lighting.

Malvern.—At a meeting of U.D.C. the electrical engineer was instructed to prepare a report on the present capacity of the electricity works and the extensions necessary for future supply.

Newcastle-on-Tyne.—At a meeting of the electrical section of the Chamber of Commerce, on the 8th inst., Mr. F. O. Hunt presiding, a discussion took place on the new Electric Lighting Bill, which, it is understood, will be promoted in Parliament next Session, and it was resolved that opposition should be made to the clauses conferring on municipalities power to make installations and also to act as retail traders in electrical fittings. A discussion also took place on the classification of railway rates for electrical apparatus. It was resolved that a report be presented at the next meeting of the Committee.

An agreement has been sealed by the Corporation with regard to the supply of electricity for the purpose of pumping water from the Charlotte Pit, Benwell. The T.C. will receive £420 per year for seven years towards the cost of the cables, and about cost price for the electricity consumed.

Newcastle (Staffs.).—The T.C. has reduced the price of electricity for power purposes to 2d. per unit for the first 5,000 units per annum.

Oldcastle.—A public meeting having decided in favour of electric lighting in the town, the L.G.B. is to be asked to hold an inquiry as to powers to carry out a scheme.

Penmaenmawr.—The Council has decided to ask the North Wales E.P. Co. for its terms for supplying the town with electric lighting.

Prestatyn.—The L. & N.W. Railway Co. has applied to the Rhyl Council for a supply of E.L. to the new station at Prestatyn.

Rochdale.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £1,359 for electricity purposes.

Rotherham.—The T.C. has appointed a sub-committee to consider a report prepared by the engineer with regard to the installation of additional plant and an extension of the buildings at the electric light station.

Sale.—Proposed Loan.—Application is to be made by the Council to the L.G.B. for sanction to a loan to enable it to install a new and larger storage battery and booster.

Settle.—Proposed E.L. Scheme.—At the last meeting of the P.C., a communication was read from a Bradford firm with reference to the suggested formation of a local company for supplying electricity in the town. The promoters suggested that the capital of the concern should be £2,500. In addition to supplying Settle the company would also be able to supply the districts of Langcliffe, Giggleswick and Stackhouse. The directors of the company will be advised that they can profitably tender for the street lighting at 25s. 6d. per 32-c.p. lamp per annum, lighted five hours per day for eight months per year. It was ultimately decided to call a ratepayers' meeting in January next to consider the matter.

Sheffield.—Loans Sanctioned.—Sanction has been received from the L.G.B. to the borrowing of the following amounts for the electricity undertaking: £2,800 for cooling towers, £4,700 for pumps, pipes, &c., and £4,800 for concrete tanks, foundations, &c. The general manager estimates a surplus of £12,154 on the working of the undertaking during the year ending March 25th, 1914.

South Africa.—In order to popularise the use of electricity for cooking and heating purposes, a new scale of charges has been adopted by the Cape Town T.C. The new terms are that an average of the consumer's consumption in any given house for lighting for the last 12 months of full occupation be obtained, such average, plus 10 per cent., being fixed as the number of units that such consumer must pay for per month at the current tariff for night lighting (7d.); consumption above this quantity to be charged at 2d. per unit for the first 100 units, 1½d. for the next 200 units, and above 300 units per month 1d. per unit. The minimum charge under this system is to be 10s. per month; and in the case of new consumers, the city electrical engineer is to fix the number of units which the consumer must pay for per month at current tariff for night lighting. It will be noticed that the use of an additional meter is obviated.

A very severe thunderstorm recently passed over Pilgrim's Rest (Transvaal), and struck the generating station of the Central Mine (Transvaal Gold Mining Estates). The building was immediately enveloped in flames, and the whole plant and buildings were completely destroyed, as when the company's employés arrived on the scene, it was impossible to arrest the progress of the conflagration. The plant was the first large electric haulage erected in South Africa.

The East London T.C. is raising loans, including £13,000 for electric lighting and tramways purposes.

The Cradock (Cape) Council is to spend £10,000 on electric supply, and the Prince Albert (Cape) Council is raising a similar sum partly for the same purpose.

Stone (Staffs.).—Prov. Order, &c.—With reference to the application of the Gas. Co. for powers to supply electricity in the district, the U.D.C. has decided to obtain a copy of the company's Bill, which the clerk will consider and report upon. The opinion is that the Bill should be opposed on the ground that electricity should be provided, if necessary, by the Council.

St. Helens.—The Corporation Electricity Committee has granted the following discounts to large consumers for lighting: From 4,500 units to 6,000 units per annum, 10 per cent.; 6,000 to 7,500, 15 per cent.; beyond, 20 per cent.

Stretford.—The Electricity Committee has decided to reappoint Mr. T. L. Miller as consulting engineer to the Council. Experiments are to be made in the conversion of flame arc lights to "cluster" lights for public lighting.

Swinton and Pendlebury.—Public Lighting.—The U.D.C. is considering a scheme for substituting electricity for gas lighting on the main roads, at an estimated capital outlay of £1,600.

Teignmouth.—E.L. Scheme.—At a public meeting held last week, a resolution was carried declaring that if the U.D.C. was not in a position at present to undertake an electric lighting scheme, the Council should favour the electric lighting being undertaken by a company.

The U.D.C. has refused Mr. F. W. Warren permission to erect overhead wires for the transmission of electricity from the premises of Mr. W. T. Welch to the proposed new premises of the National and Provincial Bank, Ltd.

Torpoint.—Public Lighting.—The U.D.C. has accepted the tender of the proposed local electric light company for street lighting at £2 14s. per 75-c.p. lamp. A penalty of £50 to be imposed if the company was not ready to supply by May 1st, 1914, was inserted in the contract.

Trimdon (Co. Durham).—A special meeting of the P.C. has been held for the purpose of considering the lighting of Trimdon Grange and Trimdon Colliery with electricity. The manager of the electric supply company is to be interviewed on the matter.

U.S.A.—An electric signboard, 48 ft. high, and containing 32,000 lamps, is to be placed on the roof of the Josse Building, San Diego; it is said that it will be the largest electric sign in Southern California.

Walsall.—The Corporation Electricity Committee's recommendation that the price of electricity for purposes other than lighting and traction should be increased 20 per cent. has been adopted by the T.C. The Committee has again had under consideration the question of popularising the use of electricity by the hiring out of motors, cookers, and other appliances, but at present it cannot see its way to recommend the Council to incur the capital expenditure that would be required.

Watford.—The Electric Lighting Committee has approved an offer by the electrical engineer for lighting the Council's houses now in course of erection. The engineer proposes to charge £10 per KW. of maximum lighting demand (such charge determined by the use of current limiters in each house), and a secondary charge of ¾d. per unit for all energy consumed (this charge to be determined by one main meter serving the whole block of houses). The initial cost of wiring the 12 houses is put at £36. The offer has been accepted.

West Ham.—NEW LOANS, &c.—The Electric Lighting Committee reports having had before it a question raised by the electrical engineer with regard to an invention for improvements in electrical apparatus designed by a member of his staff, who desired to protect it. On the undertaking that the inventor derives no pecuniary benefit either directly or indirectly from the purchase of the apparatus by the Council so long as he remains in the Council's service, the Committee has decided to allow him to protect the invention. This arrangement is to apply in any similar case in the future.

Apolication is to be made to the L.G.B. for permission to increase the Council's previous application to borrow £9,000 for transformers, &c., and £8,500 for mains extensions, to £13,500 and £12,750 respectively.

West Lancashire.—The West Lancashire R.D.C. on December 4th decided that in view of the Leyland Electrical Co. seeking for a prov. order to put down plant sufficiently large to supply the needs of certain parishes in the West Lancashire area, the clerk be authorised to take such steps as will protect the interests of the portion of the West Lancashire area which may be affected. Hesketh Bank and Tarleton are the places it is desired to protect.

West Yorkshire Rural Lighting.—The Halifax R.D.C. has decided to support the application of the Yorkshire Electric Power Co. for powers to supply electric light in districts at present without a supply.

The R.D.C. also appointed the Upper Greetland Parochial Committee to meet the company at Thornhill to discuss the question of lighting Upper Greetland by electricity.

Wigan.—LOANS SANCTIONED.—The L.G.B. has sanctioned the borrowing, by the E.L. Committee, of £7,500 and £200 for a new turbo-alternator and accessories respectively.

Wrexham.—Permission has been granted to the T.C. to extend its mains to the garden village of Acton for the purpose of lighting the latter by electricity.

TRAMWAY and RAILWAY NOTES.

Burnley.—TRAMWAY EXTENSIONS.—Tramway extensions formed the subject of a report brought before the T.C. on December 3rd. The extensions are proposed to serve the Abel Street, Stoneyholme, and Brunshaw districts. Two schemes are suggested, the first estimated at £61,500, and the second at £29,130.

The Tramways Committee has received a letter from the B. of T. sanctioning the running of a goods wagon on the tramways for an indefinite period, subject to a speed condition, and on the understanding that it may at any time be prohibited if that is considered necessary by the Board.

Canada.—There are now nearly 40 electric industrial motor vehicles in service in the City of Winnipeg, where every facility for the charging of such machines is afforded by the electric lighting and tramway authorities. In the case of contracts, the rate for energy for battery charging is ¾d. per KW.-hour.

Dearne Valley.—E.L. SCHEME.—The promoters of the tramway scheme for the Dearne Valley are seeking extensive powers for electric lighting in the district, including part of Barnsley, eight urban districts and two rural parishes.

Continental Notes.—SWITZERLAND.—The Standing Committee of the management of the Swiss Federal Railways recently considered the question of the construction of the Erstfeld-Bellinzona section. It was decided to throw open to public tender the constructional works although part would be carried out departmentally. The supply of energy would not, however, be called for, but it was decided that the Federal Railways should build their own hydro-electric stations. The reason for this step lay in the opinion that were supplies obtained from private companies, the latter would form themselves into a trust, and dictate prices to the Railway Administration, and allusion was made, in this connection, to the danger of large foreign bank undertakings (by which were meant no doubt, German companies) acquiring a preponderating interest in the share capital of such companies as formed the trust.—*Elektrotechnische Anzeiger.*

AUSTRIA.—The Dux Bodenbach Railway has contracted to supply the Karlsbad T.C. with electricity for 25 years from a power station at the Kaiser Colliery, which it owns.

ITALY.—According to the *Giornale dei Lavori Pubblici*, the extensive tramway scheme for the province of Cuneo is held up for the present.

Three sections of tramways of 280, 115 and 85 km., joining certain prominent towns, were proposed. The tramways would be subsidised by the various communities interested.

BULGARIA.—A scheme is at present under consideration for the construction of an electric tramway between Sofia and Banki.

FRANCE.—The tramway line between Chambery and Le Bourget was carried away by a storm last week. The railway and telegraph poles also suffered.

East Ham.—Barking U.D.C. has given the T.C. six months' notice to terminate the arrangement now in force between Barking, the L.C.C. and the East and West Ham Corporations with respect to inter-running of the tramcars of each authority between Aldgate and Loxford Bridge.

Glasgow.—The T.C. this week granted conditional consent to a prov. order in the next Parliamentary session for about 20 miles of double-track tramways. There are some short extensions within the city proper, but the larger extensions are from the city boundaries through the more distant suburbs into adjacent towns, including Milngavie and Coatbridge. Negotiations have been in progress for some months, and while the outcome of these has not been made public, the convener of the Tramways Committee assured the T.C. on Monday that unless satisfactory arrangements were made with the county and other local authorities interested, the Committee would not propose proceeding with the extensions.

At the same meeting the T.C. decided to seek powers for the construction of a bridge over the river to link up Oswald Street and Commerce Street, to carry a section of the north and south tramway traffic and relieve Glasgow Bridge.

Grimsby.—An accident occurred last week on the Grimsby and District Electric Railway running to Immingham, to the centre of the new dock area, due to a collision between two cars. Although the cars were badly damaged, those travelling on them, with the exception of a conductor, who was cut by glass, escaped injury.

Leeds.—RAILLESS TRACTION SCHEMES.—At a meeting of the City Council on December 3rd, the tramway clauses in the Corporation's Bill were approved. They embody various extensions, and the running of a service of railless cars from Menston to Burley, and from Menston to Otley, in Wharfedale, and it was stated by Alderman Wilson that these were the only routes the Tramways Committee had in mind at present, though, should additional powers be secured, the Committee would consider the advisability of inaugurating further routes.

Leigh.—The chairman of the Tramways and Electricity Committee has presented a report to the General Purposes Committee containing information from other towns with respect to the running of motor-'buses and railless trolley cars, and also two schemes of running similar 'buses and cars in Leigh. Consideration of the report has been deferred.

Lincoln.—The T.C. on December 2nd, by 15 votes to 5, rejected a proposal in favour of the Sunday running of the cars.

Liverpool.—Alderman Smith, at a recent meeting of the Tramways Committee, said the Council intended to spend £13,000 or £14,000 in trying motor-'buses for linking up certain tramways and testing districts where tramways were being asked for.

London.—According to the *Standard* a proposal for "express" tramcars for the suburbs is being considered by the Highways Committee of the L.C.C. The idea is that, instead of every car stopping at every halt along the line, in the outer area certain cars should only stop at important points. This would mean a considerable speeding-up of tramway traffic. At present the rate of travelling is on an average nine miles an hour.

AN EDISON 'BUS.—It is reported that the London General Omnibus Co. is building an electric motor-'bus at its works at Walthamstow to the order of the Edison Battery Co.

THE L.C.C. AMBULANCE SCHEME.—At the meeting of the L.C.C. on Tuesday, the chairman of the General Purposes Committee said the Committee could not recommend the Council to adopt the ambulance scheme of the Metropolitan Asylums Board. A sub-Committee has been appointed, and it is hoped that a scheme will be placed before the Council next week.

Manchester.—Additional Cars.—Instructions have been given for the building at the works of the Tramways Department of 25 additional car-bodies of the bogie type.

Newcastle-on-Tyne. — At a meeting of the City Council, on the 3rd inst., it was decided to promote a Bill to sanction extensions of the tramways in the area of the Longbenton U.D.C. The capital expenditure is estimated as follows :—Tramways construction, £51,150 ; sub-stations, £4,400 ; 12 motor-'buses, £9,600 ; total, £65,150.

Poole.—Railless Traction Scheme. — The Sandbanks Railless Electric Car Co., Ltd., is promoting a Bill for powers to work a system of railless traction from Branksome Park to Park Gates East. The T.C. has instructed the town clerk to oppose the Bill.

Sheffield.—The B. of T. has sanctioned the City Council's proposal to alter all speed limits of six miles per hour on its tramways to eight miles, and all limits of 10 miles to 12 miles per hour. The net balance on the working of the tramways during the present financial year is estimated at £28,500, and the traffic revenue is estimated at £386,100, as against expenses of £127,694.

South Africa.—During the progress of a terrific thunderstorm in Johannesburg, a tramway motorman named J. F. Hendry received a severe shock. He was driving a car up Orange Grove Hill when a flash of lightning struck the overhead wires. This affected the mechanism of the car, and whilst attending to it Hendry collapsed in the roadway and had to be conveyed to the hospital, where he is now recovering from the shock.

Westhoughton.—Tramway Facilities.—The General Purposes Committee of the D.C. has instructed the clerk to ask the Bolton Corporation to receive a deputation, to ask that Westhoughton be placed within the area of the extension of its tramway district.

Wolverhampton.—The Corporation Tramways Committee proposes to establish a service between Victoria Square and Upper River, and also between Victoria Square and Compton. The Town Clerk has been instructed to apply to the Leisdon R.D.C. and the Tettenhall D.C. for their consent to the services within their respective areas. The Tramways Committee has been authorised to purchase, at the estimated cost of £2,744, four motor-omnibuses for this service.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—The Belgian Minister of Posts and Telegraphs proposes to issue new regulations subjecting the establishment of private receiving and transmitting apparatus to the sanction of the authorities. It is estimated that the number of receiving installations secretly erected in Brussels alone is about one thousand.

Germany.—A company has been formed in Hanover under the title of "Erforschung des Erdinnen," for the exploration of the interior of the earth by means of wireless telegraphy, according to a process devised by Drs. Löwy and Leimbach. The electric waves will be used to locate reservoirs of water, beds of ore, oil and gas accumulations, &c., with a view to turning them to profitable account. Practical tests, it is said, have already demonstrated the utility of the process.

Experiments of this kind were made years ago in this country, with varying success, but eventually the idea was abandoned. We doubt very much whether it is of any value.

Hull.—At a meeting of the Hull Chamber of Commerce on Monday a resolution was passed supporting the proposal of the Corporation's Telephone Committee to take over from the Government the old National Telephone system in the Hull area at a cost of £192,000, subject to the condition that a clause be inserted in the terms of arrangement giving power to the Government to ensure that the system at Hull be efficiently maintained in keeping with the telephone system of the country.

Ireland.—The Post Office authorities last week commenced work in connection with an extensive scheme for developing the telephone service in the Midlands and West of Ireland. Hitherto, messages from Dublin to Athlone and other towns in the centre of Ireland have had to go through Maryborough, but new trunk connections are now about to be made between Dublin and the more important centres in the provinces, and direct services are promised in the near future.

New Cable.—The *Times* correspondent at Colombo states that the cableship *Colonia* arrived there on Thursday last week. She laid 700 miles of cable in the Red Sea, and left Aden on November 23rd. On her voyage to Colombo she let down cable at the record rate of 9½ miles per hour. She will proceed to Malabar, and will return in January.

Norway.—The wireless station at Flekkerö suffered considerably during the heavy storms of last week, which ravaged the whole coast of Norway. One of the masts was broken in two like a match, and by its fall the whole aerial network of wires was torn in pieces. The damage done was enough to put the station out of use for at least a week.

Postal Servants.—At the conference of Postal and Telegraph Clerks at Leicester on Saturday a motion to adopt a strike policy, and to endeavour to make a compact with the National Union of Railwaymen, the Miners' Federation, and the Transport Workers' Union, was defeated by two votes. The conference, however, agreed to stand by any decision of the general body of postal workers on the strike question. The conference rejected the Holt report, and supported by a large majority the application for a 15 per cent. increase for all grades.

On Wednesday the National Joint Committee met and considered the situation in private, and communicated with the P.M.G., who consented to receive the whole of the Committee at the General Post Office on Thursday.

The Telephone Service.—In the course of a speech on Wednesday, Mr. Herbert Samuel said that during the past year the telephone service had been improved in many ways, but was still very undeveloped. The question was largely one of plant, and millions of pounds were being spent on exchanges, subscribers' equipment, trunk lines, &c. The quality of the service was below the standard his department was determined to attain.

U.S.A. Wireless Patents.—In 1910 the National Electric Signaling Co. began suit against the Telefunken Wireless Telegraph Co. of America, for infringement of two patents issued in 1909 to Prof. R. A. Fessenden, and owned by the National Co. On October 20th, 1913, the United States Circuit Court of Appeals handed down an opinion in which the Fessenden patents were sustained and the Telefunken Co. was declared an infringer.

Having these two patents adjudicated, the National Electric Signaling Co. at once began an action for injunction against the Marconi Wireless Telegraph Co. of America, which is alleged to be one of the largest infringers of the patents. A hearing in this case was held at Trenton, N.J., on November 17th, at which time Judge Rellstab issued a preliminary injunction restraining the Marconi Co. from further infringement except as to its pending contracts with the United States Navy. From the representations of the Navy Department it appeared to the Court that a severe inconvenience might result if the Marconi Co. were not allowed to deliver the instruments already contracted for, so this was permitted by the Court under the provision that there be given a bond of $25,000 for the protection of the owners of the Fessenden patents.

Following the order of Court described above, there was filed a motion to suspend the injunction, with affidavits from the Marconi Co.'s engineers stating that the apparatus complained of as infringing was installed at over 500 stations, and that to remove it would require some two months' time. In the argument before Judge Rellstab, on November 21st, at Trenton, the Marconi Co. stated that removing the apparatus immediately, as originally ordered, would so cripple the wireless service that if an accident at sea should occur, great loss of life might result. With this in view, Judge Rellstab suspended the injunction temporarily as to existing ship stations and those on shore intended for ship communication, but still restrained the Marconi Co. from installing the infringing apparatus at any new plants pending final settlement of the case. He further required a bond of $100,000 to guarantee payment to the National Co. of any damages which may be proved to arise from the partial suspension of the injunction.

The invention concerned is a method of sending and receiving wireless telegrams by the use of high-pitched sparks. These rapid musical sparks produce a distinct tone at the receiving station and so permit the operator to distinguish them from other and lower-pitched sounds merely by concentrating his attention on the desired signals.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th, 1914.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" December 5th.

January 14th.—N.S.W. Government Railways and Tramways. Two electrically-driven turbine pumps, 50 gallons per minute, to specification No. 432, price 2s. 6d., obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Melbourne.—March 18th, 1914. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

December 22nd. Melbourne Suburban Railways. (1) Track feed boxes, including signal transformers, switchgear and accessories. (2) Track resistances. (3) Impedance bonds. (4) Track relays and relay boxes. See "Official Notices" November 7th.

December 22nd. Melbourne Suburban Railways. Copper track bonds and accessories. See "Official Notices" November 28th.

January 27th.—Deputy-P.M.G. 17 switchboards and accessories. B. of T. Com. Intelligence Department in London.

Brisbane.—January 7th, 1914. Switchboards, parts and accessories. Schedule No. 274. Telephone instruments, &c. Stores Schedule No. 275. Measuring instruments, &c. Stores Schedule No. 277. Telegraph instruments, &c. Stores Schedule No. 276. Protectors, parts, &c. Stores Schedule No. 278. See "Official Notices" December 5th.

Perth.—January 21st. Deputy-P.M.G. Telegraph instruments and parts. B. of T. Com. Intelligence Department in London.

Belgium.—December 20th. The Belgian Post and Telegraph authorities (Salle de la Madeleine) are inviting tenders for the supply and erection in the basement of the General Post Office in Brussels of three air compressors and three vacuum pumps, all to be electrically operated.

Bootle.—December 17th. 400 tons of steam coal and 3,000 tons of slack for the E.L. station. Borough Electrical Engineer, Pine Grove.

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 KW.; storage batteries, boosters and switch and regulating gear; two 1,500-KW. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" to-day.

Canada.—Bowness, Alta.—December 31st. For the Bowness Improvement Co., 200-KW. traction motor, one four-panel switchboard, one 250-K.V.A. generator, and a gas engine. Mr. T. L. Turnbull, 220, 8th Avenue West, Calgary, is the engineer-in-charge.

Medicine Hat, Alta.—The City Council has decided to call for alternative tenders for a 1,500-KW. and a 2,000-KW. electric generating unit, though it is probable the contract will not be awarded for some time.—*Canadian Electrical News.*

Cardiff.—December 16th. Steel grooved girder tram-rails, British standard section, Nos. 4 and 4 C (500 tons) and steel fishplates (23 tons) for the T.C. Mr. W. Harpur, City Engineer.

Carlisle.—December 31st. Corporation. Two 1,250-KW. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600-KW. rotary converters; and high-tension switchgear. See "Official Notices" to-day.

Crete.—March 13th. Tenders to the "Bureau de la Mairie," Canea, for (1) a 50 years' concession to construct and work an overhead system of electric tramways in Canea and the neighbourhood; and (2) a 50 years' concession for the installation and maintenance of the water supply of Canea and suburbs. Tenders for these concessions were previously invited in June, 1912, and the conditions for the present call are the same as for the previous one.

Copies of the conditions, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Exeter.—December 15th. Steam coal (washed, bean or pea) for the Corporation Electricity Works (about 2,200 tons per six months). Mr. H. Lloyd Parry, Town Clerk.

France.—January 12th. The French State Railway authorities (Bureaux du Service Electrique), 43, Rue de Rome, Paris, are inviting tenders for the supply of 12 electrically-operated cranes at the railway engineering shops at Batignolles.

Paris.—December 23rd. Supply of telephone commutator tables. Ministère des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

Holland.—The Naamlose Vennotschap Electriciteits-fabriek (Yssel Centrale) of Zwolle, is at present inviting tenders for the establishment of a central electric lighting station in the town.

Jerusalem.—Turkey.—December 31st. The Commission d'Adjudication du Government Ottoman. Construction of an electric tramway and the installation of an electric lighting service. Particulars at the Conak du Government Ottoman at Jerusalem.

Leigh (Lancs.).—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" December 5th.

Liverpool.—The Tramways Committee proposes to invite tenders for the supply of six motor-omnibuses.

London.—L.C.C.—December 23rd. Steam, exhaust, condenser, feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" December 5th.

The Highways Committee recommends that tenders be invited from selected firms for additional control gear and recording apparatus for use in connection with the dynamometric testing of car motors at the central car repair depôt; and for the supply of feeder pillar panels, switches, &c,, for the Council's tramways.

Royal Mint.—December 15th. 100 tons of copper in ingots. See "Official Notices" December 5th.

Shoreditch.—December 16th. Corporation. Sub-station plant (transforming and converting plant, starting and controlling apparatus). See "Official Notices" November 21st.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Hackney.—Tenders for the erection of electricity sub-stations. Time extended to December 22nd.

Manchester.—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follows:—Four 1,000/1,250-KW. sets; one 1,000-KW. set; and two 650/800-KW. sets. See "Official Notices" December 5th.

December 16th.—The Corporation Tramways. Material for route number boxes: (*a*) metal fittings; (*b*) aluminium number plates; (*c*) metallic filament lamps. Particulars and forms from the Tramways Manager.

New Zealand.—February 18th. The Christchurch City Council invites tenders for (1) underground and aerial cables, (2) testing instruments, (3) underground trenching and covering, (4) transformers, (5) meters and demand indicators, (6) marline tape and rubber mats, (7) enamelled iron tablets, (8) insulators, (9) service fuse boxes. Specifications 10s. each or £3 for complete set of nine. Apply High Commissioner for New Zealand in London. *New Zealand Shipping and Commerce.*

Roumania.—December 20th. The municipal authorities of Targu-Ocna are inviting tenders for the establishment of a central generating station, and for the electric lighting of the public streets, the latter having a length of about 12 miles.

South Africa.—Heidelberg (Transvaal) municipality is about to invite tenders for the proposed electric lighting scheme, and has been advertising for the names of local firms wishing to participate.—*African World.*

Johannesburg.—January 10th. Six alternating-current to direct-current converters for the Municipality. Specifications from the General Manager, Gas, Electric Supply and Tramways Department, President Street, Johannesburg.

Durban.—January 7th. Gas-electric plant for the Municipality. Town Clerk, Municipal Buildings, Durban. Copies of specifications at the office of the Borough Engineer, Municipal Buildings, Durban, £1 1s.—*British and S.A. Export Gazette.*

South Shields.—December 13th. Corporation. Two water-tube boilers, with mountings and fittings, &c.; one economiser. See "Official Notices" November 28th.

Spain.—December 18th. Tenders are being invited until the 18th inst. by the municipal authorities of Agudo (Province of Ciudad Real) for the concession for the electric lighting of the town during a period of years.

The municipal authorities of Borja (Province of Zaragoza) have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Wigan.—December 22nd. Corporation. Six double-deck tramcar bodies with top covers, six trucks, six complete electrical equipments. See "Official Notices" to-day.

Wolverhampton.—December 16th. Supply and laying of cables, re-wiring lamp standards, &c., Heath Town Workhouse, for the B. of G. Mr. F. Harrison, Clerk.

Worksop.—December 15th. Electric light installation (123 lamps) for the B. of G. Mr. J. S. Whall, Clerk, 66, Bridge Street.

York.—December 22nd. Corporation. Stores for electricity and tramways department. See "Official Notices" December 5th.

CLOSED.

Argentina.—The Santa Fe Municipality has contracted with Messrs. Barnes & Gross, of Rosario, for the supply of 500 arc lamps for the public lighting service. The contract price is about $50,000.—*Review of the River Plate.*

Australia.—The following tenders have been accepted:—

N.S.W.—Postmaster-General's Department.

9,200 rectangular dry cells, 2s. 1d. each—W. G. Watson & Co., Ltd.
54,000 ft. glazed earthenware conduit.—Hoffman Brick and Potteries, Ltd.
Two sections of switchboard, common battery, multiple, for the Sydney Telephone Exchange, £2,824.—British General Electric Co., Ltd.

Victoria.—Postmaster-General's Department.

Telephone material.—Western Electric Co. (Aus.), Ltd.

Tasmania.—Postmaster-General's Department.

Telephone material.—Western Electric Co. (Aus.), Ltd.
500 electrical registers, 7s. 9d. each.—G. Bartram & Son, Pty., Ltd.

Melbourne.—

Telephone material.—J. Bartram & Son., Ltd.
2,000 jacks, five-part, £67; 500 combined listening and ringing keys, £76; 15 miles paper insulated, lead-covered cable, 416 pairs, 19-lb. conductors, not served, £16,500; 15 miles ditto, 26 pairs, 12½-lb. conductors, served, £2,490.—B.I. and Helsby Cables, Ltd.—*Australasian Record.*

Prahran and Malvern Tramways Trust.

Tramway points and crossing, £917.—The Steel Co. of Australia.—*Tenders.*

Goulburn (N.S.W.).—A contract has been secured by the I.R., G.P. and Telegraph Works Co., Ltd., Sydney, for the whole of the plant, consisting of 128-B.H.P. Hornsby suction gas plant, two 75-KW. 480-500 Silvertown generators, belt-driven, and equipped with static balancers, and a motor-driven three-wire booster.—*Commonwealth Engineer.*

Bacup.—The Corporation has decided to order 12 three-ampere meters from the B.I. and Helsby Cables, Ltd.

Batley.—The Electricity Committee has accepted the tender of the Leeds Meter Co. for pipe scraper apparatus (£120).

Bradford.—The Corporation Sewage Committee has accepted the tender of Messrs. Whitehead & Poole, Ltd., of Manchester, for an electrically-driven revolving sewage screen, with reducing gear and motor complete, for £288, for the Esholt Sewage Works.

The Visiting Committee of the Board of Guardians has accepted the tender of Mr. Charles Bell, of Bradford, for the alteration of the electric lighting installation at the Guardians' laundry.

The City Council has accepted the tender of Messrs. G. A. Steinthal & Boydell, Ltd., for installing electric light at the Technical College, at £539.

Caledonian Railway.—The Edison & Swan United Electric Light Co., Ltd., have secured the contract for the supply of electric lamps to the Caledonian Railway Co.

Canada.—The Canadian British Insulated Co., Ltd., has received an order from the Hydro-Electric Power Commission of Ontario for 24,000 ft. of 300,000 cm. three-core paper-insulated lead-covered cable, for 13,000-volt service.

The City of Winnipeg has awarded contracts as follows :—Three 600-KW. transformers and electrolytic lightning arresters, the Canadian General Electric Co.; switches to Ferranti, Ltd.—*Canadian Electrical News.*

Colne.—Tenders received for the installation of a water softening and grease eliminator plant at the electricity works have been referred to a Sub-Committee with power to act.

Darlington.—The T.C. has accepted the tender of Messrs. Dove & Co., of Darlington, for the wiring of outside lamps.

East Ham.—The tender of Babcock & Wilcox, Ltd., has been accepted by the T.C., at £534, for two automatic stokers for the generating station.

France.—The results of the adjudication on the tenders called for on November 11th by the French Ministry of Public Works, Posts and Telegraphs for rubber and cotton-covered copper wire, with two conductors, are the acceptance of the following offers :—

Société Industrielle des Téléphones.—First and second lots, 109.90.
Geoffroy et Delore.—Third lot, 96 65; fourth lot, 96.55; and fifth lot, 96.35.

Ilkley.—The Town Hall Committee, after considering schemes for lighting the Winter Gardens by electricity, has resolved to obtain the necessary fittings from Mr. Charles Bell, of Bradford.

Keighley.—The Corporation Tramways Committee recommends the Council to accept the tender of the Cedes Electric Traction, Ltd., for the supply and erection of overhead equipment on the Oakworth and Eastburn trolley vehicle routes at an inclusive price of £923 per mile, and for the supply of four trolley vehicles at £720 each. The approximate length of the route is six miles, seven furlongs.

The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a spare motor, at £500.

Llandaff and Dinas Powis.—The U.D.C., on December 3rd, accepted the tender of the B.I. and Helsby Cables, Ltd., for cables and laying, at £3,161.

London.—WESTMINSTER.—The City Council has accepted the tender of Speedy, Eynon & Co., at £20, for rewiring and rearranging the electric lights at the Buckingham Palace Road Library.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E., have obtained the contract for tantalum and Wotan drawn-wire lamps for the Metropolitan Railway for the ensuing 12 months.

L.C.C.—The Highways Committee has placed a contract with Messrs. Cammell, Laird & Co., Ltd., for 100 axle forgings, 5¼ in. diameter, at £2 1s. 9d. each.

L.C.C.—The Stores and Contract Committee recommends the acceptance of the following tenders:—For electric carbons (Schedule No. 13) for 12 months, Crompton & Co., Ltd., items 2, 3 and 4; and the Sloan Electrical Co., items 1 and 5.

HACKNEY.—The Electricity Committee has accepted the tender of Rice & Son, Stockwell Road, S.W., of £11,569, for the completion of the electricity works extensions.

STEPNEY.—The Electricity Committee. For the supply of switchgear, the following firms tendered :—

Reyrolle & Co., Ltd.	(recommended)	£6,275
Johnson & Phillips, Ltd.		6,656
Switchgear & Cowans, Ltd.		6,732
British Westinghouse Electric & Manufacturing Co., Ltd.		7,012
British Thomson-Houston Co., Ltd.		7,200

The Highways Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for 16 armatures (class 220), and 80 field coils at £38 18s. an armature and £6 a coil; 20 coupler heads have been obtained from the A.B. Coupler, Ltd., at a cost of £60 for fitting to standard cars for use with trailers, also six buffer heads for tractors, and bufferhead couplers for trailers as spares, at £27.

BATTERSEA.—The B.C. is purchasing from the British Vulcan Soot Cleaning Co., for £83, an apparatus which is designed to facilitate the cleaning of the No. 10 boiler at the central generating station.

Manchester.—The Electricity Committee of the Corporation has accepted the following tenders :—

1,800/2,200-KW. converter for Dickinson Street sub-station.—Bruce Peebles and Co., Ltd.
Supply of 12 months' requirements of static transformers.—Ferranti, Ltd.
Supplies of cable.—W. T. Glover & Co., Ltd.; Liverpool Electric Cable Co., Ltd.; Charles Macintosh & Co., Ltd.; and Johnson & Phillips, Ltd.

Rotherham.—The T.C. has accepted the tender of the Rees Roturbo Engineering Co, at £488, for motor-driven pumps at the sewage outfall works.

Sheffield.—The City Council has accepted the tender of the Brightside Foundry and Engineering Co., Ltd., at £73, for installing hot-water supply apparatus at the Holme Lane car depôt.

St. Helens.—The Electricity Committee has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable required in connection with the new 600-KW. rotary converter.

Tunbridge Wells.—The T.C. has accepted the tender of Mr. H. A. Stonham for installing the electric light at the sanatorium, at £105.

Wakefield.—The Electricity Committee has accepted the tender of the Victoria Coal and Coke Co. for coal.

Walsall.—The following tenders have been accepted by the T.C. :—

General Electric Co., Ltd.—Sub-station gear, £41 10s.
G. Robson & Co.—Combined electric track grinder and drilling machine.

Watford.—The tender of the Electrical Construction Co. has been accepted by the U.D.C., at £52 10s., for a new feeder panel.

Wolverhampton.—The Corporation Electricity Committee has accepted the following tenders :—

Willans & Robinson, Ltd., £13,159, for a 4,000-KW. turbo-alternator with condenser, and steam and water pipes, &c.; and
A. Reyrolle & Co., Ltd., £650, switchgear for the extension plant.

Worthing.—The T.C. has accepted the tender of Messrs. Bodle & Addison, of Eastbourne, for extensions to electricity works, at £1,787.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, December 15th.—"A" Company. Technical instruction 7 p.m. to 10 p.m.
Tuesday, December 16th.—"B" Company. Ditto.
Wednesday, December 17th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.
Thursday, December 18th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.
Friday, December 19th.—"D" Company. Special class on Crossley engine, 7 p.m. Technical instruction, 7.30 to 9.30 p.m.
Saturday, December 20th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Strike at Schenectady.—Labour troubles at the Schenectady Works of the General Electric Co. have resulted in partial cessation of work there. On the morning of November 25th, after negotiations between the company and representatives of the men, from one-third to one-half of the employés struck. During the day many of those who had remained at their posts in the morning left their work. A number of the men have since returned to work, and at the time the *Electrical World* of November 29th went to press, about 13,000 were out. Two workers who were laid off are the ostensible cause of the trouble. These employés were said to have been active in Union matters, and for that reason the action taken by the company in regard to them was made the basis of a strike. Another definite cause which had a potent influence in the matter was the existence of Unions among the employés between which there has always been strong feeling. Mr. G. E. Emmons, manager of the Schenectady Works, made a statement to the effect that, owing to a falling-off in business, it had become necessary for the General Electric Co. to reduce force in all of its apparatus factories, the Schenectady Works being the last to be affected. Instructions were accordingly issued to the superintendents of the various divisions directing that such reductions in force as were necessary to meet business conditions should be made. Without any intent to discriminate against any individuals or class of employés, it happened, on the merits of the case, that a certain man and woman who had been prominent in labour matters were laid off, among others in the department where they were employed.

ELECTRICITY AT THE MIDDLESEX GUILDHALL.

An installation of more than ordinary interest has recently been carried out at the new Guildhall of the County Council of Middlesex, in Westminster, by Messrs. A. V. Gifkins and Co., to the specification of Mr. R. A. Smith, M.I.E.E. The building is a very fine example of high-class architecture, in a style resembling that of the Tudor period, which harmonises admirably with the environment—the site being close to Westminster Abbey and other historic buildings; the architects were Messrs. J. S. Gibson, Skipwith and Gordon, in collaboration with Mr. H. T. Wakelam, M.Inst.C.E., the County Surveyor, and the general contractor for the building was Mr. J. Carmichael.



Middlesex Guildhall: Court No. 1.

The equipment comprises, in addition to the electrical installation, a steam heating system and domestic hot water supply, and the arrangements for heating and ventilation have been carried out with exceptional completeness and foresight.

The wiring is enclosed throughout in screwed solid-drawn steel barrel, the whole of which was laid before a single wire was run. The ends of the pipes are fitted with smooth brass bushes wherever they enter boxes. The latter are of cast-iron, and are provided, where necessary, with bridge-pieces for adjusting the switch-plates to suit any possible variation in the final level of the plaster; the switches are all of the flush type, with plates finished to match the corresponding fittings.

The cables were supplied by Messrs. W. T. Glover and Co., Ltd., of the C.M.A. 2,500 and 600-megohm class; the largest are 37/16, supplying the main switchboard, which is fixed in the basement. Connections are made to both sides of the Westminster Electric Supply Corporation's three-wire system, to balance the load as closely as possible. An entirely separate connection, however, is taken from the mains to the electric kitchen, which is in a room on the third floor; the main cable in this case is paper-insulated, lead-covered and armoured, size 37/14.

The main switchboard consists of three marble panels, carrying D.P. switches and fuses: the centre panel provides for the three larger motors at 400 volts across the outers, and each of the other panels, at 200 volts, carries 11 ways for lighting, and two ways for power, besides two main switches for these sections. The power installation comprises a passenger lift, three service lifts, sump and sewage pumps, and four ventilating fans. Two fans in the basement are blowers, driven by 2½-H.P. 200-volt Holmes variable-speed motors; two in the tower are exhaust fans, similarly driven, and all are controlled by two starter and regulator panels, made by Messrs. A. V. Gifkins & Co., and fixed in the basement. To prevent accident to workmen, a three-pole switch in a lock-up case is provided in the tower fan room, by means of which the mains and the shunt connection to the fan-motors can be completely cut off from the supply.



Court No. 2.



Council Chamber.

About 30,000 ft. of conduit and 20 miles of wire (including that used for bells and telephones) were required to carry out the work.

The whole of the ornamental fittings used in the Guildhall were made by Messrs. H. H. Martin & Co., under the direction of Mr. O. R. Albrow, and were specially designed to suit the surroundings in which they would be used. They differ,

accordingly, in the various halls, and as the beauty of a fitting cannot be justly apprehended unless it is seen in the appropriate setting, we have photographed the upper parts of the principal rooms with the fittings in place.

In the Council Chamber there are six electroliers, each carrying eight 32-watt tungsten lamps, in two sets, fed from different circuits. Each fitting is of hand-hammered metal with a plume bronze finish, and weighs over $1\frac{1}{2}$ cwt.

Court No. 1 is provided with 12 fittings in bronze, each of which carries four 32-watt lamps ; and Court No. 2 has eight corona fittings, six of which carry four lamps and two five lamps each.

The main corridors are provided with two-light fittings, shown in one of our views, and the staircase will be lighted by a very handsome electrolier.

The kitchen contains an unexpectedly large array of electric cooking apparatus, the whole of which is of the "Tricity" make, and was supplied and fitted by Messrs. A. V. Gifkins & Co. The 800-watt standard heating unit,



Electric Cooking Apparatus: Grill, Ovens, &c.

with double control, is used throughout the installation, in connection with the special plug-boards, with signal lamp, &c., supplied by the British Electric Transformer Co. for the purpose. Thirty of these units are provided, making a total maximum demand with other apparatus of 29·5 kw.

There are two double ovens, each fitted with four units, and built in two compartments ; over these are hoods. A large double grill of the standard hotel type is provided, with four heating units—two above and two below ; under the grill is a large hot cupboard, capable of warming 150 plates, and provided with portable racks holding 30 plates each.

In the middle of the room is a carving table fitted with four units ; on the top are two hot carving dishes, and below there is a hot cupboard.

The remaining apparatus includes three steamers, each large enough for three 12-pint saucepans, and fitted with two heating units ; two 2-gallon copper urns ; one fish-kettle ; one ham-boiler ; one milk-saucepan ; two bains-marie, with copper pots ; and one large fish frier, heated by two units.

The tables are covered with polished pewter, the walls are lined with white tiles, and the whole kitchen presents apicture of neatness and cleanliness unapproachable with any but the electric system of cooking.

The bell and telephone installations are of the same high quality as the rest of the equipment. All the wiring—which is insulated with "Pernax"—is enclosed in solid-drawn screwed barrel ; the bell-pushes are of Messrs.



Fittings in Corridor.

Lundberg's "Pixie" type. The bell system is exceptionally complete, single bell circuits from room to room being used in many cases in addition to indicator systems. A 30-line private telephone exchange is installed.

The heating apparatus for the Courts and the Council Chamber, installed by Messrs. Rosser & Russell, Ltd., is controlled by an automatic electrical regulator.

The whole undertaking reflects credit alike on the engineers and contractors, and is worthy of the fine building which it is to serve. We are much indebted to Mr. R. W. Willis, A.M.I.E.E., who has supervised the work on



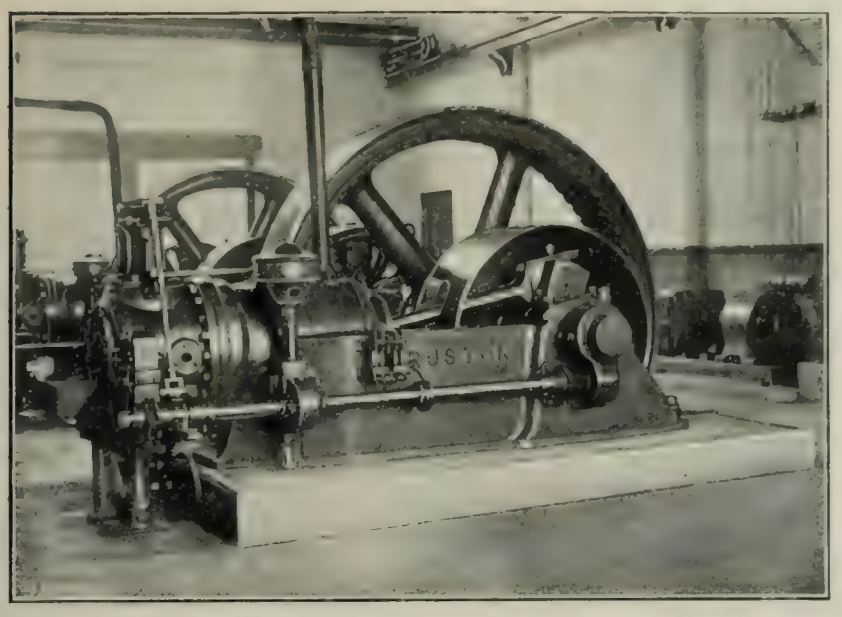
Carving Table and Various Utensils.

behalf of Mr. R. A. Smith, and to Mr. G. H. Kilsby, of Messrs. A. V. Gifkins & Co., for their kind assistance in compiling these notes.

SMALL ELECTRIC LIGHT AND POWER UNDERTAKINGS.

By H. P. GIRLING, M.I.E.E.

There has been much discussion recently in these columns concerning the possibilities of the development of electric lighting in villages, and I firmly believe that there is considerable scope in this direction provided the problem is



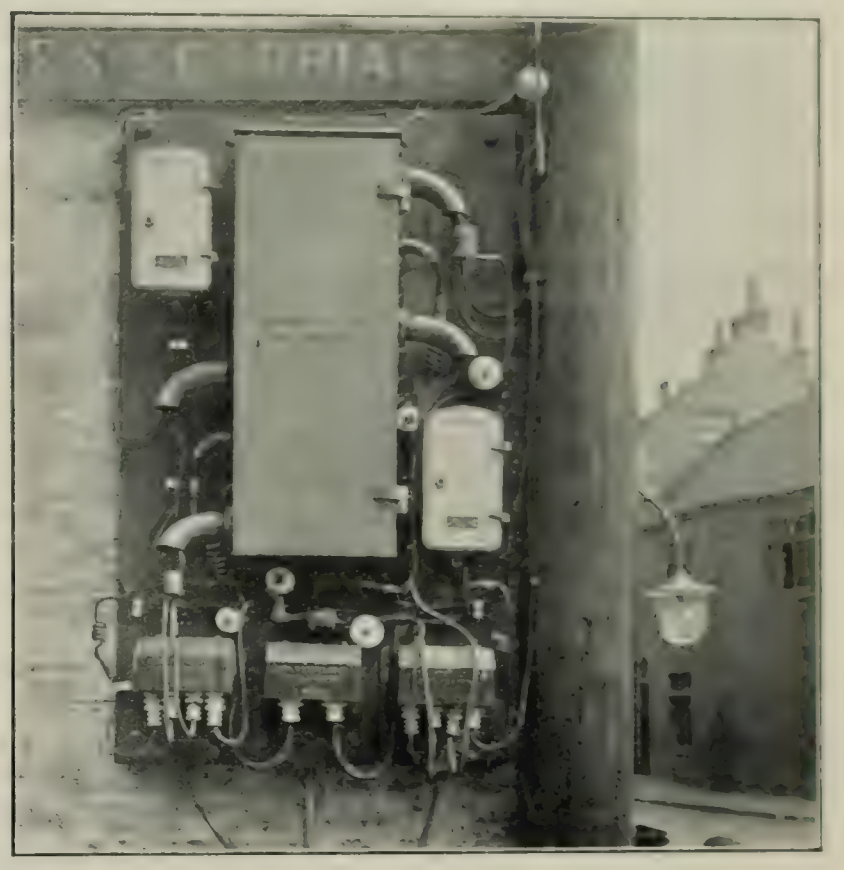
Gas Engine Plant, Barton-on-Humber E.L. Station.

tackled in a common-sense, businesslike way. Villages must inevitably be treated upon different lines to small towns; in fact, there is just as much difference between the two propositions as there is between the provision of electric supply for a small town and for a large city.

A very good object-lesson is found in methods of supplying ordinary everyday necessities. For example, the grocer in the village is more often than not also the linen draper, and may also supply newspapers, tobacco and boots, and sometimes he is a universal provider in a humble way. Then, again, he does not wait for customers to come in from the outlying farms, and other scattered houses, but two or three times a week sends out a miniature shop on wheels, to catch those who might otherwise leave their shopping to a weekly visit to the nearest market town, and generally to encourage trade.

Electricity, to be a success in a village, must be supplied on the same lines; it must be an additional commodity offered by the local cycle engineer, plumber, repairer of property, builder, or even the blacksmith, any of whom, if personally intelligent, can be trained to run the "central station" as a well-paying hobby, the wiring being done by an electrical man from the nearest town if the promoter is not prepared to undertake it himself. If no suitable tradesman can be found, it often happens that there is a well-to-do resident in or near the village who desires the convenience of water and light in his own house on modern lines, and has the interest of the village sufficiently at heart to entertain a scheme for public lighting, especially if he can be satisfied that it will be self-supporting, and if he has a chauffeur who can, by attending to it, earn part of his wages.

To come to the point with which this article is more directly concerned, viz., the supply of electric light and power to small towns; there is, of course, a much better chance of securing the necessary consumers and financial support in this case. Though not absolutely essential, two very important factors in the successful operation are street lighting and a power load, since while private house lighting



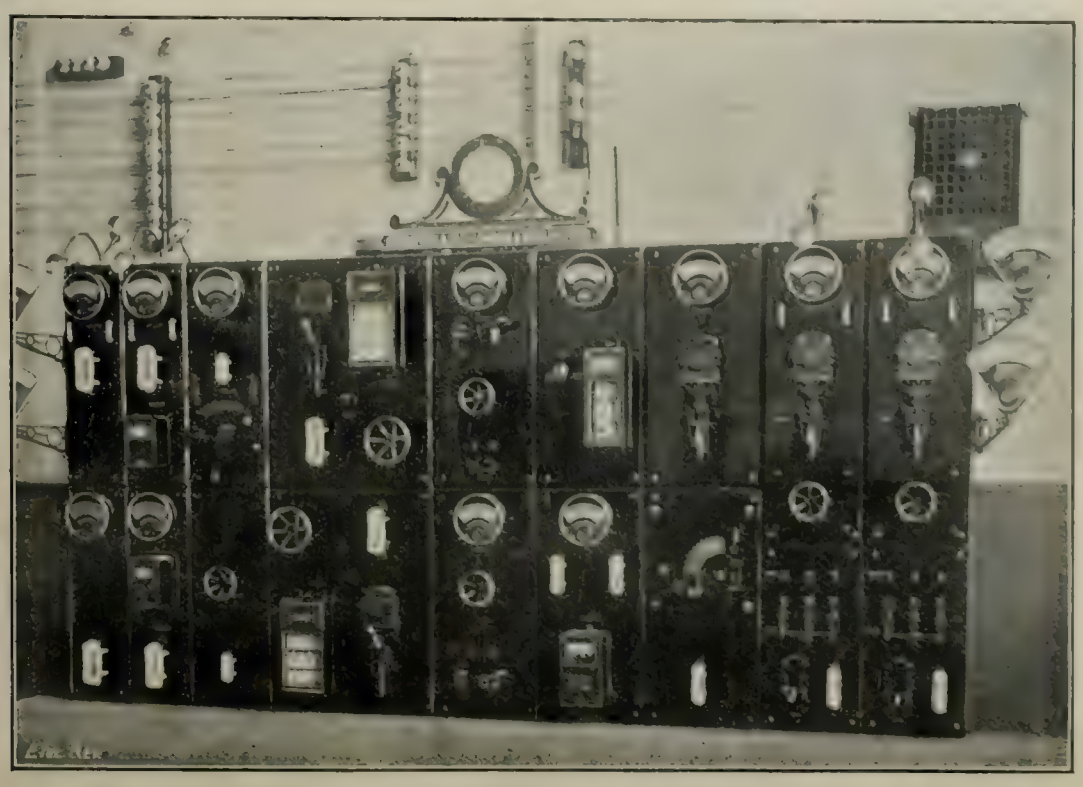
Terminals for Overhead Lines.

may be the most remunerative per unit supplied, it is generally insufficient to maintain an efficient special staff except, perhaps, at seaside towns and other holiday resorts where an exceptional demand for plenty of good light is experienced. When neither of these two outlets is obtainable, the problem has to be dealt with on similar lines to village lighting as above described, if it is to pay its way.

A third, and still more important, factor in small town lighting on a successful basis is found in overhead wiring. There are very few unpretentious towns that can afford the doubtful luxury of underground wiring. It costs five or six times as much, and is a continual source of annoyance both to the engineer in charge and the "man in the street."

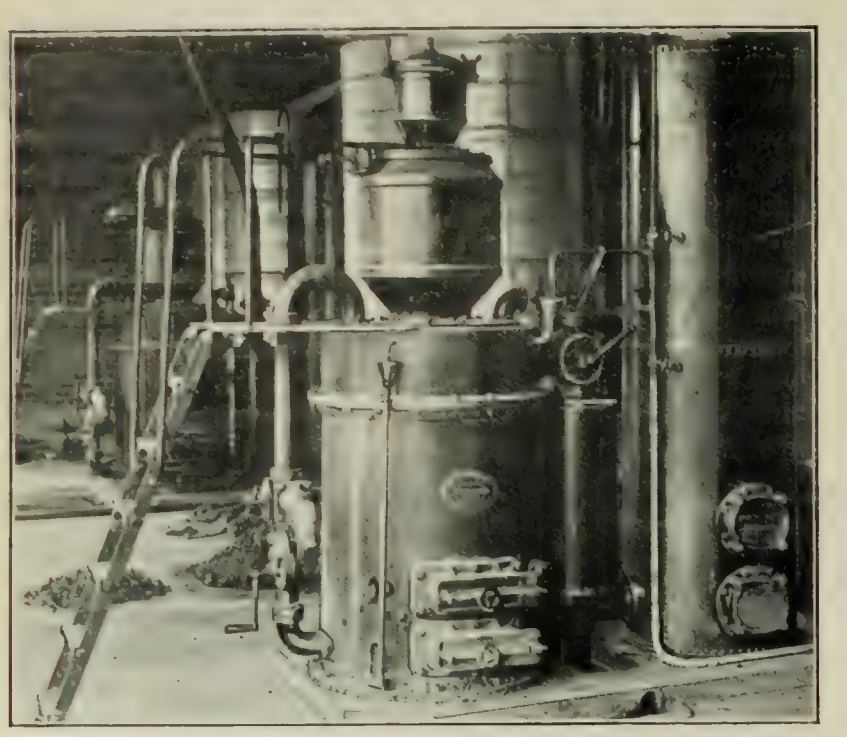
The necessary additional capital outlay involved by underground wiring usually cripples the small concern hopelessly, which struggles to rectify matters by a higher price per unit, thus choking off prospective consumers, and sounding its own death knell.

Then, again, even if it is a fairly wealthy neighbourhood, and the money is



View of Main Switchboard.

forthcoming, the new company, though successfully floated, gets itself into bad odour from the start by disturbing all the roads, and continues to be a nuisance so long as new consumers are being connected; and after this has died down to unimportance by its infrequent occurrence, it is more than probable that faults may begin to develop, again necessitating the disturbance of the road



Producer Plant, Barton-on-Humber E.L. Station.

surface with its accompanying adverse comments tending to make the supply unpopular.

On the other hand, overhead wiring and services can be erected without incommoding the public at all, and faults, which are much less likely to occur, can generally be detected very readily and rectified without their occurrence being known. The objection of appearance is often raised, but can be overcome by well-designed steel poles in the more important thoroughfares, and neat wooden ones in the outlying districts, especially if people are well informed that current will be available at a lower rate as a result of overhead wiring, and much annoyance to them will be avoided.

A brief description of the plant and general conditions



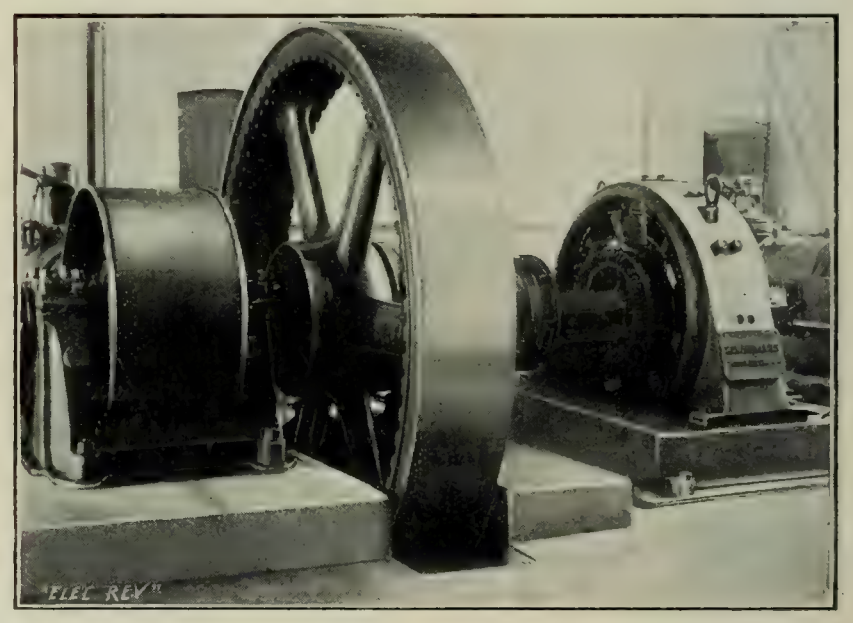
Overhead Transmission and Street Lighting.

at Barton-on-Humber will serve to illustrate the usual difficulties met with, and points of interest which arise in connection with small town supply.

By way of introduction, it may be stated that the conception and inauguration of this scheme were almost entirely due to the enterprise of Mr. F. Hopper, the founder of the large cycle factory in Barton-on-Humber, known as the Elswick-Hopper Cycle and Motor Co., Ltd., which now employs some 800 persons, and sends out, amongst other things, about 1,000 cycles per week to all parts of the world.

The electric lighting and power scheme originated from the uncompromising attitude of the local gas company, and the consequent demand for some other and better form of light to compete with gas. Street lighting was one of the chief troubles, and this was met by an offer from Mr. Hopper to undertake a 12 years' street lighting contract for 150 electric lamps of 100 c.p. each at £2 2s. per lamp per annum, from lighting-up time until 12 o'clock midnight during the lighting season. This offer was accepted, and the present company, with a nominal capital of £20,000, was the result. The company has a very excellent prospect before it, owing to the local industry consisting largely of the manufacture of bricks and tiles, which only require power in the daytime of the summer months. This should prove an immense help to the establishment of a good load factor. In addition to this, there are numerous small power consumers, as well as one or two using several hundred horse-power each, in the district.

It is not proposed to issue the whole of the shares at present, as a good margin has been allowed for future extensions. It is interesting to note, however, that nearly half the total amount has already been subscribed locally, and fully paid up in £1 shares issued at par, thus establishing the company on a good sound financial basis,



Crompton Generator, coupled to Gas Engine.

especially as the directors include some of the most influential gentlemen of the district.

As regards plant which has actually been laid down, the buildings, which are often dealt with on the "anything will do" principle, have in this instance been very carefully thought out, and specially erected to the designs of a local architect, Mr. W. Stamp, who has not neglected to make them of good appearance, and has been assisted by the writer in his capacity of consulting engineer. They consist of a lofty engine room, 65 ft. × 28 ft., fitted with a suitable overhead travelling crane to facilitate repairs and extensions, a lean-to on one side accommodating gas producers with a reinforced concrete floor above for the storage of fuel, which can thereby be fed straight through hoppers by gravity to the producers. The side of this lean-to, which is partly open at the top, has the ground floor entirely closed in by sliding doors to admit of unlimited ventilation.

On the other side of the engine room is a second lean-to forming the battery room, stores and offices.

In addition to this, a very nice engineer's house has been erected on an adjoining site with a showroom in the front, which has the obvious advantage of making it easy to keep goods on show all day and throughout the evenings with very little expense or trouble, and, incidentally, there is a much greater likelihood of the chief being in the power house quickly should any emergency arise which may enable him to avert serious trouble. It also gives him numerous opportunities of tackling prospective consumers while they are in the mood to listen to his propositions. It may be suggested that the engineer does not always want to be too

handy to be bothered by just anybody and at all hours; but if he has the success of his undertaking at heart as he should have, this will not be the case in a small town, whatever it might be in a larger one.

The generating station at Barton has been designed for two 70-H.P. units as already installed, with room for one 140-H.P. set at one end of the building, and ample space to extend the building at the same end when necessary. In addition to this, an arrangement has been made whereby power shall be available in emergencies from the cycle factory of the Elswick-Hopper Cycle and Motor Co., Ltd., on the adjoining property, where some 400-H.P. of generating plant is in operation.

The plant installed by the Barton-on-Humber Electric Supply Co., Ltd., includes two 70-H.P. anthracite suction gas plants and engines by Messrs. Ruston Proctor & Co., Ltd., of Lincoln. The engines are fitted with their electric lighting type heavy fly-wheels and throttle governing, with the result that a very steady voltage is obtained.

Each of these engines is directly connected by means of a Zodel Voith flexible coupling to a 45-KW. 440-480-volt Crompton continuous-current interpole compound dynamo with a single-pole handgrip ironclad fuse attached to it to avoid the otherwise fatal consequences of a short in the mains between it and the switchboard.

The auxiliary plant includes a double hand reversible motor-driven booster, consisting of three machines coupled together on one bedplate, and a C.M.B. balancer capable of dealing with 40 amperes out of balance. Both of these are of Messrs. Crompton & Co.'s manufacture and are doing their work very satisfactorily.

The whole of the apparatus is controlled from a 19-panel switchboard which has been erected along the wall dividing the engine room from the battery room, and right up at the extension end of the building, so that there will be ample room for adding to it, and it may be somewhere near central when the station has assumed its probable final dimensions.

The switchboard was also supplied by Messrs. Crompton. The dynamo panels are fitted with the usual meters, shunt regulators, voltmeter plugs and pilot lamps. A S.P. overload and reverse loose-handle type circuit-breaker is fitted in one pole, and a porcelain handgrip damped fuse in the other pole. The dynamos are also arranged with the aid of a D.P. field-breaking switch and three-pole change-over main switch (positive, negative and equalising) to start the gas engines electrically by means of one of the boosters. One position of this main switch is arranged to join the booster armature terminals direct across the terminals of the generator with the compound winding cut out. When ready to start the engines, the gas is turned on full and the engine put on half compression. The booster is then started up and adjusted to give two or three volts in such a direction that the positive of the booster armature shall be connected to the positive of the generator armature when the main three-pole switch is closed in the starting position. This operation is then performed and the pressure on the booster increased gradually by means of its shunt regulator so as to maintain the current through the dynamo armature at about its normal full-load rating. This current is allowed to pass until the engine fires sufficiently to bring the current down to nearly zero, when the circuit is immediately broken and the voltage of the generator adjusted in the usual way as soon as full speed is obtained, when it can be paralleled by dropping the main switch into the running position.

This method is found to be very satisfactory, and is a great improvement upon compressed air or other means of starting owing to its almost unlimited capacity since the booster motor takes a trivial amount of current to supply the heavy low-voltage current required, *i.e.*, only about 10 or 15 amperes are taken from the battery during the process.

The booster panels are fitted with an auxiliary circuit arranged to avoid the possibility of an accident due to the booster being switched into circuit with the battery, before the motor is started, or the motor being shut down before the booster is taken out of the battery circuit, either of which operations would be very liable to cause the booster to race and burst by centrifugal force, a fact which central-station engineers know to their cost. To accomplish this an overload circuit-breaker is fitted in one pole of the motor circuit, which short-circuits the no-volt coil on the motor starter if, due to any cause, it should trip. This, of course, throws the motor starter into the "off" position, and thereby closes an auxiliary circuit by means of a small short-circuiting switch attached to the handle, provided the three-way booster switch is in the position to connect the booster in series with the battery, when it also closes the same auxiliary circuit at another point by means of a similar short-circuiting switch on its underside, and two small contacts. This auxiliary circuit includes a shunt-coil round the battery circuit-breaker powerful enough to trip it, thus preventing the battery from driving the booster, as would otherwise be the case.

This would, of course, mean a momentary discontinuity in the supply if there happened to be no engine sets connected on to the bars at the same time, but it only requires a moment to get the booster three-way switch on to the battery terminal, and to close the battery breaker, or, alternatively, to get the booster motor running again, and it is certainly better to risk this than the possible expense of rewinding a booster and repairing any consequential damage, which might be of a very serious nature.

The writer has had this arrangement fitted elsewhere, and in every case it has had occasion to fulfil its function sooner or later, especially when a new hand is on the switchboard. This more than warrants the slight extra expense involved.

Each of the battery panels has an overload loose handle circuit-breaker fitted with the above auxiliary coil, a porcelain handgrip fuse in the other pole, and a hand wheel connected by bevel gears to the single function battery regulating switches mounted on the wall behind the board, so that bare connections can be taken from the back of it direct to the regulating cells in the accumulator room behind. The position of the switch on the contacts is made clear by means of a mirror suspended above the board.

An integrating recording wattmeter is provided to indicate the total number of units generated, and in addition there are a pair of ampere-hour meters arranged to integrate the total watts delivered at the declared voltage, for checking the house-service meters.

The battery supplied by the Tudor Accumulator Co. consists of 260 cells capable of a discharge rate of 66 amperes for six hours down to 1·8 volts per cell; the plates are mounted in glass boxes of such size that additional plates can be added so that the battery can be brought up to a capacity of 100 amperes for six hours down to 1·8 volts per cell, if required later on.

The mains are of the overhead type, consisting of bare single-strand copper supported on creosoted wooden poles in the outlying district, which have been finished off by having painted battens banded on to them for about 4 ft. up. In the better streets, however, painted steel poles with dwarf bases have been used for the sake of appearance, and in the leading streets, which are very narrow, underground lead-covered cable has been drawn into earthenware pipes, these cables being of the four-core type, so far as the distributors are concerned, and two-core feeders. The branches are connected by married joints in hermetically sealed lead joint boxes filled up with compound.

Lightning arresters, and the necessary choke coils have, of course, been fitted wherever the overhead work joins the underground, and the neutral wire is well earthed at the ordinary Board of Trade station earthing panel.

The street lamps are controlled in groups by Venner time switches, which are designed to give morning lighting as well as evening lighting when required.

The mains and machinery have been very neatly installed by Messrs. Crompton & Co.'s contract department, and the whole of the work has been carried out to the writer's specification.

It is interesting to note that wiring for lighting purposes to the extent of considerably over the equivalent of 1,000 20-watt lamps was completed ready for use before the first engine was started up in July last, in addition to a good power and heating load, and that some considerable extensions to the mains have already been carried out, and others are under consideration.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, December 12th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, December 12th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Primary Batteries," by Mr. A. Bucklitsch; "Secondary Batteries," by Mr. H. J. Roberts.

Junior Institution of Engineers.—Friday, December 12th. At 8 p.m. At 39, Victoria street, Paper on "Efficiency of Production," by Mr. H. N. Munro.

Saturday, December 13th. At 7 p.m. Reception, Dance and Whist Drive, at Caxton Hall, Westminster.

Manchester Association of Engineers.—Saturday, December 13th. At Grand Hotel, Aytoun Street. Paper on "Commercial Motor Road Traffic," by Col. R. E. Crompton.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 13th. At 2 p.m. At Newcastle-on-Tyne. General meeting.

Monday, December 15th. At 8 p.m. At Chemical Theatre of Armstrong College, Newcastle. Fifth and last lecture on "Utilisation of Fuel," by Prof. J. W. Cobb.

Institute of Marine Engineers.—Monday, December 15th. At 8 p.m. Paper on "Electric Welding," by Mr. J. B. Hamilton.

Royal Society of Arts.—Monday, December 15th. At 8 p.m. At John Street, Adelphi, W.C. Cantor Lecture (III) on "The Measurement of Stresses in Materials and Structures," by Prof. E. G. Coker.

Wednesday, December 17th. At 8 p.m. Paper on "The Channel Tunnel," by Mr. A. Fell.

Physical Society.—Tuesday, December 16th. At 3 to 6 p.m. and 7 to 10 p.m. At Imperial College of Science, South Kensington. Annual exhibition. At 4.30 p.m. Discourse on "Spiral Electric Discharges," by Prof. the Hon. R. J. Strutt.

Illuminating Engineering Society.—Tuesday, December 16th. At 8 p.m. At the Royal Society of Arts, 18, John Street, Adelphi. Paper on "Daylight Illumination, with special reference to School Planning," by Mr. P. J. Waldram.

Institution of Civil Engineers.—Tuesday, December 16th. At 8 p.m. At Great George Street, S.W. Ordinary meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, December 16th. At 7.30 p.m. At the University (Physical Laboratory). Paper on "Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, December 16th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Papers.

Institution of Electrical Engineers (Students' Section).—Wednesday, December 17th. At 7.45 p.m. At Victoria Embankment, W.C. Discussion on "Underground and Surface Transport of Passengers and Goods in London."

Institution of Electrical Engineers.—Thursday, December 18th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Chemical Society.—Thursday, December 18th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Institution of Electrical Engineers (Birmingham Local Section).—Friday, December 19th. At 7.30 p.m. At the Grand Hotel. Annual Dinner.

Institution of Mechanical Engineers.—Friday, December 19th. At 8 p.m. At Storey's Gate, S.W. General Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Junior Institution of Engineers.—Friday, December 19th. At 8 p.m. At 39, Victoria Street. Paper on "Continuous Feeding Elevators," by Mr. T. C. Morewood.

Saturday, December 20th. At 2.30 p.m. Visit, Generating Station at Stratford.

Association of Mining Electrical Engineers.—Saturday, December 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Electric Winding," by Mr. J. Gillespie.

NOTES.

The Christmas Holidays.—We shall be glad if readers and advertisers will take special note of the following arrangements consequent upon the ELECTRICAL REVIEW for December 26th having to appear on the morning of Wednesday, December 24th.

It will be necessary for that issue to go to press much earlier than usual, and it is imperative that all communications for the editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 22nd.

The advertisement department announces elsewhere in to-day's pages, that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, December 19th. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, 23rd inst.

Northampton Institute.—On Friday and Saturday last the staff, students and friends of the Northampton Polytechnic Institute, Clerkenwell, as usual at this time of the year, gave themselves over to the interesting proceedings connected with their annual prize distribution and conversazione. This time the prizes and certificates were handed to successful students by Mr. Cyril S. Cobb, chairman of the L.C.C. Dr. R. Mullineux Walmsley, the principal, made an interesting report on the work of the year, and after the distribution there were the usual demonstrations in the laboratories and workshops, an organ and choral concert in the Large Hall, and several lecturettes, including one by Mr. Samuel Field, head of the Technical Chemistry Department, on "Artificial Nitrates," with demonstrations of new electric furnaces, by Mr. E. Kilburn Scott. On Saturday evening the lecturettes were repeated, and there were again demonstrations in the workshops, gymnastic and boxing displays, &c.

Foreign Trade in November.—The following are the electrical and machinery figures given in the official returns for November trade :—

IMPORTS.	*Month of Nov.*	*Inc. or dec.*	*Eleven months, 1913.*	*Inc. or dec.*
	£	£	£	£
Electrical goods, excluding machinery and uninsulated wire	153,990	+ 10,007	1,431,771	+ 111,589
Machinery	563,012	+ 2,710	6,664,162	+ 458,037
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	937,055	+632,646	5,058,207	+1,008,449
Machinery	3,309,266	+393,083	34,070,126	+3,651,688

Wotan Half-Watt Lamps.—On Wednesday afternoon, at the Dalston Works of Messrs. Siemens Bros. Dynamo Works, Ltd., we were present at a demonstration of the firm's "Wotan" half-watt lamps, which are the result of extensive experiments, and are manufactured, under master patents, with drawn-wire filaments. They are suitable for both A.C. and D.C. supplies. A 2,000 C.P. lamp was shown running on the works private supply voltage of 225 volts. The lamps have a novel arrangement of the filament and the bulb is filled with an inert gas. The range of lamps is from 300 to 1,500 watts, and 50 to 240 volts. They will shortly be placed on the market in sizes from 600 to 3,000 C.P., and a large use is anticipated for street lighting and the illumination of large areas where arc lamps now serve. Wotan half-watt lamps will be supplied with Goliath E.S. caps only.

Fatalities.—Ernest Fenbow, a young telephone lineman belonging to Dundee, was killed at No. 3 Pit of the United Collieries, Carfin, near Hamilton, last week. He was working along with another telephone lineman repairing wires, and their operations had caused a live wire to come into contact with a wire fence. Fenbow, unaware of this, put his hand on the fence, and was killed almost instantaneously.

Tyne Electrical Engineers.—The *Newcastle Chronicle* states that Lieut.-Col. Scott, the commanding officer of the Tyne Electrical Engineers, entertained the non-commissioned officers to supper, at the headquarters, Clifford's Fort, North Shields, on Saturday night.

Institution and Lecture Notes.—THE ROYAL INSTITUTION OF GREAT BRITAIN.—Friday evening meetings before Easter, 1914, members and their friends only admitted; the discourse begins at nine o'clock. On Friday, January 23rd, at 9 p.m., Prof. Sir James Dewar, F.R.S., will lecture on "The Coming of Age of the 'Vacuum Flask.'" Other Friday evening arrangements to follow include :—

February 13th.—Prof. J. Norman Collie, F.R.S., on "Production of Neon and Helium by Electric Discharge."

February 27th.—Prof. W. A. Bone, F.R.S., on "Surface Combustion."

March 20th.—Lord Rayleigh, O.M., &c., on "Fluid Motions."

March 27th.—Prof. J. A. Fleming, F.R.S., on "Improvements in Long-Distance Telephony."

April 3rd.—Prof. Sir J. J. Thomson, O.M., &c., on "Further Researches on Positive Rays."

Three lectures will be delivered on Thursdays, March 5th, 12th, 19th, on "Heat and Cold" (modern applications, theory of caloric, heat engines, freezing machines, &c.), by Prof. C. T. Jenkin, M.Inst.C.E.

Dr. J. A. Harker, F.R.S., will give two lectures on Saturdays, February 14th, 21st, on "The Electric Emissivity of Matter" (1. The Metals; 2. Other substances), with experimental illustrations.

On Saturdays, February 28th, March 7th, 14th, 21st, 28th, April 4th, Prof. Sir J. J. Thomson will deliver six lectures on "Recent Discoveries in Physical Science."

INSTITUTION OF ELECTRICAL ENGINEERS.—On Monday the annual dinner of the Students' Section was held. Owing to pressure on our space, the report is deferred to our next issue.

At the last meeting of the I.E.E., the president announced that the Council had elected Alexander Graham Bell an honorary member of the Institution.

At a meeting of the SCOTTISH LOCAL SECTION at Edinburgh on Tuesday last, the paper by Dr. Klingenberg on "Electricity Supply in Large Cities" was read, in the absence of the author, by Mr. W. W. Lackie.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, a paper was read by Mr. A. R. Everest, entitled "Notes on International Standardisation of Electrical Machinery." The discussion was closed.

At the meeting of the YORKSHIRE LOCAL SECTION on Wednesday last, the paper by Mr. S. H. Holden on "The British Standard Specification for Consumers' Electric Supply Meters," was read and discussed.

FARADAY SOCIETY.—The annual general meeting was held on Wednesday, November 26th, 1913, at the Institution of Electrical Engineers. The following officers and Council were elected to serve for the year 1913-14 :—President, Sir Robert Hadfield, F.R.S.; treasurer, F. Mollwo Perkin, Ph.D.; Council, R. Belfield, Dr. H. Borns, W. R. Cooper, Prof. F. G. Donnan, F.R.S., Emil Hatschek, Dr. R. S. Hutton, Prof. Alfred W. Porter, F.R.S., E. H. Rayner,

Dr. R. Seligman, Maurice Solomon. At a special general meeting which was subsequently held, certain alterations in the rules were agreed to by which members of cognate societies, to be determined from time to time by the Council, might be elected to membership without being proposed by a Member and without paying the usual entrance fee.

Institution of Post Office Electrical Engineers.—A paper on the "Elimination of Waste in Telephone Plant and Operating" was read before a general meeting of the London Centre on December 8th by Mr. B. O. Anson.

Junior Institution of Engineers.—At a meeting on Friday last the new president, Sir Boverton Redwood, read a communication from Mr. Albert Vickers, stating that he desired to endow a fund for the presentation each year of a gold medal and a premium in books or instruments for the best paper read by a member, to commemorate the occupancy of the presidential chair during the past year by his friend, Sir Trevor Dawson.

Institution of Civil Engineers.—At the Students' meeting, on Friday last, Mr. H. V. Hutt, B.Sc., read a paper on "The Liverpool Street Extension of the Central London Railway."

British Association.—The Council has made grants of £500 to the Committee on Radiotelegraphic Investigations, and £250 towards the cost of the magnetic re-survey of the British Isles, which has been undertaken by the Royal Society and the British Association in collaboration.

A paper on "The City of Dublin Electricity Supply" was read at the last meeting of the Institution of Civil Engineers (Dublin), by Mr. Mark Ruddle, who said the use of electricity as an illuminant in Dublin had almost reached the stage of being a necessity where health and economy were considered. Doubt, he said, had been expressed whether or not the electric supply scheme of the Corporation would be a financial success, but the figures for 1912 supplied a sufficient answer. In that year there was a net surplus of £11,670 on the trading of the department, and the passage of time had proved that in the electricity supply the citizens of Dublin possessed a valuable municipal property.

A popular lecture on "Wireless Telegraphy," with experiments, was given on Wednesday last week, at the London Institution, by Mr. Richard Kerr.

The London Electrical Masters' Association.—The Association, which has been formed for the express purpose of dealing with workmen employed in the electrical trades, embraces any employer who employs workmen who are eligible for joining the Electrical Trades Union or any other such body, and therefore would comprise all supply authorities, manufacturers, contractors, railway companies, telephone companies, &c. Mr. J. Horace Bowden, the supply engineer for Poplar, is the chairman for the ensuing year, and Mr. Leonard G. Tate has accepted the position of secretary. The first committee consists of :—

Mr. J. Horace Bowden.
Mr. E. R. Radford (Trollope & Colls).
Mr. H. Marryat (Marryat & Place).
Mr. A. R. Phipps (Rashleigh Phipps & Co.).
Mr. W. R. Rawlings (Rawlings Bros., Ltd.).
Mr. L. L. Robinson (Hackney Borough Council).
Mr. H. B. Read (Edmundson's Electricity Corporation, Ltd.).
Mr. H. F. Simon (Electrical Installations, Ltd.).
Mr. F. H. Starling (Blackburn, Starling & Co., Ltd.).
Mr. D. M. Strode (Strode & Co.).
Mr. G. E. Taylor (G. E. Taylor & Co.).
Mr. Duncan Watson (Duncan Watson & Co.).
Mr. L. H. Hordern (Westminster Electric Supply Corporation, Ltd.).
Mr. F. J. Walker (St. James' and Pall Mall Electric Light Co., Ltd.).
Mr. Leonard G. Tate, secretary.

London Electricians' Wages Movement.—The Electrical Trades Union has sent in a demand for an increase of pay to 11d. an hour, and for an accepted code of working rules; the Committee of the "London Electrical Masters' Association" has considered the same, and has sent the following letter to the Electrical Trades Union :—

"Referring to your letter of November 11th, and the meeting held on December 3rd of the 'London Electrical Masters' Association,' the Committee then appointed has discussed the questions referred to and will be prepared to meet representatives of your Union at a Conference to be held during the month of January, if your representatives will agree to the following conditions :—

"(1) That there shall be no stoppage of work or interference with non-Union men now, or while the matter is under discussion; (2) that where any interference has already taken place, the same shall be immediately stopped, and work resumed: and (3) that the rule adopted by most trades as to interference with other trades be included in any agreement come to, namely, no exception shall be taken to the employment or non-employment of a man on the ground that he is, or is not, a member of the Electrical Trades Union. Neither shall any exception be taken to the employment of a man in any other trade on the ground that he is, or is not, a member of a trade society."

L.C.C. Conciliation Boards.—Owing to the inability of Sir Edward White through ill-health to attend the meetings of the Rolling Stock Conciliation Board, Mr. Isidore Salmon has been asked by the Council to act in his place. The fitters and fitters' labourers employed at the Greenwich power station, have asked for an increase of ½d. per hour. The questions have been referred to the Electrical Conciliation Board.

The Palace of Varieties, Manchester.—The Palace of Varieties, Manchester, was re-opened on Friday last by the Lord Mayor. The interior of the theatre has been entirely rebuilt, the central pillars having been removed, and a perfect and uninterrupted view of the stage is now obtained from any seat.

The electrical equipment embraces many novel and interesting features, and the whole of the decorative fittings have been specially designed to harmonise with the decorations of the building. Current is taken from the Manchester Corporation mains, and the whole building is wired on two separate and distinct systems, the auditorium and the stage being in each case independently balanced. The stage lighting consists of about 1,500 lights, aggregating about 100 k.w. Six battens and one float have between them about 1,100 lamps. The main switchboard controls the whole of the stage lighting and auditorium proper; a separate panel is provided for feeding the bioscope arcs and stage arcs, current for this purpose being supplied by a motor-generator. The dimming equipment is of the A.E.G. design, such as has recently been installed to a considerable extent in large Continental theatres. It is of the metallic type, and consists of resistances controlled by a bank of levers through the medium of wire ropes running over pulleys fitted with ball bearings. The bank of levers consists of three lines for red, blue and white respectively, each section of each fitting being separately actuated by its own lever with graduated scale. Any combination of the colours and intensity can therefore be obtained, or if desired the different banks of levers can be operated simultaneously by means of worm gears, separate wheels being provided for quick and slow operation. In addition to controlling the stage lighting, provision is made for dimming the auditorium through resistances; we understand that this is the only variety theatre in the country which is fitted with this arrangement. The external lighting consists of 12 arc lamps.

The whole of the electrical work has been carried out to the specification of the consulting engineer to the Variety Theatres Co. (Mr. F. J. Humphrey), the decorative effects being to the design of the architect, Mr. Bertie Crewe. The contractors were the A.E.G. Co., the work being carried out under the personal supervision of Mr. F. W. Joll, manager of the Manchester branch.

The heating is carried out on the low-pressure hot water system, exhaust steam from the Manchester Corporation electric station being used in conjunction with calorifiers. This system has recently been adopted in several buildings adjacent to the generating station. A complete system of vacuum cleaners has been supplied and fixed by the Waygood Vacuum Cleaner Co., London.

Fires in Germany.—The 17 companies forming the Union of Private Fire Insurance Companies (Verband der Privat Feuer Versicherungs Gesellschaften) have for a number of years past made a practice of collecting statistics respecting the damages alleged to be caused through electrical installations. According to the Union's report for 1912, there were 483 fires, as compared with 482 in the preceding year, and the compensation paid amounted to £59,900, and £54,100 in the two years respectively. Out of the total number of cases of fire, 231 were proved to have been due to short circuits, and 139 cases were presumed to have arisen from the same cause, and most of the fires (206) occurred in dwelling houses, villas, &c.

Electric Cooking in L.C.C. Schools.—At the sitting of the London County Council Administrative Committee on December 10th, the Elementary Education Sub-Committee reported that they considered it desirable that an opportunity should be taken in connection with the accommodation for cookery being provided at the Bloomfield Road School, Woolwich, to test methods of cooking by electricity, and they suggested that an electric stove be installed in the centre for one year as an experiment. This was agreed to.

Appointments Vacant.—Chief engineer (50s.); assistant (good jointer), 40s.; assistant shift engineer (30s.); two improvers (10s. each), for Bingley U.D.C. Overhead linesman, for Kirkcaldy Corporation Tramways. Jointer (8d.; 56 hours), for West Bromwich Corporation. Senior switchboard attendant, for Salford Corporation. Three switchboard attendants, for West Hartlepool Corporation (25s. to 30s.). Assistant electrical engineer, for Dundalk U.D.C. (£100). A well-known manufacturer is inviting applications for the position of foreman or superintendent of a battery department. Particulars are given in our advertisement pages.

Inquiry.—The Barlaw Engineering Co., Ltd., inform us that an error occurred in their letter inquiring for a supply of power for a special purpose. The current required was stated as 50,000 amps.; this should have read 15,000 amps.

Sir Wm. White Memorial.—According to the *Times*, the fund for establishing a permanent memorial to the late Sir Wm. White, K.C.B., F.R.S., amounted last week to £1,368. Cheques are to be sent to Dr. J. H. T. Tudsbery, the secretary of the Institution of Civil Engineers.

Strike.—An evening paper states that 160 men engaged at the Pearl Assurance Co.'s new offices in Holborn struck work in sympathy with the electricians, the latter having ceased work because the contractors for the electrical work were employing non-union labour at lower wages.

Charge of Stealing.—At the Greenwich Court, on 3rd inst., four men (named Adams, Smith, Lindsey and Piller) were remanded on a charge of stealing electric cable, the property of the South Metropolitan Electric Light and Power Co., Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Lancaster T.C. has increased the salary of Mr. Patterson, superintendent of the electricity works.

Mr. Sellars, at present heating and cooking representative of the West Ham electricity undertaking, has been promoted to the position of superintendent canvasser of the sales department (owing to Mr. Hellaby having obtained an appointment as assistant sales manager at Sunderland) at a salary of £200 per annum, plus a commission of ½ per cent.

Mr. G. Sowersby, of Watford, and Mr. J. E. Chamberlain, of Canterbury, have been appointed shift engineers to the Watford undertaking.

The Cheltenham T.C. has increased the salary of Mr. J. M. Robb, assistant engineer, from £3 10s. to £3 15s. per week. The Electricity Committee has revised the rates of wages paid to the various employés in the department. In addition to raising the wage of the lower grade employés, the Committee has made some changes as to hours. The charge engineers and drivers, who worked in eight-hour shifts, have been in the habit, ever since the start of the undertaking, of working seven shifts per week. They will now be given a shift holiday once a fortnight. This will necessitate the employment of another man, with a consequent increase of expense, but the Committee feels that it is due to the men that they shall have at least one day off in every 14.

Mr. C. Crofton Sleigh has left the Rochdale Corporation Electricity Works, and accepted a post with the British Continental Electricity Co., Ltd., at San Remo, Italy.

Mr. Hopper, chief assistant engineer and deputy manager to the Rhondda Tramways Co., has resigned his appointment to take up the position of resident engineer and manager of the Wisbech electric supply undertaking of the National Electric Construction Co. On November 27th he was entertained at a smoking concert, at which Mr. H. J. Nisbett presided. The Porth Hospital Carnival Committee presented Mr. Hopper with a gold-mounted walking stick, in recognition of hard work done in the interests of the Hospital.

Mr. H. W. Smyth has been appointed shift engineer at the Stuart Street station, Manchester, at a commencing salary of £175 per annum, rising to £190 at the end of 12 months' satisfactory service.

Mr. H. Redfern has resigned his position with the Yorkshire Electric Power Co., Ltd., having secured an appointment with the Oldham Corporation.

On Saturday, November 29th, at St. Mark's Church, Plumstead Common, Mr. Robert Berrington, charge engineer of the Erith B.C. electricity works, and late of the Woolwich B.C. electricity works, was married to Ethel Alice, elder daughter of Mr. and Mrs. R. Rawlinson, of 35, Ancona Road, Plumstead.

Increases of salary just granted by the Nelson Corporation, include the following:—Mr. G. R. Naylor, electrical engineer and tramways manager, from £180 to £200; Mr. Jas. Stanworth, mains superintendent, from £98 16s. to £104.

The Rochdale T.C. is to be recommended to increase the salary of Mr. C. C. Atchison, the electrical engineer, by £50 per annum, making his remuneration £500 per annum. Mr. Atchison took the management of the electricity works 13 years ago, his commencing salary being £200.

Alderman Smethurst is to be presented by the Warrington Electricity and Tramways Committee with a vote of thanks, engrossed on vellum, for his services on the Committee.

Tramway Officials.—Mr. D. Smith, who is known to some of our readers in connection with advertising on the L.C.C. tramcars, was due to retire from the Council's service next March under the age limit. On the ground that his retirement would "cause inconvenience to the public service," Mr. Smith has been asked to postpone his retirement for a year.

On December 5th, Mr. Young, traffic superintendent under the Oldham tramways department, who is leaving to take up a similar position at West Ham, was presented by the men at the Wallshaw depôt, Oldham, with a gold albert, and Mrs. Young was given a gold pendant. Mr. Dugdale, the tramways manager, made the presentations. Mr. Joshua Brierley has been appointed in succession to Mr. Young.

General.—At the meeting of the Stepney B.C., on Wednesday, the Electricity Committee recommended that £100 be given to the town clerk, £50 to the borough engineer, £25 each to Mr B. J. Belsher, the chief assistant engineer, and Mr. W. W. T. Lynex, chief clerk in borough treasurer's department, as annual honorariums for their services after the usual office hours in connection with the electricity supply undertaking.

The *Times* New York correspondent states that, at a meeting of the American Society of Mechanical Engineers, on December 3rd, Mr. George Westinghouse was presented with the Grashof Medal for having obtained the most important results during the past year in the engineering field.

Mr. E. E. Eccles, who has been appointed assistant general manager of the British Aluminium Co., entertained the workers and their families at Foyers, on the eve of his departure for London.

We are sure that our readers will read with regret and sympathy the announcement, which appears in our "City Notes" to-day to the effect that Mr. Robert Kaye Gray has been obliged through ill-health to resign his position as managing director of the India-Rubber, Gutta-Percha and Telegraph Works Co. He has been appointed an extraordinary director of the company, and his brothers, Messrs. C. H. and W. E. Gray, have been appointed managing directors. There is no man in the electrical industry to-day who is more highly esteemed, honoured and admired, than Mr. R. K. Gray, and we do not believe there will be one reader of this note who will not desire to associate himself with us when we express a sincere hope that he may have a speedy recovery.

According to the *Commonwealth Engineer*, Mr. E. P. Groves, the electrical engineer who is to act as chief representative for Mr. Merz during the conversion of the Melbourne suburban railways to electric traction, arrived there in October. Mr. Groves will have complete charge of the carrying out of the undertaking, in accordance with the plans and specifications prepared by Mr. Merz.

The same exchange states that Mr. A. Smyth has been appointed overhead superintendent of the electric supply undertaking of the Melbourne City Council at a salary of £286 per annum.

Will Mr. J. Beschloss kindly communicate his address to the Editors?

Mr. Henry Coates, chief sales engineer in the northern districts for Messrs. Ferranti, Ltd., Hollinwood, Lancs., is leaving this company to take up a position in a similar capacity for the United Kingdom with Messrs. Voigt & Haeffner (England), Ltd., Birmingham, and from the beginning of the new year he will be at the firm's London offices and showroom, 22, Queen Street, E.C.

Mr. J. Martin Blair, M.I.E.E., 53, New Broad Street, E.C., has been appointed the London representative of the Record Engineering Co., Ltd., Manchester, manufacturers of petrol and paraffin engines, steam traps, &c.

The *Canadian Electrical News* states that Mr. R. W. Bruce, of London, has been appointed general superintendent and chief engineer of the Canada Electric Co., Amherst, N.S., and will also have charge of the electrical equipment of the Maritime Coal, Railway and Power Co. at Joggins Mines. Mr. P. Whitfield has been appointed electrical superintendent for the town of Battleford, Sask.

Mr. H. Nightingale, chief clerk, Power House, Immingham Dock, was presented with an overmantel and clock on Monday last, from the electrical staff, on the occasion of his marriage to Miss Goodhand, of Elsham. The presentation was made by Mr. James Harris, senior charge engineer.

Obituary.—The death took place at a nursing home in Garstang Road, Preston, on December 4th, of Mr. John Lemon, district manager of telephones for Blackburn. Mr. Lemon had been in the service of the National Telephone Co. for 30 years, and was formerly chief clerk in his native city of Belfast. On promotion to a district managership, he was sent to Jersey; then to Barrow in 1900, and to Preston three years later, where he remained until the Government took control. He then went to Warrington as assistant district manager, and remained there for some months, until appointed recently to take charge of Blackburn as district manager, in succession to Mr. C. Remington, who went to Liverpool.

The Berne Correspondent of the *Daily News and Leader* reports that Dr. Henri Simon, chief of the radiotelegraphic service in the Cantonal Hospital at Geneva, died on Monday, a victim of X-rays. "Dr. Simon was a pioneer in using the rays before their dangers to operators were known and provided against. He had endured many operations and amputations, having lost one arm completely and the other partially."

NEW COMPANIES REGISTERED.

Luminous, Ltd. (132,531).—This company was registered on December 2nd, with a capital of £100 in £1 shares, to carry on the business of advertising contractors and agents, manufacturers of advertising devices, &c., and to adopt an agreement with Raghib-Raif Bey and H. Leitner. The subscribers (with one share each) are:—Raghib Raif, 15, Clifford Street, W., gentleman; Hy. Leitner, 35, St. James's Place, S.W., electrical engineer. Private company. The first directors are Raghib Raif Bey and H. Leitner. Registered office, 1, York Buildings, Adelphi, W.C.

W. T. Clarke & Co., Ltd. (132,534).—This company was registered on December 2nd, with a capital of £2,000 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of a manufacturing electrical engineer and contractor carried on by W. T. Clarke, at 8, New Oxford Street, W.C., as "W. T. Clarke & Co." The subscribers (with one share each) are:—W. T. Clarke, 217, Albert Road, Alexandra Park, W., electrical engineer; E. A. Sheppard, 62, Tooting Bec Road, S.W., secretary; M. Payne, 23A, Allington Road, Queen's Park, W., electrical engineer. Private company. The first directors are W. T. Clarke (managing director) and M. Payne; qualification, £10, Registered office, 8, New Oxford Street, W.C.

Birkenhead Rubber Co., Ltd. (132,559).—This company was registered on December 4th, with a capital of £1,000 in £1 shares, to take over the business carried on by D. R. Rowlands at 110, Chester Street, Birkenhead, as the "Birkenhead Rubber Co." The subscribers (with one share each) are:—D. R. Rowlands, 20, Hampden Road, Birkenhead, pharmacist; R. J. Gallagher, 110, Chester Street, Birkenhead, rubber factor's manager. Private company. D. R. Rowlands is the first director and secretary. Solicitor: T. Pugh, Birkenhead. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Leonard W. Holmes & Partners, Ltd. (132,598).—This company was registered on December 5th, with a capital of £1,000 in £1 shares, to take over the business carried on by L. W. Holmes and others, to carry on the business of owners of patents, technical advisers, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—L. W. Holmes, M.I.E.E., 48, Great Russell Street, W.C., electrical engineer; H. M. Harris, 48, Great Russell Street, W.C., merchant; P. A. E. Armstrong, A.M.I.Mech.E., 48, Great Russell Street, W.C. Private company. The first directors are L. W. Holmes, M.I.E.E. (governing director), H. M. Harris and P. A. E. Armstrong, A.M.I.Mech.E., &c. Registered office, 48, Great Russell Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £5,500 on October 17th, 1913, of trust deed dated July 1st, 1908, securing £195,000, has been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on November 27th, 1913, of £50,000 debs., part of a series of which particulars have already been filed.

Reason Manufacturing Co., Ltd.—A memorandum of satisfaction in full on January 25th, 1913, of charge dated July 4th, 1912, securing £2,000 and any other moneys, has been filed.

CITY NOTES.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

In their report for the year ending September 30th, 1913, which is to be presented at the meeting to be held at 106, Cannon Street, E.C., on Thursday, December 18th, the directors state that the accounts show, after provision for doubtful debts, a net profit of £51,551. Adding £5,904 brought forward and deducting £12,500, the dividend on the preference shares paid in January and July and accrued to September 30th, and £12,500, the interim dividend on the ordinary shares paid in July, there remains a disposable balance of £32,455, which, after providing for the proposed dividend on the ordinary shares, will leave £7,455 to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders, and that a dividend of 10s. per share, free of income-tax, amounting to £25,000, making with the interim dividend paid in July a total payment of 7½ per cent. for the year, be paid to the holders of ordinary shares; both these dividends to be payable on January 1st prox. The general business of the company has been fully maintained, but the price of rubber having fallen considerably during the 12 months under review, the difficulty of stocks made with material at a higher price than that now ruling has had to be met. The trading of the French factory and some of the company's foreign branches has not made the progress which had been anticipated. There has been a considerable falling-off in the amount of submarine cable manufactured, but the company's steamers have been well employed. The *Silvertown* returned from Australia in May, and in September laid a cable between England and Denmark. The *Dacia* has been engaged in the repair of an Atlantic cable and in work off the coast of Morocco. The *Buccaneer* has been twice to the West Coast of Africa, under charter to the French Government. The works at Silvertown have been efficiently maintained, though one or two of the buildings have been affected by the subsidence of the land through the draining caused by the excavations for the Albert Docks extension. Those who are responsible will, however, be held liable for any damage which results. The board much regrets to state that the managing director, Mr. Robert Kaye Gray, has been obliged through ill-health to resign his position. He has been appointed extraordinary director, so that the business will still receive the benefit of his advice. His brothers, Mr. C. H. Gray and Mr. W. E. Gray, have been appointed managing directors. Mr. Nigel Hanbury has been appointed a director of the company.

Melbourne Electric Supply Co., Ltd.

The directors' report states that during the year ended August 31st, 1913, they cancelled the £250,000 6 per cent. second debenture stock created in 1911, but not issued, and created instead 5 per consolidated debenture stock, limited to £500,000, or the amount of the company's issued share capital, whichever may be the greater, but to be inclusive of the outstanding amount of the 5 per cent. first mortgage debenture stock. £100,000 of such consolidated debenture stock was offered for subscription at 93½ per cent. in March last, the whole of which was allotted and is now fully paid. The area of the suburban districts in Melbourne covered by the company's statutory powers is approximately 74 square miles; and a supply is now available in 410 miles of streets, being an increase of 106 miles during the year. 4,875 new consumers were connected to the mains during the year, bringing up the total number connected to 13,571, being an increase of 56 per cent. as compared with the previous year. The power supply has increased by 28 per cent., the electric motors now connected being equivalent to 9,581 H.P.; the total connections, including lamps, motors, heating and other apparatus, have increased by 38 per cent., and the total units sold by 37 per cent.

In accordance with last year's report, the sum of £10,287 has been applied during the year in writing off certain items in the Melbourne and Geelong capital accounts, and the latter now stand as follows:—

	Expenditure at Aug. 31st, 1912.	Further expenditure during the year.	Amount written off.	Net expenditure at Aug. 31st, 1913.
Melbourne	£553,899	£140,154	£6,512	£687,041
Geelong (including the tramways)	127,195	19,875	3,775	143,296
Total	£680,594	£160,029	£10,287	£880,337

The continued expansion of the company's business will in due course require the provision of further capital, a statement in regard to which will be made at the meeting on Monday, December 15th. The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings amounted to £77,092 as compared with £66,272 for the previous year, being an increase of [illegible] per cent. After payment of debenture interest and management and general expenses at the London head office, and after making the following allocations, viz.: To first debenture stock sinking fund £2,500; to income certificate service fund, £1,800; to general reserve (raising the latter to £60,000) £5,000; to suspense account to meet the cost of writing off sundry items of plant at Melbourne, £1,000; to amount written off the cost of the recent issue of consolidated debenture stock, £5,780; to writing down head office furniture, £50—there remains a credit balance of £39,936, plus £5,080 brought forward, making a total credit balance of £45,016. Deducting from this sum the dividend on the 7 per cent. first cumulative preference shares for the half-year ended February 28th, 1913, and the interim dividend of 4 per cent. on the consolidated ordinary stock paid on June 2nd, 1913, there remains an available balance of £27,766. The directors recommend the dividend on 30,000 7 per cent. first cumulative preference shares for the half-year ended August 31st, 1913 (paid on September 1st, 1913), requiring £5,250, and a final dividend of 6 per cent., free of income-tax, on £300,000 consolidated ordinary stock, making 10 per cent. for the year, £18,000, leaving to be carried forward, £4,516. The following tables show the progress of the Melbourne and Geelong undertakings:—

Date.	Consumers.	Lighting in KW.	Motors in rated H.P.	Total Connections in KW.	Total units sold.	Gross profit.
Melbourne—						
August 31st, 1911	5,076	5,680	5,196 H.P.	10,668	5,099,162	£[illegible]
August 31st, 1912	8,696	8,282	7,453 H.P.	15,735	7,[illegible]82,571	£[illegible]
August 31st, 1913	13,571	12,139	9,581 H.P.	21,720	9,740,184	£[illegible]
Geelong (including the tramways)—						
August 31st, 1911	884	1,138	1,133 H.P.	2,225	506,267	£3,206
August 31st, 1912	1,099	1,483	1,380 H.P.	3,049	75[illegible]1	£[illegible]
August 31st, 1913	1,456	1,734	1,846 H.P.	3,580	1,034,062	£5,511

Important modifications have been made in the scale of charges for the supply of electricity for power purposes, which it is anticipated will lead to an increased demand from manufacturers and others.

Stock Exchange Notices.—The Committee has ordered the undermentioned security to be quoted in the Official List:—

Urban Electric Supply Co., Ltd.—Further issue of £156,697 4½ per cent. first mortgage debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Electrical and Industrial Investment Co., Ltd.—£100,000 4½ per cent. debenture stock and £100,000 5½ per cent. debenture stock.

London Electric Railway Co.—36,508 ordinary shares of £10 each fully paid, Nos. 1 to 36,508 (renewed special application).

Underground Electric Railways Co. of London, Ltd.—Further issue of £76,600 4½ per cent. bonds of 1933 of £100 each, Nos. 16,668 to 17,447.

Power-Gas Corporation, Ltd.—The directors recommend that for the year ended September 30th a dividend of 5 per cent. per annum upon the ordinary shares, leaving to be carried forward £3,549.

International Light and Power Co., Ltd.—The directors have declared a dividend of 1¼ per cent. upon the preference shares for the quarter ending December 31st.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a dividend of 1¾ per cent. ($1.75 per share), for the quarter ending December 31st, on the common capital stock.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended September 30th last of 2s. 6d. per share.

Automatic Telephone Manufacturing Co., Ltd.—The transfer books will be closed from 17th to 24th inst., both days inclusive, for the purpose of preparing the warrants for the dividends on the 6 per cent. preference shares for the six months ending December 31st.

Prospectus.—*Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.*—The list was to close on Wednesday in an issue of 175,000 7 per cent. cumulative participating preference shares of £1 each. The shares are issued for the purpose of discharging the floating indebtedness of the company incurred by mains and plant extensions, and for meeting additional expenditure to which the company is committed.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a quarterly dividend of 2s. per share, free of tax.

Western Telegraph Co., Ltd.—The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1914, being at the rate of 6 per cent. per annum.

National Telewriter Co., Ltd.

The fourth ordinary general meeting of this company was held on December 4th, at Cannon Street Hotel, E.C., Sir John George Craggs presiding.

In moving the adoption of the report, which showed for the year ended June 30th last an improvement of £3,500 for the year, and expressed the hope and expectation "that, as the current expenditure is now met by the current income, the future results will be more commensurate to the importance of the invention," the Chairman said he hoped the shareholders would regard the progress made during the year as satisfactory. The expenditure on capital account during the period on instruments, construction, exchanges, plant, &c., was £4,914, as against £5,651 for the previous year, whilst the amount carried to suspense account on the year's working was £854 as against £4,345 for the previous year, an improvement of about £3,500. The total of the minimum rentals provided for in their contracts was £5,765, as compared with £3,066, for the previous period, an increase of about 88 per cent. for the year. The apportionment of rentals carried forward to next year was £1,975 as against £1,463. That was an encouraging rate of advance. Since the date of the balance sheet they had secured a fair amount of new business. This, coupled with the fact that a great part of the contracts secured during the year were carried forward, satisfied him that at the present time their income balanced the working expenditure, and he was looking forward with some confidence to the next meeting, when he hoped to announce profitable results. The improvement in the profit and loss account of £3,500 was 3¼ per cent. on the whole of the preferred ordinary capital issued. If this increase was maintained or improved upon, as they hoped and expected would be the case, they would see that in the near future, now that the revenue balanced expenditure, they would be in the happy position of having profits to divide. Where conditions of working were normal, the instrument was giving the utmost satisfaction, but the conditions they had to meet were not ideal. Some of them might be surprised to learn that there were thirty-two companies supplying electricity in London with no less than thirty-six variations in the supply, such as direct current with a wide range of voltages, alternating current with an even greater variation in voltages and periodicities, all of which necessitated the employment of additional apparatus of special character. Notwithstanding those extraneous difficulties they were going ahead satisfactorily, and had been able to reduce their several types of instrument to one standard machine available for either exchange or private line operations. The Walbrook and Charing Cross public exchanges were proceeding satisfactorily, and the Liverpool Exchange, foreshadowed at the last meeting, was now an accomplished fact. There was evidence of a considerable demand for public exchange facilities in Liverpool, particularly among cotton brokers, to whom a saving in time in the transmission of telegrams, cables, and other messages, was of very great importance. Active canvassing was now in progress, and it was hoped at an early date that the Liverpool Exchange would be placed upon a sound commercial footing, when they could turn their energies to Manchester and establish an exchange in that city. They had, for some time, had instruments in operation between Liverpool and Manchester, which had proved the success of trunk working over that distance, and, when the Manchester Exchange was opened, they would be in a position to meet the demand which existed for inter-communication by Telewriter between the two cities. He mentioned at the last meeting that they had concluded an agreement with the Liverpool Cotton Association whereby the Telewriter was to be employed for the simultaneous transmission of prices and other news from the Cotton Exchange to its members. This service had proved to be highly satisfactory, and was growing in popularity, about sixty machines being now in active employment in the members' offices, all operated by one transmitter situated inside the exchange. The success of this installation had created a lively interest in the system both in Liverpool and Manchester. Negotiations were now on foot for the establishment of a similar service in Manchester operated from the Manchester Royal Exchange, for which official permission had been granted, and there was already evidence of a good demand for such facilities amongst the cotton brokers and spinners in the Manchester district. They also had hopes of introducing a similar service at one of the important commercial exchanges in the City, as well as another service for the dissemination of advertisements and news from a central point throughout London. Dealing with the wide range of uses to which the Telewriter could be put, the Chairman said that many of the important drapery houses and stores in the West-end used the instrument for the purpose of sanctioning credits. In several cases the instruments were used in banks for a like purpose; in the United States there was a large use made of the instruments by bankers. Another service which was becoming popular was the transmission of orders from the telephone clerk direct to the department concerned, and simultaneously to the cashier who authorised execution. They were told that this system saved hours in the despatch of orders, apart from economising in the staff. The public Telewriter exchanges in London and Liverpool were principally used by subscribers for the despatch and receipt of telegrams to and from the post office. Something like half-a-million telegrams per annum were now dealt with by this system, and the appreciable saving in time effected was fully recognised by their subscribers, apart from the convenience afforded and the fact that messengers were dispensed with. The particular use which they were endeavouring to encourage was inter-communication between subscribers for the ordering of goods in writing without the delay of sending a letter or paying the wages of a messenger. As the shareholders were aware, the company had a number of patents in connection with the Telewriter. The earliest one would in the ordinary course have expired this month. The directors deemed it desirable to apply for an extension and took the necessary steps. He was pleased to be able to inform them that they were able to satisfy the court that their claim was reasonable, and the judge granted an extension of five years. There was something in hand just now which might add considerably to the fortunes of the company, but as the matter was not yet complete and would be the subject of a patent, his tongue was tied at the moment. He only mentioned it so that they might know that they were going ahead not only in the accounts as presented, but also in developments for the future.

Mr. E. W. Wynn Edwards seconded the motion, and said he did not think he was too optimistic in saying that now the company's revenue met the income, it would not be very long before the shareholders would receive a dividend upon their investments.

The report was adopted.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

Mr. A. R. Monks (chairman) presided on December 4th at Winchester House, E.C., over the ordinary general meeting of this Company.

The Chairman, in moving the adoption of the report (Elec. Rev. p. 928), said that on the debit side their capital and their debentures remained the same. They had reduced their creditors by some £3,400, that being practically the payment of a large account for cables. On the other side they had expended four items amounting altogether to £3,669; made up of £222 for additional rolling stock, £1,093 for additional machinery, £89 for a new sub-station, and £2,209 for electric light installations. These items had been paid out of revenue for reasons that he would deal with later. On the revenue side there was a total increase of £4,123. The result of the traction department was £2,291 better than last year. This was attributable to better weather and of course the visitors stayed longer in September. With respect to their tramway traffic, they had had to meet some competition from omnibuses and with a view to obtaining certain experience the Directors hired two buses on which they had made a profit of £348. The lighting he was pleased to say had again increased by £1,400; and again they were indebted to the zeal and ability of their manager, Mr. Ford. The expenditure had increased by £2,256. Fuel had undergone an increase of £211, coal having gone up 2s. 6d. a ton; but they had generated 138,000 more units; they had changed the wheels of their rolling stock from chilled iron to steel, and there were also increases in salaries and wages, insurance, etc. Interest had also been greater owing to the higher bank rate. Last year he told them they had contracted for the delivery of a Diesel engine in June, but he was sorry to say that when delivered it was far from satisfactory. However they came to an agreement with the contractors for cancelling the contract and the contractors paid them a sum of money which left them without a penny loss. In fact they made a gain. In addition they generated nearly half a million units with the engine, at the cost of about ½d. per unit. They were disappointed with the engine but it was only fair to say that the Diesel Co. met them fairly and reasonably over the matter. They then determined to go back to steam plant and they had ordered a turbine, generator, condenser, cooling tower, superheater and accessories for delivery in June, all of which would entail a cost of about £9,000; and they hoped this would get them out of their difficulties. They hoped that with the economies the turbine would effect and the increased lighting, they would be in a better position when he met them next year. They had an available balance of £16,607 and they proposed to pay a dividend of 3 per cent. on the preference shares (absorbing £4,500), place £2,000 to the rolling stock reserve account, appropriate £6,000 towards future maintenance of permanent way, add £1,000 to third party insurance reserve, and carry forward £3,108.

Lord Arthur Butler seconded the motion.

Mr. Lee Smith said he took it that if the Diesel engine supplied had been satisfactory the Company would not have made the economies anticipated. In other words whilst coal had gone up in price in his opinion it was likely to come down, whereas oil had gone still higher in price than coal and was not likely to decrease.

The Chairman thought Mr. Lee Smith was fairly right in his observations. The engine might have produced the results anticipated, but they were bound to move with the times.

Mr. Lee Smith said he was not objecting to the action of the Board but he thought they were well out of it. When the Company ordered the Diesel engine he believed oil came

out at about half the price of coal, now oil cost considerably more than coal, so he thought the Company had scored.

Mr. Waldron asked how the Board were to pay for the turbine.

The Chairman said they proposed taking it out of revenue and the balance would come out of the current year's revenue.

Mr. Waldron pointed out that the arrears on the preference shares now amounted to 30s., and suggested that it would be well if the Board brought forward a scheme for capitalising the arrears.

The Chairman said they had had that in their mind but they did not propose to deal with it for a year or probably two. He did not see how the preference shareholders could well be asked to capitalise the arrears seeing that in a few years they would get it all. The Board had considered the idea of capitalising the arrears and writing down the ordinary shares.

Mr. Lee Smith said he thought if the preference shareholders were brought together they would come to some arrangement with regard to the arrears.

Dr. Moody hoped the Board would not be in too great a hurry to bring forward a scheme of reconstruction. He hoped soon they would get 5 per cent. on the preference shares, and when they reached that happy stage then would be the time to bring a scheme before the shareholders.

The Chairman said he rather agreed with the last speaker. They could hardly induce the preference shareholders to give up much till they got on the 5 per cent. basis which he hoped would be in 1916.

The motion was carried.

Mr. H. Brown in proposing the re-election of the Directors said they would use the money they should have paid for the Diesel engine for the purchase of the turbine, but instead of getting 400 k.w. they would get 1,000 k.w., and that in ordinary circumstances should carry them on for four or five years. They ought to be able to pay for the plant out of this year's revenue, and then the following year the surplus revenue could be at the disposal of the Company for increasing the dividend or building up the reserve.

The motion was carried.

Burmah Electric Tramways and Lighting Co., Ltd.

The directors' report for the year ending the 31st July, 1913, states that the total gross receipts amount to £18,949, and the expenditure under all heads to £11,374, leaving a balance of £7,575. Out of this there has been transferred to reserve for depreciation account £5,000, against which account will be charged the cost of the installation of a second Diesel set, referred to below. This leaves £2,575 plus £1,333 brought forward, giving an available balance of £3,908, out of which it is proposed to pay a dividend on the preference shares at the rate of 3 per cent., absorbing £3,000, leaving £908 to be carried forward. The receipts for traffic, lighting and power, amounting to £18,665, show the satisfactory increase of £2,385 over the previous year. Writing, however, with reference to the increase in traffic receipts amounting to £1,850, the manager comments as follows:—

> The principal factor in the uniformly good receipts obtained during ten months of the year was undoubtedly the general healthiness of the town, which enjoyed not only complete immunity from plague, but comparative freedom from any epidemic. This state of affairs, by restoring confidence in the town and districts, greatly improved trade all round, the bazars and tramways participating. So favourable a conjunction of circumstances cannot, however, be reckoned on, nor can it therefore with confidence be presumed that receipts will continue to expand in the same remarkable manner, the expansion noted being apparently due more to extremely favourable trading conditions than to a natural growth. It appears, therefore, that the presence of similar conditions is necessary to a continuance of the high level of receipts secured.

As regards the expenses, the power costs show a reduction of £1,610, due to the working of the Diesel engine set, which has been running in a satisfactory manner. It has, however, been necessary or expedient to use the steam set as a stand-by from time to time during the year, and latterly to help the peak load during holiday traffic, with consequent extra cost, and it is with the object of obviating this and providing for an increased output that an order has been placed for a second Diesel set, provision for the cost of which has been made in the accounts. The directors consider that the company is now established on a sound financial basis, and will be in a position to make regular payments of part of the dividend on the preference shares. Under these circumstances the directors think it advisable to readjust the dividend rights on the preference shares, and with this object a scheme has been prepared.

Our report of the annual meeting will appear in our next issue. The directors withdrew their scheme.

Alldays & Onions Pneumatic Engineering Co., Ltd.

—For the year ended August 2nd, the directors report that the result of trading (after providing for depreciation and all other outgoings) is a net profit of £18,436, plus £20,097 brought forward, making £38,533. The dividend for the year is 5 per cent., and there is also a bonus of 5 per cent. per annum paid. There is transferred to reserve fund for contingencies and equalisation of dividends, £10,000, leaving to be carried forward £17,443.

Adelaide Electric Supply Co., Ltd.

The ninth annual meeting was held on Monday at the offices, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

Before proceeding to move the adoption of the report (see Elec. Rev., page 926) the Chairman formally proposed a resolution increasing the capital of the company from £[illegible] to £500,000 by the creation of a further [illegible] per cent. cumulative preference shares of £1 each. The resolution having been carried unanimously, the chairman in asking the meeting to adopt the report, said the directors again had the satisfaction of meeting the shareholders with a report which he hoped they would consider satisfactory. The figures which were given constituted very remarkable progress during the year. That progress alone was he thought, sufficient proof of the energy with which they had endeavoured to discharge the duty which fell upon them under their Act for the supply of electricity throughout the 155 sq. miles of the area which their powers covered. He did not know of any English concern that could show progress of a similar character. The results reflected very great credit on their officers in Adelaide, both technical and commercial and was also a testimony to the active interest which the local board in Adelaide were taking in the development of the company. Wherever possible it had always been the policy of the board to reduce prices, and last year important modifications had been made in the scale of charges for electricity for power purposes, which the directors anticipated would lead to a largely increased demand from manufacturers and others. It had always been their desire to avail themselves of every possible opportunity for popularising electric supply by reducing prices to their customers where it could be done without injuring the company. They would readily understand that in South Australia they were somewhat handicapped in their capital costs by the necessarily heavy duties which they had to pay on various items, which in some cases brought their costs up to 30 or 40 per cent. more than the same material would cost them here. That was a point which could not be lost sight of when comparing the prices they charged for electric current. Obviously the prices they charged depended upon two points—first, upon their capital cost of installation, and secondly, the cost of generation. He had shown them how they were handicapped in regard to the first point, and as regarded generation, they were faced with the absence of a good supply of water for condensing purposes, which obliged them to use cooling towers. In spite of these drawbacks, they had succeeded in making a very large increase in their business, and in making reductions in the price of current. They were hoping, as opportunity offered in the future, to make further reductions in prices. During the year they had spent £118,000 in developing the business. The ordinary shares, which last year stood at £150,000, had been raised to £200,000, and since the conclusion of the financial year they had raised the ordinary capital to £250,000, the full authorised amount, by a further issue of 10,000 shares of £5 each. In addition, during the year they had sold a further £25,000 of their 5 per cent. debenture stock, and those two items together had supplied them with the additional capital which they had required during the past year, and had gone some way towards providing the capital they would require during the current year. Further capital would be provided by the issue of a further amount of debenture stock probably, and either the whole or part of the 120,000 preference shares, the authority for which they had just obtained. With the expenditure last year, the cost of the undertaking now stood at £603,590. The dividend equalisation fund was intact; they had not had to draw upon it to pay the dividends, and it still stood at £28,000, to which figure it was recently raised. They had raised their carry forward very considerably, and to that extent it tended to secure the position of the capital of the ordinary shareholders and of the new preference shareholders. The table given in the report showing the progress of the company was one which he felt sure the shareholders must view with a good deal of pleasure. They would see that taking the business from 1904 to 1913 the number of consumers had increased from 585 to 11,354; the lighting in KW. from 1,016 to 7,752; the motors, from 677 H.P. to 6,270 H.P.; the connections, from 1,667 KW. to 14,022 KW.; and the units sold, from 729,821 to 5,446,488. Those figures illustrated in a most conclusive manner the active way in which the company were endeavouring to discharge their statutory obligations to the people over whom they had powers. Anyone who undertook an inquiry into the way in which they had exercised their powers and the vigour which they had developed their area would, he thought, come to the conclusion that there was nothing to complain of in that respect. The net increase in earnings last year was £12,000, which was fully on a par with the increase in other directions. They had had an advantage during the year of a visit from Mr. Brookman, the chairman of the local board, who had conferred with them on a good many points.

Mr. R. P. Sellon seconded the motion.

The Chairman, in reply to a shareholder, said that the general reserve was invested in the business. It would be foolish to invest that money outside the business for possibly 5 per cent., when they could do so much better by using it for their own purposes. The company did make depreciation, but it would be the greatest possible mistake for them to earmark any specific sum for that purpose in view of the fact that the Government had the right to purchase them any two years.

The report was adopted.

Electric and General Investment Co., Ltd.—A dividend of 1s. per share for the six months ending December 31st is announced.

STOCKS AND SHARES.

Tuesday Evening.

Investment business has not been greatly perturbed nor checked by fresh weakness which developed in Consols, and which caused the price of the stock to fall lower than it has done since 1821, when it was, of course, a 3 per cent. security. Consols are still overpriced, in the opinion of many people, having regard to the change which has come over the value of money. Investment nowadays demands—and receives—4 per cent. with first-class security, 5 per cent. from sound issues, and 6 per cent. from stocks and shares upon which the risk run need not be excessive.

Markets have commenced their last Stock Exchange settlement of the year with buoyancy and a fair amount of activity, dramatic rises in American and Canadian railroad shares setting the pace. In the domestic markets, the settlement of the Great Western Railway dispute in Wales led to a substantial recovery in the prices of Home Railways, the Undergrounds participating to a moderate extent.

Metropolitans and Districts dipped with the rest, to rally sharply on Monday, upon attention being directed to the possibilities held out by the published traffics. It is thought that the Metropolitan will pay an increased dividend over that declared a year ago, when 1¾ per cent. was distributed; and expectation looks for a dividend of 2½ per cent. on District Second Preference, which would be an increase of the fraction. The last-named stock, by the way, is not at present quoted in the Stock Exchange. Underground Electric issues are a little better. East Londons remain at 7¼. London United Tramways Debenture stock has risen a point. British Electric Traction issues are steady, with advances in the 5 per cent. Debenture and the 7 per cent. Preferred stocks.

The strength of the Electricity Supply market is well maintained. County of London Ordinary and City Ordinary show gains of 2s. 6d. and 10s. respectively; an order to buy 250 of the latter company's shares had the effect of stiffening the group as a whole. Holders naturally prefer to keep their shares and await the course of events, which ought certainly to be interesting when the County Company's Bill comes before Parliament next session. Accordingly, the quiet demand which has been stimulated by the publication of the Bill finds little floating supply on offer; and, as a matter of fact, some of the prices are better than might be supposed from the quoted margins.

The Marconi group is better, although the parent shares show no quotable change on the week. There is a disposition to buy the Marconi subsidiary shares once more, on the part of a few hardy speculators. Canadians keep steady about 9s. 3d. Americans rallied to 17s. 9d., Spanish to 8s. 9d., and Marines to 13s. 8d. American Telephone and Telegraph Capital stock has been dull, on the idea that trouble may be brewing in the United States through the possibility of fresh competition, but this was offset by the strength of the American Railroad market, noted in the second paragraph above, the result being that the price of the stock is two points higher at 125. The Telegraph market is disposed to droop, and there has been a little selling of the Eastern descriptions. Eastern Telegraph Ordinary stock fell 2, Eastern Extension shares 1s. 8d., and one or two of the Debenture stocks are a trifle lower. Several deceased accounts are declared responsible for the dulness. Cuba Telegraphs fell 10s. to 8½. West India and Panama reacted $\frac{1}{16}$ after their rise, and Reuters went back to 8¾. Anglo-American Telegraph Preferred improved to 105½, and New York Telephone bonds are better at 98. Commercial Cable Debenture and Direct United States Cable shares have drooped

The speech of the American Ambassador at the Savage Club last Saturday night, briefly outlining an unexpected extension of the Monroe Doctrine, has given rise not only to surprise, but to some perplexity, as it opens up new paths, whose turnings may have important results for companies, other than United States undertakings, which have concessions in the areas which the Doctrine is supposed to cover.

The news from Mexico continues to be of the usual conflicting character, but prices of the Mexican group are not fluctuating much at present. Mexican Light and Power Common shares and Mexico Trams second bonds are both a point down, but, on the other hand, the Power Company's Preferred and the Tramways 5 per cent. bonds are both better to a similar extent. Improvements occurred in Rio Tramways bonds. The Anglo-Argentine Tramways issues hardened; and the new issue of Buenos Ayres (Province) Electric Preference shares, advance particulars of which were given here last week, has been notified as being subscribed in full. Brazil Traction shares keep very steady at 89½.

The Manufacturing division is featured by another big rise in Willans & Robinson's 4 per cent. Preference stock, which, at 30, has trebled in value within the last few weeks, the present gain being one of 7½ points; the Debenture is also a little better. Small falls occurred in British Insulated and Helsby shares, Callender's Ordinary and Preference, British Aluminium of both classes, and Edison & Swan fully paid. Consolidated Diesel Engines lost a few pence at 2s. 3d., after the meeting. India-rubber shares dropped 10s. to 13. Prices in the Rubber Share market are still dull and depressed. There has been no advance in the price of the raw material, and until some further development takes place in connection with this, the public are not likely to be attracted to the market. Rumour has it that the methods of the auctions will be changed early in the new year, when monthly inscription sales are amongst the proposals put forward to regulate the price of rubber—these to supersede, of course, the present open auctions, which take place fortnightly.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, December 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/6	.
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	£1 10 dec.
a Lead, Nitrate	„	£29 10	10/- dec.
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only) ..	„	7½d.	..
a Shellac	per cwt.	92/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8½d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£96	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£121 6 8	..
b „ Sheet, in ton lots ..	„	£126	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	..
c „ Tube (brazed)	„	9½d.	..
c „ „ (solid drawn) ..	„	8⅝d.	..
c „ Wire, basis	„	7⅝d.	..
c Copper Tubes (brazed)	„	10⅝d.	..
c „ „ (solid drawn) ..	„	10⅝d.	..
g „ Bars (best selected) ..	per ton	£82	£1 dec.
g „ Sheet	„	£82	£1 dec.
g „ Rod	„	£82	£1 dec.
d „ (Electrolytic) Bars ..	„	£68	£1 10 dec.
d „ „ Sheets ..	„	£85	£1 10 dec.
d „ „ Rods ..	„	£73 10	£1 10 dec.
d „ „ H.C. Wire	per lb.	9d.	½d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/6	..
h India-rubber, Para fine	„	3/0½	½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	49/7	4d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£18 10	7/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	½d. to
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£174 to £175	£8 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/5	1d. dec
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£24 15	15/- dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Manx Electric Railway Co., Ltd.—The directors' report for the year ended September 30th, 1913, states (says the *Financial Times*) that the gross receipts amounted to £40,160, and the gross expenditure to £18,740, leaving £21,419 plus £920 brought forward, making together £22,340. It is proposed to pay a preference share dividend in respect of the year, £3,580; to reserve for special renewals, £2,000; and pay a dividend of 2 per cent. on ordinary shares, £2,000; leaving £2,179 to be carried forward. The weather during the past summer was very fine, increasing the passenger receipts by £6,349. Goods and other receipts show a slight decrease. Working expenses amount to £18,740, an increase of £1,071. The ratio of working expenses to receipts was 46·66 per cent. in 1913, as compared with 51·4 per cent. in 1912. The passengers carried during the 12 months totalled 704,188, as against 574,187 last year.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8½ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94 xd	..	4 5 1
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅜ — 5⅜	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	+ ½	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅝ — 12⅜	+ ⅛	4 19 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	103½ — 105½	+ ½	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅛	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	8 — 8½	+ ⅜	5 6 0
Kensington & Knightsbridge, Ord.	5	[illegible]	[illegible]	7⅛ — 5/16	..	[illegible]
Do. 4 % Deb.	[illegible]	[illegible]	[illegible]	[illegible]	..	[illegible]
Kent Elec. Power, 4½ % Deb. ..	[illegible]	4½	4½	[illegible]	..	[illegible]
London Electric, Ord.	3	2½	..	1⅜ — 1⅝	..	4 14 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 14 3
Metropolitan	[illegible]	4	4	[illegible]	..	[illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅜	..	5 16 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	4⅜ — [illegible]	..	4 14 6
Do. 3½ % Mort. Deb.	Stock	3½	3½	[illegible] — [illegible]	..	4 10 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	[illegible] — [illegible]	..	4 5 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅛	..	4 17 1
Oxford	5	7	6†	6 — 6⅛	..	5 11 7
St. James' and Pall Mall, Ord. ..	5	10	[illegible]	[illegible]	..	5 7 8
Do. 7 % Pref	5	7	7	6⅞ — 7	..	5 1 1
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	5 0 0
South London, Ord.	4	5½	..	2⅜ — 3⅝	..	4 1 10
Do. 5 % First Mort. Deb. ..	100	5	5	[illegible] — [illegible]	..	6 15 6
South Metropolitan, 7 % Pref. ..	1	7	7	1⅛ — 1⅜	+ 1/16	5 0 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	[illegible] — [illegible]	..	5 13 9
Urban, Ord.	£3	Nil	..	5/16 — ½	..	4 13 7
Do. 5 % Cum Pref.	5	3	..	2⅛ — 2⅜	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	[illegible] — [illegible]	..	..
Westminster, Ord.	5	10	10†	8½ — [illegible]	..	5 4 8
Do. 4½ % Cum Pref.	5	4½	4½	4⅛ — 5⅛	..	5 14 3

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	5	6†	5 — 5½	+ ⅛	5 14 3
Calcutta, Ord.	5	8½	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	108 — 112	..	7 2 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	½ — 11/16	..	7 5 6
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	— ½	5 8 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	5/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ — 104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	46 — 50	—	8 0 0
Do. 7 % Cum. Pref.	$100	7	7	81 — 86	+1	8 2 9
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 82	..	6 1 11
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 62	..	8 1 4
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 222	..	4 16 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	[illegible]	99 — 104	..	5 15 5
Do. 5 % Deb. Stock	Do.	5	5	89 — 101	+1½	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	136 — 140	..	4 6 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ — 107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	97 — 99	— ½	4 11 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 — 100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	11/16 — 13/16	..	6 13 6
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 106	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6¼ — 6⅜ xd	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 — 126	+2	6 7 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105 — 106	+ ½	5 13 9
Do. Def.	Do.	30/-	..	23⅞ — 24⅜	..	6 3 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7⅜ — 7⅝	+ 1/16	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	— 1	4 18 9
Cuba Telegraph	10	6	6†	8 — 9	— ½	6 13 4
Do. 10 % Pref.	10	10	10	14⅜ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8⅝	..	5 3 8
Do. 10 % Cum. Pref.	5	10	..	6⅝ — 7¼	..	6 12 0
Direct United States Cable ..	10	4	4†	6¼ — 6⅜	— ⅛	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 — 127	— 2	5 10 8
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	— 1	4 8 4
Eastern Extension	10	7	7	12 — 12½	— ⅛	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅜	..	4 19 0
Great Northern Telegraph ..	10	20	5†	30½ — 32½	..	6 2 8
Indo-European Telegraph ..	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	78 — 82	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	..	8⅜ — 8¼	..	5 14 3
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2 1/16 — 2 1/8	+ 1/16	6 1 0
Monte Video Telephone, Ord. ..	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¼ — ⅜	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	+ ½	4 11 5
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9½	— ½	10 16 2
Submarine Cables Trust	Cert.	6	6	122½ — 125½	..	5 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6½ — 6¾	..	5 1 6
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	3½	2½	..	1 3/16 — 1 1/8	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 8
West India and Panama Teleg.	10	1½	1½	2 1/16 — 2 1/8	— 1/16	4 12 7
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10½	+ ½	5 17 1
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 — 100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12½ — 18½	..	5 5 8
Do. 4 % Debs.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$100	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	..	..
Do. Do. Deferred	100	..	..	4 — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	+2	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	+1	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	81 — 83	+2	4 16 5
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	77 — 79	..	5 1 3
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅛ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	3/16 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	½ — ⅝	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	+1	6 7 0
Metropolitan Railway Consol.	100	1⅝	1¼†	43¼ — 43¾	+ ½	3 14 3
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30¾ — 31¼	+ ½	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅝ — 3⅞	..	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	1½†	3¾ — 4	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 9/16 — 4 13/16	..	5 14 8
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	90 — 92	+ ½	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 7 0
Do. 5 % Deb.	100	5	5	96½ — 98½	+ ½	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	101½ —103½	..	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	..	6 13 4
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7¾	..	5 3 8
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	114 —119	—1	6 14 6
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5⅞ — 6⅜	..	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	N
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4⅜d.	6	⅝ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅜ — 1⅝	..	4 7 3
Do. 6 % Pref.	1	6	6	1 5/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	+ ⅛	5 14 3
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	85 — 87	..	5 15 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	78 — 81	..	8 12 10
Do. Gen. Con. 5 % Bonds	..	5	5	81 — 86	+1	5 16 3
Do. 6 % Bonds	100	6	6	82 — 85	—1	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅜ — 6¼	..	8 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96½ xd	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅜ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 6 % Bonds	..	5	5	100—102	+1	4 18 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91½	+ ½	5 9 3
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	99 —102	..	4 18 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5¼	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅛ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	25/32 — 29/32	..	7 13 4
Babcock & Wilcox	1	16	14†	2 13/16 — 2 15/16	..	5 8 11
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	—1/16	..
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	—1/32	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7¾ — 8¼	— ¼	6 1 3
Do. Pref.	5	6	6	5½ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1⅛ — 1 5/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10⅜ — 11¼	— ¼	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	— ⅛	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	32 7/32 — 33 1/32	..	5 8 5
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co., Deb.	100	5	5	67 — 72	..	6 18 11
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	25/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	— ⅛	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	68 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 3/16 — 1 5/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6⅞ — 7½	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	— ½	4 8 3
India-Rubber, G. & T.	10	7½	5	12⅜ — 18½	— ½	5 11 1
Do. Pref.	10	5	5	9¼ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	55 — 59	+1	6 15 7
Do. B 4 % Cum. Pref.	100	..	..	28 — 32	+7½	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd 1913.

EFFECTIVE WINDOW LIGHTING.

By "WHISTLEFIELD."

Most shopkeepers recognise that a well-lit window is a good investment as well as a good advertisement, but a walk along the main streets of any of our large towns in the evening reveals the fact that the great majority of contractors must have very crude ideas as to what constitutes good lighting ; yet this is a point which deserves more attention than is usually bestowed on it, because the matter not only affects the attractiveness of the window display, but has a direct bearing also on the problem of getting the best value from the money expended on light.

Everyone is familiar with the fact that people who walk into a room out of bright sunshine can hardly distinguish

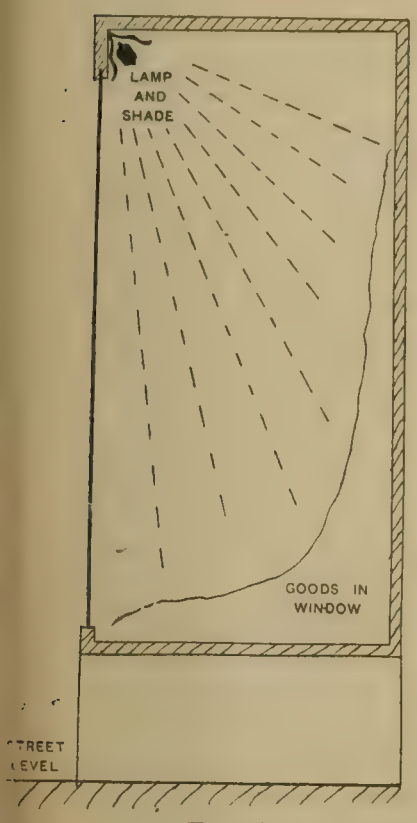


Fig. 1.

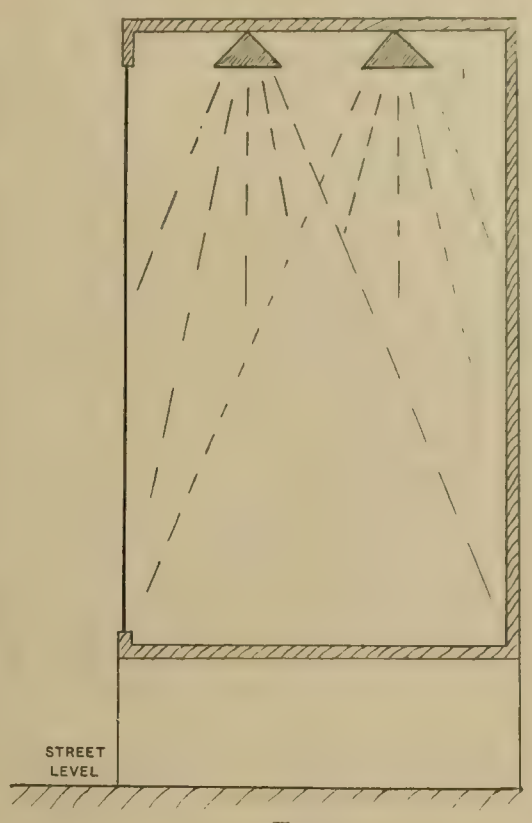


Fig. 2.

anything in the room, though others who are sitting in the room can see everything quite clearly. The reason for this is that the eye automatically adjusts itself to the strongest light that it has to endure. In bright sunshine the iris contracts and the pupil admits much less light than when the eye is subjected to the much weaker illumination of the room, and it takes a few minutes for the eye to adjust itself to the new scale of light intensity.

Every object has the power, more or less, of reflecting the light that falls on it. This reflected light enters the eye and forms there the image of the object which we "see." The brilliancy of the image depends not so much on the quantity of light which falls on the objects, as on the quantity which enters the eye, and this is governed by the degree to which the iris is opened to admit light. When looking into a window where the lamps are concealed, the eye adjusts itself to the strongest light which is within the range of vision. This will be the light reflected from white goods ; should a lamp be introduced among the goods displayed, the eye will immediately adjust itself to the greater intensity of the glow from the lamp, and thus the pupil will be partially closed, and so will admit only one-half or one-third of the light previously admitted. In other words, the objects shown in the window will appear only one-half or one-third as bright as they were before the lamp was introduced into the range of vision, so that there is nothing to be gained by concentrating light on goods in a window, if, at the same time, the glare from the source of light is increased by a corresponding amount, for the greater the glare the more the pupil of the eye is closed, and although the goods actually reflect more light, only a small proportion of it enters the eye, and so they do not appear to be brighter.

When windows are lit by electric glow-lamps there is no reason whatever for lowering the lamps into the range of vision ; they ought to be taken right up to the ceiling, and the light should be thrown down on to the goods by means of reflectors.

The arrangement of the lamps and the style of the reflectors used will naturally depend on the nature of the goods displayed, and the method in which they are arranged in the window space. Fig. 1 shows a shallow window with the goods spread out in front, and piled up round the sides and back. This arrangement can be well lit by a few lamps placed in the very top edge where the glass of the window meets the roof, as shown ; the lamps in this position are quite out of the range of sight of those who are looking into the window, and suitable reflectors will give an even illumination.

When a window is fairly deep and there is sufficient height for the lamps to remain out of the line of sight, the arrangement shown in fig. 2 can be adopted. Where goods are actually placed against the glass of the window, outside lighting is essential, but suitable reflectors which prevent the light from falling in any direction except that of the window ought always to be provided, as shown in fig. 3.

Fig. 4 shows a very popular method of lighting. A neat reflector fitting is suspended inside the window by chains or cords about 6 ft. above the street level, and lamps are fixed behind the reflectors, which throw the light on to the back and floor of the window ; this method is better than that shown in fig. 1 in cases where goods are not spread out flat, and so are liable to have shadows cast by a top light.

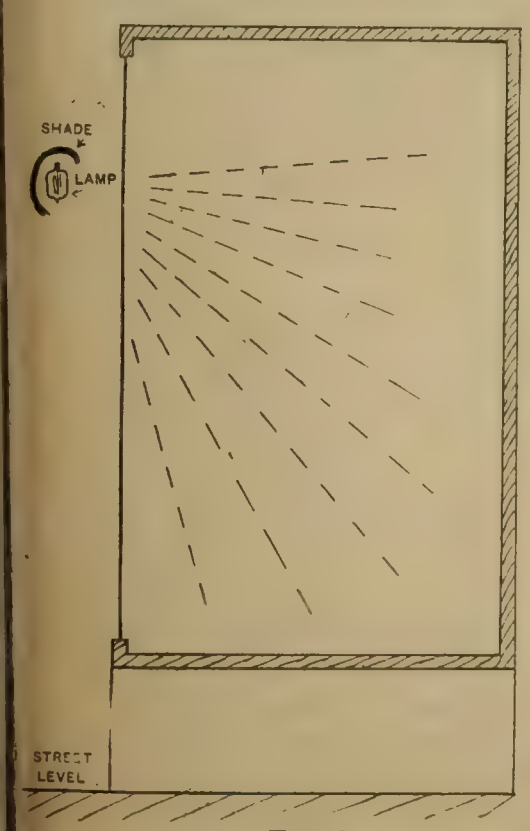


Fig. 3.

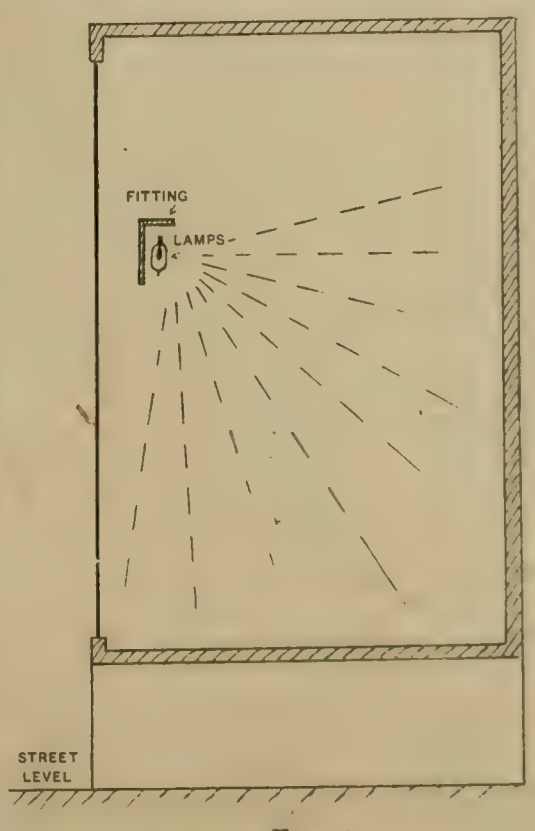


Fig. 4.

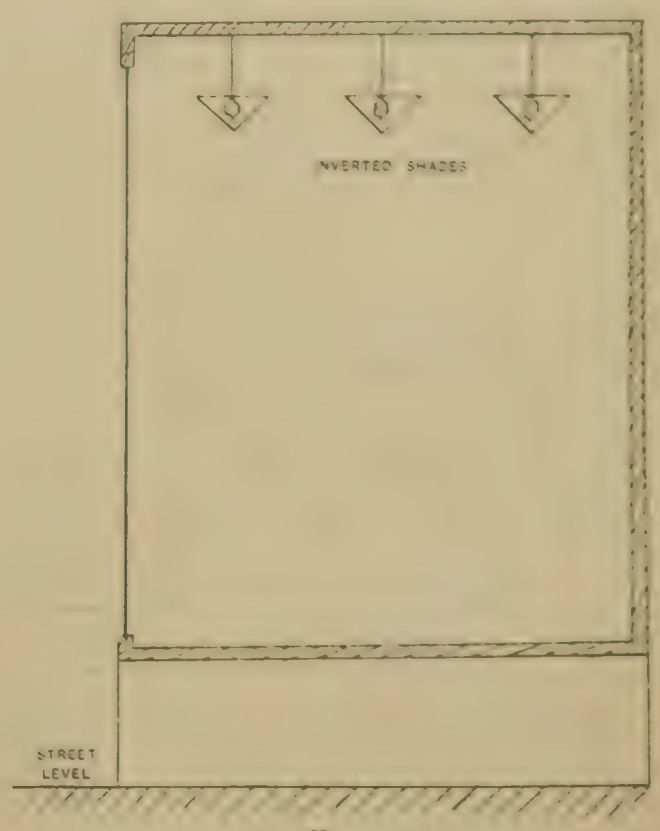


Fig. 5.

Hats which are displayed on stands are best illuminated in this manner. The name of the firm or special notices can be fixed to the front of the fitting, which thus performs the duty of an illuminated sign as well.

Where a very deep window is fitted with costumes displayed on models, or goods of a similar nature, the method of illumination shown in fig. 5 is very suitable ; shades are hung below the lamps to throw the light on to the ceiling, from which it is reflected in the form of a shadowless glow, which is extremely effective in the display of light-coloured or delicately-tinted fabrics. When the ceiling is of a good height, the method shown in fig. 2 can be used also, the shadows thrown by the first row of lamps being illuminated by the lamps of the second row, and *vice versâ*. In all these methods of illumination which have just been described, the source of light is either concealed or else placed out of the direct line of vision, with the result that the eye is attracted by the even bright illumination of the goods.

Any windows that are lit by means of pendant lamps can be altered at a trifling cost into one of the styles illustrated by merely raising the lamps to the ceiling and using suitable reflectors.

From the very nature of their design metal-filament lamps shed most of their light in a horizontal direction, and deep shades are needed to deflect the horizontal rays of light downwards, but there are so many good and cheap reflectors on the market that there is really no excuse for a badly-lighted window.

REVIEWS.

Application of Electric Power to Mines and Heavy Industries. By W. H. Patchell. London : Constable and Co., Ltd. Price 10s. 6d. net.

This book, as we are told in the preface, is the outcome of a course of special advanced lectures delivered at the University of London, King's College, last winter, and is undoubtedly the best work that has yet come before us on the very important question of electricity in mines. Its practical nature is due to the author's experience while acting as consulting electrical engineer to the Ferndale Collieries in South Wales.

The book is divided into 12 chapters, the first of which deals shortly with legislation, accidents, field for electricity, &c. ; with this we are in complete agreement, especially with the pertinent query : "Why should there be special rules for the use of electricity in mines ?" Cables, coal cutters, haulage, electric winding, ventilation, and air compressing, pumping, rolling mills, machine tools and cranes, and electric welding and furnaces, are the chief items in the other chapters ; it seems rather a pity that the last three items have been included in a work which is mainly devoted to mining, and we are of the opinion that had what we may term the "iron-works" section been extended and published under a separate title, a useful and interesting work would have been available to those engaged in the important industries concerned. We take it, however, that the work is intended for the use of electrical engineers engaged in designing plant for mines and the heavy industries rather than for the instruction of the engineers and managers engaged in the industries themselves, and we are disposed to think it is the latter who want educating more than the former.

Whilst we have nothing but praise for the book as a whole, we think a little more detail might have been given, in regard to mining, as to costs of generation and operation. The author gives an example showing the cost of endless rope as against main and tail haulage, but as energy is assumed to cost 1d. per unit it is not of much value. The chapter on cables is fairly good, but we are rather surprised that the method of suspending a shaft cable by means of a socket like a "rope socket" attached to the armouring of the cable is not mentioned. Further, one or two methods of installing shaft cables are mentioned by the author, such as "slinging the drum in or under the cage," and lowering with the aid of a locomotive. The proper method is that mentioned by the author on page 36 : "To lower the full drum to the pit bottom and raise it into position by means of a good flexible rope." The section on "Earthing" also might be improved, and certainly the use of "old haulage ropes" should be absolutely condemned. In the section on shot firing we read : "Low-tension fuses consist of small platinum wires embedded in fulminate of mercury" ; this is hardly correct, as the electric fuse, in both high and low-tension detonators, is quite separate and distinct from the detonator, which is a copper cap containing the fulminate of mercury. The chapter on haulage gears is good, but we are just a little disappointed with "winding engines." The various systems are briefly described, but the diagram of the "Whiting system," on page 138, is not quiet correct, as in the actual system the driving pulleys are set one in advance of the other, and not side by side. Further, at Grand Hornu, there are three electric winding engines, not two ; and so far from these being unsatisfactory—as undoubtedly the winder at Preussen II was—they are quite the opposite, and when circumstances are favourable, an ordinary three-phase winder is the best to adopt. The failure at Preussen II was not due to the winder itself, but was unsuitable to the method of caging and the system of generating the current. The main points to be considered in the selection of any type of winder are : effect on generator or supply station, type and weight of drum, method of decking, load to be raised, and at what speed, and these must be considered together. An interesting description of a test with the Ilgner winder at Ferndale Collieries is given ; it would have added to the interest if the costs had been included.

Dealing with ventilation, the author discusses the important question of speed regulation ; shows the advantages of the cascade motor, and that speed regulation by a resistance for fan driving is not only convenient, but economical. Air compressing is briefly dealt with, and in the following chapters we have pumping, rolling mills, heavy machine tools and cranes, and finally electric welding and furnaces, all of which sections are good, and should prove useful to those interested in these branches of electrical engineering. We regret to notice that Benardos is again spelt "Bernados." The work is well got up, illustrated mainly with half-tones and folding plates, printed on good paper, and is generally a credit to both author and publisher.

Experimental Wireless Stations. By Philip E. Edelman. London : S. Rentell & Co. Price $2.

This book professes to cater for the requirements of wireless telegraph experimenters of all classes, and to embody the results of practical experience and information gained by the author in pursuing experimental work on the subject.

In the first chapter the theory of wireless transmission is somewhat scantily touched upon, but the reader is clearly expected to have a good groundwork of general electrical theory, or else to acquire a knowledge of the fundamental principles from standard works. The chapter forms an introduction to the descriptive and practical parts which follow rather than a serious attempt to expound the principles of wireless transmission.

The practical treatment of the subjects of aerials, grounds, transmitters and detectors is carried out in a way which will, no doubt, appeal to the amateur and render him much real assistance in carrying out the work of installing an experimental station. Clear and adequate illustrations are given freely throughout the book, making it easy to follow the descriptions. The design of simple apparatus for various systems of transmission and methods of reception is treated of, including appliances for fixed spark, quenched and rotary spark gaps, continuous wave transmitters, coupling coils, oscillation transformers, crystal receivers, &c. Practical hints on the construction of measuring and testing apparatus are also a feature of the book.

The author makes the sensible proposal that manufacturers of spark coils should rate these appliances in watts

instead of spark lengths, which convey no adequate idea of their utility for wireless purposes.

Incidentally, it may be pointed out that the signal code given on page 219 shows wrong characters in Continental Morse for the letter F. There are also numerous other misprints and misplaced punctuation marks throughout the book.

The use of the testing buzzer described at the end of Chapter XIV, for actuating and proving the setting of detectors, calls for some comment. Text-books in general fail to indicate the proper connections of this useful appliance to make it give tuned transmission of regulable wave length and small damping when used in conjunction with an adjustable condenser and inductance. A wave meter may readily be fitted with a buzzer in such a way as to effect this purpose. Such a contrivance is always a boon for use in experimental and testing work.

This book will, no doubt, appeal to the numerous class of experimenters who take up wireless telegraphy as a hobby more or less seriously. To them it can be recommended for useful guidance and assistance, at any rate, in the earlier stages of their progress. The practical advice given is generally sound and useful.

Switchgear and the Control of Electric Light and Power Circuits. By A. G. Collis. 1913. London : Constable and Co. Price 1s. net.

This little work deals in a concise and easily understandable manner with the main principles of direct and alternating-current switchgear. In a way it is an introduction to the larger and more comprehensive treatise by the same author, which was reviewed in our issue of September 19th.

The first 50 pages deal in an entirely satisfactory manner with the essential ideas underlying continuous-current switchgear, a considerable number of particular cases being described with the aid of connection diagrams. Considering the limited space available in a small book like the present one, the quantity of genuine information that is incorporated in this section is remarkable.

The remainder of the book discusses in a similar fashion the switchgear and apparatus used for the control of alternating-current circuits. While quite good, it is not quite so detailed as the preceding direct-current section.

At the end of the book is a list of formulæ, which, however, would be of more use if the meaning of the various symbols involved were explained. To an experienced man this definition of symbols would not be necessary, but at the same time neither would the list of formulæ. In several places the author's style is a little curious.

The book contains 85 pages and 47 illustrations, and considering the small price it is very cheap, and should sell in large quantities.—H. G. S.

BRITISH TRADE WITH CANADA.

We have written so much lately on the difficulties of the Canadian market, that it might be thought that we had left little more to say by way of profitable contribution to the study of the British position. We have no desire to overdo the subject in our columns, nor to weary the reader, but when any new suggestion is put forward by those interested in the market that appears to be deserving of full consideration, we do not think our readers' patience will be tried by our outlining it and inviting them to see whether it is worthy of their support.

The proposal to which we wish to refer is fully dealt with in an address which was given before the London Chamber of Commerce, at a meeting held at the end of October, by Mr. J. H. Turner, chairman of the Canadian Chamber of Commerce in London. The whole of the ground covered by Mr. Turner we need not state, for so many of his points are quite familiar to our readers. We will content ourselves with quoting what he believes to be the reasons for the comparative non-success of British traders in the market referred to, and indicating one way in which he and others who have studied the matter believe it to be possible for us to do better in the future.

First, then, let us quote the stated causes of failure :—

(A) So Far as the Consumer is Concerned.

1. Even though quality of goods excellent design and make unsuitable for Canada—quite a minor detail will often kill the sale of an article.
2. Goods unnecessarily heavily made and packed, thus incurring the handicap of heavy rail transport charges and consequent increase in cost.
3. Owing to lack of advertising, consumer does not know where to obtain British goods.
4. Owing to insufficient representation of British manufacturers, storekeepers do not stock British goods and they are therefore never brought before the Canadian consumer.

(B) So Far as the Distributor or Storekeeper is Concerned.

1. Cannot get in touch with manufacturers, therefore will not stock goods.
2. Cannot buy British goods that sell ; owing to unsuitability for market.
3. Cannot get goods packed in suitable packages for ready sale according to local conditions.
4. Cannot get catalogues and invoices in dollars and cents.
5. Cannot obtain quotations c.i.f. his city.
6. Cannot arrange suitable terms.
7. Is mulcted in excessive charges for packing, casing, &c.

(C) As Far as the Manufacturer is Concerned.

That owing to the great expense involved—where the actual trade in sight does not appear to warrant it—he is at present unable to obtain the necessary personal, definite and reliable first-hand information and particulars of sales publicity which is absolutely necessary in order to enable him to meet and overcome the difficulties enumerated in A and B ; and, it is in order to endeavour to supply this deficiency that the Canadian Chamber of Commerce now suggests the establishment in Canada of a British Manufacturers' Exhibition Train.

We have lately had an opportunity of discussing this British train proposal with the Secretary of the Canadian Chamber in London (Mr. L. J. Beirne), and from our conversation with him, together with a study of Mr. Turner's address, we are inclined to think that the matter is fully worthy of attention at the hands of all who are desirous that their goods should become known or better known in Canada. It should be said before going any further that Mr. Turner knows the general trade position in Canada from long experience, having been in business in the Dominion for over 40 years. The idea of running manufacturers' trains is, of course, not new ; indeed, it has been applied with great success by Canadian firms themselves in getting their names and goods known in new parts of their own country. The question that now calls for consideration is how far British firms could help to remove the ignorance that exists over there respecting British electrical manufactures, by co-operating in the scheme that is advanced on behalf of the Canadian Chamber in London. The project may be briefly described in Mr. Turner's own words, as follows :—

The manufacturing cities in the United Kingdom shall each hire from one of the Canadian railways a high grade passenger coach—72 ft. × 10 ft. × 10 ft.—such coach to be suitably fitted up with show-cases, window frames, &c., as a travelling exhibition of the products of those manufacturers in each city who are willing to show their goods to the actual consumer throughout the Dominion of Canada ; and who are wishful of entering into commercial relations through the medium of such a train with the distributors of the Dominion. The annual cost for, say, a nine-car exhibition train would be roughly £30,000, this figure to include cost of hire, haulage, maintenance and upkeep, demurrage at stations, lighting and heating, insurance, salaries and wages, steamship and rail fare of employés, advertising, postage and incidental and general administration charges both in Canada and the United Kingdom. It is proposed to meet this annual charge by the letting of exhibition spaces in the cars to manufacturers at rates ranging from £40 to £240 a year, according to space required ; that is, for payments ranging from 15s. 6d. to £4 12s. a week, a manufacturer may place his actual products before both the consumers and the distributors of a continent.

It is proposed that the train shall carry an efficient publicity staff whose work it will be to see that in all cities towns and districts at which the train will be making a stay, the interest of the public shall be fully aroused in advance ; that it shall be met on its arrival by the public functionaries of the place ; and that times shall be suitably arranged for general and trade visitors to separately make a tour of the train and an inspection of the exhibits. A carefully selected staff of expert salesmen would be carried with the train, and there would also be a well-organised system for

the discreet distribution of catalogues to *bonâ fide* trade inquirers. Furthermore, it would be one of the duties of the train staff to keep British manufacturers or their local agents, as the case might be, fully posted regarding the names and addresses of these possible clients. But we need not go into further details at the moment ; all we desire to do at this stage is to outline the scheme, to ask that it shall receive the careful consideration that it deserves, and that any of our readers, or electrical organisations, who may be interested, will write for information to Mr. Beirne, the secretary, at the Royal Colonial Institute Building, Northumberland Avenue, W.C.

PRESSURE RISES.

By W. DUDDELL, F.R.S.

(*Abstract of Inaugural Address delivered by the President of the* Institution of Electrical Engineers, *Nov. 13th*, 1913.)

(*Concluded from page* 893.)

If the cable is electrically very short there will be practically no diminution in amplitude or change of phase while the wave progresses along it. This is in general the case for the underground cables and power lines in this country at ordinary frequencies, and under these conditions the cable may be considered to be replaceable by an equivalent arrangement of self-inductions and condensers, as shown in Fig. 14, in which the capacity of each of the two con-

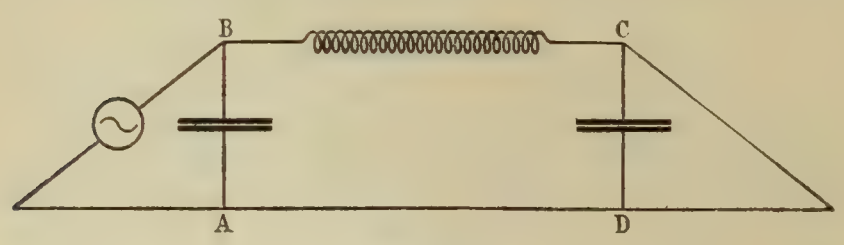


Fig. 14.

densers is equal to one-half of the capacity of the cable, and the self-induction and resistance of the coil between them are equal to the self-induction and resistance of the whole cable.

Very long lines, such as those in use abroad, cannot be considered quite so simply. Suppose a long line is on open circuit at the far end, and, as before, it is suddenly connected to the generator at the zero point of the potential curve. Then the wave of current flows down the line, and when it gets to the open far end it is reflected or turned back on itself and flows back towards the generator; now at this reflection at the far end, the potential difference of the wave is doubled. The wave now travels back towards the generator, where if the generator is assumed to be very large the wave will go to earth quite freely and the reflection will take place with a reversal of phase and no increase in amplitude. The current wave will again travel back towards the far end of the cable where it will again be reflected, and it will travel successively backwards and forwards and so build up to the steady state. Consequently in the steady state of such a cable the voltage of the far end may be looked upon as being built up on a number of components of different phases. The magnitude of the voltage will naturally depend upon the phases and magnitudes of these components, which depend upon the frequency, the length of the line, and its constants. In order that the components may add up to a considerable total it is necessary that they should all arrive at the far end in the same phase, or more accurately that the phases should differ by a multiple of 2π. As the reflection at the generator end is accompanied by a reversal of phase the travel of the wave along to the end and back must be accompanied by a change of phase of π, *i.e.* the alternator must have changed its phase by $\pi/2$ during the time the wave takes to travel along the line, which means that the length of the line is a quarter of the wave-length at this frequency. This condition leads to a building-up of the potential at the end of the line.

Another way of looking at the effect is to consider that the wave which is started flows along the line and after reflection at the open end returns to the generator, where it should arrive at the moment that the alternator has reversed the direction of its e.m.f., so that the returning wave and the e.m.f. of the alternator act in the same direction and assist one another. This effect, namely the building-up of the potential at the far end of the line on open circuit, is generally known as the Ferranti effect, owing to its having first been observed by Dr. Ferranti on the Deptford mains.

In general the velocity of propagation of the wave along the line is less than the velocity of light, say from one-quarter this velocity upwards for ordinary cables and lines, though nearly equal to it for straight wires in space away from other bodies.

At 50 frequency, with a cable having a self-induction of 0.5 millihenry per mile and a capacity of 0.25 microfarad per mile, the velocity of propagation is about 86,000 miles per second in round figures. Hence the distance travelled in one quarter period, or one two-hundredth of a second, is 430, so that the quarter of a wave-length will correspond approximately to 430 miles.

With higher frequencies the length to produce the effect is considerably shorter, so that the effect can become quite marked with the upper harmonics and moderate lengths of circuit, and considerable rises of pressure due to this cause have been observed in the United States. Load on the end of the line reduces the effect, so that on loaded lines it soon becomes inappreciable.

With the higher frequencies employed in wireless telegraphy the Ferranti effect is very marked. Aerials are always adjusted with their added self-induction to the quarter wave-length, so that the potential at the free or open end may amount to some hundred times the pressure employed at their base.

With the short cables in use in this country the effect is rarely observed, but it is of considerable importance from the point of view of sparking and arcing that may take place in switching operations and during faults, which may generate oscillations of a suitable frequency to produce the effect to a very marked degree with comparatively short leads. The magnitude of the effect depends on the resistance being small, which is generally the case in practice.

In making calculations of the frequency which will produce the Ferranti effect on very short lines, the line may be considered to be replaced by the circuit shown in Fig. 14, as pointed out by Dr. Kennelly, and the frequency of resonance of the part B C and D may be calculated by the simple Kelvin formula. A more accurate result can be obtained for short lines of small resistance by taking $2/\pi$ of the capacity and $2/\pi$ of the self-induction of the whole line, and calculating the free period of a circuit composed of a capacity and self-induction having these values.

Some very interesting cases occur when inductive windings are suddenly switched into circuit; for instance, the high-tension coils of transformers, induction motors, or any alternating-current apparatus. In this case there may be no observable pressure rise between the terminals of the coil, but yet during the initial stages the full pressure which is applied between the terminals of the coil may be so unequally divided between the windings as to produce local differences of potential far above the normal.

Let us consider the coil shown in Fig. 15, and let us assume that a high voltage V is suddenly applied to it by means of the switch *s*. Now in the steady state the voltage V will be assumed to be uniformly divided among the turns

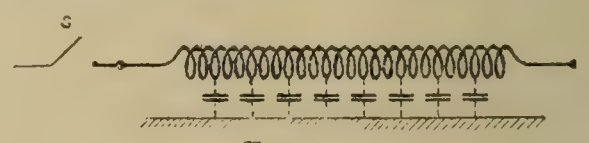


Fig. 15.

of the coil, so that between the ends of the first turn there will be V/n volts, if n is the number of turns. Now consider what happens at the first moment of closing the switch *s*. The current will not instantly attain its steady value; there will be a preliminary stage, and during this preliminary stage one may imagine that a quantity of electricity is travelling forward along the coil from its end. In other words, that there is a sort of wave front starting from the switch to travel along the coil similar to the charge of a long cable. If the coil possessed no electrostatic capacity, *i.e.*, no condenser action, either from turn to turn or from turn to earth, the current would be propagated instantaneously round the coil, and would start to grow from zero in all parts of the coil equally at the same time; but in practice this is never the case, for every coil, however made, possesses some finite though very small condenser action. The wave front therefore takes some appreciable time to travel round the coil, although this time may be exceedingly small. During this progress the potential difference is by no means uniformly distributed along the coil; in fact, the coil may be looked upon as similar to a long submarine cable if one remembers that the electrical constants are very different, and consequently the times of propagation of the disturbance.

In the case of a submarine cable, say an Atlantic cable, if the voltage is suddenly applied at this end, the wave starts off and travels towards the States, and the first trace of its arrival occurs rather less than 0.1 sec. later. In the case of the windings of an ordinary transformer the length of time required for the wave front to travel along the coil is probably less than 1/10,000th of a second. In both cases during the initial stages practically the whole of the potential difference is localized.

The localization of the voltage on the turns of a transformer at the moment of switching it into circuit is of great practical importance and is the cause of many failures. The effect is further aggravated by any sparking which may take place at the switch contacts, which sets up high-frequency oscillations in the leads connected to the trans-

former. As the high voltage between turns due to switching-in only lasts a very short time, too short to be recorded by an ordinary oscillograph, the failure of the insulation between turns may only take place after a number of switchings, when the insulation between turns having been locally weakened, heating sets in at the normal working voltage and a breakdown of the coil to earth soon follows. For this reason extra insulation is often placed on the end turns of transformers, or choke coils are used in series with them as a protection.

High-voltage motor windings are subject to a similar effect, and with asynchronous motors there is a further possible cause of localization of the pressure on a limited number of turns of the windings, not necessarily the end turns. This depends on the fact that the self-induction and mutual-induction of the different sections of the windings are not necessarily equal, owing to the mechanical difficulties in making the short air-gap perfectly equal all round the machine.

The localization effect on the end turns of the apparatus is especially noticeable in connection with the high-frequency oscillations or with the steep wave front currents which may travel along overhead lines after lightning discharges. These are very similar in their properties, but, owing to the much higher voltages which may be induced, much more destructive and difficult to guard against than the steep wave fronts and oscillations that can be set up by switching-on apparatus. This effect has been investigated by Jackson.

Switching-off ordinary loads is generally safe, for even should the switch try and open the circuit when the current has its maximum value it is improbable that the rate of decrease of the current will be sufficient to produce dangerous pressure rises. On the other hand, abnormal currents and short-circuits may give rise to excessive pressure, as the energy liberated at the break is so large that it may form an arc and blow the switch to pieces. If the rate of break is sufficiently rapid to avoid this, the rate of change of the current may be so great that a dangerous pressure rise is produced. A number of valuable records showing the switching-off of large powers amounting to tens of thousands of kilowatts are given in a paper by Maguerre in which practically no rises of pressure are observable, but I think it is unwise to assume that this is always the case. The best means to employ to limit the short-circuit current of generators is one of the problems which face designers at the moment, both to protect the machines themselves from damage and to reduce the risk of pressure rises on opening the circuit.

The whole question of the rate of change of current that may take place at the moment of switching-off is really a question of the suddenness with which the arc or spark between the switch contacts can be extinguished, for except under very exceptional cases it is impossible to break any considerable current without some arc or spark forming at the contacts. The rise due to these causes will, however, be considered in the next sections.

Arcs and Sparks.—Pressure rises may in many cases be traced to the properties which arcs and sparks have of facilitating or causing rapid rates of change of current. The electric arc is one of the few electric conductors which are in general essentially unstable. It is well known that it is necessary to have a steadying resistance or its equivalent in series with any arc in order to reduce the tendency of the current to go off suddenly to infinity or to become zero. This instability of the arc favours the sudden suppression of the current should an arc be formed, and tends to produce pressure rises if there is any self-induction in the circuit, which in practice is always the case. The instability of the arc may be greatly increased if the electrodes are kept cool and close together. A transverse magnetic field also makes the arc unstable. Shunting the arc with a condenser greatly increases this instability, because should the current through the arc decrease due to any accidental cause the potential difference between the terminals of the arc will increase. This will tend to cause the current to flow into the condenser shunting the arc, which current will be diverted from the arc. It should therefore tend to reduce still further the current through it, rendering the conditions more unstable than without the condenser as a shunt.

In my mind the fundamental difference between an arc and a spark is that in the arc the electrodes are being continuously volatilized, and the vapour of the electrodes takes part in the passage of the electric current. The spark, however, is generally of an intermittent or a transitory nature, the electrodes are not appreciably volatilized, and the current is largely transferred through the air. The properties of the spark are more difficult to investigate than those of the arc owing to its transitory nature, but there seems little doubt that they are essentially similar with regard to instability. In fact there are reasons to suppose that the electric spark possesses the same instability as the arc but in an enhanced degree.

Any arcing or sparking taking place in a circuit is liable to set up oscillations which may give rise to dangerous pressure rises. The best-known case is the oscillatory discharge or charge of a condenser such as is used in wireless telegraphy. Fig. 16 shows the usual connections.

If the source of supply is high-tension alternating, each time the condenser charges up to a sufficient voltage the gap S will break down and an oscillatory discharge will take place. This discharge repeats itself each half-wave or several times per half-wave if the conditions are suitable. If the supply is continuous, current oscillations can still be produced.

A water model can be made which will to some extent indicate the instability of the arc and will give a good representation of how the oscillations are produced. With this model a great many of the properties of arcs both intermittent and oscillating can easily be shown.

Intermittent discharges may take place either with alternating or continuous current and give rise to oscillations as

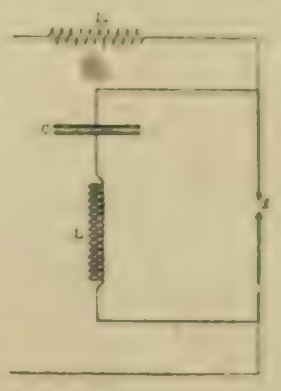


Fig. 16.

follows:—If the generator has a very drooping characteristic, or if L (Fig. 16) is a very high resistance or inductance, then the condenser will take an appreciable time to charge up to the discharge voltage. After the discharge, which may be oscillatory, has taken place a certain time must elapse before the condenser is again charged to a sufficient voltage, so that a regular succession of charges and discharges will take place even with a continuous-current supply. The time to charge the condenser depends for a fixed generator voltage and length of gap on the capacity of the condenser and on the impedance of L, including that of the generator. If the impedance is not too large the successive discharges may follow one another very rapidly. It is possible with a continuous-current supply at very high voltages, and spark-gaps that are well cooled, to make the sparks follow one another tens of thousands of times per second. Probably these intermittent discharges play a considerable part in the production of pressure rises.

The practical applications of the above short résumé of the production of oscillations by arcs and sparks must now be considered. The only capacities available are the capacities of the connections, the network, the feeders, and the windings of the machines to frame. The self-inductions available are those of the windings of the transformers and machines and of the connections, network, and feeders.

Sparks and arcs may in practice be formed at switch contacts or when faults take place. Under normal working conditions sparks mainly take place at the switch contacts, but when large currents are being broken regular arcing is observed at the contacts. In the case of a fault, except a sparking fault to earth with both poles insulated, the discharge at once takes the form of an arc. I have already mentioned that in switching on and off cables on open circuit, pressure rises may be produced should the switch contacts chatter in going in or out. A similar effect can easily be produced by sparks between switch contacts if they are held stationary and almost touching on sufficiently high-voltage alternating circuits. For in this case at the peak of each half-

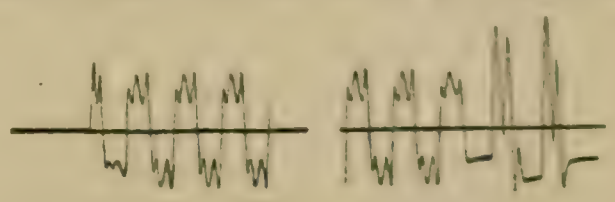


Fig. 17.

wave a spark will take place tending to charge the cable first in one direction and then in the opposite. These reversals are naturally attended with the pressure rise already referred to under "vibrating contacts." Fig. 17 is a good example of the rises that may be produced when a feeder on open circuit is disconnected, intentionally allowing the switch to spark in air between its brass contacts. The voltage has risen from the R.M.S. value of 2,000 to 5,100 at the last spark before the final break.

When switching off an inductive circuit a high pressure may occur should the current be interrupted suddenly. This well-known effect in the case of continuous-current circuits

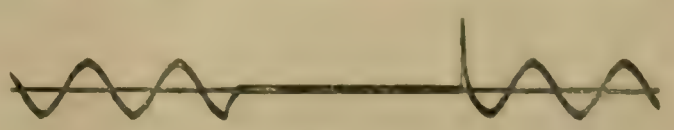


Fig. 18.

can also take place on alternating-current circuits when using oil-break switches, though it is usually supposed not to be the case. It is true that the oil-break switch in general does tend

to open the circuit when the current is in the neighbourhood of the zero value, but this is not always the case. Fig. 18 shows the switching on and off from a 2,500-volt sine-wave machine of a large transformer on open circuit. The oscillograph in this case was connected between the terminals of the switch so as to show the pressure rise at the switch, which amounted at the moment of switching off to 11,000 volts. The rise in pressure lasted about 1/20th of a period, that is to say about 1/500th of a second. It is to be noted that the switch only opened the magnetizing current of the transformer. When making this experiment there was a small piece of cable between the switch and the transformer, and there is no doubt in my mind that the capacity of this cable materially assisted the suppression of the current at the spark, and consequently increased the pressure rise.

I have already mentioned that if an inductive circuit carrying a continuous current be interrupted by a switch, a condenser shunting the terminals of the switch will stop the arcing at the switch contacts and produce a serious pressure rise. The following tests show that a similar effect occurs with alternating currents. A transformer of about 150-kw. capacity was switched on and off by means of an oil switch from the 2,500-volt mains. The measurements were made between the terminals of the transformer. The connections between the switch and the transformer were very short. In this case after switching-off a number of times very few pressure rises were observed. The worst was a peak of 5,500 volts.

On introducing a length of about 60 yards of cable between the switch and the transformer nearly 60 per cent. of the breaks produced pressure rises, the worst of which had a maximum value of 7,500 volts. These two tests illustrate very well the effect of capacity shunting the switch contacts in increasing the tendency to pressure rises when switching-off inductive circuits. It may be said that introducing a cable between the switch and the primary of the transformer does not constitute a condenser shunting the switch contacts, but a little consideration will show that the capacity of this cable to earth is in series with the capacity to earth of the supply main, and that these two condensers in series do shunt the switch contacts; this is the usual arrangement whenever the switch has connected to each terminal a length of cable which has any appreciable capacity to earth.

The arcs which take place when fuses blow have similar properties, and as in this case they are nearly always shunted by the capacity of the cable connected to them, similar rises

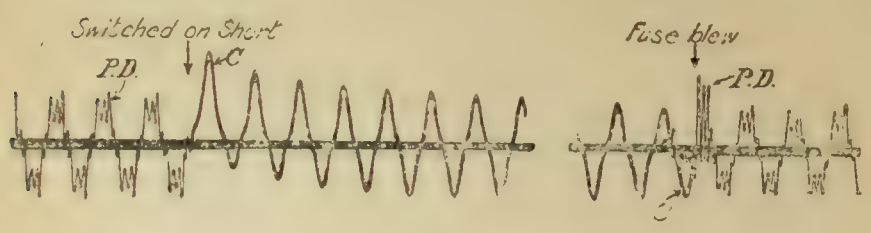


Fig. 19.

take place. Fig. 19 shows a short-circuit on the end of a feeder connected to a 2,000-volt 400-kw. generator which was allowed to remove itself by means of a fuse.

The big initial rush of current and the pressure rise attendant on the blowing of the fuse are clearly shown, the maximum value being 4,200 volts. Another example is shown in Fig. 21, in which a light fuse was suddenly connected as a short-circuit to the secondary of a 10,000-volt transformer; the fuse blew instantly. During the short-circuit the potential difference between the terminals of the secondary of the transformer was of course reduced to zero. This lasted for about half a period, when the fuse melted and a rise in pressure of 27,000 volts was recorded. In this case the great suddenness of the interruption of the current was in part due to the fineness of the fuse used, leaving very little volatilized metal to form an arc, and partly to the capacity of the leads connecting it to the transformer.

Sparking at switch contacts may also set up oscillations along the leads in much the same way as the oscillations are set up in wireless aerials by sparking into them at their bases. The mere sparking into the lead will not in general set up very violent oscillations because these oscillations will have to pass round the generator, but should there be considerable capacity between the generator and the switch contact, oscillations may be set up which will pass through the condenser to earth. In this case the apparatus situated at the end of the lead might be subjected to considerable strain, and might run the risk of having its end turns damaged owing to the high-frequency oscillations set up along the lead.

At high voltages any sparking taking place between one point of an insulated circuit and earth will set up oscillations in the leads, connections, and apparatus. The whole circuit may be considered as equivalent to a complicated aerial system of a wireless transmitter which is excited in the manner generally spoken of as plain aerial, that is with a spark between it and earth. The effect of this is to set up a number of high-frequency oscillations in the system, producing high potentials at all points where reflections of the oscillations may take place, such as open ends and the connections to apparatus having appreciable self-induction. A spark fault to earth may produce very high voltages localized on the end coils of transformers, etc.

I have not yet come across a well-authenticated case in practice of an arc acting as a musical arc and producing dangerous pressure rises. There is a great deal more risk in intermittent arcs maintaining oscillations than from the arc producing continuous oscillations.

The opening of large currents, whether it be by switches or fuses, or by faults which burn out, is always attended by the risk that the current may be suppressed too suddenly and that the energy stored in the self-induction of the circuit may not be dissipated. In this connection I am inclined to think that sufficient attention has not been paid to the self-induction of the leads and cables. Although the self-induction per mile of the cables is comparatively small—it may apparently range from a fraction of a millihenry for cables very close together to some 5 millihenries for conductors like track rails on continuous-current railways—yet the amount of energy that may be stored is considerable owing to the large current that may flow at the moment of short-circuits or faults. It is to be noted that as the great part of the magnetic field is situated in air, should the current be suddenly suppressed the whole of the energy is liberated at once, giving rise to very high voltages. This is not necessarily the case in

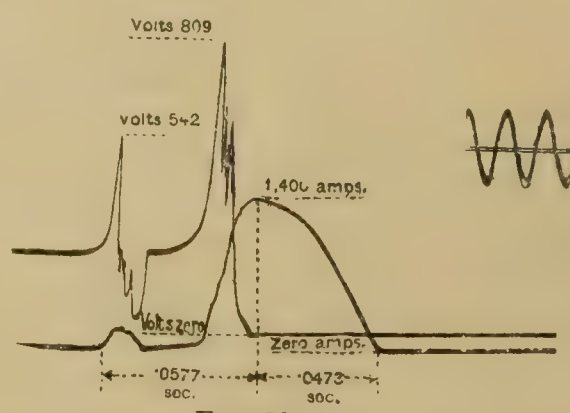


Fig. 20

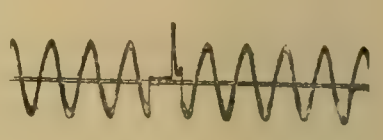


Fig. 21.

machines and apparatus, as with these quite a considerable part of the self-induction may be due to the lines of force threading the iron, and it is impossible for these to collapse so suddenly on to the conductors owing to the eddy currents they would produce in the mass of material; therefore when they do collapse some of the energy is wasted by this means and the pressure rise is reduced.

The self-induction of one mile of two 0.5 sq. in. cables laid in non-metallic ducts at 4-in. centres is about 1.6 millihenries, the capacity about 0.1 microfarad, and the resistance 0.176 ohm. Taking these figures the maximum possible voltage rise neglecting the self-induction of the machine is 252 times the current suppressed, if the cable is considered to be equivalent to localized condensers and a self-induction arranged as in Fig. 14. For 500 amperes interrupted, the limit of the pressure rise might thus be 126,000 volts.

If a short-circuit is suddenly interrupted somewhere in a long cable a high-voltage wave front starts from it and travels in each direction towards the ends of the cable, where it may be reflected if the end is open or connected to a high self-induction, its amplitude being then doubled.

There is no doubt that in many cases of short-circuit whether of a continuous current or of an alternating current—the current is very suddenly suppressed. The arc is quenched somehow, to use a wireless term. In ordinary cases of supply mains there may be two causes which tend to this quenching of large-current arcs. First and foremost, the considerable magnetic field produced by the current itself. Second, and this applies to insulated mains in enclosed spaces, the production of a gas surrounding the arc due to volatilization, and the splitting-up of the insulating material. Third, the cooling effect of the large masses of the metal which are usually present in circuits to carry large currents. Some tests made by Collis show very well the pressure rises that may occur on breaking continuous-current circuits. Fig. 20, taken from his paper, relates to a magnetic-field blow-out circuit-breaker operating on a dead short-circuit, the voltage rising to 809, and the steady value after the circuit-breaker had operated being 226. The arc in this case appears to have been suddenly extinguished, producing the high-pressure rise, and then to have re-started, causing a second but smaller rise.

In order to illustrate the pressure rises that may occur in cables due to short-circuits, I have prepared a model line, representing 10 or 15 miles of cable, in which the self-induction, capacity, and resistance per mile are, roughly, increased tenfold. Consequently the frequency of the line is reduced tenfold. With this line connected to the ordinary continuous-current mains it is possible to make short-circuits anywhere along it and to observe on the oscillograph the attendant pressure rises. The tests made with this line indicate how easy it is to obtain very considerable pressure rises by means of short-circuits which are suddenly opened, and they also indicate the strain at the end of the line due to the reflection at that point of the wave that travels along it each time a short-circuit is removed somewhere along the line.

THE CHARACTERISTICS OF INSULATION RESISTANCE.

By S. Evershed, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, November 26th, London, November 27th, and Cardiff, Dec. 1st*, 1913.)

(*Concluded from page* 937.)

To experiment with a series of drops and connecting films deposited on any kind of exposed surface would have led to almost certain failure, owing to the difficulty of protecting the films against currents of air. This liability is almost non-existent inside a porous insulator, where any considerable change in the humidity of the air occupies a comparatively long time, and the consequent changes in the films and their resistance are not too quick for experiment. To imitate this condition of moderate stability it was decided to construct a model insulator by drawing a series of drops of water and bubbles of air into a capillary glass tube, so that each bubble should constitute an enclosed region within which a film could form on the internal surface of the tube, and remain there entirely undisturbed by air currents. The glass tube, which was about a couple of inches in length, with a bore of 12 or 14 mils, had its ends bent downwards, so as to dip into water contained in two small beakers. Two copper wires, one in each beaker, served as the electrodes. The complete arrangement, as shown in fig. 18, was fixed under a microscope in

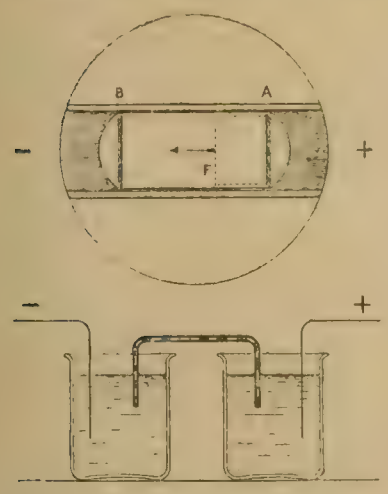


Fig. 18.—Elementary Model of an Absorbent Insulator. The Upper Figure represents one of the Air Bubbles as seen in the Field of a Microscope.

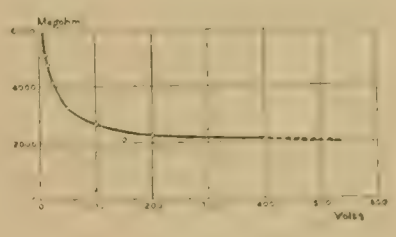


Fig. 19. — Characteristic Curve obtained from a Capillary Glass Tube filled with Drops of Water and Bubbles of Air, and arranged as shown in Fig. 18.

such a position that portions of two adjacent drops, with the whole of the air bubble in between them, came within the field of view, as indicated in the upper part of the same figure. At A and B dark transverse lines, corresponding to Newton's rings, were seen at the end of each drop where the water-air surface approached the glass at a capillary angle. These lines formed convenient gauges for estimating the initial thickness of the film of water deposited on the glass, and it was apparent that in the neighbourhood of the capillary edges of the drops the thickness of the film did not exceed one-quarter of the mean wave-length of light.

To understand the behaviour of this tube it is necessary to have the principle of electric endosmose clearly in mind. When an electrically-charged body is placed in an electric field, it is attracted one way or the other, according to whether the charge it holds is positive or negative, the attractive force being proportional to the potential gradient (volts per centimetre). Water which is lying on an insulator in an electric field will be urged towards the negative side of the field, and will flow in that direction if it is free to do so.

Any liquid would exhibit the phenomena of electric endosmose provided two essential conditions were fulfilled. These are, that the liquid must be either electro-positive or negative to the channel which contains it, otherwise there will be no charge and no force; and its specific resistance must be very high, otherwise it will be impossible to maintain a steep potential gradient inside the liquid without overheating by excessive current.

Water, and especially pure distilled water (or condensed water), happens to possess both the essential properties in a remarkable degree. It is strongly electro-positive to all insulators, and its resistance is such that it is possible to maintain a potential gradient of several hundred volts per centimetre without any overheating by electric current.

Endosmose may be made visible in a short glass tube connecting two water vessels. By contact with the glass the water in the tube acquires a positive charge which occupies a cylindrical layer of water next the wall of the tube, being held there by the corresponding negative charge in the glass surface. When a potential difference of several hundred volts is maintained between the water vessels, the charged water in the tube is strongly attracted towards the negative vessel, and moves in that direction down the potential gradient. This movement is confined to the charged layer and such water as it can drag along with it, and when the bore does not much exceed half a millimetre the whole of the water will be set in motion and may be seen travelling slowly towards the negative end of the tube.

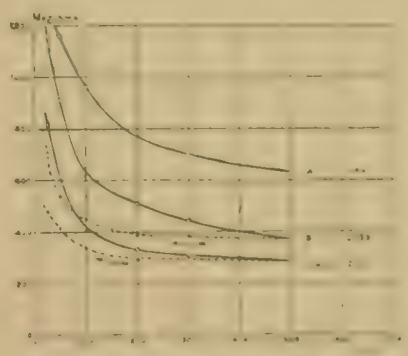
It is not essential to have the water within anything; all that is necessary is that the water should be lying in contact with an insulator and forming a conducting path between two electrodes. Then, if the voltage gradient between the electrodes is steep enough, and the water is free to move, it will find its way towards the negative electrode whether there is any definite channel for it to run in or not. But without some kind of trough or tube the water is apt to go by all sorts of devious ways towards its goal, and the confused motion becomes difficult to follow by eye.

On applying an electromotive force to the electrodes in the two beakers the effect of electric propulsion or endosmose was at once apparent. On closing the circuit the surfaces of the two drops visible in the field of the microscope instantly changed their curvature, the positive surface A pushing its edge out towards the negative side of the field of view, and the negative surface B decreasing its curvature by withdrawing its edge inwards. The dotted lines in fig. 18 indicate the general nature of this effect, but grossly exaggerate the extent of the change. If the film connecting the two drops happens to be visible,* every part of it is seen to experience a sudden force pushing it towards the negative side. The effect of the hydraulic pressure produced in the drops by the electric propulsion is seen at the same time; a stream of water is forced out from the edge of the positive drop and flows rapidly towards the negative drop, increasing the thickness of the film as it goes along. The advancing wave front (F in fig. 18) of the travelling water is clearly visible, and if the potential difference is gradually increased, the growing thickness of the now moving film is made apparent by its assuming, one after another, the colours characteristic of thin films.

The sectional area of the films is, of course, exceedingly small compared with that of the drops, and hence the resistance of a complete tube of given diameter is determined almost entirely by the aggregate length and mean thickness of the films, the resistance of the drops being negligible by comparison. The visible increase in the thickness of the film will therefore be made evident also by a concurrent fall in the resistance of the tube, and if a series of tests be made at gradually increasing potential differences the characteristic curve of the tube as an absorbent insulator may be drawn, as shown in fig. 19.

When the electromotive force is cut off, the surfaces of the drops are instantaneously restored to their normal shape. The surplus water in the films then withdraws very slowly into the adjacent drops, until, after a period which may be hours rather than minutes, the films are reduced to their initial thickness and the resistance of the tube recovers its initial value.

A single tube, one capillary channel, could hardly be expected to give a faithful imitation of a real insulator. Much better results have been obtained from models composed of a number of similar tubes connected in parallel, particularly when they have been given ample time to settle down into a normal condition. The three curves in fig. 20 were obtained from a model made up of 13 tubes in parallel, curve A being taken 20 hours after filling the tubes.



A 20 hours after filling the tubes.
B 44 " " "
C 98 " " "
D 113 " " "

Fig. 20. — Characteristic Curves obtained from a Model Insulator composed of 13 Capillary Glass Tubes arranged in parallel.

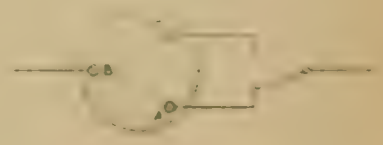


Fig. 21.—Glazed Porcelain Block fitted with three Electrodes for Investigating the Polarity or "Valve" Effect.

and curves B and C at 44 and 98 hours respectively. In these tests leakage along the external surfaces of the tubes was eliminated by guarding each tube, and in order to ascertain whether the guard wires upset the uniformity of the potential gradient, a fourth curve D was taken at 113 hours with the guard wires removed. This curve so closely follows curve C that to avoid confusion the mean values of the observations in the two tests have been plotted in fig. 20 as a single curve representing both C and D.

Reckoning from the average of these four curves the ratio R_{50}/R_{500} is 2·1, a figure which agrees surprisingly well with the average ratio 2·2 obtained from absorbent insulators.

Hysteresis, which is such a marked feature of the moisture curves of real insulators, is equally characteristic of the model. In each series of tests upon the model the return curve obtained by retracing the voltage steps from 500 back to 25 volts has indicated a pronounced hysteresis effect. The return curves obtained imme-

* The film is only visible when parts of it are thick enough to give some of the colours of Newton's rings. If its thickness is much less than a quarter of a wave length the film cannot be seen.

diately after curves B, C, and D, have been included in fig. 20, and should be compared with the example of hysteresis in real insulators which has been given (as in fig. 2).

The general resemblance of the curves given by glass models to those which are characteristic of absorbent insulators is evident. In the decreasing resistance with increasing voltage, in the extent of the decrease, in the slow recovery or hysteresis, even in instability, the films and drops possess properties which are common to every absorbent insulator. The dormant water which we found in the pad of paper is here in the drops, and the resistance water is visible in the films which link the drops together into a conducting chain, and provide the high resistance.

But in one matter a simple model composed entirely of open tubes differs fundamentally from a porous insulator. The first effect of heating an absorbent insulator is to bring about a very large decrease in resistance. Heat this too simple model, and the expanding air bubbles lengthen the films and increase the resistance.

But, after all, the structure of the model is not much like the real thing. For the tangled maze of interconnected channels in a porous insulator, the model substitutes a number of parallel channels, each going without break from one electrode to the other; it contains no blind alleys and no cross-connections. Hence in the model the proportion of dormant water falls far below the proportion which we have found by weighing the water in the real insulator.

In one tube the thickness of the films was about six millionths of an inch when swollen by the action of endosmose. Hence judging by the concurrent decrease of resistance, their initial thickness must have been about two millionths of an inch. This is so much less than one-quarter of a wave-length of light that in the initial state, the film had no perceptible colour by which to estimate thickness.*

That is to say, for one part of water in the films there are less than 2,000 parts of dormant water. In a real insulator the corresponding proportion is, as we have seen, from five to 50 times as much. To represent reality in this respect it would be necessary to build up a model with a very large number of closed tubes in addition to the open or conducting tubes, and to interconnect the two sets, by numbers of cross tubes.

Heat this complex model and the expansion of the trapped air† in the closed tubes will drive a large volume of dormant water into the conducting channels. At the same time the expansion of the air in the open tubes may have lengthened or even broken up some of the films, but the quantity of dormant water forced out from the blind alleys will be enough to flood the conducting channels, bringing about an enormous fall in resistance. Lower the temperature and the air bubbles throughout the system will contract and the flood water will retire into the blind alleys. The films then slowly recover their initial thickness and the resistance rises to its former value.

The permanence in the shape of the moisture curve has already been referred to, and in view of what has been demonstrated by means of a bundle of capillary glass tubes the explanation is clear. Each film gives more or less the same sort of curve; the curve is characteristic of the film with its adjacent reservoirs of dormant water; the magnitude of the conductance is simply a question of the number of film paths acting in parallel.

The marvellous rapidity with which the resistance alters when a change occurs in the humidity of the air is attributable to the extreme tenuity of the films.

The facts which have emerged from the investigation leave no room for doubt as regards the main characteristics of insulation resistance under working conditions.

The true dielectric resistance of insulation is enormous, compared with the actual insulation resistance obtained in practice, and in all ordinary cases we need only consider the leakage which takes place through films of moisture condensed on the external and internal surfaces of the insulating material. Dielectric leakage is insignificant and may be left out of account.

At what point leakage through moisture becomes dangerous; whether the ultimate effect of prolonged endosmosis is to safeguard the insulation by driving all the water away from the positive conductor in a continuous-current system, and from both conductors if the supply is by alternating current; whether it is possible to predict the breakdown voltage—these and other questions can only be answered by an investigation of the second part of the characteristic curve.

The whole of the experimental work has been carried out at Acton Lane works by Mr. S. F. W. Finnis, to whom the author is greatly indebted for the skill and patience with which the experiments were conducted. The author also wishes to thank Mr. B. Welbourn, of the British Insulated and Helsby Cables Co., for providing samples of paper cables and the oil and paper used in their manufacture, together with data relating to the specific resistance of these materials.

Appendix.

The effect which polarity has on the resistance of some kinds of insulation has been known from the early days of telegraphy in connection with overhead wires run on earthenware insulators. The same effect is frequently met with in testing the insulation resistance of electric light wiring. So far as the author is aware it was first traced to porcelain insulators by Mr. Bernard Holt, of Perth, West Australia.

House wiring, whether tested from wire to wire with the switches open, or from the wires to earth, often shows a valve effect. Porcelain base switches of inferior quality have invariably acted like valves. On the other hand, switches of the best quality in which well glazed china is used, gave resistances from about 100 megohms up to several thousand megohms.

To ascertain the cause of the valve action, tests were made on a flat block of porcelain of good quality. The resistance being far too great for easy measurement, the glaze was partially removed by grinding in order to approach the condition of an ordinary switch base and at the same time obtain a smooth flat surface. Three small electrodes, A, B and T (see fig. 21), were secured to the surface, and the method of experiment was to measure the resistance of the path A B and compare it with that of the path T B, the region round B being common to both paths. Current was never allowed to traverse the path T B for more than two or three seconds at a time—just long enough to allow the ohmmeter reading to be noted—and hence any substantial increase which might be observed in the resistance of this path would be confined to the neighbourhood round electrode B and would be the result of current flowing in the path A B. It was found that when current, flowing in either direction, traversed the path A B, the resistance of this path gradually rose until by the time the current had been flowing for half an hour or so the resistance would be 20 or 30 times the initial value. By cutting off the current in A B and immediately taking the resistance of the reference path T B, it was at once seen whether the increase in A B had taken place at electrode B or not. In this way it was proved that when electrode B was positive, practically all the increase in the resistance of A B occurred at or near B; and when that electrode was negative then no material change took place there. That is to say, the increase in resistance that results from the leakage current is almost entirely confined to the region round the positive electrode, the conductor where the current enters the earthenware. In one experiment the initial resistance of the path A B was 40 megohms, and on switching on the testing current, which in this instance entered the porcelain at A, the resistance rose to several thousand megohms in the course of two or three minutes. During this time the reference path T B changed from an initial value of 8·0 megohms to a final value of 8·2 megohms. Hence of the enormous increase in the resistance of A B only 0·2 megohm occurred in the region near the negative electrode B; practically the whole increase took place in the region of the positive electrode A.

Much depends upon the size of the electrodes and the area of access to the interior of the porcelain. A complete installation of switches may show no valve effect, because they are coupled up to the wiring without any regard to valve direction. But where there is some systematic difference in access-area the circuit as a whole will show the valve effect. An overhead telegraph line is a good example. At every insulator the line wire, and its binding on the well-glazed surface of the insulator, has a far smaller access-area than the fixing bolt embedded inside the earthenware. Such a line will have a higher insulation resistance to earth when the line is made positive than it has when the polarity is reversed. Electric wiring when tested from circuit to earth will show the valve effect for much the same reason.

The increase in resistance at the positive electrode seems to be due to the clogging of the leakage channels, both the cracks in the glaze and the capillary passages in the body of the earthenware, by the products of electrolysis. The action of endosmose in driving moisture from the positive towards the negative electrode must not be overlooked.

An installation of wiring, which when new may have no valve action when tested from wire to wire, will soon acquire it if the supply is by continuous current. In this case the positive side of every porcelain switch base becomes so clogged by the prolonged electrolysis which goes on whenever the switch is open, that a systematic difference in access-area comes about, the positive terminals in contact with the clogged earthenware acting as the electrodes of small access-area.

The insulation valve is thus seen to be closely related to other well-known electrical valves which depend for their action on the two electrodes having widely different freedom of access to an electrolyte.

Discussion.

Prof. S. P. Thompson, in opening the London discussion, said the paper was a definite contribution to a very unexplored part of their science, and they were particularly indebted to the author for what he called his characteristic curve. He had given them many data and many hints as to what was going on in insulation. As regarded the action of water in porous material, it was surprising how little of it was really taking part in the leakage. It was also a remarkable fact that no chemical compound had been found to impregnate the cellular structure to prevent moisture entering. It was clear that they did not get a constancy in the conductivity unless there were a considerable number of channels; the conduction of current through a liquid was always a phenomenon of lively movement, and the greater number of channels averaged things out. He protested most emphatically against the suggestion that any substance did not obey Ohm's law; it was impossible to expect the resistance to be constant, but this did not affect the law, which was true, unless one put something into it which was not intended.

* The wave-length at the sodium line in the spectrum is 23 millionths of an inch. It is worth noting that at its thinnest the film has depth for about 170 molecules.

† Inside a porous insulator containing a normal amount of moisture the volume of air will vastly exceed the volume of dormant water, and there must be innumerable bubbles of air trapped inside capillary spaces by drops of water.

Mr. C. Beaver said most of the phenomena referred to were familiar to cable makers, who had always recognised the necessity for protecting fibrous insulation by non-absorbent coverings, such as lead, and thereby sealing off the insulating material from contact with moisture. The absorbency of fibrous materials was due to capillarity, which meant a much greater susceptibility to moisture than would be due to other effects such as condensation, deliquescence, and so on. The capillarity of fibrous materials was due largely to the capillarity of the individual fibres themselves. The sequence of events demonstrated by the characteristic curve for cotton corresponded exactly to the cable makers' experience as to what happened during breakdowns from moisture faults. The osmotic effects merged into the formation of electrolytic products in the wall of dielectric, and incipient charring in the second part, passing to final breakdown in the third part of the curve. The fall in resistance with increase of testing voltage was simply a matter of the electrodes not making contact with the virtual conductor contained in the non-conducting mass of fibrous material.

The "valve effects" referred to by the author were well known in cable practice; it was because of these effects that factory tests on cables were always made with a negative current. In Government and other standard specifications, it was customary until a few years ago to specify that cables should be tested with both positive and negative currents, and the results compared. A difference of not more than 5 per cent. in the insulation resistance figures thus obtained rendered the cables liable to rejection. The various hysteresis effects noted by the author were probably closely connected with "valve effects." The customary method of testing the insulation resistance of cables by "loss of charge" was the only practical method. The real dielectric resistance was much greater than was indicated by the nominal grade or guaranteed figures; the steadiness of the rate of "loss of charge" gave a valuable indication as to the soundness or otherwise of a cable under test, which was quite independent of the observed value at the end of the standard one minute electrification. Porcelain could readily be obtained which was so thoroughly vitrified throughout its mass that it was non-absorbent and did not depend on its glazing for non-absorbency. He suggested that the matter of dormant water might with advantage be reconsidered on the basis of actual volumes of cellulose, air and water, both normal and added water being taken into account. He disagreed that it was customary to account for breakdown by dielectric stress; the primary cause of a breakdown was hardly ever dielectric stress *per se*, the presence of moisture was almost invariably found to be the chief contributory cause.

Mr. C. H. Wordingham said so-called "blind tests," though unscientific, were exceedingly useful. The author did not seem to make a distinction between the conduction of moisture on the surface and through the interior of porcelain, but it was important as one got a better result with a long leakage path.

Mr. B. Welbourn said a great deal of information was being obtained by present methods of cable testing, and many faults were removed from networks without the consumers knowing anything of them. He did not see how the use of flash tests could be avoided. It was a question whether the fall in potential was only due to moisture and air, as indicated in the paper, as the insulation possessed physical properties which might alter. Useful results might be obtained from some A.C. tests on the lines adopted by the author. He questioned whether the withdrawal of all the moisture from insulation was advisable in any case.

Prof. Schwartz drew attention to the peculiarities of pure rubber, which was certainly not non-absorbent. Its absorption depended partly on the character of the rubber and partly on its physical condition, and the latter underwent a considerable change within a small range of temperature. They might learn something from the work of the botanist, which showed that the water channels in plants were intersected by partitions, although they were to convey water; there were also air bubbles, and it was estimated that about half the channels were filled with air. The partitions limited the size of the bubbles, preventing them uniting and obstructing the passages. It also appeared that the smaller the pores were, the more likely water was to get in.

Mr. E. H. Rayner drew attention to the remarks in the paper concerning the speculation as to the evolution of some method which would enable the weakening of insulation of electrical plant to be detected by systematic tests, which would enable weak places to be repaired before actual failure occurred.

He said that on a laboratory scale this could now be done by superposing a continuous potential on the alternating supply used for a pressure test, and measuring the continuous current passing through the insulation by a sensitive moving-coil instrument. The results showed that with ordinary oiled cloth insulation, the increase of the continuous current as the insulation warmed under the alternating potential showed whether the insulation would stand for a long time, whether it would fail, and how quickly, with the great advantage that the application of the voltage could be stopped before permanent damage was done.

A disadvantage of the method, as at present used, was that the alternating capacity current passed through the ammeter, and was many times the rated current of the instrument. Suggestions were made as to overcoming difficulties which might be caused thereby.

Mr. Evershed briefly replied to the discussion.

Patent Restoration.—An order has been made restoring letters patent, No. 14,733 of 1905, granted to Harry Wilkins for "A New Alloy."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

UNITED STATES.—The Board of Trade through the Foreign Office, have received a copy of an Act of the United States Congress, which provides that all articles imported from foreign countries for the purpose of exhibition and articles and material imported solely for use in constructing, installing and maintaining foreign buildings and exhibits at the Panama-Pacific International Exposition upon which there is a tariff or Customs duty, may be admitted free of the payment of duty. Customs fees or charges under such regulations as the Secretary of the United States Treasury shall prescribe. It shall, however, be lawful at any time during the Exposition to sell for delivery at the discretion of the Exposition Company any goods or property imported for and actually on exhibition in the Exposition buildings or grounds on payment of the duty, if any, imposed upon them by the revenue laws in force at the date of withdrawal; and on such articles as have suffered diminution or deterioration from incidental handling and necessary exposure, the duty, if paid, shall be assessed according to the appraised value at the time of withdrawal for consumption or use.

The Act further provides for the establishment at the Exposition, not later than the 1st July, 1914, of a branch office under the direction of the United States Register of Copyrights and the Commissioner of Patents, from which the proprietor of any certificate of registration, copyright, trade-mark, or patent issued by any foreign Government protecting any pattern, model, design, copyright, trade-mark, or manufactured article, imported for exhibition and exhibited at the Exposition, may, upon presentation of satisfactory proof of such proprietorship, obtain, free of charge, a certificate which shall be legal evidence of his proprietorship. It is to be held unlawful for any person, without the authority of the proprietor thereof to copy, imitate, reproduce, or republish any pattern, model, design, trade-mark, copyright, or manufactured article, protected by the laws of any foreign country by registration, copyright, patent, or otherwise, which shall be imported for exhibition at the Exposition and there exhibited. The rights protected under the provisions of the Act are to begin on the date of the arrival of the pattern, model, design, copyrighted article, trade-mark, or manufactured article imported for exhibition within the grounds of the Exposition at San Francisco, and are to continue for a period of three years from the date of the closing of the Exposition.

S. AFRICA.—The Union Commissioner of Customs has issued to the Cape Town Chamber of Commerce further decisions as to the calculations of the value of goods on which duties are to be payable, in the following terms:—

(1) Current value for home consumption in the open market can only mean the values at the time of exportation from the country in which purchase was effected of the goods if they had been sold to be again sold in such country, such value being that at which any person without any special or exclusive favour or agreement could buy. The value that should be quoted is that of the goods if sold for home consumption in the open market at the time of exportation.

(2) Current value for home consumption at place of purchase bought in the ordinary manner from the manufacturer or supplier. The meaning assigned to (1) applies, except as regards the words "bought in the ordinary manner."

The Commissioner states that there cannot be any doubt that this means "the usual way in which a buyer deals with a manufacturer or supplier." In this connection there must be considered what is the usual practice of buying certain articles. As the current value in its relation to Customs clearly means the value at the time of exportation or importation it is obvious that contract or special agreement purchases, lasting over specified periods, are not within the meaning of the words "ordinary manner." The words, therefore, can only mean "bought outright at the time of exportation, without any special or exclusive favour or agreement."

(3) *Normal quantities.*—It must be obvious, it is stated, that this expression can only have one meaning. The obvious meaning of the word "normal" in relation to the purchase of goods to be imported into the Union is unquestionably the word "analogical." No other meaning could possibly be assigned to it. The expression, therefore, clearly means "quantities analogous, *i.e.*, similar to those being actually imported."

The Commissioner adds that the words "normal quantities" exclude the possibility of "retail prices" being the base of charge, except as regards the importation of single articles. In all cases where goods are exported from bond in the country of purchase it is obvious that the value in bond is the value in the open market. The wholesale price to dealers, applicable to the quantities exported, and as if the goods were to be sold to be consumed in the country of purchase, is obviously the value that is wanted. It is further pointed out that the law takes no cognisance of contracts, and the Commissioner states that he is not prepared to alter the practice in that respect, except that the values obtainable for the goods at the time of entering into the contract, if such goods had been

sold for consumption in the country of purchase must be stated on the invoice, and where duty is leviable, duty paid on such values. It is, however, to be clearly understood that if circumstances arise which prove that undue use is being made of the contract system, the matter will be again fully considered with the view to the Government being protected.

It is also notified that, on and after December 1st, refunds on account of full duty having been paid owing to non-production of the certificate of origin at the time of importation will not be allowed. If the preferential duty is desired, certificates must be produced when entry is made, otherwise the higher general duty will be charged.

BRAZIL.—The tax on rubber exported from the Territory of Acre will be reduced from 20 per cent. *ad valorem*, to 10 per cent. *ad valorem*, from January 1st next.

FINLAND.—The Board of Trade is informed that the quantity of samples which may be imported free of duty by commercial travellers entering Finland, is limited to such quantity as the Customs Officer at the place of importation considers necessary for commercial purposes. Any samples in excess of this quantity are dutiable at the rates fixed for the article in question in the Customs Tariff.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,946. "Means for and methods of changing the frequency of alternating electric currents." A. M. Taylor. November 24th.

26,948. "Apparatus for generating and storing electricity." W. J. Sheppard. November 24th.

26,956. "Automatic reversing controllers for electric motors." H. Bailey. November 24th.

26,962. "Electric switch and brake combined." A. W. Watson. November 24th.

26,978. "Magnetic or radio-magnetic hair or toilet pins, curlers, slides, or the like." W. H. Hyatt. November 24th.

26,992. "Method of and means for rendering the effervescent contents of closed containers radio-active." O. A. Elias. November 24th. (Complete.)

26,997. "Testing-instruments for electric conductors." C. L. Faries. November 24th. (Complete.)

27,018. "Selective electric signalling." New Phonopore Telephone Co., Ltd. and A. H. Nicholson. November 24th.

27,029. "Solenoids and electro-magnets." Clarke, Chapman & Co., Ltd., and R. C. Harris. November 24th.

27,048. "Process for producing insulating and building materials and the like from wood pulp." B. Jirotka. November 24th.

27,059. "Method of and apparatus for separating dust particles from gases or air by means of high-tension current." G. A. Krause. November 24th. (Convention date, November 25th, 1912, Germany.) (Complete.)

27,060. "Method of separating suspended particles from gases by means of high tension electricity." G. A. Krause....November 24th. (Convention date, November 25th, 1912, Germany.) (Complete.)

27,063. "Resonating relays." H. von Kramer and Gisbert Kapp. November 24th. (Addition to 10,856/11.)

27,098. "Automatic telephone systems." W. Aitken. November 25th.

27,099. "Calling-devices for automatic telephone systems." W. Aitken. November 25th.

27,114. "Spark-plugs." E. W. Cole. November 25th. (Complete.)

27,127. "Apparatus for automatically regulating electric circuits." H. Leitner. November 25th.

27,137. "Apparatus for recording number of telephone calls." A. J. Fitzgerald and E. G. Fitzgerald. November 25th.

27,148. "Electric lighting apparatus." Cold Light (Dussaud Processes), Ltd. November 25th. (Soc. International de Lumière Froide (Procedes Dussaud), France). (Complete.)

27,157. "Supports for electric incandescent lamp filaments and materials for same." G. Ludecke & Brimsdown Lamp Works, Ltd. November 25th.

27,175. "Radio-telegraph stations." W. J. Mellersh Jackson. November 25th. (Signal G.m.b.H. Germany.) (Complete.)

27,182. "Electric switches, fuses and the like." British Thomson-Houston Co., Ltd., and E. B. Wedmore. November 25th.

27,183. "Methods of tuning alternating-current circuits." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) November 25th.

27,190. "Lighting by means of electric incandescent lamps." H. W. Handcock and C. W. Smith. November 26th.

27,198. "Ships' telegraphs." J. Kostmann. November 26th.

27,218. "Improvements in electric light fittings, especially applicable to fittings adapted for indirect illumination." Simplex Conduits Ltd., and L. Waterhouse. November 26th.

27,225. "Electric telegraphs." E. Raymond-Barker. November 26th.

27,249. "Electric switches for train lighting and like installations." J. Stone & Co., Ltd., and A. H. Darker. November 26th.

27,275. "Telephone apparatus." S. Cooke and B. C. Matthews. November 26th.

27,298. "Electric tram trolley-pole wheel guides." C. E. Bingley. November 27th.

27,321. "Non-spillable valve for portable batteries with liquid electrolyte." G. Pearson and L. Fielder. November 27th.

27,322. "Elastic lamp-holder, combined with reflector for miners' electric safety lamps." G. Pearson and L. Fielder. November 27th.

27,323. "Arrangement for positive electrode in round accumulators." G. Pearson and L. Fielder. November 27th.

27,329. "Production of electric impulsive discharge." R. C. Galletti. November 27th. (Complete.)

27,347. "Effecting the automatic interruption of the current in single electric conductors upon a short-circuit or serious leakage occurring." Felten and Guilleaume Carlswerk Akt-Ges. November 27th. (Convention date, November 27th, 1912 Germany.) (Complete.)

27,348. "Means for use in concurrently producing upon the same strip or chart records or diagrams relating to several electric currents." Hartmann and Braun Akt-Ges. November 27th (Convention date, January 17th, 1913, Austria.) (Complete.)

27,354. "Dynamo-electric generators." F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th.)

27,355. "Magneto-electric machines." F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th.)

27,356. "Dynamo-electric generators." F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th.)

27,357. "Electric incandescent lamps." Pope's Electric Lamp Co., Ltd. and F. R. Pope. November 27th.

27,409. "Earthenware troughs." C. E. Morris. November 28th.

27,426. "Electric vacuum light apparatus." Moore Licht Akt.-Ges. November 28th. (Addition to 1,218/13, Convention date, November 28th, 1912, Germany.) (Complete.)

27,452. "Circuit arrangements for telephone systems." Siemens & Halske Akt-Ges. November 28th. (Convention date, November 28th, 1912, Germany.) (Complete.)

27,454. "Tramway rails." J. Thon. November 28th.

27,468. "Electric arc lamps." H. J. Booker. November 28th.

27,472. "Electrically-driven vehicles." Siemens-Schuckertwerke G.m.b.H. November 28th. (Convention date, November 28th, 1912, Germany.) (Complete.)

27,473. "Ampere-meter and volt-meter for vehicles and the like." Schoeller & Co. November 28th. (Convention date, February 10th, 1913, Germany.) (Complete.)

27,476. "Sparking-plug for internal-combustion engines." E. Rene. November 28th.

27,477. "Controlling-devices for variable-speed dynamos." L. Renault. November 28th. (Convention date, December 7th, 1912, France.) (Complete.)

27,480. "Receivers for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd. and H. J. Round. November 28th.

27,498. "Incandescent electric lamps and the holders thereof." T. Kelly. November 29th.

27,515. "Control of electro-mechanical switches for telephone exchanges." H. Baron. November 29th. (Fritz Aldendorff, Germany.) (Complete.)

27,524. "Electric flashlight." R. Pavey and J. Pavey. November 29th.

27,533. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. and F. Newforth, Jnr.). November 29th. (Complete.)

27,541. "Electric alarm clock." I. Pillersdorf. November 29th. (Convention date, December 23rd, 1912, Germany.) (Complete.)

27,542. "Apparatus for use in connection with the electric lighting of automobiles." F. E. Wilson. November 29th.

27,549. "Switches for opening and closing electric circuits." H. Leitner. November 29th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Manufacture of Envelopes of Vitreous Materials. British Thomson-Houston Co. (General Electric Co.) 18,300.

Electrolytic Production of Metals. R. W. Wallace and E. Wassmer. 18,449. August 10th.

Process for the Production of Ammonia. R. W. Wallace and E. Wassmer. 18,450. August 10th.

Lamps. M. E. M. Hagnauer and J. J. H. Crepin. 25,647. November 8th. (November 8th, 1911.)

Lighting Apparatus for Automobiles, Motor-cycles, Bicycles, Aeroplanes, Air-ships, Boats, and the like. J. De Coster. 25,861. November 11th.

Incandescent Electric Lamps. J. T. Robin. 26,186. November 14th. (Addition to 6,856/11.)

Method of and Means for Cleaning Electro-plating and Finishing Articles, more particularly Small Articles. G. P. M. Lee and W. A. Brame. 26,255. November 15th.

Electric Secondary Clocks. T. Rushton. 26,309. November 15th.

Method of and Means for Cleaning Electro-plating and Finishing Surfaces, more particularly Surfaces in Situ. G. P. M. Lee and W. A. Brame. 26,504. November 18th.

Voltage Regulators for Dynamos. A. P. Froger. 26,893. November 22nd. (November 23rd, 1911.)

Regulating Mechanism for Electric Distribution Systems. British Thomson-Houston Co., E. Garton and A. H. St. C. Watson. 27,235. November 26th.

Electric Incandescent Lamps. British Thomson-Houston Co. (Allgemeine Electricitats Ges.) 27,432. November 28th.

Electric Current Regulating and Controlling Apparatus such as Electric-motor Starting and Controlling Apparatus and the like. J. A. Hirst and P. S. Brook. 28,635. December 12th.

Electric Miners' Lamp. P. Rosenberg. 28,772. December 13th.

Electric Locks for Lift and Hoist Gates. C. G. Major and Smith, Major and Stevens, Ltd. 29,778. December 27th.

1913.

Electric Ceiling-roses. J. P. Smith. 534. January 8th.

Selecting Devices for Telephone or other Circuits. Siemens Bros. and Co. and T. Pettigrew. 818. January 10th.

Apparatus for Detecting and Estimating certain Substances by Virtue of their Polarizing or De-polarizing Action on an Electric Couple. E. K. Rideal and U. R. Evans. 1,776. January 22nd.

Primary Electric Batteries. A. P. Manchester and H. M. Spooner. 2,693. February 1st.

Ignition Gear for Internal-combustion Engines. W. H. Moore and Ambrose Shardlow & Co. 3,487. February 11th.

Aerial Conductors for Use in Wireless Telegraphy. Marconi's Wireless Telegraph Co. and C. S. Franklin. 4,514. February 21st.

Ozonators. British Thomson-Houston Co. (General Electric Co.) 4,575. February 22nd.

Automatic Electrical Switches. Electric Sign Co. and W. K. L. Dickson. 4,591. February 22nd.

Electric Fuses. Appareillage Gardy (Soc. Anon.) 4,686. February 24th. (February 25th, 1912.)

Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.) 5,961. March 10th.

Electric Candle Fittings. F. Hodgson. 6,901. March 20th.

Ignition and Priming Devices for Internal-combustion Engines and the like. C. G. Nobbs and L. Dodson. 8,584. April 11th.

Electric Supply Systems. H. D. Earl. 9,278. April 19th.

Carrying of Metal-sheathed Electric Cables through Bulkhead and similar Partitions. Metal Jointing Co. and T. Harden. 9,752. April 25th.

THE

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION.

IN PREPARATION.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

LONDON'S ELECTRICITY SUPPLY.

ALTHOUGH we commented on this question in our last issue, our attention is already recalled to the matter by the publication of a scheme for the solution of the great problem of supplying the Metropolitan area with electricity on lines in accordance with the practice of the present day. The idea at the root of the scheme is not new; it has been before the public in a more or less nebulous form for some months, but now the outlines of the proposal are taking more definite shape and light is thrown upon many incidents which have hitherto possessed no apparent connection with one another.

In brief, the scheme is to form a large "holding company" which shall acquire control of the existing companies operating in the London area, by purchase or exchange of shares, and which shall then proceed to unify and co-ordinate the various undertakings on a sound basis, retaining such works and plant as are capable of economical operation under the new *régime*, closing works which are not suitable for inclusion, erecting new bulk supply stations outside the city, and so on.

The undertaking would be, of course, of enormous magnitude and importance, and the process of amalgamation would have to be spread over many years; very large amounts of capital would have to be raised on the security of debentures, and the utmost care would be necessary to ensure the financial stability of the concern.

But, apart from the financial and technical aspects of the question, each of which presents problems of the greatest complexity, there is a third consideration of even greater weight, which will have to be dealt with before a single step can be made towards the fulfilment of the project; and that is the political aspect of the matter. The London County Council possesses the statutory right to purchase all the private undertakings at the expiration of the period of 42 years from their inauguration, on terms which have never been defined; and whether the Council decides to exercise that power or not, it is certain that it will claim the right to an important share in controlling the course of events. Up to the present the Council has not adopted any definite line of policy, but it has appointed a Committee to investigate the circumstances and to prepare a report, which, it is expected, will be ready some time next year. It is understood that the promoters of the new scheme will introduce their proposals in the form of a Bill in the next session of Parliament, and unless the Council is in a position to introduce a Bill embodying its own proposals at the same time, it will be compelled to enter opposition to the company's Bill in order to obtain a hearing on the matter. In any event, it seems clear that the hands of the Council will be forced by the action of the company, and the former will be obliged to define its future policy; thus the battle will almost certainly be joined next year, and, as we remarked last week, the supply of electricity to London will become the question of the hour.

It appears that a unique opportunity is now at hand for the reorganisation of this great industry, which at present is in a state of chaos. If the attempt were made to adopt a single uniform system of distribution throughout the area, the

cost would undoubtedly be very heavy, no matter what system was adopted; but we doubt whether so drastic a step would be either necessary or desirable. Certainly in some cases fundamental changes should be made, to remove anomalous voltages and frequencies; at present the cost of these alterations would fall upon the supply authorities, and, therefore, upon the consumers in the areas concerned, and this would obviously be unjust, seeing that Parliament deliberately split up the metropolis into separate districts of supply, and the object of a change of system would essentially be that of benefiting the whole of London. The cost of such changes should, therefore, be distributed over the whole area. But the problem of reducing the variety of supplies to one voltage for both A.C. and D.C., and one frequency for A.C., would be less difficult than might appear at first sight. Probably the greater loss would be entailed by the scrapping of old generating plant and the substitution of converting or transforming plant, with the necessary trunk feeders. These questions, however, need not detain us at the moment. The more important question is the broad one of policy. Will the County Council insist on taking over the whole business, lock, stock and barrel? Or will it agree to the conduct of the business by a "holding company," subject to the provision of suitable safeguards for the interests of the public? Or will it enter into a compromise with the representatives of the companies, whereby it will assist in financing a scheme of reorganisation, whilst retaining control of the policy of the undertaking, but avoiding interference with the commercial and technical management of the concern? Each of these alternatives has its own advantages and drawbacks. In this connection the views of Mr. R. A. Chattock, a leader in the field of municipal enterprise, and Mr. George Offor, a pioneer in the electrical industry on the company side, will be read with interest elsewhere in this issue; they deal not directly, but certainly not remotely, with the question which is now before the London authorities. To these we may add the opinions of Mr. Frank Bailey, expressed in his paper before the Society of Arts in April last,* on "Electric Supply in London," as being worthy of close consideration. Mr. Bailey points out that no great city outside the United Kingdom entrusts its electricity supply to municipal enterprise. Chicago, Berlin, Paris and Buenos Ayres are cited in support of Mr. Bailey's remarks, and it is noteworthy that, as in Berlin, so in Paris—where the process of reorganisation is approaching completion, the concession to the Compagnie Parisienne de Distribution d'Electricité coming into force on January 1st, 1914—the municipality has adopted the plan of leasing the business to a company subject to a heavy annual payment, with the right to terminate the arrangement at stated dates.

Our own view of the matter is emphatically opposed to the first of the three alternatives that we have outlined. Between the second and third it is less easy to decide, but on the whole we favour the third as providing the most efficient safeguards for the interests both of the public and of the shareholders, and the best prospects of disarming opposition to the scheme of reorganisation. As we have already pointed out, the tendency in Germany is in this direction, and while we do not advance this fact as a sufficient reason for our following in the same path, we think that the experience gained abroad in this connection strongly indicates that the plan offers excellent prospects of a satisfactory outcome.

Christmas and Codicils.

With the approach of the season for "Christmas Cheer," the period for ghostly stories in the firelight, the E.T.B.I. reminds us that whether we eat, drink and be merry or no, to-morrow we shuffle off this mortal coil! The Benevolent Institution is an excellent organisation—everybody knows that we are amongst its most ardent well-wishers, and the idea suggested at the last annual meeting for the circulation of legacy slips once a year was a capital one, but "Christmas comes but once a year, and when it comes it brings"—what? the spirit of a good old-fashioned festive season? Away with all such—sit thou down, dear reader, scan again that last will and testament of thine, and write a codicil! Let it be in proper form, as drawn up by the Benevolent Fund's Executive, that there be no mistake, lest when another Christmas comes thine own erratic form haunt secretary and executive.

Perhaps the reader may have thought that there are other times in the year more fitting for the issue of such a request as this; in case that may be so, we venture two alternative suggestions. One is that the thing be filled in, signed and witnessed now, right on the spot, and got out of the way; the other that the new year, when some men make a practice of turning over a new leaf, be started well by making the desired addition. All that the executive is out for is the strengthening of the funds of the Institution, so that available resources may justify pension allowances. This codicil has been drawn up to make it as easy as possible for would-be legators to make proper preparation so that the Institution shall eventually receive that benefit which so many wish to grant from their estates, but for which they have so far neglected to make the necessary testamentary provision. The E.T.B.I. will take the greatest possible pleasure in sending copies of the above Christmas card to anybody whose name and address are received by them during the next few days.

* Elec. Rev., April 18th and 25th, 1913.

Lead.

Since last writing the Lead Market has displayed considerable irregularity, prices at one time showing a substantial depreciation with a most unsettled feeling, while this phase was followed by a better market and a moderate restoration of confidence. There have been rumours about of heavy quantities of lead arriving, and of substantial lots being put into warehouse, but the apprehensions on this score proved to have been overdrawn, and the discovery that there was no immediate actual alteration in the fundamental conditions of the market did a good deal to restore waning confidence. At the same time it must be admitted that there is not nearly such a buoyant feeling about as there was, and a much more modified view is now taken of the position and prospects. The high prices witnessed this year have undoubtedly hindered the normal growth of consumption, and since trade everywhere appears to be slackening, it is a very good thing for the market at large that prices should have come down to a more reasonable level. Latterly there has been too much ragged speculation in lead and a restriction of the use of the metal as a mere gambling counter would be a good thing for all concerned.

This, however, is merely a side issue. After the sharp decline in the price there was a considerable amount of "bear" covering, which had the inevitable result of tending to strengthen the price, and a moderate degree of confidence was restored, but nobody now believes that the £20 level, or anything like it, is to be justified. A little home trade buying has developed, and this, in conjunction with some scattered export orders, combined to assist the recovery, which, however, did not proceed very far, though the chances favour a pretty steady to firm market in the near future, with, of course, fluctuations.

What is a satisfactory feature is that although the arrivals of lead in London have recently been quite heavy, all the metal which came to hand was taken up easily, and it has not been possible to trace any surplus material. At all events, the price of immediate and near deliveries has been maintained at a premium over forward metal, and this could hardly be the case if spot stuff were pressed. Conditions at the producing centres are easier, however, and no doubt, with a continuance of output on an enlarged scale, there will be a corresponding growth in the quantities reaching European centres, and rendered available for consumption. If so, the tendency of the market generally should be towards relaxation, but the process, under normal conditions, should be a gradual one.

In any event, it is not wise to anticipate any material difference between the course of lead prices and conditions and those which obtain as regards other metals. The general outlook is not bad, but there is nothing whatever now in the situation to warrant anticipations of materially higher prices than those in evidence to-day, and the broad tendency should be in the direction of an easement as time goes on. The Mexican position remains pretty well as involved as ever, and it really seems to be quite useless to expect any amelioration of affairs in this distressed country for months to come.

The events of the last few weeks have not helped to put industrial conditions there on any better basis, and the resumption of mining and smelting operations seems likely to be deferred for an indefinite period, because most of the mining areas seem to be badly involved in the civil war, while even the ports are now the centres of fighting. Really the position has gone from bad to worse. It is hopeless, therefore, to look to Mexico to supplement the supplies at present coming forward, and these are to all appearance ample for the satisfaction of trade needs. Hence, any resumption of shipments from there would be the signal for a sharp attack on the market.

Failing the development of any fresh features of importance, the price is likely to keep from steady to firm with moderate fluctuations, and, of course, should there not be any resumption of supplies from Mexico by the spring months when export demands on a liberal scale have usually to be satisfied, there may be a moderate upward movement, but this is looking rather far ahead.

Nottingham Exhibition.

Some time ago we drew attention to the "Universal Exhibition" which is to be held at Nottingham next year, from May to October, and pointed out that it would appeal to a population of no less than 12 million people within easy range of its attractions. We understand that the intention is to make it by far the largest Exhibition ever held in the Provinces, and that the plans are already far advanced. Unfortunately, however, according to present indications, the electrical industry is not likely to be adequately represented at this very important show—probably because the leaders have not fully realised its importance, though other branches of the engineering industries have promised their support.

While we do not suggest that manufacturers should attempt to exhibit heavy machinery, in view of the great cost and inadequate return on such a proceeding, we do think that every effort should be made to ensure that there shall be an ample representation of the lighter apparatus, particularly consumers' appliances for lighting, heating, cooking and motive power. The importance of this will be better appreciated when we state that the Nottingham Corporation, although it possesses a large electricity supply undertaking, has thrown its whole weight into the scale in favour of the gas department, and has taken a building covering an area of 15,000 sq. ft., to be called the "Nottingham Gas Pavilion," wherein a most elaborate and comprehensive display of gas engineering and apparatus will be organised, and the interests of the gas department will be strenuously promoted. The greater portion of the splendid river frontage of the Exhibition, extending for about half a mile, will be lighted with gas, and half the grounds with high-pressure gas; the gas department has done its best to induce the Exhibition authorities to light the remainder of the grounds with gas, but, fortunately, they have stood fast by electricity for this purpose.

It will be seen, then, that unless immediate steps are taken to prevent so regrettable a result, the Nottingham Exhibition of 1914 will represent a triumph for gas. The time available is short, and we sincerely hope, in the best interests of the electrical industry, that our manufacturers will realise before it is too late the importance of defeating the plans of their rivals by securing space at once, and preparing exceptionally attractive exhibits of their products.

Openings for the Electric Vehicle.

That the gas engineer, in his efforts to meet the ever-growing competition of electricity, not only for lighting, but nowadays for heating and cooking also, has in many cases adopted both electric lighting and electrically-driven machinery in the gas works, is only a natural development. It would have been surprising had he not done something of the kind, when one considers that the convenience and safety of electrical methods have almost compelled their adoption in far more salubrious and certainly far less dangerous industries than gas manufacturing.

It seems quite possible that this community of gas and electrical interests could be still further extended, judging by the costs of motor haulage in connection with various gas undertakings, mentioned at the recent meeting of the Southern District Association of Gas Engineers and Managers. The electric battery vehicle, like other things electrical, is simple, inexpensive in use, convenient, and, compared with other motors, free from fire risk; a figure of 2½d. per car-mile for 4 or 5-ton vehicles has been found in the States to cover everything, including liberal depreciation, and there is, therefore, no reason why our gas friends should continue to pay for running costs only over 6d. per ton-mile for 30-cwt. petrol vans, and 2·3d. to 3·17d. per ton-mile for steam haulage as at Bournemouth, or on a mileage basis only, 7·5d. per mile for a 30-cwt. van, and from 3·6d. to 5·4d. per mile for 15-cwt. vans, as appears to be the case with the Gas Light and Coke Co. As regards this company, a figure inclusive of depreciation, for a 2-ton vehicle, has been mentioned, viz., 10d. per mile.

At Norwich the costs are apparently 2·5d. per ton-mile for steam, 6d. per ton-mile for petrol, and 8¾d. in the case of horse haulage, for a typical 11-mile journey.

We are, of course, aware that figures for haulage costs, quoted off-hand, do not afford an accurate basis for comparison, but the fact remains that given suitable, though not specially chosen, conditions, electric vehicles are now running in this country—with charging energy at 1d. per unit—at a cost for electricity of ½d. per mile, and we do not think that either petrol or coke fuel can compete with such a figure.

At the meeting in question, 1½d. per "ton-mile" for petrol and ·55d. to ·74d. per "ton-mile" for coke fuel were mentioned.

The steam wagon appears to be favoured because it is more robust and easily repaired; moreover, it uses a by-product as fuel.

The electric vehicle is, however, easier to handle and repair than any other, and if the consciences of our gas friends can be strained to the extent of using electricity in their works for power and lighting, no doubt they can be stretched sufficiently to cover a few battery vehicles, especially if the batteries are charged from a gas engine-driven plant—the indirect use of gas being the solatium in such a case.

Another possible opening for the electric goods carrier was mentioned by Mr. Mallins in his recent report on goods transport matters in connection with the port of Liverpool and the South Lancashire manufacturing centres.

Although mainly dealing with tramway matters, Mr. Mallins points out that for the local traffic between the docks and railway stations and warehouses—which, owing to the peculiar conditions existing at Liverpool, has attained enormous proportions, resulting in congestion of quays and roads—some 11,000 horse and 124 mechanically-propelled vehicles are in use.

He is of opinion that if a well-organised system of mechanically-propelled vehicles, possibly of the electric battery type—with a cheap power supply—were provided, the work could be performed by 50 per cent. fewer vehicles, which would greatly relieve matters. The negligible fire risk of the electric vehicle—a feature to which we have already referred above and one which should specially appeal to the dock authorities—and the short heavy hauls which we believe prevail in connection with this traffic, are strong points in favour of the "electric," the adoption of which would, no doubt, receive material assistance from the city's electrical department.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A BY-LAW for the construction of a municipal electric light plant is likely to be voted on soon by the ratepayers of South Vancouver, B.C., and one to raise $150,000 for extensions to the plant at Medicine Hat, Alberta, is to be put forward in a few days. The cost of the former is estimated at $300,000.

In Hamilton, Ontario, the Dominion Power and Transmission Co. is considering the question of installing two 10,000-H.P. steam turbo-generators. A Marconi wireless station is being erected at Port Nelson, Hudson Bay, to facilitate the work of constructing the Hudson Bay Railway, which is now in progress. The railway is intended to give an outlet for the grain shipments from the West, which are now so large that it is impossible for them to be efficiently handled by the present railway routes and the shipping facilities on the great lakes.

The Toronto Hydro-Electric System has made a contract to supply 2,500 H.P. to a local firm, and is laying a 13,200-volt three-phase underground cable for the purpose. The Canadian Stewart Co., who recently obtained the contract for dredging the harbour, on the improvement of which, as already stated in these notes, several million dollars are to be spent, are apparently intending to make extensive use of electricity in their operations, as they have asked the T.H.E.S. for rates for the supply of 8,000 H P.

The City of Toronto is calling for tenders for the installation of a complete "mechanical filtration plant, boilers, steam turbo-generator plant, and all appurtenances." These have to be delivered by noon on January 20th, 1914.

About this time last year a substantial reduction in rates charged to consumers was recommended by the Hydro-Electric Power Commission, of Ontario, to all the municipalities served by this body, with about three exceptions. Reductions of from 10 to 18 per cent. have just been recommended on lighting and power rates in Toronto, Ottawa and London; other reductions have not yet been announced.

It is said that two companies are willing to relieve the transportation difficulties at present existing in Montreal. The Montreal Tramways Co. offers to build underground railways, while the Canadian Autobus Co. wants to carry out similar work. A new company, called "Electrical Properties, Ltd.," has just been incorporated in the city referred to, the capital being one million dollars.

From Niagara Falls comes a report that a water and power scheme to cost about $2\frac{1}{2}$ million dollars, which will apparently be found in Great Britain and Canada, is proposed, half of the water from the American and Canadian sides of the Falls, respectively, being tapped. At Sault Ste. Marie, the Michigan Northern Power Co., and the Algoma Steel Corporation wish to utilise water-powers on the St. Mary River to supply electrical energy for industries both here and in the U.S.A. The plans have been submitted to Ottawa and Washington for approval.

CORRESPONDENCE.

Letters received by us after 5 P M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Concerning a Review.

In view of all that has been written lately in the electrical Press, by editors and correspondents, by reviewers and "reviewed," on the reviewing of books, the writer begs leave, first of all, to state his own convictions.

These are that a review of a book should comprise: (1) Impartial statements alike as to the book's shortcomings and its good points; (2) a summary of contents—letterpress and appendix; (3) name or initials of the reviewer—excepting when the author of a book reviewed chooses to remain anonymous.

To come, now, to a concrete instance, namely, the review in the ELECTRICAL REVIEW of December 5th of "Graphs in a Cable Ship Drum Room: Notes for Junior Assistants," hereafter, in this article, referred to as "the book."

Regarding the book itself, its modest pretensions are clear enough. While giving prominence to the work of Bright, Brunelli, Ciceri-Smith, Clark and Sabine, Munro and Jamieson, Wilkinson, and of Werner Siemens, it claims (1) to offer parallel series of exercises useful and interesting to the "Junior Assistant"; (2) to lay before the young aspirant various graph possibilities and modes of figuring; (3) to suggest a graph method involving the limitation of tables to one set—example 38—*applicable to all cable types*, with subsequent correction from the percentage curve—page 20—once the cable circumference has been measured (in old worn cable a varying quantity even in the same type); (4) to describe the author's alternative devices for facilitating drum-room graph work. All this, having no direct connection with the author's own ship work, which all along has been on the electrical side, has been put forward tentatively as regards new methods, but always on the basis of actual experience, gained by close contact with actual sea work and the men who carry it out. There is also an appendix of tabulated matter, much of which is new.

The writer of this letter is very much afraid that any reader who may derive his first ideas of the book from the ELECTRICAL REVIEW criticism will scarcely become aware of the book's actual claims as here summarised. The title, even, at the head of the review in question is not complete. In the book itself there is no full-stop after . . . . "Drum-room," but only a colon which precedes the completion of the title, namely, "Notes for Junior Assistants," thus showing the main purpose of the book at its beginning, and not at the end, as in the review.

The writer s sincere thanks are accorded to the reviewer (1) for his close study of the book; (2) for his having pointed out the slip d_1 instead of d_3 in Example 34; (3) for his useful information regarding the construction of celluloid disks, and he now begs to be allowed to answer other queries seriatim.

The "certain marks" in figs. 3 and 4 on graph lines previously drawn between two calculated points are merely by way of an illustrative exercise corroborative of past work.

The reviewer's words: "The introduction of the drum constant reciprocal on pages 14 and 15 is a little unfortunate, as it is never required," give to the writer as hard a knock as is compatible with the exigences of courteous intercourse. The pity of it is that this dogmatic statement does not accord with facts.

Not only are *constant* reciprocals—as expressing corrected drum revolutions in terms of the nautical mile—in frequent use, as may be seen in submarine cable expedition records in the I.E.E. library, but the advantages their use offers are self-evident, and the five figures following the "0·00" . . . in the reciprocal are easily dealt with by the Fuller slide rule.

On inquiry quite outside his own circle of work, the writer finds on absolute authority that at least three important submarine-cable contracting firms invariably employ drum-constant reciprocals for paying-out purposes. In this connection the remark has been made that it is hard to see how any other constant than a reciprocal could be used with the arithmometer—a favourite instrument with at least one of the leading firms.

The reviewer tells us that division on the flat slide rule is more readily performed than multiplication. The writer does not agree. As a matter of fact, the calculator almost invariably used is Prof. Fuller's cylinder, with its logarithmically divided helical line 500 in. long, and workable to five places; but whether with this or with the small flat rule, multiplication is often preferable to division.

With several quantities, each to be divided by a common divisor, a good way with the Fuller is to set a cross index to the reciprocal of the divisor. Then each subsequent multiplication involves only one readjustment of the outer cylinder. With the ordinary small flat slide-rule, multiplication of several factors by one reciprocal is a still more simple matter, as the rule, once set, any number of products may be read straight off without readjustment of the slide-

rule ; though to not so many places as with the Fuller. Readers will forgive these details. It was not the writer who started them.

With regard to the critic's reference to the list on page 14, the cable circumferences were, in each case, taken from the mean of 12 tape measurements. The means happen to have been recorded to the third place. The drum-constants obtained from the curve are stated to two decimal places. The reduced graph as shown on page 15 had its ratio graph lines considerably thickened by the printers for reproduction purposes. In practice a hair line would be used, and a much larger sheet.

Regarding examples 36, 37 and 79, the writer sees no reason for modifying his words.

To deal, now, with the reviewer's criticisms of the calculator boards on pages 28 and 32.

The book clearly emphasises the fact that the board on page 28 (which the reviewer wishes had been omitted) while capable of dealing with all cable values, has been devised for the avoidance of converging origins ; a kind of *tour de force*, in fact. Also, it is quite in keeping with the purpose to which the book is dedicated, and is easily worked.

The reviewer's preference for the calculator board on page 32 has, in so many words, been anticipated by the writer on p. 31.

As for the means for setting the cursor-threads, certainly these "might be improved in obvious ways," but at what increase in the price of the board ? The present simple devices have worked well.

Surely the reviewer's searching examination and, in some respects, highly detailed description of the boards might have included some brief mention of two leading features upon which, from quite unexpected quarters, the writer has been much complimented. Reference is here made (1) to the device on page 32, in which the set vertical cursor indicates not only cable *knots*, but also the required corresponding drum revolutions per minute for any one of the many cable types aboard, these latter values being on a slip easily renewable for each fresh cable expedition ; and (2) to the writer's quite new application of Morse signal figures or numbers as a means for quick identification of sectional lines and curves on the boards ; a system capable of limitless application elsewhere.

While cordially thanking the reviewer for his concluding remarks, the writer must add a word on behalf of the average junior assistant. This youngster, probably for the first time on a cable-ship prior to returning, at the end of the trip, to the comparative monotony of fifth-form or sixth-form routine at his school, is keen as mustard on new work which is no "pill" to him "well sugared" or otherwise.

It may be well here to mention that among the photographs kindly referred to by the reviewer, four blocks were made specially for the book to the writer's order, as likewise five new blocks of tables and a diagram, so—as the reviewer has pointed out—the book is much more than a reprint of the Electrical Review articles.

The writer has ventured to review his reviewer only in pursuance of a duty he owes to the Editors of the Electrical Review, who accepted his articles, and to the publishing firm who brought out the book.

E. Raymond Barker.

London, *December 8th*, 1913.

Canadian Electrical Trade.

To one who, like myself, has staked considerably on the chances of success in the supply of British electrical machinery suitable for the Canadian market, Mr. Berry's letter has a good deal of interest. With a great deal of what he says in his instructive letter I cannot but find myself in agreement, but at the same time I feel also that, while dealing with the results of the observations which he made during his trip through Canada, he has rather overlooked the causes which have operated to produce the state of affairs which he criticises.

It is not my purpose in this letter to deal at length with the facts and arguments which Mr. Berry states and uses, but I think that the briefest possible reference to the causes as they appear to me may be of interest.

It should be remembered that Canada is, by its geographical situation, intimately linked up commercially with the United States of America. When we couple this with the fact that that country has been the home of the electrical manufacturing industry on a large scale from its earliest infancy, is it surprising that Canada, requiring as she did some rules and regulations for the control of her enormous hydro-electric power schemes, should turn to the practice of her great neighbour ?

The American electrical manufacturer, entrenched as he is behind tariff walls which have secured him from foreign competition, and being in touch with Canada over the thousands of miles of international boundary line which alone divide the two countries, has naturally turned his attention to the market lying at his hand, and as soon as he found that the Canadian traffic was operating against him, put down branch works in the country which to-day supply the great bulk of the electrical machinery which Canada absorbs.

With this we cannot quarrel. The history of some of our greatest electrical manufacturers reminds us of their early connection with the American industry, and from experience I can say that the plant turned out by the Canadian manufacturer to-day is equal to the best product of Britain or the European Continent. Considering further the fact that our home manufacturers for years past have been too much occupied in cutting prices to a point at which there was no margin to allow for setting aside sums to develop business in a country like Canada during the time when the industry there was comparatively in its infancy, I think we can see why at the present day the Chicago Board of Underwriters and its regulations are the recognised authority for the acceptance of suitable electrical equipment on the other side of the water.

Only in recent years, when the Canadian market has grown to such enormous dimensions, have British firms tackled the problems of meeting Canadian ideas with any real zest and determination. Those of us who have so done have found in some cases to our chagrin that certain classes of apparatus cannot be installed in Canada without the seal and approval of the Board of Underwriters quoted above, as laid down in what is known as "The National Electric Code." Fortunately, the code gives little trouble to the supplier of plant as opposed to apparatus, and therein possibly Mr. Berry, as a manufacturer of the latter, has looked on the subject somewhat from one point of view alone. The items which he has selected for criticism, however, will illustrate how open the code is to advantageous improvement, but any movement which could be expected to be crowned with success must, in my opinion, come mainly from within the country rather than without. The reason of this is that Canada has built up her electrical industry to suit her own special conditions, which are entirely different to those found in the old country, and only prolonged experience can teach the British electrical expert wherein she can, with advantage, adopt our methods, and wherein, on the contrary, she is doing better on the lines at present being followed.

In conclusion, I would like to draw your attention to, and give one illustration of, the fact that the Government of the country are entirely sympathetic to regulations which, in their opinion, make for increased safety of life. In considering the illustration which I give, it must be remembered that in Canada this class of legislation is not dealt with by the Dominion but by the provincial Governments, and hence concerted action is not always possible.

I have before me at the present moment a copy of the rules for the installation and use of electricity in mines passed by the Government of Alberta by order in Council dated September 17th, 1913, and on studying these rules I find that, with two important exceptions and a number of minor details, these rules are word for word a copy of the electricity rules in force in this country as adopted after investigation and discussion between the Home Office and the mining industry of Great Britain.

The exceptions referred to are (1) that the Government of Alberta prohibit altogether the use of electricity underground above 600 volts, and (2) allow the use of electrical locomotives underground with the special consent of the Minister responsible for the safety of mines. The date for

complete compliance to these regulations is January 1st, 1916, as against 1920 in our own rules.

It seems to me this case is clear evidence of the desire of the authorities to take every possible precaution to secure the highest degree of safety in the mining industry, at any rate, where electricity is used. If the state of public opinion in the country permits, or, perhaps I should say, encourages, the passing of regulations such as these, by Order in Council, the day cannot, I think, be very far distant when much more general adoption of rules to secure protection of life from electrical accidents will be established by the responsible authorities on lines more or less similar to those which are accepted here in the United Kingdom. In the meantime, those acting as representatives of British firms in Canada, or in touch with her electrical industry, can do much to further the cause which is, I think, the root problem raised by Mr. Berry's letter, viz., that of standardisation in Canada of rules and regulations for the use of electricity more in consonance with British practice than the National Electric Code, while at the same time designed to suit the purely local conditions and problems which are so much at variance with those found in the Old Country.

C. Atherton Atchley.

Glasgow, *December 10th*, 1913.

Christmas Presents.

I should be glad to know whether members of the B.E A.M.A. are prevented by reason of their agreement from sending Christmas presents to their customers.

If I am correct in my assumption, may I also inquire whether all members of the B.E.A.M.A. are intending honestly to observe this condition?

Anti-Corruption.

December 11th, 1913.

[In regard to the last paragraph of our correspondent's letter, we are not aware that it is possible for one to know the intentions of the rest. In regard to the general principle involved, it may be said that the arrangement introduced by the National Electrical Manufacturers' Association respecting Christmas presents was continued by the B.E.A.M.A. Members of the latter, while having perfect liberty of action in distributing personal "Christmas cards" to their friends, have through their organisation a suitable means of dealing with the matter if it exceeds moderate limits.—Eds. Elec. Rev.]

Boiler Furnace Efficiency.

In reference to your remarks in your issue of the 28th ult. on the above subject, it does not appear to be fully recognised that boiler furnace efficiency—or inefficiency—depends mostly upon the nature of the fuel fed into it, other conditions being equal. Some of your readers may have had the disappointing experience of obtaining about eqnal evaporation with different fuels of apparently widely different heating value. During the combustion process coal is split up into its carbonaceous and gaseous constituents, which require widely different conditions to ensure their complete combustion and realisation. Roughly, to obtain smokelessness the gaseous constituent requires about double the amount of air necessary for the complete combustion of the solid or carbonaceous constituent and, in common practice, the air supply to the furnace cannot be so nicely divided and regulated that each obtains the necessary amount and no more. As the proportion of volatile matter in the coal increases—in some classes it is over 30 per cent. by weight—the furnace efficiency usually decreases, and the usual practice of basing fuel contract prices merely on the apparent calorific value without restriction as to the volatile content is open to adverse criticism. Contracts based on the calorific value with 5 per cent. reduction in price for each 1 per cent. increase in volatile matter over an agreed maximum are more advantageous to the consumer, and where low volatile fuels, natural or artificial, are obtainable at reasonable cost, improved results should be obtained by their use. The nearer a fuel approaches in composition a simple compound of carbon and ash, the easier becomes the process necessary to realise its full "potential."

E. W. L. N.

The Association of Mining Electrical Engineers.

After reading your leader of November 21st, I looked forward to the "slating" you would get from the A.M.E.E. in your next issue. However, you didn't, due to the fact that there is not a member in the whole of that illustrious body in a position to do so. Your article truthfully exposes the state of affairs prevailing to-day, which is exactly what it was before the inception of the A.M.E.E. During the early canvass for members I was handed a copy of the rules and aims (*sic*) of the Association, and asked to become a member, but after a few pointed questions, *re* the qualifications necessary, the classification of members, and the means to be adopted to attain the objects set forth, I decided to deny myself the "honour."

In your reply to Mr. Hall you quote the argument I have expressed scores of time against becoming a member. About a year ago I attended a lecture organised by a branch of the Association to mine managers and electricians, and listened about two hours to some piffle about Arago's disk and Oersted's experiments, after which questions were asked, and I innocently said something practical; this immediately brought a request from a member of the audience for further information, which was endorsed by the chairman, subject to my qualifications being in order. On inquiring what these were, I was informed that to become a member cost two guineas.

For about seven years my business has brought me into constant touch with colliery electricians and engineers, during which time I have carefully watched for any signs of improvement in the status or the capabilities of electricians-in-charge, but in vain. In your article *you* deal with the tragic side of the question, but must realise that to men who make money out of this state of affairs it offers scope for considerable merriment. Here is a case from hundreds I alone could supply. The traveller sold a squirrel-cage motor and auto-starter, with a centrifugal pump. This was put to work without a gate valve in the delivery side and was found to operate very unsatisfactorily; therefore, when the traveller called again he suggested a slip-ring motor and rotor starter, got the order and then told the story in the commercial room.

F. W. A.

I have been an interested reader of the correspondence on the above Association, and had hoped to contribute a few more or less rambling remarks to this discussion. It, however, appears that if one dares to breathe, or write, a word of criticism against this most important body one cannot do so without being accused of "having a grievance" against it.

I, therefore, content myself by sending you an extract from a letter I received on the 13th inst. from a member of three or more years' standing. The extract I quote is a casual paragraph in a letter dealing with quite a different subject.

"The A.M.E.E. is not much good now. There is more than a little trouble amongst the members owing to the large number of managers and their pet men the engine-wrights. You dare not say anything at a meeting or else you get sat on afterwards for it. The manager's clique sits round the table with its back to the electricians, who sit silent behind."

It would appear that many members "have a grievance" as the managers make it unpleasant if the electricians do not join the Association, do not attend the meetings, and say anything if they do attend.

Nemo.

London.

Asbestos Insulation.

We notice in your issue of December 5th an article on Aluminium Insulation for Magnet Coils, in which the writer points out that "When higher temperatures have to be withstood, asbestos coverings have sometimes been adopted, but only at great sacrifice of space," and goes on to say that even a small wire requires a radial thickness of asbestos of about ·35 mm., while the corresponding thickness in double cotton covering is only ·1 mm.," and so on.

We take the liberty of pointing out that for some year

we have now placed before electrical engineers our Asbestin Copper Wire, and enclose a pamphlet giving some particulars of this wire, also a sample by which you will notice that the asbestos insulation on this wire is put on in so compact a manner that the space taken up is not more than that of an ordinary double cotton covering, and the radial thickness of covering in No. 33 G. wire, for example, is only ·1 mm.

This is the only asbestos-covered wire on which the covering does not take up any more space than it would do in the case of an ordinary cotton-covered wire.

The Concordia Electric Wire Co., Ltd.,
R. Fifer, *Director.*

London, N.W., *December 12th*, 1913.

[Tests that we have applied to the sample show that the insulation withstands a very high temperature.—Eds. Elec. Rev.]

Electric Clocks.

Will you allow me to say a few words of comment on Mr. Hope-Jones's letter *re* electric clocks?

The "Hipp" pendulum as used in the "Silent" system, notwithstanding the "powerful switching operation," is a very good timekeeper. If it were not nearly so good in this respect, I should still consider it excellent for all practical purposes, because of the mechanical and electrical goodness of the contact arrangement, but as clocks of this type have been found to go as near as 1 second per week, the horological objections are more academic than practical.

The K.R. conditions of the circuit can, in the Synchronome system, have control of contact duration, but that is not to say that this control extends to the mechanical action of the clockwork in the individual dials—the margin of safety to cover this is necessarily arbitrary.

After some years of experience, I am convinced that nothing is more undesirable in any clock than an ultra-rapid actuation of any part. It is a question of avoiding undue wear and tear, and of giving liberal opportunity for correct functioning of all parts at all times.

I am in full agreement with Mr. Bousfield *re* Mr. Hope-Jones's services in the development of electric time service.

G. B. Bowell.

Margate, *December 15th*, 1913.

Your correspondent, Mr. Hope-Jones, sets forth certain principles underlying the operation of electric clocks, and as he admits there is room for difference of opinion in the practical working, it may be my excuse for detailing some divergence from his opinion.

Regarding the Hipp-Foucault method of pendulum-driving, Mr. Hope-Jones states that the amplitude of oscillation is perpetually varying with irregular frequency. This, however, is not the case in practice. It is true that the arc must fall to allow the re-energising contact to be closed, but this is so slight that it is almost invisible upon a degree scale shown at the termination of the pendulum. If the frequency of the impulses is arranged so that they occur at intervals of not more than five seconds' duration, and provided that the design of the pendulum has been properly carried out, no more ideal mode of driving could be obtained, and the disturbance of the natural rate is extremely small. Contrasted with the gravity arm drive, where a heavier thrust is given to the pendulum every 30 seconds, and the arc considerably increased thereby, much is apparent in favour of the Hipp method. This is further borne out in practice by the fine performances of Hipp-driven pendulums, both as regards time-keeping and reliability, even when doing the work of periodically closing contacts for secondary dials. If the contact is closed while the pendulum is in the zero or middle position, and the contact gear is so arranged that any power absorbed by springs is returned to the pendulum, the disturbance is very small; in fact, the work is little greater than the release of a latch holding a gravity arm where the power is not regained.

The limitation of the duration of contact when the current has attained the summit of the inductive wave is a matter of importance only where the power is supplied by primary cells. Where plenty of current is available, the contact may be left sufficiently long for the whole of the dials to operate without undue absorption of power. In battery working, it is easy to adopt a device which will automatically cut off the current when it has reached full strength.

H. Bevan Swift.

London, E.C., *December 15th*, 1913.

Code Books for Engineers.

Replying to Mr. D. Eardley McLaren's letter in your issue of December 12th, there exists one published code which contains all ordinary commercial and also electrical engineering matter. The code in question, notwithstanding it has been recommended by the British Electrical and Allied Manufacturers' Association, is too little known, owing to the fact that it has not been advertised. Those firms who have heard of it employ it, one engineering firm having 20 copies in use.

The author has had 25 years' practical experience in compiling codes, and has almost completed a more extensive work embracing still more technical and electrical engineering matter. But the fact is, it is a question of support or remuneration, and it only requires the co-operation of the B.E.A.M.A. or others to bring about the publication of what should become a standard work.

But to return to the code already on the market. This book contains commercial phrases combined with "voltage, phase, cycles, speed, candle-power, type of motor, coupling, efficiencies, and the hundred and one other important detail matter" called for by Mr. McLaren. I fear no other published code could cope with the example given by him, even in any number of words. In eight words the book in question will code :—

Quote price f.o.b. and c.i.f. motor-generator D.C. compound-wound 18 point 00 KW., 100 volts, compounded 15 per cent. higher, shunt regulator, not to exceed 900 R.P.M., motor A.C., three-phase, 100 cycles, 400 volts, starter.

And in two and a half words the supposed reply :—

Price of plant complete £319, £378, ready for shipment in 25 working weeks from date of full particulars.

If the above code is not sufficient for any engineering and electrical firm, I should be happy to co-operate in producing the more extensive code mentioned in the second paragraph above.

C. H. Cole.

Rugby, *December 15th*, 1913.

A Question of Terms.

I might point out that the most likely answer to the query of your correspondent of December 5th concerning the relative values of the terms "fool-proof" and "mistake-proof" appears to be contained in the pages of your contemporary the *Electrician* for July 25th last, where it has been noted in this connection that "a fool is among all men the most sensitive as to his shortcomings." Hence we may suppose that the American, in his courtesy crusade, one among the many startling movements for which the electrical community of that nation has recently become famous, coined the word "mistake-proof" to save the face of the potential purchaser of such apparatus to which the name applied.

An Observer.

December 9th.

Trade with the United States.—We have received a copy of the prospectus of the Merchants' and Manufacturers' Exchange, a United States corporation which is stated to be a clearing house of merchandise of almost every description, and which, by special Act of Congress, is enabled to receive imported goods duty free into its head establishment, the Grand Central Palace, New York. There the goods will be displayed for sale in a building visited by vast numbers of prospective purchasers, and duty is only payable when the goods are actually sold. Such a warehouse is considered to afford an excellent opportunity for British firms who want to get their electrical and engineering wares known in the American market. We are informed that Mr. M. S. Mannes and Mr. Lee Kolpman, the vice-president of the Exchange, and the secretary of the Sales Syndicate (a department of the Exchange) respectively, are now staying in London (Savoy Hotel) in connection with their tour of industrial centres in Europe.

VARIABLE SPEED "CASCADE" WINDERS ON THE RAND.

A Rand Correspondent informs us that two winders which embody several novel and interesting characteristics have recently been installed underground at the Van Ryn Deep Gold mines in South Africa.

These winders have been supplied by Messrs. Sandycroft, Ltd., of Chester, and are of their patent variable speed "Cascade" design suitable for two constant synchronous speeds, *i.e.*, 500 r.p.m. and 333 r.p.m., while at the same time capable of giving any intermediate speed between these mentioned and zero, with a uniform torque throughout.

The motors have a normal rating of 700 b h.p. and are capable of developing 2½ times full load power; they are supplied from the Victoria Falls Power Co.'s mains at 2,000 volts 50 cycles.

The motors drive the main drums through single reduction gearing, and the plant is placed underground at a depth of 2,000 ft. so as to deal with the incline section of the Van Ryn Deep hoisting system. The gradient of these inclines varies from 12° approx. to 42° approx., which necessitates varying the winding speeds at certain points, which can be carried out most advantageously by either the Ward-Leonard or "Cascade" systems, so as to obtain a maximum efficiency and ideal working conditions; the maximum winding speed required is 2,500 ft. per minute.

The system of control is simple, the whole operation being controlled from the driver's platform by means of one lever. The first motion of this lever in either direction controls the motor operating the oil reversing switch; a further movement of the lever operates a valve on a small air engine which, in turn, operates the controllers. The position of the valve is in accordance with the speed required. The controllers for each winder are of the Sandycroft patent screen type, and are divided into two units, one regulating the stator circuit and the other the rotor circuit. Both controllers are operated in turn by the full stroke of the common air engine on the up-going stroke, and *vice versâ* on the down-going stroke.

The sequence of events is as follows:—In connection with the operation of the controllers by the air engine, the stator controller is first operated, the slate screen being lifted and so exposing a certain amount of plate area according to the speed required; the screens are eventually lifted the full amount and expose the full plate, so bringing the motor up to full "Cascade" speed, the driver's lever being pushed on to "Cascade" speed position.

The lever being pushed forward beyond this position, allows the up-going stroke of the air engine to continue; the screens of the rotor controller are then raised and the stator screens lowered, until at the end of the stroke the rotor plates are fully exposed and the stator plates are again covered; this allows the motor to run at top speed.

It is interesting to note that during the process of slowing down from top speed to "Cascade" speed, current is being generated, hence such winders can always be braked down to two-thirds speed on the regeneration system. With reference to the general principles of the variable-speed "Cascade" motor, we would refer our readers to the paper read by the inventor, Mr. L. C. Hunt, before the Institution of Electrical Engineers and to the papers read by Mr. M. I. Williams-Ellis before the A.M.E.E. and S.A.I.E.

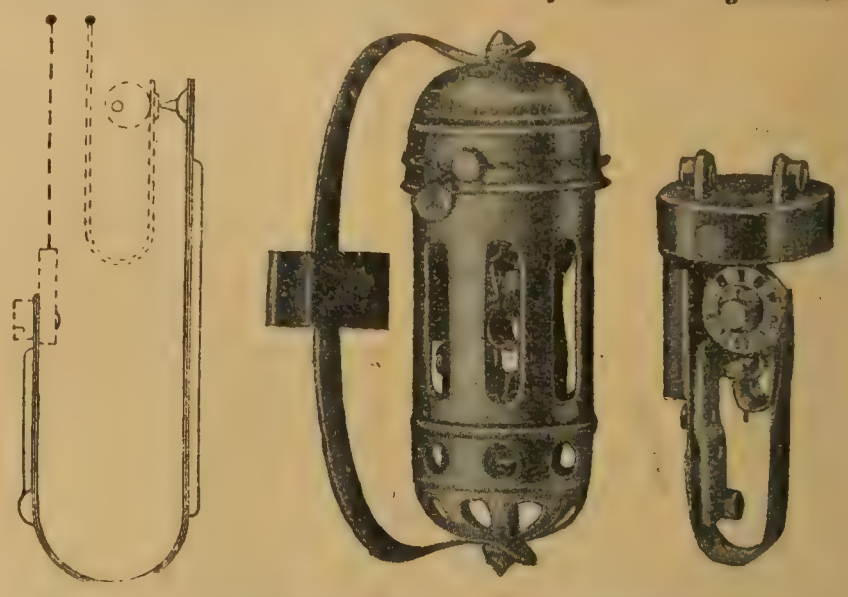
Diesel Engines.—Referring to the recent correspondence respecting Diesel engines in our pages, Messrs. R. S. Price, Ltd., of Amberley House, Norfolk Street, W.C., send us particulars of the "Maihak indicator and Bottcher power counter." Over 7,000 of these instruments have been sold, the purchasers including the following well-known Diesel engine builders:—Sulzer Bros., 170 apparatus; C. and T. Pattison, 120 apparatus; Diesel Engine Co., 108 apparatus; Fried-Krupp A.G., 86 apparatus; Korting Bros., 78 apparatus; Franco Tosi, 41 apparatus; M. A. N. Augsburg, 60 apparatus. Messrs. Price do not understand Mr. C. J. Wood's expression "blast-recorder" as applied to Diesel engines, but if the same signifies "pressure recorder," they regret that the invitation to which he refers was not extended to them.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Fire Alarms.

The Siemens & Halske Co., of Berlin, have recently introduced two distinct types of electric fire alarms to meet the practical conditions which occur most frequently.

The first form (maximum temperature alarm) is shown in fig. 1. It consists of a U-shaped metal strip, formed of two strips of materials of different expansion coefficients welded together. When a temperature rise occurs the unequal expansion causes the strip to bend up, and so either make or break a contact, as desired, at some definite predetermined temperature. This temperature can be varied between 40° C. and 90° C. by means of a graduated



Figs. 1 & 2.—Expansion Strip and Complete Maximum Temperature Fire Alarm.

wheel. Fig. 2 shows the alarm in its complete state, with its perforated outside protecting case. The whole is arranged for suspension by means of a spring clip from the wall or ceiling of a room.

The second type (differential alarm) is shown in fig. 3. It consists of a glass U tube, each arm of which is about half filled with mercury, over which a small quantity of a volatile liquid is placed. One limb is composed of thicker glass than the other, so that when a rapid rise of external temperature occurs, the heat penetrates much more slowly into the thick glass limb than into the other. The liquid in the thin glass limb will, therefore, be vaporised first, and the excess of pressure so produced will cause

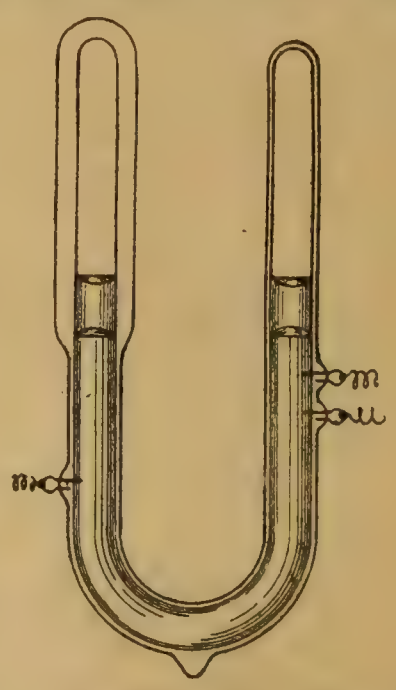


Fig. 3.—Differential Type Fire Alarm.

the mercury to fall in that limb, and, as soon as the drop is sufficient, the mercury contact between two platinum wires sealed into the glass will be broken, and this serves to give the alarm.

The dimensions are so chosen that ordinary temperature variations produce no effect, but any exceptionally rapid rise of temperature, such as occurs at most fires, will at once be notified. Occasionally, *e.g.*, in the case of spontaneous combustion, a fire occurs with only a slow rise of temperature, and in such a case this differential alarm would possibly fail to act, and, to meet such cases, an alarm of each form (maximum and differential) is sometimes made up in a single frame.

Besides the alarms themselves, the apparatus includes an indicator-board at the fire station, by which the locality of the fire is shown, and the necessary testing instruments.—*E.T.Z.*

Ediswan-Zenith Sign.

The Edison and Swan United Electric Light Co., Ltd., Ponder's End, Middlesex, have recently acquired the manufacturing rights of the "Ediswan-Zenith" Light Saving Sign (Beville's patent).

The lamp is fixed between distributing screens, while its side rays are thrown on to mirrors at either end of the sign, by which arrangement, an even distribution of light over a large surface is obtained. In the case of either single or double sided signs the width of the containing box is reduced to the absolute minimum, thus offering extra facility from a decorative point of view.

The arrangement is applicable to facias, projecting signs, window signs, wall signs, and, in fact, to all signs illuminated from within.

New Bastian Heaters.

A new heating element, called the "Rodolite" glower (fig. 4), has been introduced by the Bastian Electric Heating Syndicate, Ltd., 185, Wardour Street, W. The 10-in. glower is interchangeable with the Quartzalite glower, and is made of 250 watts



Fig. 4.—Rodolite Glower.

capacity, for all voltages from 25 to 250 volts or more. The spiral seen in the figure is of Tabasco alloy, and has a thin thread running through it, which binds it in place. When the glower is switched on, the thread is burnt off, and the spiral takes a permanent set in the correct position.



Fig. 5.—Heater with Rodolite Glowers.

The "F" type heater case shown in fig. 5 is of 2-kw. capacity, and is used with the "Rodolite" glowers; the capacity is increased by one-third, compared with the "Quartzalite" apparatus, and the price has been reduced.

A New Lock-nut.

A new lock-nut, known as the "Perfloc," has lately been introduced by the Engineering Improvement Co., Ltd., of 39, St. James Street, London, S.W., which combines the functions of a nut and locking device, consequently doing away with the usual second nut and split pin. The feature of the "Perfloc" nut is the simple yet ingenious method by which the self-locking action is secured. The nut itself is of standard form and thread, but a size larger than the bolt, in order to allow a spiral spring to be em-

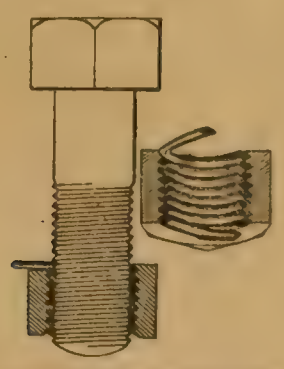


Fig. 6.—The Perfloc Lock-Nut.

bedded in the thread of the nut. One end of the spring is firmly fixed in the base, while the other is left free, and projects slightly beyond one of the faces of the nut, a slot being cut on the latter to accommodate the free end so that it does not jamb on the face of the washer against which the nut bears. The spring is of a special diamond section, so that, in reality, its inner surface becomes the actual thread of the nut; the latter is screwed on to the bolt in the customary manner, locking itself automatically and instantaneously in position, all tendency for the nut to slacken, under even the greatest vibration, being arrested by the binding of the spiral-spring thread on the bolt.

An important characteristic of the new nut is that the action is such that, whilst under no circumstances can the nut slack back, it has an automatic tendency to tighten itself up against the plate or other part which it is maintaining in position, this tendency increasing with the intensity of vibration. The removal of the nut, notwithstanding its tight grip of the bolt thread, is quite a simple matter, it being only necessary to apply a slight pressure to the free end of the spiral-spring thread, which releases the binding action of the latter; it is then possible to turn back the nut by hand as long as the pressure is maintained.

The "Perfloc" nuts have been subjected to a variety of exhaustive tests, by which the claims with regard to the non-slackening qualities and absence of wear even when under trying conditions have been fully substantiated. The new nut both as regards strength and freedom from liability to damage by rust, is fully equal to that of the ordinary form, and there are no saw cuts or holes in the nut by which dust or grit can enter to interfere with its action.

Double-Pole "Igranic" Remote Control Circuit-Breaker.

This type of circuit-breaker forms an integral part of many "Igranic" starting switches and controllers with which it is interlocked in various ways; it is also suitable for independent use, and is made by the Igranic Electric Co., Ltd., of 147 Queen Victoria Street, London, E.W.

The current-carrying contacts consist of a laminated phosphor-bronze brush pressed against a hard rolled metal surface. This construction eliminates the danger of partial contact, for whenever contact is made at all, it must be over the whole surface area.

Furthermore, the contacts are always clean, because each time that the switch closes the flat contact surface is slightly scraped by the edges of the leaves of the laminated brush as they expand.



Fig. 7.—Igranic Remote-Control Circuit Breaker.

These current carrying contacts are reinforced and protected by easily renewable circuit-breaking contacts of carbon of large size, and so disposed as to always make contact before the metal contacts and break after them.

As will be seen by reference to the illustration, the pole-pieces of the blow-out magnet swing up to permit easy inspection of the contacts.

Variable-Speed A.C. Motors.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, are introducing a line of A.C. motors with a wide range of speed. These

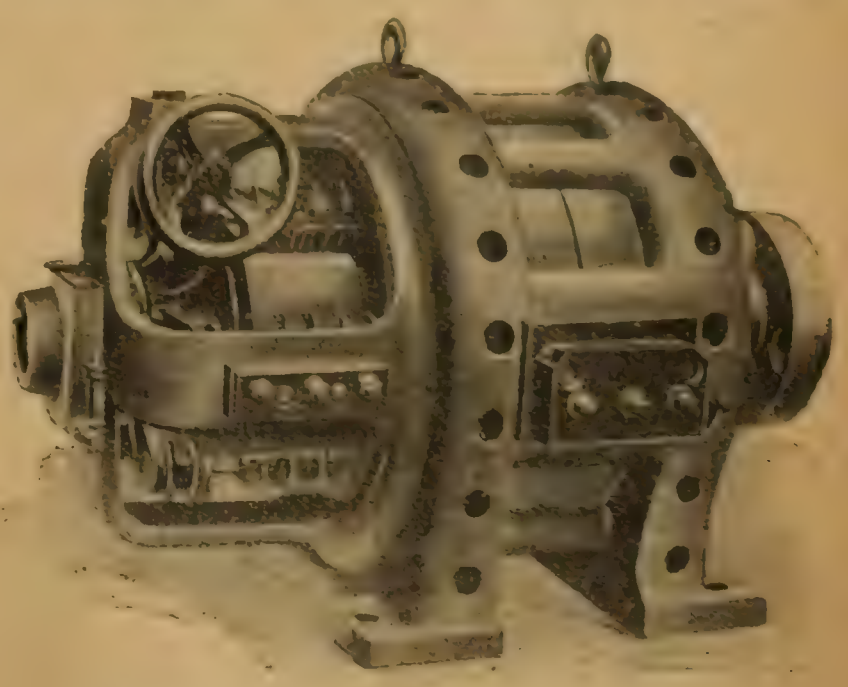


Fig. 8.—Latour Three-phase Variable speed Motor.

machines are made on the Latour system, with commutators, both single and polyphase, and run at speeds variable in the ratio of

1 : 3 : all sizes are manufactured from ½ to 300 H.P. The single-phase motors are of the series type ; the polyphase motors have an ordinary three-phase stator and a D.C. rotor with three sets of brushes spaced 120° apart. Both stator and rotor are supplied with current from the three-phase mains, producing two magnetic fields rotating at synchronous speed ; the two fields are in phase with regard to time, but not in space unless the brushes are in a particular position on the commutator. If the brushes are shifted the fields are correspondingly displaced in phase, but produce a couple depending upon the angle of displacement, and thus affecting the speed of the rotor. The speed can thus be economically regulated over a wide range, and the motor can start with a large couple, without any loss of energy except that due to the ohmic resistance, &c., of the machine. It is claimed that high efficiency and high power factor are other advantages possessed by these motors.

The rotor is connected in series with the stator, except when the supply pressure is too high for the former, in which case a transformer is employed for the rotor currents. Speed regulation is

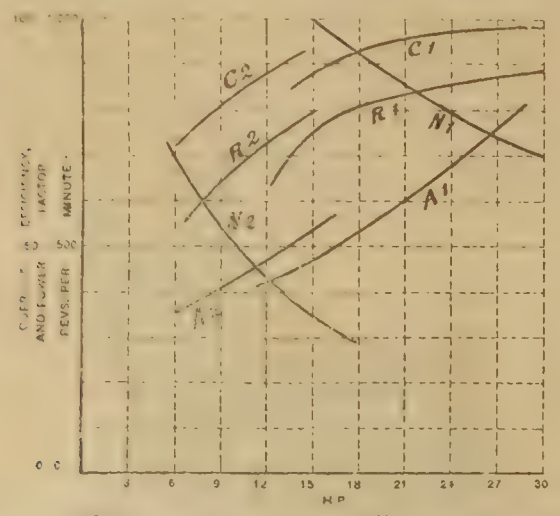


Fig. 9.—Characteristics of Latour Motor.

effected by shifting the brushes with a handwheel and screw. Special windings adopted for the rotor on the Latour system render commutation sparkless over a range of speeds of 1 : 3. The motor behaves like a D.C. series motor when the brushes are left stationary, but racing on light load is prevented by a patent method involving the use of an air-gap in the transformer supplying the rotor.

Fig. 8 shows a 27-H.P. three-phase motor for 220 volts, 50 cycles, intended to drive a feed pump, and capable of running at any speed from 350 to 750 R.P.M. Fig. 9 shows the characteristics of this motor with the brushes set for 750 and for 350 R.P.M. at normal torque ; A_1, A_2 are the current strengths, R_1, R_2, the efficiencies, C_1, C_2 the power factors, and N_1, N_2 the speeds.

Motors for driving textile machinery are also supplied by the firm. They are totally enclosed, and ventilated by a current of air

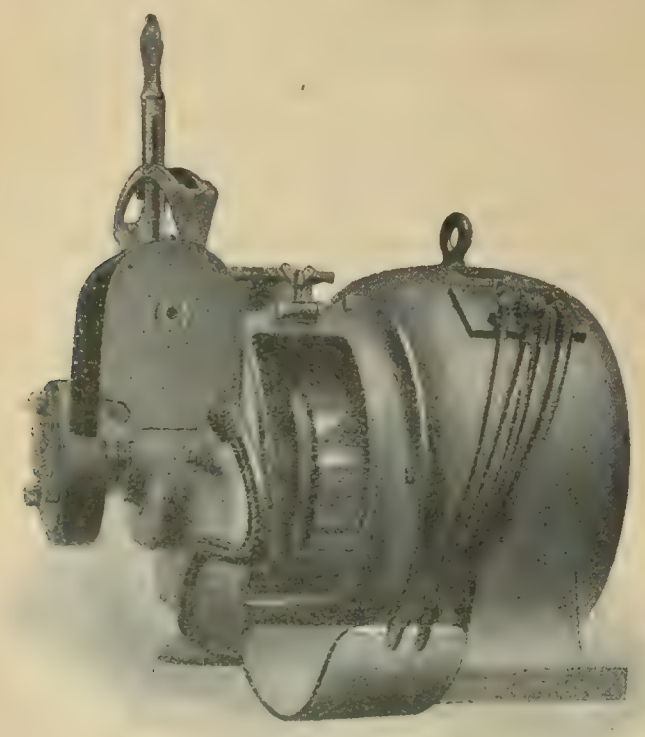


Fig. 10.—Motor for Driving Spinning Machinery.

drawn through a duct. Fig. 10 shows one of these motors, with the controller for starting and regulating the speed mounted on the cover ; on opening the circuit the brushes are automatically returned to the position of lowest speed. The motor illustrated gives 8·5 H.P. at 900 R.P.M., falling to 5·5 H.P. at 600 R.P.M., and is built for 110 volts, 25 cycles. The efficiency between these limits remains at 80 to 85 per cent., and the power factor varies between 0·85 and 1. A large number of these motors has been supplied to various Continental firms.

Relay-type Crane Panels.

Mr. George Ellison, of Warstone Lane, Birmingham, has supplied a number of relay-type crane panels, which are doing excellent service on steel works and wharf cranes.

One of these panels for a three-motor direct-current crane is illustrated in fig. 11.

The general scheme consists of an automatic circuit-breaker (controlling the whole of the supply to the crane), fitted with loose handle feature and overload and no-voltage releases : each motor of the crane is provided with a patent time-limit overload relay adjustable between 20 per cent. overload and about 100 per cent. overload, and also adjustable for the time of retardation of

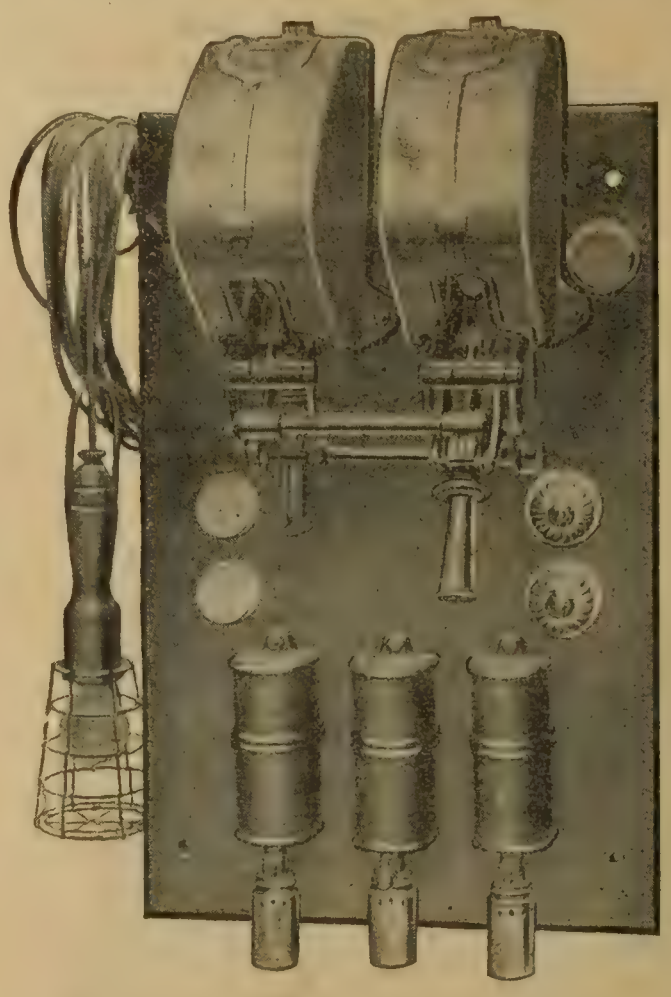


Fig. 11.—Relay Type D.C. Crane Panel.

operation, that is, having 11 different settings on the time lag, giving any desired retardation between three seconds and five minutes.

The relays are of the solenoid type, and open the main circuit-breaker when a motor is overloaded ; the breaker can be replaced without the delay associated with fuse renewals.

A hand lamp with flexible and tumbler switches, are provided on the panel, which conforms with the Home Office Regulations.

Fig. 12 shows diagrammatically a panel for three three-phase slip-ring A.C. motors, equipped with a main three-pole circuit-

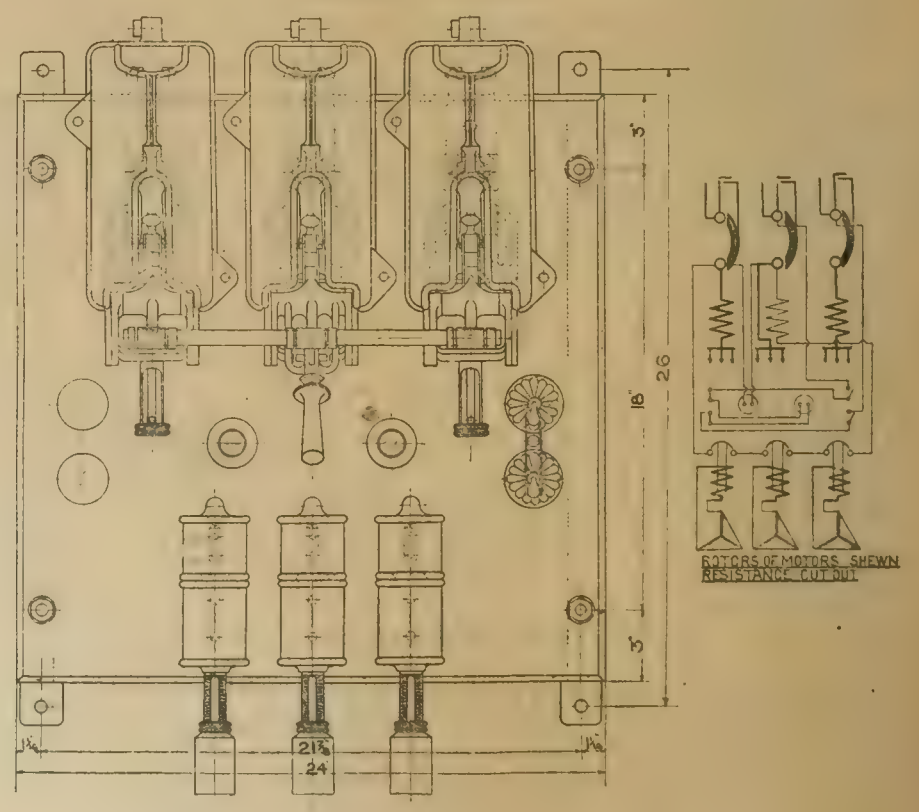


Fig. 12.—Relay Type A.C. Crane Panel.

breaker, controlling the stator circuits of the motors and fitted with no-voltage and two overload releases ; one time-limit overload relay for each motor, connected in the rotor circuit ; pilot lamp, flexible, &c.

The placing of the overload relays in the rotor circuit not only gives protection against overloads, but also against the failure of supply in one phase only, with which in the ordinary way a motor continues to run, with exceedingly heavy induced currents in the rotor windings.

Seymour Patent Tire.

One of the most important questions in the management of a railless trolley system is the life of tires; in the ordinary way a resilient tire has a short life, while a tire designed for durability is hard and unyielding. The two qualities of resilience and durability have been ingeniously combined in the "Super-resilient" band tire recently introduced by the St. Helens Cable and Rubber Co., Ltd., of Warrington, for heavy vehicles. The special feature of this device is the insertion between the hard tread rubber and the steel band, of a layer of specially pure, soft and



Fig. 13.—Section of Seymour Patent Tire.

resilient Para rubber, which absorbs road shocks and relieves the tread rubber of the deleterious effects of hard usage. This resilient layer can be seen in the section shown in fig. 13.

This tire, we are informed, retains its shape under a load, does not break out at the sides, does not overheat, and possesses 70 per cent. greater resilience than the ordinary type of tire.

Porter Patent Safety Seal.

The Porter Patent Safety Seals, Ltd., of Belfast Road, Stoke Newington, N., have introduced a lead seal which it is claimed cannot be tampered with by the outsider without detection. It consists of a leaden sleeve, a small flat piece of lead, pierced by two parallel holes, to allow it to be slipped over the ends of the seal wire, as shown in fig. 14; the wire being threaded, the lead



Fig. 14.—Lead Sleeve on Wire.



Fig. 15.—Finished Seal.

is crushed into a zig-zag between the jaws of a small sealer, and impressed with the name of the Corporation, &c., as in fig. 15. The sealer, which is only 5 in. long and 6 oz. in weight, can easily be carried in the waistcoat pocket; it is of spring steel, nickelled and well finished, and is shown in fig. 16. The jaws impress upon the seal 20 letters, five on each angle, and when crushed the lead assumes a sharp zig-zag form, therefore the zig-zag crush and

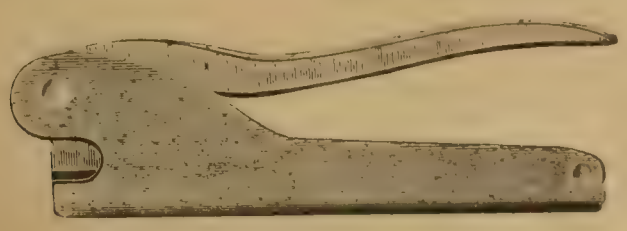


Fig. 16.—Sealer for Safety Seal.

impress claims to be the most efficient seal upon the market, as it cannot possibly be tampered with unless detected immediately. The arrangement is simple, effective and economical. In addition to many electricity works, it is now being used by the British and Colonial Post Offices, Civil Service Commissioners, Foreign and Colonial Offices, British Embassies and Legations, British and foreign railway companies, mints, banks, &c.

Fire.—We have received the following note:—"The chemical laboratory of the St. Helens Cable and Rubber Co., Ltd., was burnt down on Sunday night, the 7th inst., but luckily without damage to the rest of the premises. Careful investigation proved that the suffragettes had nothing to do with it."

LEGAL.

Grant Finance Co., Ltd. v. The Victoria Falls and Transvaal Power Co., Ltd.

As briefly mentioned last week Mr. Justice Pickford, on December 9th, delivered his reserved judgment in this action heard before him on November 19th and 20th, in which the plaintiffs claimed to recover from the defendants certain sums as percentage of an agreement of April 26th, 1907, made between the defendants and Mr. Montague Fullerton Armstrong as engineer, the sums relating to receipts received by the defendants as to the supply of electrical current to certain mines on the Rand.

Mr. Gore Brown, K.C., Mr. Norman Craig, K.C., M.P., and Mr. McCardie appeared for the plaintiffs, and Mr. Leslie K.C., Mr. H. F. Dickens, K.C., and Mr. G. H. Allen for the defendants.

The case related to a long and complicated agreement, and involved questions as to the plaintiffs' rights to have commissions on money received by the defendants for electrical supply, from various Rand companies and mining groups, but the substantial questions were whether any receipts from the group of Eckstein were subject to the agreement, whether the Eckstein group were being supplied by the defendants' works, and questions were also raised as to whether plaintiffs were entitled to commission on renewals of contracts.

The defendants said they had paid the commission due in respect of certain groups, but they had not paid for the Eckstein group as they said Mr. Armstrong got no contract from the Eckstein group, it being obtained by a Mr. Harper, who was paid a considerable sum for it. They said the Rand Mines Power Co. was formed by them to supply the group, and they could not be regarded as the assignees of the defendants. Mr. F. Eckstein had given evidence for the defendants that he refused to consent to the Victoria Falls Co. supplying the Eckstein group with electrical power. Lord Winchester, chairman of the defendant company, had also given evidence.

Mr. Justice Pickford said that in this case the plaintiffs claimed to sue as the assignees of a Mr. Armstrong to recover certain remuneration or commission alleged to be due to Mr. Armstrong under an agreement between him and the defendants, and a number of questions arose in connection with which various declarations were asked for by the plaintiffs. It appeared that Mr. Armstrong was employed by a syndicate called the South African Concessions Syndicate, which promoted the defendant company to perform certain work or get arrangements by which the syndicate and the company it promoted were to supply electrical power to mines and other undertakings in the Transvaal, entirely, he understood, on the Rand. Mr. Armstrong succeeded in doing a very considerable work for the syndicate, and when the defendant company was promoted there arose the necessity for arranging Mr. Armstrong's rights of payment. The agreement of April, 1907, was ultimately entered into, and it recited among other things that Mr. Armstrong would be entitled to receive from the company various sums of money in respect to his services and that he should receive certain shares. An important provision was that for 25 years from January, 1907, there should be paid to Mr. Armstrong or his assignees sums equal to 2½ per cent. on the gross receipts obtained by the company for the supply of electrical power to certain corporations and companies and undertakings, and there was a question raised in the case as to whether the mines forming the Eckstein group came under the agreement. At the time the agreement was made, his Lordship thought both the defendants and Mr. Armstrong were of opinion that—whether there was a signed contract or not—they had in fact obtained the opportunity of supplying the Eckstein group with electrical power. By the 11th Clause it was provided that for 25 years from January, 1907, Mr. Armstrong should have a sum equal to 1¼ per cent. on receipts obtained by the company for the electrical supply to a number of Corporations, and the list included the municipality of Johannesburg and Johannesburg Consolidated Investment Co., Ltd., and the group belonging to or controlled by them. The case for the plaintiffs was that the defendant company by itself or by its assignees had supplied electrical power to the Eckstein group, and the defendants replied that it was not supplied either by themselves or their assignees, and, therefore, it did not come within the clauses of the agreement. The defendants said that neither they nor any of their assignees had the right of the supply, nor had they received the gross receipts in respect to such supply. In respect to the Rand Mines Power Co., the defendants held the shares, and it was said that they could do what they liked with it, and that their supply to the Eckstein Group was a supply by the defendants or their assignees. On this point he saw no reason for not accepting the evidence of Lord Winchester, chairman of the defendant company, and of Mr. Eckstein, that Lord Winchester did *bona fide* try to get his company accepted as the supplying company, in which event they would have paid the commission, and he had no doubt that Mr. Eckstein declined to consent to the defendant company supplying the power. It seemed to his Lordship that he was bound to say that this was not a supply by the defendants, although they did hold the whole of the capital of the supplying company, and he was also bound to hold that it was not a supply under the circumstances by that company as the agents of the defendants. Therefore, it could not be held to be a supply by assignees of the defendants. It had been argued that they were assignees of the defendants, because they were the assignees of buildings built by the defendants in which the power was generated, but it did not seem to his Lordship that there was ever a contract by which the defendants had the right to supply, or the

right to receive the gross receipts of the supply of, electrical power to the Rand Mines. Therefore, on that chief point in the case the defendants were right and must have judgment. In regard to Clause 12, that related to all contracts existing in 1907, relative to certain bodies, he thought the contention of the plaintiffs also failed, but under Clause 11 that provided for a percentage payment on gross proceeds received by defendants or their assignees obtained by supplying certain specified corporations, including the Johannesburg Investment Co., for a period of 25 years, he thought the plaintiffs succeeded, and were entitled to a declaration accordingly. In regard to the contention of the plaintiffs that where there was a contract with any one mine comprised in a group, they were entitled for 25 years to the commission on the receipts for supplying all the group, or that if they got one company they got the whole, he did not think the contract supported this, as each group was not spoken of as a company or undertaking. It might have been intended as the plaintiffs had submitted, but he could only say that it did not seem to him that the contract said so, and he had to go by the contract, and on that feature of the matter he upheld the case for the defendants. Therefore, on the whole of the case his decision was for the defendants except as to the commission upon the continuous or discontinuous supply under Clause 11. This meant he presumed that the defendants substantially succeeded in the action.

Mr. Norman Craig, K.C., said he took it his Lordship would make declarations putting his judgment into effect.

Mr. Justice Pickford said counsel could draw up the declarations accordingly. The effect of his judgment was that defendants had succeeded on all points except one, as to which the plaintiffs had succeeded.

His Lordship said that as to the costs, the ordinary course would be for the parties to have these on the issues in which they had succeeded, and he thought there had better be a set-off on these lines.

Mr. Norman Craig said the parties to the action were both substantial, and it might be desired to take the opinion of the Court of Appeal, and he therefore asked for a stay.

Mr. Justice Pickford: Yes; give notice in 14 days.

The Sunderland District Electric Tramways *v.* The Newcastle-upon-Tyne Electric Supply Co. and the County of Durham Electric Power Supply Co.

In the Chancery Division, on December 10th, Mr. Justice Sargant had before him this action, by which the plaintiffs sought to establish their right of having from defendants a supply of electrical energy for the working of their tramway upon the terms of an agreement of January, 1905.

Mr. Mark Romer, K.C., and Mr. Percy Wheeler appeared for the plaintiffs, and Mr. Martelli, K.C., and Mr. Gibson for the defendants.

In opening the case, Mr. Romer said that the plaintiffs, by their statement of claim, asked for a declaration that they were entitled to a continuance of a supply of electrical energy on the terms of an agreement of January 30th, 1905, and for an injunction to restrain the defendants from cutting off or discontinuing the supply of energy during the term of the agreement. The plaintiffs further asked for a declaration that they were entitled to a right of set-off, but he did not think that any question would arise between the parties as to that, for if the plaintiffs were right in their contention on the first point, he did not think that there would be a contention that they were not entitled to an adjustment of the account by way of set-off. The point between the parties was as to whether the agreement referred to was, under the circumstances, binding on the defendants, the Newcastle-on-Tyne Electric Supply Co., as being an agreement that was entered into, as it was entered into not by them, but by a company called the Durham Collieries Electric Power Co. It was an agreement by the Durham Collieries Co. to supply the plaintiff company with the electrical energy necessary to run their cars. The Durham Collieries Power Co. went into liquidation, and a Receiver was appointed in an action brought by a debenture-holder to enforce the debenture security. All the assets, with practically all the assets and undertaking of that company, were sold to the defendants, the Newcastle-upon-Tyne Electric Supply Co., but they said that they were not bound to carry out the agreement in question. If it turned out that they were right in that contention, counsel did not think that they would be unwilling to supply the plaintiff company with energy, but the price the plaintiff would have to pay would, no doubt, be considerably larger than the price agreed upon when the Durham Collieries agreed to give the supply.

His Lordship asked how the County of Durham Electric Power Supply Co. came into it.

Mr. Romer said they were the second defendants and a power company. They were authorised by the first defendants to supply electricity in bulk throughout a very large district, including the district in which these tramways were run. They had been made defendants because it was by them that this threat to cut off the electricity was made. He supposed that the Newcastle Co. had made some arrangement to take a supply from them. The history of the matter went back to 1900. It began with a provisional order made by the Board of Trade in 1900 authorising the construction of the tramway in question. It was known as the Houghton-le-Spring District Tramways Order, and it authorised the promoters to construct and maintain a tramway, and provided for the use of electric power for the purpose of running the tramway. In 1903 the plaintiff company was incorporated for the purpose of acquiring from the promoters the tramway undertaking. In 1904 a provisional order was obtained called the Houghton-le-Spring and District Electric Lighting Order, and that order was obtained for the benefit of the plaintiff company, though they were not mentioned in the provisional order as the promoters. It was an order authorising the promoters to supply electricity within the district mentioned in the order, which was substantially the district supplied by the tramways. There was in the order an express provision that the promoters should within a certain period assign the benefit of the order to the plaintiff company. The tramway company were not prepared to take the trouble of supplying the electrical energy for either of the purposes, and it was contemplated by them that the energy should be generated by another company, and accordingly the Durham Collieries Electric Power Co. was incorporated. Shortly before, or shortly after, the incorporation of the company, the agreement now in question was entered into. At the time of the agreement the Sunderland Tramways Co., Ltd., had not obtained an actual assignment from the promoters of the electric lighting order, but it was contemplated that the statutory powers would be, and as a matter of fact they were assigned shortly afterwards. The plaintiffs now having these undertakings entered into the agreement with the Durham Collieries Power Supply Co., and it was an agreement for a supply of electricity for 10 years. The rate at which the electricity was to be supplied was for the first five years ·75d. per unit, and for the remaining five years ·65d. per unit. This agreement was, no doubt, a very beneficial one for the plaintiffs, but it was intended that it should be so, for it had not provided for any payment to the Sunderland Co. for the transfer of the whole of their powers under their electric lighting order. There was provision for the payment of a royalty of £1,000 in respect of the electricity supplied from the Durham Co.'s generating station, and for special payments for electricity taken for special purposes.

At this stage, Mr. Romer announced that the parties, who had been negotiating, had come to terms. After an adjournment to enable the terms to be put in writing, counsel said that the terms were such that it would be unadvisable to mention them, but they had been put in writing and had been signed. They, therefore, asked his Lordship to make an order staying all proceedings upon the terms that had been signed.

His Lordship asked whether they would be scheduled to the order.

Mr. Romer said no, but they would be identified. There would be also an order for the taxation of costs, as part of the terms was that the plaintiffs were to pay certain costs of the defendants.

His Lordship said then the order would be to stay all proceedings in the action except for the purpose of carrying out the terms agreed, and for taxation of such costs as were payable under the agreement by the plaintiffs to the defendants.

Tramcar Accident Claims.

The record was closed and issues ordered in the Court of Session in an action by a Fife woman against the Dunfermline and District Tramways Co. for £200 damages in respect of injuries sustained last September. Plaintiff stated that when she started to cross the line a car was stationary, and that it was started suddenly and without warning before she got across, and she was knocked down. Defenders deny fault, stating that pursuer dashed across in front of the car before the driver could pull up.

At the Oldham County Court, on December 11th, Elizabeth Ogden, wife of James Ogden, carter, Middleton Road West, Chadderton, claimed £50 damages against the Middleton Electric Traction Co., Ltd., for injuries alleged to have been sustained through the negligence of the company's servants. The plaintiff's case was undertaken by the Carters' Union, of which her husband is a member, and an objection on the ground that plaintiff herself was not a member of the Union was upheld by Judge Spencer Hogg, who non-suited the plaintiff.

Edwards *v.* Brixham Gas Co.

(*Continued from page* 951.)

The Plaintiff, giving evidence in support of his case, said that directly the defendants' electrical works were started, the tenants of his cottages were continuously complaining of the vibration. In cross-examination, he denied that he had refused to let his cottages, and told applicants that they were in the hands of the Gas Co.

After other evidence as to the effect of the vibration, Mr. Hawes, electrical engineer, spoke regarding the engines used by the defendants. They were, he said, of the horizontal type, and not suitable for the position. There were others that would work with less vibration.

Cross-examined: There was nothing wrong, in his opinion, with the horizontal type of engine, and they could be worked without vibration. He did not ask whether he might go into the generating station while the engines were working, because he thought it was unnecessary. He could not say, as a matter of fact, whether there was vibration in the engine house, as he was not there while the engines were working. He did not suggest that there were any free horizontal forces in the engine at Brixham, and he should say that it had been very carefully balanced. The revolutions of the engine were 200 a minute, and he should explain the reason why some of the witnesses who had counted the vibrations put them down at 180 a minute, by the fact that some of the vibrations became absorbed.

Mr. R. Worth, civil engineer, of Plymouth, gave evidence as to the tests he had made on the plaintiff's premises for vibration. It produced, he said, sufficient oscillation on a vessel of water to cause a wave of a quarter of an inch on the surface. The vibration was such that he would not have cared to live on the property.

Mr. Matthews, consulting engineer, of Paignton, gave similar evidence and said, in cross-examination, that the plaintiff's representative offered to stop the engines four times, but that no one on the plaintiff premises would be able to say when they were stopped. He did not take the bet as it would have been sheer robbery.

Evidence was given as to the cracks found in the plaintiff's property, by architects and others who, in cross-examination, admitted that the soil was such as to be liable to subsidence.

Evidence was given by architects and house agents to the effect that vibration on the property was clearly perceptible while the defendants' engines were running, and there was no indication of vibration when they were not. The traffic in the street, even a traction engine passing, caused no perceptible vibration in the Fore Street house.

On Friday, December 12th, opening the case for the defence, Mr. McCall said that his submission would be that plaintiff had not proved that either he or anyone residing on this property h d suffered in health to the smallest degree through this alleged nu sance. The serious question, however, was the position of the defendant company. The defendants had an obligation under the statute to provide electric current for the village of Brixham. The discharge of that statutory obligation necessitated the employment of an engine, and you could not get an engine without you got noise and vibration. What, then, was the defendants' duty in order to discharge their statutory obligations? It could not be put higher than this—there being an obligation upon them to supply an engine, they were bound to provide an engine in accordance with reasonable engineering skill and with reasonable engineering appliances. Admittedly, they had put in an engine which for vibrationlessness and noiselessness was an engine of the very best type that engineering skill had yet been able to produce. The plaintiff's case, therefore, came down to this—that no artificial intercepting cushion had been put between the concrete on which the engine rested and the plaintiff's premises. The evidence which he should call would show that, having regard to the nature of the soil, there was no necessity for such a cushion. Where there was silt, or a porous clay, as there was here, there was no necessity for an intercepting cushion at all, the soil itself provided the cushion. The burden of proof was on the plaintiff to show that the amount of vibration was excessive, and beyond what was necessary for the carrying out of the defendant's statutory obligations. That, counsel submitted, he had failed to do.

For the defence, Mr. Walter Bridges, consulting electrical engineer, was called. The installation of this electrical plant, he said, was carried under out under his directions. The very best type engines were used, and on his advice 200 tons of concrete was used for the bed. That, in conjunction with the soil in which it was set, would effectually prevent any serious vibration. He had been on the plaintiff's property, and found the vibration hardly perceptible. At the meeting of experts he had offered to bet the plaintiff's representatives that they could not tell when he stopped or started the engines, but they declined the bet. He found vibration in two of the cottages, but they were in a dilapidated condition.

Other evidence was given in support of the defendants' case as to the nature of the soil and the condition of the plaintiff's buildings.

On Wednesday his Lordship, without calling upon plaintiff's counsel to reply, granted the injunction.

(*To be continued.*)

Electric Lamp Litigation.

Mr. Justice Bankes, sitting without a jury, in the King's Bench Division on Tuesday, December 16th, concluded the hearing of an action brought by the Wolfram Lampen Aktien Gesellschaft, a German company, who are manufacturers of electric lamps with metal filaments, at Augsburg, against Mr. William J. Johns, Mr. Corbin Harris and Mr. Carl Werth, claiming to recover a sum of about £571, in respect to electric lamps supplied to the defendants between June 30th and December, 1912. The defendants denied liability.

For the plaintiffs, Mr. Colam, K.C., and Mr. MacNaughten appeared; and Mr. Pollock, K.C., M.P., and Mr. Compton Smith represented the two defendants, Johns and Harris; while Mr. Werth appeared in person.

Mr. Colam, in opening the plaintiffs' case, said the defendants had carried on business together, and the plaintiffs were suing them for lamps supplied to their order.

A number of defences had been set up, one of which was that a limited company, called the Oro Light and General Supply Co., Ltd., who had offices in London, were the persons who ought to pay, while counsel understood that Mr. Werth had stated that as he was only a guarantor, he could only be held liable if the limited company were unable to pay. The defendants, counsel said, had carried on business under the name of the Oro Light Co., and the word Ltd. was added to the title eventually. It was also said by the defendants that they were agents of the Oro Light Co., and further that on October 4th, 1911, there was an oral representation made by a representative of the plaintiff firm, named Mr. Henrich Zameczink (who was now deceased) that the lamps the plaintiffs were selling did not constitute any infringement of the patents for electric lamps held by the Osram Lamp Co.

It was the latter defence that represented the substantial body of the case. The contention of the defendants was that the representation that was made amounted to a warranty or a condition, but he (Mr Colam) would show that this could not be sustained here, and he would also show that even if the view were taken that there was the implied warranty, there was no infringement of patent rights. He would also show that the defendants were relying on a representation that was made in connection with the negotiation of a contract that was never in fact entered into. Counsel also said that there was a suggestion of the repetition of the representation on a date that was only a few days before the end of the contract. The contract with the defendants was dated February 20th, 1912, and plaintiffs' case was that it was a clear contract of sale to the defendants personally, and as the lamps had been supplied and delivery had been taken, they were entitled to recover payment. In regard to the representation amounting to a warranty as had been pleaded, the defendants had suggested that the breach of warranty could go in extinction or reduction of the price, but plaintiffs would say that the contract was with the defendants personally, and there was no warranty that formed part of the contract. As to the suggestion of the warranty, the Courts had held that the Osram Co. were only entitled to a particular chemical method, and the plaintiffs were ready to prove—although this did not arise in this action—that their method was different and did not constitute any infringement of Osram patent rights.

Mr. Compton Smith said his clients would admit that they signed the contract in such a way as to be personally liable under it, and Mr. Werth, in reply to Mr. Justice Bankes, said that if the goods were proved to have been delivered under the agreement, he considered he could be held responsible.

Mr. Colam went on to say that the defendants had sold a portion of the lamps to third persons. He added that he took it the only question that really remained in the case was whether there was the representation alleged, amounting to a warranty set up by the defendants that could be said to apply to this contract, and the onus was on the defendants to establish this

Mr Pollock, K.C., subsequently argued the case for the defendants, pointing out that Mr. Johns was assured that the lamps of the plaintiffs represented no infringement of English or Canadian patents before the agreement was entered into

Mr. Johns gave evidence that he had known Mr Harris for many years, and it was through him that he met Mr. Werth. They agreed to go together into the business of selling the metal filament lamp. Witness spoke to the interview with Mr. Zameczink, the plaintiffs' representative, that took place in London at the offices of the Oro Light Co., and said that Mr. Zameczink stated that he could supply the defendants with lamps that would not represent any infringement of patent rights. Upon this assurance they began business, and received lamps from the plaintiffs, and then the present contract was entered into. Witness said that when in Germany he also received an assurance from a director of the plaintiff company that there was no infringement of patent rights.

Cross-examined by Mr. Colam, witness admitted that no particular patent was discussed. Witness said the Osram Co. brought an action against them for an injunction.

Mr. Colam said that when the Osram Co. began proceedings against the defendants, the plaintiffs wrote to say that they had never undertaken any obligation in England as to Osram patent rights.

Mr. Colam (to Witness): Did you attach importance to the subject of this guarantee?—Yes.

Then why was it not put into the contract?

Witness replied that they relied on the assurances verbally given to them.

Mr. Johns, in re-examination, said that some of the people to whom they had sold lamps had refused to pay.

Mr. Corbin Harris also gave evidence as to the assurance being given by the plaintiffs that their lamps constituted no infringement, and he said that plaintiffs declined to put any warranty into writing. An action was brought against the Oro Light Co. by the Osram Co., and he was the liquidator of the Oro Co. The Osram Co. got an interim injunction, and they (defendants) were ordered to destroy certain lamps. The Oro Light Co. were not in a position to defend the action brought against them.

After hearing Mr. Werth, Mr. Justice Bankes delivered judgment. He said that, in his opinion, there was no guarantee or warranty given that formed part of the contract with the defendants—what the plaintiffs did was to express their honest opinion that the lamps would not infringe patent rights. Therefore he gave judgment for the plaintiff company for the amount claimed, with costs.

Electrical Welding.—A Norwegian mail steamer recently ran aground, and was afterwards taken into the dockyard at Trondhjem, where it was found that the stern-post had been broken. In the ordinary way the damaged part would have had to be replaced entirely by a new one, but it was decided to adopt electrical welding to repair the damage. The work was taken in hand at once, and after about 28 hours' stay in the dock, the ship was able to leave. If electric welding had not been employed, it would have taken at least a fortnight or three weeks to put the ship in order.

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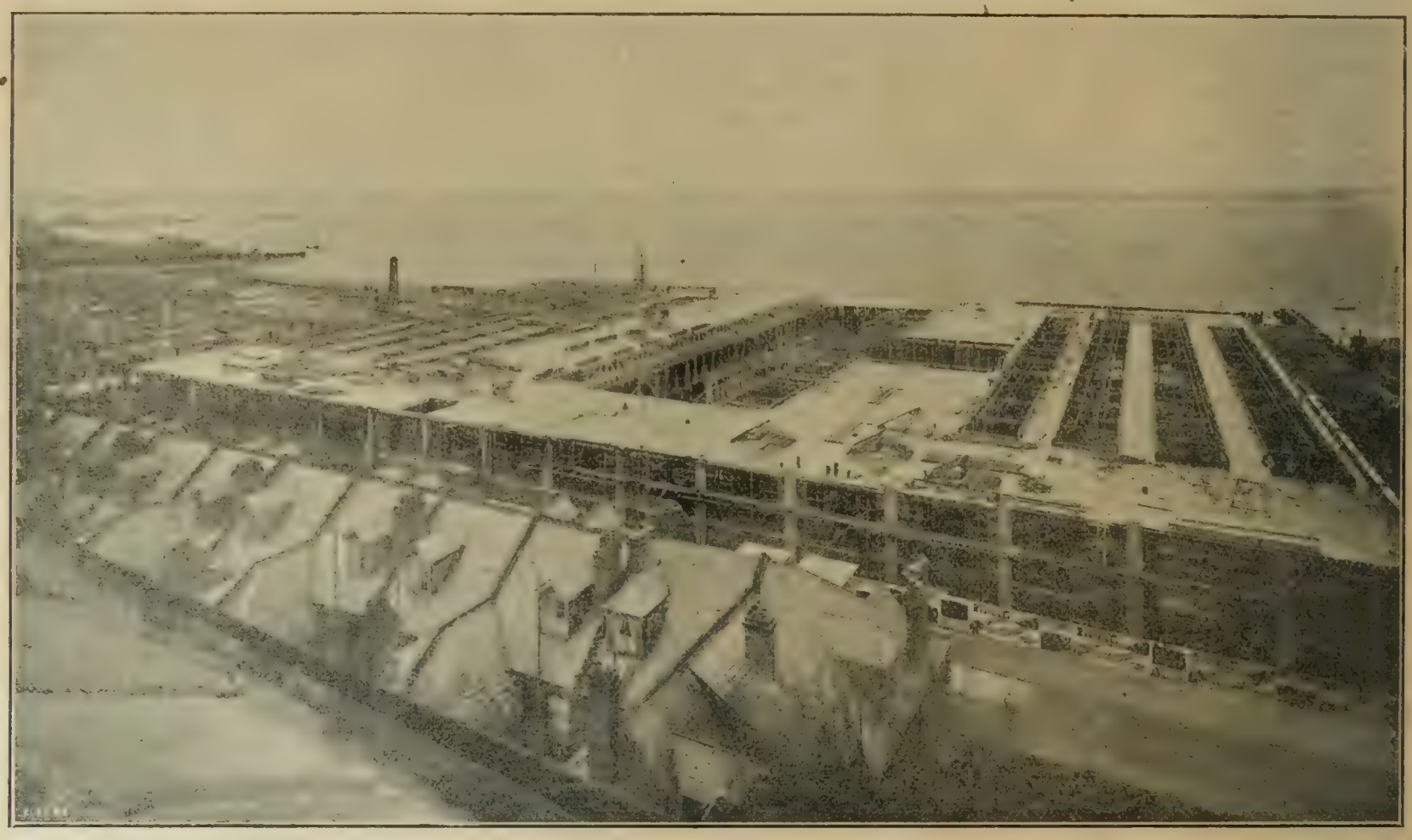
BUSINESS NOTES.

Battleship Lighting.—We learn from the Edison and Swan Co. that two battleships—one a Turkish boat belonging to the Imperial Ottoman Government, and the other H.M.S. *Emperor of India*, belonging to the British Admiralty—will be lighted throughout with Royal Ediswan electric lamps. Nearly 12,000 lamps will be supplied.

Lists of Consumers.—Referring to our recent article on lists of consumers, Mr. R. B. Beattie, of 1A, St. James' Street, Burnley, states that he has a complete list of all consumers in Accrington, Burnley, Colne and Nelson, which he is willing to place at the disposal of manufacturers who are prepared to co-operate with him in advertising their wares.

Cheap American Electric Vehicles.—A company has been formed in Detroit, U.S.A., to manufacture a popular-priced type of electric motor-car. It is stated that the vehicle will be put on the market complete at £150.

The Pirelli Works at Southampton.—From the accompanying picture our readers will be able to see what progress is being made with the erection of the Pirelli new works at Southampton on the western shore nearly opposite the London and South-Western Station. We understand that Southampton was selected as a site on account of the shipping facilities it affords, and it is also directly connected by railway with all the principal industrial centres of the United Kingdom. The road frontage of the site is over 400 yards, and, when completed, the works will consist of 32 bays similar to those shown on the photograph, which was taken on November 20th last. At present it has been decided to erect one storey over part of the ground floor, but the foundations have been built sufficiently strong to permit of three or four storeys being added, and these will be built as required. A pier is being erected and will be fitted with an electric crane of sufficient capacity to handle with ease the various goods that will be required for the different manufactures, and it will be connected with the various stores by railway tracks over half-a-mile in length. The machinery used throughout the work will, of course, be of the latest type, electrically driven, and will include an electric travelling crane and all modern factory labour-saving devices, &c.



Pirelli's Works at Southampton.

Swiss Enterprise in South America.—The A.G. Columbus für Elektrische Unternehmungen, which was formed at Zurich some time ago as an investment company, particularly for South America, is reported to have acquired the plant of the electricity company of the province of Buenos Ayres at Bergamino, and the larger portion of the share capital of the Electric Light and Motive Power Co., of Bergamino. It is now proposed to amalgamate the two companies.

German Lamp Factory in Spain.—It is stated that negotiations are proceeding with a view to the erection of a German factory for wire lamps in Spain. Those interested in the scheme are the Incandescent Gas Light (Auer) Co., the A.E.G. and the Siemens-Schuckert Works, all three of which work the patents of the United States General Electric Co. for wire lamps in Germany.

New Zealand.—A decision has recently been given by the New Zealand Customs authorities that "lightning protectors, switchboards, wall terminal blocks, micro-telephone and telegraph head receivers and breast transmitters" are all to be classified as "electric appliances," under No. 176 of the tariff, the duty being 30 per cent. on foreign manufactures, and 20 per cent. *ad valorem* on British goods.

Electric Furnaces in France.—A new company has lately been formed at Levallois, Paris (53, Rue Chaptal), with a capital of £7,000, and the title La Société de Metallurgie Electrique, to acquire from M. Massip, and work, certain patents relating to electric steel furnaces.

Water Turbines.—Messrs. Boving & Co., Ltd., of London, have lately booked the following contracts for hydro-electric plant :—

Two 450 h.p. impulse wheels and governors with the electric generators; Head Works; 1,500 m. of riveted and welded pipes; for the Dorada Railway (Ropeway Extension), Ltd., Columbia.

One 65-h.p. turbine for the town of Waverley, New Zealand.

One turbine of 350 h.p. for the Bressis Tin Mining Co., Tasmania (repeat order).

One turbine of 250 h.p. for Boving & Co., Japan.

One turbine of 250 h.p. against a head of 156 ft., for Messrs. Bagnall and Hilles, Yokohama.

They have also received orders for "Victoria" turbo pumps from firms in Holland, Egypt, India and New Zealand, and from the Harton Coal Co., Pearson & Son, and Easton, Gibb & Co., of Rosyth.

Patent Application.—Application for amendment of Patent No. 4,677, of 1906, for "Improvements in or relating to electric arc lamps," has been made by M. André Blondel, of Paris An announcement will be found among our advertisements to-day

Electric Iron Campaign.—The General Electric Co., Ltd., yesterday opened an advertising campaign in connection with the "Magnet" electric iron, by offering, through the pages of the *Daily Mirror*, one of these irons, complete with connector, flexible cord, and adaptor, for 15 days' free trial, and with a three years' guarantee. It is expected that, being timed a week before Christmas, the campaign will lead large numbers of readers to purchase such irons as Christmas presents. The co-operation of 600 electrical contractors has been secured, these having taken up stocks so as to be prepared for the demand which the free trial offer will create. Nearly 200 electricity undertakings also have interested themselves in the matter, and distributed copies of the above paper to all consumers on their mains.

Concert.—The second of this season's series of staff and foremen's smoking concerts given by the Edison & Swan United Electric Light Co., Ltd., was held at the Staff Café, Ponder's End, last Friday evening. Nearly 100 members of the staff and visitors were present. Mr. J. W. Elliott, of the lamp department, was in the chair, supported by vice-chairman J. Davison, engineering stores manager.

Discounts Notice.—The Walsall Electrical Co., Ltd., of Walsall, have issued a new discount slip in connection with their catalogue, the majority of prices having been considerably reduced. Copies of same will be forwarded on application.

Holiday and Stocktaking Notices.—The Midland Electric Manufacturing Co., Ltd., of Birmingham, announce that their works will be closed for holidays and stocktaking from noon on Wednesday, December 24th, until the morning of Thursday, January 1st. A small office staff will deal with urgent communications.

The British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester, announce that their works will be closed from 5.30 p.m. on Christmas Eve, until 7 a.m. on Monday, December 29th, 1913, also on New Year's Day.

Fittings Showroom.—The British Thomson-Houston Co., Ltd., have recently opened a new fittings showroom at Mazda House, 77, Upper Thames Street, London, E.C., wherein are exhibited the varieties of lighting units of which the company have made a speciality, as well as a number of new types. B.T.H. "Eye-Rest" system is of course shown, and indirect fittings of every size and description are hanging from the ceiling. Semi-indirect lighting is represented by a wide range of Alba, Veluria,



B.T.H. Fittings Showroom.

Calla and glass bowl fittings, and direct lighting by Mazdalier, Tungstolier and other fittings equipped with Veluria, Holophane, Pyro, Opalux or Sudan glass reflectors. Some "Fostoria" table standards are shown, made entirely of white or tinted glass, etched in patterns, and moulded into various shapes. These standards have a lamp inside the pedestal as well as under the shade. Table decorations, electric radiators, flat-irons, vacuum cleaners and other manufactures are also in evidence.

Book Notices.—"A New Era in Chemistry." By Harry C. Jones. 1913. London: Constable & Co., Ltd. Price 8s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 114. December 15th, 1913. London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 7. November, 1913. Toronto: The Society.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX. No. 9. November, 1913. New York: The Society.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, No. 2. December, 1913. Glasgow: The Institution.

"*Journal* of the American Society of Mechanical Engineers." December, 1913. New York: The Society. Price 35 cents.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 1. November, 1913. Liége: The University. Price 1 fr.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXX. November, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 29. November, 1913. Paris: Gauthier-Villars. Price 2 fr. 50.

"Whitaker's Almanac, 1914." Price 1s. and 2s. 6d. "Whitaker's Peerage, Baronetage, Knightage and Companionage, 1914." Price 5s. London: J. Whitaker & Sons, Ltd.

"Hazell's Annual, 1914." London: Hazell, Watson & Viney, Ltd. Price 3s. 6d. net.

"Village Electrical Installations." By W. T. Wardale. Price 2s. net. "Elementary Graphic Statics." By J. T. Wright. Price 4s. London: Whittaker & Co.

"*Practical Engineer* Electrical Pocket Book and Diary, 1914." London: Technical Publishing Co., Ltd. Price 1s. net.

Dissolutions and Liquidations.—J. T. Pickering Hoist and Engineering Co., Ltd.—This company is winding up voluntarily with Mr. S. B. Saunders, of King's Walk, Nottingham, as liquidator. A meeting of creditors is called for December 29th, at 107, Lothair Road, Leicester.

Anderson & Smith, plumbers and electricians, 172, Warbreck Road, Blackpool, and 20, St. David's Road South, St. Anne's-on-Sea. Messrs. M. Anderson and J. G. Smith have dissolved partnership. Debts will be attended to by Mr. Smith.

Trade Announcements.—Mr. W. A. Maddick announces that he has severed his connection with Messrs. A. Emanuel & Sons, Ltd., and he will shortly complete arrangements for putting before the trade the electrical specialities and inventions of Messrs. Maddick & Maddick. His present address is Alfreton Road, Clapham Common, London, S.W.

The Imperial United Lamp Co., Ltd., announces that its telephone Nos. are "Victoria 7271-7272."

Our readers are already familiar with the fact that the Edison and Swan United Electric Light Co., Ltd., are making important changes in connection with their efforts to promptly meet the requirements of the trade for everything electrical. Their new premises at 123/125, Queen Victoria Street, E.C., will have a trade counter entrance at Nos. 22a and 23a, Upper Thames Street, where arrangements will be made for a quick counter trade. Large stocks will be held in the building, and in addition the company will provide a rapid motor-van service from the Ponder's End works for bulk deliveries, and a motor-tricar service for small deliveries. The large showroom will be fitted with special consulting rooms for the benefit of the trade and their clients, and it will contain a full selection of artistic fittings and apparatus. In order further to promote rapid communications and deliveries, a private telephone line is being erected between the showroom and the works, and additional public lines are being connected to both of these premises. The foregoing are parts of a scheme to provide a highly organised Ediswan distributing centre.

Bankruptcy Proceedings.—W. R. Wells, electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor took place at the County Hall, Northampton, on December 9th, when it was stated that, following the previous hearing, the Official Receiver sent on the necessary books to the Official Receiver at Bolton. Debtor was in Lancashire. On the 5th inst. debtor wrote to Northampton saying that he had been trying to get enough money to enable him to pay his fare to Northampton, but everything had gone against him. He was living from hand-to-mouth, and had not sufficient money to come to Northampton. He asked what was his remedy as he did not want to be guilty of doing anything wrong. He hoped that more time would be allowed him. The Official Receiver stated that he had replied to the debtor that it was clear that he could not pass his examination at present. The Official Receiver added that the debtor was attending at Bolton, and presumably was doing what he could, but a receiving order had been made against him, and he would have to satisfy the Court as to what his responsibilities were. The further hearing was adjourned.

Fredk. Wm. Chamier, mining and electrical engineer, of 59, Fleet Street, E.C.—The public examination was held on December 10th, before Mr. Registrar Hope, at the London Bankruptcy Court. The statement of affairs showed liabilities £639 and assets valued at £18,519. The chief item is a debt of £76,700 due from the Deutsche Beck Bogenlampen Gesellschaft, of Frankfort-on-Main, manufacturers of electric lamps and other apparatus. Under examination by Mr. Walter Boyle, Official Receiver, the debtor stated that he formerly acted as chief engineer of mining properties in Manchuria at a salary of £6,000 per annum and a commission of 10 per cent. on the profits. He resigned that post in 1903, owing to political troubles in Manchuria. In 1906, being possessed of about £60,000 in consols and other securities, he became manager of an electrical company carrying on business at Berlin and Frankfort-on-Main, and received a salary of £1,500 per annum and bonuses. Eventually he acquired a controlling interest in the company and paid away about £73,000 on its behalf. In addition, the company owed him between £3,000 and £4,000 in respect of arrears of salary. It was now in liquidation in the Prussian Courts; witness's claim to £76,000 had been admitted, and he expected to receive £15,000 at the lowest estimate, by way of dividend. Since 1906 he had earned £6,000 by taking out and exploiting patents connected with electrical and mechanical appliances. The examination was concluded.

Catalogues and Lists.—Cambridge Scientific Instrument Co., Ltd., Cambridge.—We have received a batch of recently issued lists and leaflets describing some of the firm's manufactures. All are excellently illustrated, and price information is given. No. 120 relates to the "Callendar Recording Pyrometers for Hot-Blast Mains," and describes the application of the firm's platinum resistance pyrometers to temperature measurement, chiefly in connection with hot-air mains and blast furnaces; No. 111 on "Improvements in Hardening and Case Hardening Methods" deals with recent improvements in thermo-electric pyrometry, enabling a high degree of accuracy to be obtained in the measurements; No. 105 describes the "Rosenhain Calorimeter" as now manufactured. It is an improved form of Thomson instrument and provides a simple and accurate method for the determination of calorific value of coal and liquid fuels. No. 118 is the latest list describing the "Duddell Oscillograph" and the various accessory pieces of apparatus necessary for the taking of oscillograms. The latest forms of oscillograph, resistances, cameras, &c., are fully described, and the prices of typical outfits are included in the list, including that for an outfit for use on 50,000 volts. No. 125 ("Lantern Slides of Oscillograms") describes lantern slides, illustrating condenser discharges in single and coupled circuits, reproduced from oscillograms obtained by Dr. J. A. Fleming, F.R.S., and exhibited by him to the Physical Society of London.

The Dart Spring Co., West Bromwich.—Illustrated circulars relating to springs for motors and motor-cars, and steel spring washers.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—We have received a copy of an interesting brochure relating to the fiftieth anniversary of the founding of this firm in a small dwelling-house in Manchester, in September, 1863. To-day the firm has works and warehouses in many parts of the kingdom. Pictures of the different premises appear, including lead mills, paint and varnish departments, ironmongery, furniture, silversmiths', electrical apparatus and other showrooms, &c. The number of employés to-day runs into thousands, for as many as 1,200 were present at the jubilee celebration outing to Chester in August last.

Messrs. J. & H. Grevener, 40, Southwark Street, London, S.E.—New catalogue of 36 pages, containing illustrations and prices of lampholders of different types, keyholders, tumbler switches, counterweights, wall plugs, cut-outs, ball and spider fittings, handlamps, fuseboards, cut-outs, house-service boards, and many other like manufactures.

British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Eight-page leaflet (envelope series) relating to their flame and enclosed arc lamps.

Messrs R. S. Price, Ltd., Amberley House, Norfolk Street, Strand, London, W.C.—Forty-eight-page descriptive and priced catalogue of the Maihak indicator for gas and oil engines and other service, three-way cocks, reducing mechanism, planimeters, tachometers, and other apparatus. A separate circular describes the Maihak indicator fitted with Böttcher's power counter. Both lists contain full information.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria St., London, E.C.—No. 3 of *Scholey's Magazine* (December) contains some interesting opening comments, a photograph and brief biography of Mr. A. L. C. Fell, an illustrated article on the Frantz electric suction cleaner, more notes on the economy of electric lifts, and particulars of tool steel gears, and the Q V. enclosed indicating fuse.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—The *Mazda House News* for December (No. 3), in addition to reminding the reader of a number of Mazda lines suitable for Christmas gifts, contains illustrated articles on the lighting of golf courses, the lighting of printing works, and notes on many other matters of illuminating interest.

Allgemeine Electrizitats Gesellschaft, Berlin.—Brochure describing a new type of ampere-hour meter adapted for use on small installations, with various improvements; also leaflets relating to a number of machine tools driven by reversible variable-speed motors, and candle-lamps for Christmas-trees.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—A fine catalogue of 150 pages has been prepared (Section VI), in which a large variety of designs of electric light fittings are admirably shown on art paper. Brief particulars of each fitting and prices of same are given in both English and French, the reference numbers and prices being very distinctly printed. Brackets, ceiling fittings, drop pendants, reading, table and piano lamps, table and floor standards, hall and vestibule lanterns, bedroom fittings, suspension fittings and shade lights, appear in numerous styles, and many pages are devoted to a wide range of examples of electroliers. Semi-indirect lighting fittings and switch-covers also have place in the book.

The Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—32-page catalogue of lanterns and fittings for street, shop and works lighting. Descriptive matter, well prepared and printed illustrations, and tabulated prices, appear of "Streetlites" patent ventilated cluster lanterns, "Streetlites" sign, shop window and reflector types, also "Beatark," "Inverlite," "Onelite," "Drawlite" and other types, c.i. mill fittings, c.i. oyster fittings, "Acorn" lanterns, brackets and sundry accessories.

Annual Dinner.—The annual dinner of the sales department of the Western Electric Co., Ltd, was held at Woolwich on Friday, December 5th, under the chairmanship of the assistant manager, Mr. H. M. Pease. The loyal toast was followed by the "Sales Department," proposed by Mr. A. T. Turney, and responded to by Mr. Pease. The "Branch Office Managers" was proposed by Mr. T. F. Lee, and each manager replied. Mr. A. T. Gillanders proposed "The Chairman," who, in responding, paid a tribute to the loyalty of the sales department staff. A programme of music and song, &c., followed. The function was organised by Messrs. F. K. Jewson, W. E. Page and F. A. G. Pope.

Meter Approved.—The B. of T. has approved of single-phase A.C. meter, type LJc, lodged by the Electrical Co., Ltd.

Calendar.—The D.P. Battery Co., Ltd., Bakewell, Derbyshire.—Once again this company has prepared a charming wall calendar for the new year. The view this time is of Haddon Hall, Bakewell, and it is excellently executed in colour. Small, unobtrusive monthly calendar slips are attached in the right-hand bottom corner.

LIGHTING and POWER NOTES.

Argentina.—The Soc. Anon. de Luz Electrica y Fuerza Motriz de Pergamino has purchased the power house and complete installation in that city of the Compania General de Eléctricidad de la Provincia. The purchase price is $360,000. The new company will increase its capital to one million dollars, which will be invested in the purchase of machinery and electric tramway material.—*Review of the River Plate.*

Argentina.—A concession has been granted for the development of the Salta Grande Waterfall for electrical purposes. Two large power stations, each of 75,000 H.P., are proposed, as also that the capital shall be provided by the Governments of Argentina, Brazil and Uruguay.

Ashton.—New Loans.—Application is to be made to the L.G.B. for permission to borrow £18,552 for the electricity undertaking.

Ayr.—Prov. Order.—The T.C. has decided to apply for a prov. order to supply Prestwick with electricity.

Ballater (Aberdeenshire).—The School Board has decided to light the village schools and schoolhouses with electricity.

Belfast.—Public Lighting.—The experiment of lighting some of the central streets with electric lamps has been so successful that it is understood that the scheme will be considerably extended.

Bexley.—Public Lighting.—The General Purposes Committee is considering the question of improving the public lighting, and has requested the Electricity Committee to state what C.P. lamps it is willing to provide for £4 5s. per lamp per annum on the present lighting hours. The present price is £4 5s. per lamp per annum for 117 lamps, and £3 5s. for 227.

Bleane (Kent).—Workhouse Lighting.—The B. of G. has decided to install electricity for lighting and ironing in the workhouse.

Chesterfield.—The T.C. has entered into new agreements for the supply of electricity to Bryan Donkin Co., Ltd., and Robinson & Sons, Ltd., for power purposes, at ·75d. per unit for the first 100,000 units per annum, with reductions to a minimum of ·65d. per unit for 300,000 units or over per annum.

China.—We gather from a Hankow paper that a modern electrical installation, including 3,000-volt turbo-generators, motors and lighting, is to be installed at the Hanyang Arsenal. In consequence of trouble experienced with condensers using Yangtse water, an independent cooling plant will be installed. Part of the machinery has arrived, and work was to be commenced immediately.

An electric power plant is to be installed at the salt mining town of Tseleutsing, in Szechuan, at an estimated cost of 40,000 teals. Three-phase 5,000-volt generating sets will be installed to supply H.T. current in the town and neghbouring mining areas. The lighting of the town will be carried out at 220 volts, and machinery is being delivered. The Changsha electrical installation is also to be extended by 300 H.P.

The erecting of transmission poles and lines for the Wuchang electricity works is to be commenced; the station is under construction, and the installation will be completed about the end of next year.

The plant in each of the above cases is being supplied by the Siemens China Electric Engineering Co.

Continental Notes.—Germany.—A new 3,100-H.P. gas engine and dynamo is being added to the generating plant at the Friede ironworks at Kneuttingen, Lorraine, of the Lothringer Huttenverein Aumetz-Friede.

The first State hydro-electric power station in Bavaria has been completed at Saalach, the equipment consisting of five 2,000-H.P. turbine units. The plant will supply power for the working of the State railways.

Norway.—The four Hadeland Municipalities of Gran, Brandbu, Lunner and Jevnaker together propose to raise a loan of about £91,000 for the electricity works which are to be erected at the Toverud Falls.—*Board of Trade Journal.*

Sweden.—It is reported that a new company has been formed at Stockholm for the purpose of harnessing some large waterfalls of the River Glaamen, in the province of Nordland, in Norway. The total amount of power to be obtained from these falls has been estimated at 60,000 E.H.P., which is to be used partly for the development of the mining industry in the district, and partly for other industrial purposes. The River Glaamen has its chief sources in the glacier of "Svartisen," which is a great advantage, as the supply of water can never become affected even by the dryest season. The new company is a preliminary promoting company, the capital being £138,900 minimum, which may be increased to £333,300 maximum. But even the larger amount will not be nearly sufficient to carry out the whole scheme.

Switzerland.—The Motor Gesellschaft für Angewandte Electricität has secured a concession from the authorities of the Swiss Canton of Ticino, to establish a large hydro-electric station, in connection with which 15,000 H.P. will be "exported" to Italy—in other words, transmitted across the frontier for lighting and power purposes.

Austria.—The municipal authorities of the towns of Gratz and Marburg have jointly formed a company with the title the Gratz-Marburger Drauwerke Gesellschaft, with the object of establishing a large plant to utilise the water power of the River Drau. It is stated that 24,000 H.P. is available, and the energy generated will be used for lighting and power purposes.

Devonport.—Proposed New Loans.—The T.C. has decided to apply for sanction to borrow £11,866 for extensions at the electricity works, to be expended as follows:—New offices, £1,237; 1,250 kw. turbo-alternator, with accessories, £7,900; switchgear, £250; cables, £240; steam pipes and traps, £65; superheaters, £420; circulating water pipes and valves, £248; pump house, £428.

Dover.—Bulk Supply Proposals.—The borough electrical engineer has reported to the T.C., on the suggestions of the East Kent E.P. Co., Ltd., to supply the Council with electricity in bulk. He states that the general manager of the company informed him that the power station from which the proposed supply would come would be erected at Snowdown Colliery, and it was expected that the works would be ready to supply energy by the end of 1914. There would be two underground cables with a capacity of 1,000 kw. each, and the supply would be three-phase alternating, at 20,000 volts, 50 periods. The company was making arrangements to supply Stonehall Colliery, which was on the way to Dover, and as the question of supplying the Council would affect the size of the cable, it was necessary that the question should receive early consideration. He added that there was no suggestion as to probable terms. The Corporation would have to spend money at the works and buy a good deal of plant if the bulk supply was taken, and have to pay about £5,000; what was to be done outside was another matter, as the current would be of 50 periods, instead of 100, as in Dover. The Council decided to ask the company for its terms.

Feltham.—Prov. Order.—The local authority has received notification of an application by a syndicate for a prov. order for electric light.

Friern Barnet.—E.L. Proposals.—The U.D.C. understands that the Finchley authority is in a position to supply electricity in the whole of the North and Central Wards; it is now suggested that the Hornsey Council should take over the lighting of the South Ward, and the question has been referred to the Lighting Committee for consideration.

Galashiels.—A Committee of the T.C. has approached the Galashiels and District E.S. Co. with reference to an agreement regarding the prices to be charged and the terms upon which the undertaking can be acquired. Mr. George Balfour, one of the directors, said he expected the charge would be 5d. or 6d. per unit for lighting, and from 0·7d. to 2d. per unit for power. The Roxburgh C.C. has notified the T.C. that it will oppose the company's application for a prov. order.

German S.W. Africa.—A concession has been granted by the Governor of German South-West Africa to Herr D. K. Hoffmann for the utilisation of the falls on the upper course of the Pangani River. The concessionaire is the owner of large plantations in the district of Pangani, the falls being situated about 31 miles above the locality of this name. Power will be supplied to the factories for the preparation of hemp, where machines are employed for stripping the fibre. The question of the production of nitrogen is also said to be under consideration, together with that of ultimately working the Usambara Railway by electricity.

Gillingham (Kent).—The T.C. has been asked as to the supply of electricity at a proposed cement works for a 100-h.p. motor and a 275 h.p. motor. On a five years' contract the Council has decided to offer a supply at ·625d. per unit, with a guaranteed minimum consumption of 250,000 units per annum, subject to fuel clauses. The Council has also offered to supply current to the new works of the Recess Screws, Ltd., at 1d. per unit under a five years' contract, with a guaranteed minimum annual consumption of 50,000 units.

Gravesend.—The Electricity Committee has recommended that the charge for current on the flat rate be increased from 4d. to 4½d. per unit from December 24th next.

The engineer has advised the Council to carry out extensions to the works with a view to supplying power and inducing manufacturers to settle in the district. The matter was deferred pending consideration of an application for a power supply.

Heywood.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £3,000 for electricity purposes. This has reference to an application made 18 months ago.

Highbridge (Somerset).—Proposed E.L. Scheme.—Mr. J. A. Purves, of Exeter, has taken up with the Council, the question of forming an E.L. Co. for Highbridge. The Council has decided to wait and see how the Burnham scheme answers.

Holywell.—Workhouse Lighting.—The B. of G. is obtaining a report on the lighting of the Workhouse premises, the proposals including electric lighting.

India.—Nagpur, which is the largest city in the Central Provinces, is now lighted by electricity, which is supplied to the consumers at 220 volts. The distributing current is fed from two main feeding points, and the overhead mains—bare copper wires—cover a distance of 17½ miles. The contract was carried out by Messrs. Crompton & Co., and three weeks ago the lighting was formally inaugurated by the Commissioner of the Central Provinces.

Kirkby Stephen.—The local gas company has decided to proceed immediately with its E.L. scheme, and the West Riding C.C. has been asked to grant wayleaves for posts for street lighting.

Knighton.—E.L. Scheme.—At the recent meeting of the Council, a communication was read from Mr. J. Simon, electrical engineer, London, stating that owing to the difficulties he had experienced in forming the proposed company he had decided to drop the scheme for supplying the town with electricity at present, but hoped to renew his application later.

Leeds.—Strike Troubles.—During the last week the Corporation employés of nearly all grades have been on strike for an advance in wages. So far the electricity supply has been practically unaffected, the drivers, firemen, greasers, labourers, &c., who left work, being replaced by local engineering apprentices and students who offered their services in the emergency. The gas undertaking has been hard hit and unlighted streets, shops and factories have been numerous. For some days only one of the Corporation gasworks has been in use, the others being shut down. The tramway service has been very much curtailed owing to the absence of drivers and conductors and to the insufficiency of the power supply. At the time of writing the tramway men are returning to work, and it is considered that the strike cannot last much longer.

London.—The future of London's electricity supply has, during the past few days, received a good deal of attention in the daily papers, this arising from the proposals of the County of London Co., to which reference was made at a recent meeting of the L.C.C. The *Financial Times*, in summarising the position, remarks that as matters stand at present, the L.C.C. is in a position to expropriate certain electric lighting companies in 1931, and, in these circumstances, the directors of those concerns are not disposed to incur any heavy programme of capital expenditure, for which they are not likely to get adequate compensation when the date of expropriation arrives. This fact has been realised by a very powerful financial group, and, after very careful consideration, it was decided some months ago by these interests to ascertain whether the L.C.C. could be induced to extend the date on which it is at present empowered to take over the companies in question. If something of this sort could be arranged, it might be possible to come to terms with the electric lighting companies for the development of their business on one homogeneous plan.

Apparently the L.C.C. has not officially replied to the proposals, but the matter has been considered by the 13 companies whose interests are affected; any announcement as to definite steps having been taken appears to be premature, in view of the silence of the L.C.C.

The *Daily Telegraph* mentions the financial house of Morgan, Grenfell & Co. as being associated with the proposals. The earliest date at which the L.C.C. can purchase is August 26th, 1931; three years' notice is required, and this must be given to all the companies in the London area, the Council being compelled to purchase all or none. If the L.C.C. decides to purchase the companies—and it has no powers to purchase the undertakings of local authorities—only their value *in situ* would be paid for, and with less than 18 years of life before them, it is considered that the companies would find it almost impossible to raise fresh capital for modernising their plant. It will be remembered that an L.C.C. Special Committee on Electrical Supply is sitting at the moment, with Mr. Mern as its expert adviser, and that an authoritative report on the matter is promised for next year.

An L.C.C. return has just been issued, giving particulars of electricity supply in the metropolitan area for 1911-12. The return covers 16 Borough Councils, 8 Corporations, 18 District Councils and 33 companies, and shows that the 15 London B.C. undertakings, with 80,600 kw. of plant, supplied 13,405,061 units for street lighting, 37,945,681 units for private lighting, 45,473,198 units for power, and 41,348 units for traction, a total of 96,865,278 units.

The figures for the 14 London companies in the same order, are: 153,479; 4,097,118; 86,653,358; 61,727,949; and 8,219,070; a total of 160,697,495 units sold.

The municipal figures obviously take no account of the Council's own tramway generating station output, while the traction supply credited to the companies refers to a special case and leaves out of consideration the various railway and tramway power stations owned by companies.

The aggregate revenue of the London municipal concerns was £829,815, averaging out at just over 2d. per unit sold, while in the case of the companies the returns show £1,753,248 and an average of 2·62d.

The capital involved is, roughly, 6½ millions for the municipal and 14½ millions for the private undertakings in London.

L.C.C. Loans.—The Finance Committee has recommended the Council to sanction the borrowing of £9,427 by the Hammersmith B.C., as to buildings, £724; mains, £4,321; sub-station plant, £1,600; services, £1,593; meters, £904, and grab-bucket, £145; also of £29,334 by the Southwark B.C. for the electricity undertaking, as to £900 for site; £1,970 for buildings, and £26,464 for plant, viz., two 1,500-kw. generators, with boilers, condensers and accessories; and of £6,000 by the Stoke Newington B.C. for the electricity undertaking, as to £5,000 for mains and £1,000 for meters.

Southwark.—Application is to be made to the L.C.C. for sanction to borrow £9,512 for the electricity undertaking.

Marylebone.—The Electric Supply Committee has decided (1) in future to undertake no wiring work except small jobs of alteration, &c., on which only contractor's men will be employed; (2) all wiring orders obtained by the department will be passed on to the district contractor; (3) price and quality being equal, the contractors will purchase their materials from the department; (4) trade discount to be allowed to contractors for their accredited customers' showroom purchases; and (5) districts to be re-arranged as may be found convenient. The Committee considers that this arrangement will bring the contractors into closer and more friendly association with the department.

Wandsworth.—The B.C. has consented to the proposal of the Electric Supply Co. to suspend electric lamps across High Street, Putney.

Woolwich.—Bulk Supplies.—The T.C. has applied to the B. of T. for an order to permit it to supply electricity in bulk to the South Metropolitan E.L. and P. Co., and the West Kent Electric Co., Ltd., and to permit each company to give a supply in bulk to the Council.

Lowestoft.—Proposed Loan.—The T.C. has decided to apply for a loan of £1,500 for meters, provided the L.G.B. will make the loan repayable in five years.

Maidenhead.—Street Lighting.—The T.C. has decided to have Summerleaze Road lighted electrically at a cost of £2 15s. per lamp per annum.

Malvern.—The U.D.C. has decided to canvass the West Malvern district with a view to supplying electricity; the estimated cost for extending the cables is £1,500.

Monmouth.—The T.C. is to renew low-tension cables, at an estimated cost of £1,500.

Newcastle (Co. Down)—Public Lighting.—The U.D.C. has accepted the tender of Messrs. Curran Bros., Belfast, at £185 per annum, for the lighting of the town with electricity.

Slaithwaite.—Prov. Order.—The U.D.C. has sealed its application for a prov. order. The suggestion that electricity in bulk should be purchased from the Yorkshire Power Supply Co. has been left in abeyance pending the obtaining of the order.

Southampton.—Electricity Charges.—At a recent meeting the T.C. discussed two reports bearing on the financial aspect of the electricity undertaking, which were presented by the chairman and engineer of the E.L. department respectively. The former pleaded for an increase in the charges for lighting and heating, by ½d. per unit, on the ground that the business was not sufficiently remunerative, and also because he believed "that the ratepayers having put their hands into their pockets, should get an annual return in the shape of relief of the rates." The chairman's recommendation had been previously rejected by the E.L. Committee.

Stafford.—The Corporation has decided that lighting consumers whose yearly accounts amount to £250 net, shall receive 10 per cent. of their consumption at power rates.

Sunbury (Mssx.).—Prov. Order.—A private application is being made for a prov. order for E.L. over a very extensive area. The Council is objecting to the application unless the compulsory area is extended.

Taunton.—Proposed Loans.—Loans amounting to £5,000 for electricity purposes have been applied for by the T.C.

Teignmouth.—E.L. Scheme Abandoned.—The Council decided last week not to entertain a proposal for a municipal electrical undertaking at a cost of £21,000. The Council already owns the gasworks, the manager of which criticised the proposal adversely.

Truro.—E.L. Scheme.—Arrangements are now in hand for electricity supply in the city, with energy generated at a local mine.

Wanstead.—E.L. Proposals.—The U.D.C. proposes to obtain information with respect to E.L. for the district.

Watford.—The B. of G. has decided to adopt electricity for driving proposed new laundry plant at the workhouse.

West Bridgford.—Prov. Order.—The Derbyshire and Notts. E.P. Co. has decided to omit West Bridgford from its proposed prov. order.

West Ham.—L.G.B. Inquiry.—An inquiry was held last week, by Mr. T. C. Ekin, into the application of the T.C. to borrow £21,500 for the purposes of the electricity works, and £3,660 for buildings. It was stated that an output of 37 million units was anticipated this year.

Wokingham.—The T.C. has decided to oppose the application of the Reading E.S. Co. for a prov. order to lay cables, &c., through the town for supplying electricity to the York Town and Blackwater Gas Co.

Whitley Upper.—The U.D.C. has decided to support the efforts of the Yorkshire E.P. Co. to secure powers for electricity supply in the district.

TRAMWAY and RAILWAY NOTES.

Birmingham.—A singular accident occurred to a tramcar at Soho Hill, Handsworth, on Saturday afternoon. The driver, says the *Birmingham Daily Post*, suddenly applied the emergency brake, and this caused the suspension rod to force its way through the floor of the car, causing injuries to two passengers.

Bournemouth.—New Loans.—The T.C. has applied to the B. of T. for loans of £12,000 for 10 new tramcars, and £2,300 for doubling the track in Wimborne Road, Winton.

Brighton.—A Railless Experiment.—The General Purposes Committee proposes to hire a double-deck railless trolley car to run experimentally on London Road.

Chesterfield.—New Tramways.—The T.C. has decided to promote a Bill next session for further tramway powers, and to extend the electricity supply area. The estimated cost of the tramways is £12,930.

The T.C. has applied to the L.G.B. for a loan of £3,500 for car-shed extensions and the purchase of three double-deck cars.

Continental Notes.—Germany.—A memorandum on the present position of the water powers and the electrification of the Bavarian State Railways is about to be published by the Government of that country. Apparently in anticipation of the document, Herr von Seidlein, Minister for Railways, has just delivered a speech which is of a pessimistic character in regard to electric traction in so far as it has been tested in that State. It appears that electrical working with locomotives is already in operation on the lines Garmisch-Partenkirchen-Scharnitz and Garmisch-Griesen, and a mixed system of steam and electric trains will be started in the spring on the line Salzburg-Reichenhell-Berchtesgaden, which will be superseded entirely by electrical working in the course of the summer. So far as experience has been gained, the Minister states that the electrical system has not proved to be quite satisfactory from a technical point of view, as the working has suffered from numerous interruptions in the service, while the economy of the method cannot yet be determined with sufficient certainty. The original scheme was based upon the assumption that the cost of working with electric locomotives would not be greater than with steam locomotives, but this expectation has not been fulfilled. Apart from the higher prices charged for the electric locomotives, the remunerativeness of electrical working, in so far as the power is obtained from hydro-electric works, is closely connected with the question as to how far it is possible to dispose of the surplus power at suitable prices. On this point the Minister remarks that at the Saalach hydro-electric works the Government has many millions of KW.-hours available for which it has hitherto been impossible to find purchasers, notwithstanding many endeavours which have been put forth, and despite the "electricity famine" which has been alleged to prevail in the State. All these considerations, in the opinion of the Minister, render it desirable to await further experience in connection with the lines already converted to electric traction before proceeding with the projected transformation of the railways leading out of Munich. It is considered that the determining factor in regard to further electrification must be that of economy, but it is at present impossible to say when any extensions beyond the existing experimental lines will be undertaken. Nevertheless, it is not intended to abandon the scheme for the utilisation of the Walthen Lake, which has been considered as a means of providing power for other Bavarian railways, although years may elapse before any practical steps are taken in this direction.

The *Norddeutsche Allgemeine Zeitung* denies that any definite plans have been made for the electrification of the Berlin railways. Apparently, so far, the Landtag has only sanctioned expenditure on the preliminary studies in connection with the scheme, and for the trial of several experimental trains.

Spain.—A scheme for the construction of an electric tramway between Gibraltar and San Rogues, a distance of about 8 miles, is under consideration.

Poland.—The Lodz Electric Railway Co. has obtained permission to construct new lines, together with a power station. The total length of the projected lines will be 75 miles, and the cost is estimated at £559,000.—*Board of Trade Journal.*

Austria.—The Austrian State Railway authorities have for some time been carrying out experiments with electric lighting in the railway carriages. So far about 270 vehicles have been so fitted, and the results have been so satisfactory that a considerable extension of railway carriage electric lighting is about to be taken in hand.

Ealing.—The B.C. has decided to engage Mr. Hamilton, general manager of the Leeds tramways, to advise it in the negotiations with the L.U.E. Tramways, Ltd., respecting the postponement of purchase of that undertaking.

Keighley.—The Tramways Committee has recommended that a contract be entered into with the Cedes Electric Traction, Ltd., for the supply of, and erection of, overhead equipment on the Oakworth and Eastburn routes, at an inclusive price of £923 per mile, and for the supply of four railless vehicles at £720 each. The length of the route is 6 miles 7 furlongs. The chairman of the Tramways Committee said the system had been in operation on the Ingrow Cross Roads route since May last, and had proved very satisfactory. The single car had run 9,194 miles, and the receipts had been 11·32d. per car-mile. The total cost per mile

was estimated at 7·98d. The Corporation motor-'bus cost 1s. 1d. per car-mile, and the revenue was 12·393d., so that on the 'bus there was a loss of 4d. per mile.

Leeds.—The Tramways Committee has decided to extend the railless traction system to East and West Ardsley.

London.—A deputation from the Bermondsey B.C. has interviewed the L.C.C. in regard to the reconstruction of the tramways in Southwark Park Road, and submitted a modified scheme which will allow of the conduit system being installed, at a cost for street alterations of only £17,000, as against £67,000 suggested by the L.C.C.

The Council has decided to be represented at the proposed conference with the Executive Council of the Municipal Tramways Association, on the subject of motor-omnibus traffic.

The Finance Committee has recommended the Council to consent to automatic chocolate supply-boxes being fixed, as an experiment, on the upper decks of 37 tramcars; the proposed rental is £2 10s. der car per annum.

The Highways Committee has ordered a report to be prepared on the subject of linking up the tramway system.

Oxford.—Recently a local syndicate has placed some motor-'buses on the streets to compete with the horse tramways; these are unlicensed, as, in view of its agreement with regard to the electrification of the tramways, the Highways Committee has, so far, refused to license competing vehicles. The question of obtaining an injunction against the 'bus company is being considered. According to the *Standard*, Messrs. Tilling have applied for a licence to run a fleet of petrol-electric 'buses in the city, and have offered to contribute to the rates in the form of rent, &c.

Paisley.—The proposed increase of fares on the long-distance runs of the Paisley and District Tramway Co.'s system was the subject of a long debate at the last meeting of the Renfrew T.C. Bailie Ferguson moved that the Council approach the T.C.'s of Paisley, Barrhead and Johnstone, with a view to jointly supporting a motor-'bus service to run in opposition to the tramways. The Council decided in view of the unsatisfactory nature of the service to communicate with the neighbouring towns served by the company with regard to the increased fares.

Ramsbottom.—An endeavour is being made to arrange with Trackless Trolley, Ltd., to send one of its Cedes-Stoll vehicles to Ramsbottom for a period on free trial.

U.S.A.—Revised contracts have been made between the Commonwealth Edison Co. and the Chicago railway companies, for the remainder of the concessions of the latter. The railway supply now forms 70 per cent. of the company's huge output. Up to now entirely distinct cable systems and sub-stations have been maintained for the city supply, the surface and the elevated railways. The necessity for this duplication of plant is to be removed under the new arrangement. Under the new contract the maximum demand for any month is calculated from the heaviest hourly morning and evening loads on three consecutive days giving the heaviest six hours' consumption during that month. The Edison Co. has to supply a maximum demand of 20,000 KW., or more if the previous month shows that it is required. The scale of charges varies in the case of the primary charge from $1.25 per KW. for the first 30,000 KW. to $.833 for above 120,000 KW. The secondary charges also vary from ·4 cent per KW.-hour for the first 5 million KW.-hours per month to ·36 cent for above 40 million KW.-hours per month. A coal clause is introduced and the agreement includes many extra provisions for the future.

TELEGRAPH and TELEPHONE NOTES.

Post Office Telegraph and Telephone Society of London.—A meeting took place on Monday to hear an address by Mr. P. W. H. Maycock, a telephone traffic expert, on "Telephone Traffic Statistics."

The Telephone Service.—A number of local authorities in the Metropolitan area have been induced to waive the wayleave rentals on telephone poles, on the understanding that the concession will lead to a cheaper and better service.

Long-distance Telephony.—Telephonic connection between Berlin and Milan has lately been completed.

New Cable.—Owing to the increase of traffic with Germany, it has been decided to lay a new telegraph cable, with four wires, between Emden and Bacten, this being the seventh Anglo-German cable.

German Colonies.—The first section of the German wireless telegraph system in the South Seas has been opened to public use, with the inauguration of the stations on the islands of Yap and Nauru. Telegrams to Nauru are dispatched by cable as far as Yap, and are sent on thence by wireless telegraphy.

The wireless station at Kamina, in Togo, German West Africa, has received a number of wireless telegrams from the station at Nauen, a distance of 3,348 miles. The Kamina station will not be able to reply until its new plant has been completed.—*Reuter.*

Germany.—The number of automatic telephone exchanges installed by Messrs. Siemens & Halske, in Germany and abroad, now amounts to over [illegible]. Such figures astound in a few years attest the value of the automatic system as regards practical utility. There are 20 private exchanges at work and 12 under construction, and the automatic telephone is gaining increasing favour for quite small installations.—*Telegraphen und Fernsprech Technik.*

Austria.—Automatic telephone exchanges have been set up at Graz and Krakau, and have given most satisfactory results from the points of view of both working and economy. It has therefore, now been decided to introduce the system into Vienna with semi-automatic working.

Communication with Trains.—Very satisfactory results are being obtained with the installation of wireless telegraphy on one of the express trains of the Lackawanna Railroad U.S.A., and it is stated that the company will shortly equip all their trains with wireless apparatus.

Postal Servants.—On Thursday last week the Postmaster-General informed a deputation from the postal employés that the Government was determined not to grant the 15 per cent. increase of wages asked for. On Tuesday the Joint Executive of British Postal Unions, after considering the matter for 7 hours, decided not to ballot the members with regard to a strike, but to make an appeal to Parliament in the next session.

CONTRACTS OPEN and CLOSED.

OPEN.

Ainsworth (near Bury).—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

Australia.—Sydney (New South Wales).—March 18th.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" December 5th.

Melbourne.—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

Brisbane.—January 7th. Switchboards, parts and accessories Telephone instruments, &c.; measuring instruments, &c telegraph instruments, &c; protectors, parts, &c. See "Official Notices" December 5th.

Bedford.—Corporation. One hand-operated overhead travelling crane. See "Official Notices" to-day.

Belgium.—January 19th. The municipal authorities of Antwerp are inviting tenders for the supply and equipment of two transformer stations at the docks in that city and for the supply of a quantity of armoured cable.

Bradford.—December 19th. Corporation. One turbo-generator, about 5,000 KW.; storage batteries, boosters and switch and regulating gear; two 1,500-KW. rotary converters, transformers and switchgear. See "Official Notices" November 28th.

January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

Caistor.—December 19th. Union Workhouse. E.L. installation, 150 lights. Particulars from Mr. A. A. Padley, Clerk, Union Offices.

Canada.—Bowness, Alta.—December 31st. For the Bowness Improvement Co., 200-KW. traction motor, one four-panel switchboard, one 250-K.V.A. generator, and a gas engine. Mr. T. L. Turnbull, 220, 8th Avenue West, Calgary, is the engineer-in-charge.

Toronto.—January 20th. Board of Control. Mechanical filtration plant, boilers, steam turbo-generator plant, &c. Specifications from Mr. J. Milne, Department of Works, City Hall.—*Canadian Engineer.*

Carlisle.—December 31st. Corporation. Two 1,250-KW. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600 KW. rotary converters; and high-tension switchgear. See "Official Notices" December 12th.

Crete.—March 13th. Electric tramway concession for 50 years. See this column for December 12th.

France.—Paris.—December 29th. Tenders are invited for the metallic, mechanical and electrical equipment of a movable weir to be built across the Seine at Elbeuf, in replacement of the existing structure. Particulars from M. Vidal, ingenieur en chef des ponts et chaussées, pavillon de la Navigation, Port de la Bourdonnais, Paris.

January 20th. The French State Railway Authorities (Bureaux du Service Electrique, 1re Division), 43, Rue de Rome, Paris, are inviting tenders for the supply and laying of two high-tension three-phase cables between the Denis-Boucher Bridge and the Argenteuil-Friage sub-station, near Paris.

Leeds.—December 22nd. Electric light work, children's block, Infirmary, for the B. of G. Thos. Winn & Sons, architects, 84, Albion Street, Leeds

Leigh (Lancs.).—December 19th. Corporation. Water-tube boiler, with mechanical stoker, forced draught plant, air heater, &c. See "Official Notices" December 5th

London.—L.C.C.—December 23rd. Steam, exhaust, condenser, feed, &c., piping, water tanks, &c., for Greenwich generating station. See "Official Notices" December 5th.

The Highways Committee recommends that alternative tenders for 50, 100 and 150 new trailer cars, and tenders for 200 electric cars for use in connection with the trailer cars on the Council's southern tramways be invited, also for the supply of tramway fittings equipment, &c., for 1914-15.

The Chief Engineer is to be authorised to obtain carbons for the arc lamps on the Victoria Embankment and Westminster Bridge at a cost of £100.

January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" to-day.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

HACKNEY.—Tenders for the erection of electricity sub-stations. Time extended to December 22nd.

Manchester.—December 19th. Corporation. Motor-converters or rotary converters and static transformers as follows:—Four 1,000/1,250-KW. sets; one 1,000-KW. set; and two 650/800-KW. sets. See "Official Notices" December 5th.

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall, on or after 20th inst. Tenders to H. Hankinson, Town Clerk.

Salford.—Corporation. 4,000 yards Doulton pattern three-way brown glazed stoneware cable conduits. See "Official Notices" to-day.

Southampton.—The tramways general manager has been authorised to renew the rails in a portion of St. Mary Street. Tenders are required for about 100 tons of tram rails to the British standard section No. 4, and for a few lengths of section No. 4C for curves.

Spain.—December 22nd. The Spanish Ministry of War in Madrid is inviting tenders for the concession for the supply of electrical energy to the Fabrica de Artilleria Works at Granada, for a period of ten years.

Swansea.—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" to-day.

Turkey.—CONSTANTINOPLE.—Tenders are required (1) for the erection of four wireless stations; (2) Supply of 12 501-metre rolls of submarine telegraph cable, with 18 conductors, and paper insulated. Ministry of Posts and Telegraphs, Constantinople.

Wigan.—December 22nd. Corporation. Six double-deck tramcar bodies with top covers, six trucks, six complete electrical equipments. See "Official Notices" December 12th.

York.—December 22nd. Corporation. Stores for electricity and tramways department. See "Official Notices" December 5th.

CLOSED.

Aberdeen Line.—A contract for "Wotan" and tantalum drawn-wire lamps and carbon-filament lamps for the Aberdeen Line for the ensuing 12 months has been received by Siemens Bros. Dynamo Works, Ltd., from Messrs. G. Thompson & Co., Ltd.

Accrington.—The municipal authorities of Accrington have just placed an order with Leyland Motors, Ltd., Leyland, for a petrol motor-tower wagon for use in connection with the maintenance of the electric tramway overhead conductors.

Ashton-under-Lyne.—The Electricity Committee has accepted the tenders of Mr. H. Johnson and the New Moss Colliery Co., for coal during six months.

Australia.—According to the *Australian Mining Standard* the following tenders have been accepted by the Postmaster-General's Department:—

COMMONWEALTH—
1,768 800 B type insulators, £20,003—Commonwealth Art Pottery and Insulator Co.
426,000 A type insulators, £12,282.—Fire Brick, Insulator and Pottery Co. of Victoria.
513 000 A type insulators, £12 509.—Imported through Dalgety & Co., Ltd.
78,000 A type insulators, £1,969.—Imported through Webster & Co.

VICTORIA—
233 tons sulphate of copper, not to exceed £9,324.—Mond Nickel Co.
15 magneto non-multiple switchboards, 50 lines, £29 each; 35 magneto cordless switchboards, 10 lines, £12 each.—Western Electric Co., Ltd.

N.S.W.—
5,000 single-pole strips and protectors, with carbon plate arrester, £1 7s. 6d. each.—Western Electric Co., Ltd.

QUEENSLAND.—
Cast-iron pot-heads.—Siemens Bros. Dynamo Works, Ltd., and Noyes Bros (Sydney), Ltd.
2,000 glass cells, for Callaud battery, 2s. 8½d. each; 1,000 glass cells, 7d. each.—Brisbane Electrical Co.
6,000 glass cells, 4s. per doz.—British G.E. Co., Ltd.

SOUTH AUSTRALIA.—
Telegraph and telephone material.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
40,000 copper tapes, £1 0s. 3d. per 1,000; 5 tons bronze wire, 70 lb. per mile, £95 per mile.—B.I. and Helsby Cables, Ltd.
30¾ tons hand-drawn copper wire, £83 4s. per ton.—R. Johnson, Clapham and Morris, Ltd.
2,800 zincs for gravity cells, Star pattern, 1s. 5d. each.—A. W. Dobbie & Co.

WESTERN AUSTRALIA—Lightning arresters and detectors.
30 miles tinned copper, rubber-insulated wire, No. 20, L.S.W.G., £3 13s. per mile; 5 miles ditto, No. 22, L.S.W.G., £2 17s. 6d. per mile.—B.I. and Helsby Cables, Ltd.
100 detectors, aluminium cases, £3 5s. each; 450 miles twisted pair, tinned annealed copper wire, rubber-insulated, taped and braided, £14 4s. per mile; 70 miles tinned copper wire, rubber-insulated and braided, £5 7s per mile; 100 miles twisted pair, outside distributing wire, £17 15s. per mile.—General Electric Engineering Co.
Telegraph material.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Telephone material.—J. Bartram & Son, Pty., Ltd.
Telephone material.—Siemens Bros. Dynamo Works, Ltd.
Telephone material.—Western Electric Co. (Aus.), Ltd.
Condensers, insulators and tinned copper wire.—J. C. Fuller & Son.
150 cable distributing boxes, 5 pairs, 8s. 3d each; 250 ditto, 13 pairs, 14s. each; 200 ditto. 26 pairs, £1 2s. 6d. each; 50 ditto, 39 pairs, £1 10s. each; 150 ditto, 52 pairs, £2 each.—W. T. Henley's Telegraph Works Co., Ltd.
15,000 zincs, for gravity cells, Star pattern, 1s. 2¾d. each.—H. Armstrong, Ltd.
Various telephone material and 100 miles twisted pair wire, £19 per mile.—Malloch Bros.
Forty miles tinned-copper wire, vulcanised rubber-insulated wire, No. 16 L.S.W.G., £8 10s. per mile.—Noyes Bros. (Melbourne) Proprietary, Ltd.
Enamelled wire.—Imperial Electric and Engineering Co.
Ninety two tons hard-drawn copper wire, £84 per ton.—Gibbs, Bright and Co.
Five thousand glazed earthenware four-duct conduits, 4s. 4d. each; 1,850 ditto six-duct, 6s. 2d. each.—Mills & Co.
Automatic switchboard, for Perth, £42,612.—Automatic Telephones (Australia), Ltd.
Thirty thousand insulators.—Theodore Zwicker & Co.

SYDNEY.—Municipal Council:—
Metal-filament lamps, £987.—Australian Metal Co.
Arc lamp winches (£170).—Warburton, Franki, Ltd,
Three thousand one hundred fuse-box replacements, £87 10s.—B.I. and Helsby Cables, Ltd.
One hundred thousand A.C. flame arc lamp carbons, £1,094.—Siemens Bros. Dynamo Works, Ltd.

MELBOURNE.—City Council:—
Electric meters, £767.—Chamberlain & Hookham, Ltd.; ditto, £817.—Reason Manufacturing Co.: ditto, £498.—A.E.G. Co.
Three phase transformers, £432.—Johnson & Phillips, Ltd.—*Australian Mining Standard.*

MELBOURNE RAILWAYS.—The *Australian Mining Standard* states that, acting on the advice of Mr. C. H. Merz, the Victorian Railways Commissioners have accepted the tender of Siemens Brothers Dynamo Works, Ltd., for supplying the switchgear and accessories for the electric power station in connection with the suburban electrification scheme, the amount being £140,000. The whole plant will be manufactured in Great Britain. For the manufacture of the large condensing plant required, the tenders submitted by the G. Weymouth Proprietary, Ltd., of Richmond (V.), have been accepted, the total amount being £85,251. The Railways Commissioners express their satisfaction that a local firm should have secured this important contract in competition with overseas tenderers.

Barnes.—The District Council has accepted the tender of Pooley & Austin, at £141, for the supply of a 10-KW. steam dynamo, with Reavell engine and Mawdsley generator, with switchboard complete.

Bournemouth.—The T.C. has accepted the following tenders for the supply of 10 new tramcars:—
United Electric Car Co., Ltd.—Car bodies, £499 each, and one vestibule, £26.
Brush Electrical Engineering Co., Ltd.—Brill type trucks, £130 each.
British Westinghouse Co., Ltd.—Electrical equipment, £343 per car, ditto for brakes, £150.

Bradford.—The Electricity Committee has accepted the tender of Messrs. Brown Manufacturing Co., Ltd., for the supply of uniform clothing, as follows:—30 jackets at £1 8s. 11d. each, 30 waistcoats at 7s 9d. each, 60 pairs of trousers at 15s. 9d. per pair, and 30 caps at 2s. 11d. each.

Chesterfield.—In connection with the tramways, the T.C. has accepted the following tenders for three double-deck cars:—
Brush Electrical Engineering Co., Ltd.—Car bodies, £469 each.
British Westinghouse Co., Ltd.—Electrical equipment, £282 per car, electrical track brakes, £55 per brake.

The Council has also accepted the offer of Messrs. Griffiths and Millington of £300 a year for the right of fixing advertisements on 17 cars for a term of seven years.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Ward, of Silvertown, for an oil fuel tank of 35 tons capacity, for the new Diesel plant, at £65.

Dover.—The T.C. received the following tenders for installing the electric light at Barton Road schools:—

Mr. Martin Dover (accepted)	£51
J. Wright & Son	85
Mr. Robson	66
Mr. Pink	63

Glasgow and Leith.—The Glasgow Corporation has ordered two petrol motor tower wagons from Halley's Industrial Motors, Ltd., Yoker, for use in connection with the maintenance of the tramway overhead conductors. The Borough of Leith has also placed an order with the same company for a second 25-H.P. tower wagon.

L.C.C.—The Education Committee recommends the acceptance of the tenders of G. F. Ratcliffe & Co., of £365 10s 6d., and R H & J. Pearson, Ltd., of £367, for installing electric light in the Hammersmith Trade School for Girls, and the Lancaster Road, Kensington, L.C.C. School respectively.

Tenders for electric lighting at the following schools are expected to be received either before the adjournment of the Council for, or during, the Christmas recess. The Committee recommends that the chairman, deputy chairman of the Council, with the chairman and vice chairman of the Education Committee, and of the Building Sub-Committee of the Education Committee, be authorised during the recess to open and accept the lowest satisfactory tender in each case:—Vernon Square, Finsbury; Popham Road, Islington; Ranelagh Road, Westminster; Ocean Street, Stepney.

The Stores and Contracts Committee recommends the acceptance of the tender of the Edison & Swan United Electric Light Co., Ltd., for electric lamps, Schedule No. 17 items 8 to 27 (metal-filament lamps, drawn wire (British), for 12 months, and that the Committee be authorised to accept the lowest satisfactory tenders during the Christmas recess, for Schedules 14 (electric fittings), and 15 (electric insulating materials).

The Fire Brigade Committee reports that electric charging apparatus has been installed at Old Kent Road Fire Station at a cost of £52, and recommends that Messrs. Dennis Bros. be allowed to sub-let to Messrs. Crompton & Co., the necessary electrical work in connection with motor fire appliance for smoke helmet work.

The Highways Committee is to obtain 1,500 machines for cancelling return and transfer tickets, at a cost of £900. The tender of Messrs. J. Stirk & Sons, Ltd., at £1,020, is to be accepted for the supply of a machine for cutting high check rails on tramway tracks.

The undermentioned tenders have been received for the supply of 2½ tons of T.C.C. copper wire ·229 in. diameter and 7½ tons of D.C.C. copper wire ·229 in. square.

R. R. Todd, High Holborn, W.C. (agent for Felten and Guilleaume, of Mulheim-on-Rhine, Germany) .. (accepted)	£833
London Electric Wire Co., and Smiths, Ltd.	853
B.I. and Helsby Cables Ltd.	866
Manchester Armature Repair Co., Ltd.	897
Callender's Cable and Cons. Co., Ltd...	950
Western Elec. Co., Ltd.	956
I.R., G.P. and Telegraph Works, Ltd..	987
W. T. Henley's Teleg. Works Co., Ltd.	1,024

The Committee report the acceptance of the offer of Messrs. Newton Bros. of £320 for the supply of coils in connection with the reconstruction and rewinding of motor-generators, and that of Messrs. J. G. Ingram, Son, Hackney Wick, at £206, for the repair of plough bases. Three Burroughes adding machines are to be purchased, at £460, for use in the tramway department.

HAMMERSMITH.—The Electricity Committee has accepted the tender of Messrs. Siemens Bros. for the supply of 50 white light arc lamps, for hiring out, at £5 15s. each; and of the General Electric Co., Ltd., for arc lamps, to be supplied singly or as required, at £9 10s. each.

For the supply of mechanical stoker coal for 12 months, the tender of Messrs. Cory Bros. & Co. of 11s. 11d. per ton was accepted.

The tender of Messrs. Toy & Winslow has been accepted by the Metropolitan Asylums Board for installing electric light, telephones, &c., at the Board's research laboratory.

SOUTHWARK.—The B.C. is purchasing a 23-H.P. motor from the Electrical Co., Ltd., at a cost of £56 11s.

Newcastle (Co. Down).—The Urban Council, on 10th inst., accepted the tender of Messrs. Curran, Belfast, for the lighting of the town by electricity.

New Zealand.—Tender Board. 3,000 B.B. wall telephones, £7,537—B. L. Donne.—*Australian Mining Standard.*

Norwich.—The Corporation Electricity Committee has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a 3,000-KW. turbo-alternator, complete with condensing plant, and with two 1,200-KW. rotary converters by Siemens Bros. Dynamo Works, Ltd., at £8,578.

Nuneaton.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for 300 yards of 15 three-core cable for extensions, at £108.

Pontefract.—The B. of G. has accepted the following tenders:—

E. Brook, Ltd.—Motors, &c., £72.
Simplex Conduits, Ltd.—Lamps, £47.

Salford.—The E.C. has accepted the tender of Messrs. A J. Kirby & Co. for a complete covering with pitch-pine boards for the water-softening plant, for £95.

Sunderland.—The T.C. has accepted the following tenders:—

B.I. & Helsby Cables Co.—Cables.
I.R., G.P. and T. Works Co.—Cables.
Siemens Bros.—Meters.
A. Wright & Co.—Calorimeter.
Hopkinson & Sons, Ltd —Wrought steel saddle pieces.
Dewrance & Co.—High-pressure steam valves.

Walsall.—A contract for traction type tantalum lamps for the borough tramways has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers Birmingham Local Section.—Friday, December 19th. At 7.30 p.m. At the Grand Hotel. Annual Dinner.

Institution of Mechanical Engineers.—Friday, December 19th. At 8 p.m. At Storey's Gate, S.W. Ordinary Meeting.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 19th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Institution of Civil Engineers (Students).—Friday, December 19th. At 8 p.m. At Great George Street, S.W. Paper on "Air Filtration and the Cooling and Ventilating of Electrical Machines," by Mr. W. M. Gurry.

Tuesday, December 23rd. At 8 p.m. At Great George Street, S.W. Further discussion of paper on "Electric Driving of Tube Mills in a Gas-Engine Generating Station," by Prof. H. G. Stott and Mr. W. A. [illegible].

Manchester Electro-Harmonic Society.—Friday, December 19th. At 7.30 p.m. At Albion Hotel. Third Concert.

Junior Institution of Engineers.—Friday, December 19th. At 8 p.m. At 39, Victoria Street. Paper on "Continuous Reading Recorders," by Mr. T. C. Morewood.

Saturday, December 20th. At 2.30 p.m. Visit, Generating Station of the Charing Cross, Strand and Co. at Stratford.

Association of Mining Electrical Engineers.—Saturday, December 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Electric Winding," by Mr. J. Gillespie.

Institute of Marine Engineers.—Monday, December 22nd. At 8 p.m. Discussion on Fuel Test.

Salford Technical and Engineering Association.—Friday, December 26th. At 6.15 p.m. At the Institute. Annual Social.

Royal Institution of Great Britain.—Saturday, December 27th. At 3 p.m. At Albemarle Street, W. Juvenile lecture, first of a series on "A Voyage in Space," by Prof. H. H. Turner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the next two weeks:—

Monday, December 22nd to Saturday, December 27th. Headquarters will be closed for technical instruction, but will be open for the transaction of regimental business.

Monday, January 5th.—"A" Company. Technical instruction 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 to 8 p.m.

Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

The Christmas Holidays.—We shall be glad if readers and advertisers will take special note of the following arrangements consequent upon the ELECTRICAL REVIEW for December 26th having to appear on the morning of Wednesday, December 24th.

It will be necessary for that issue to go to press much earlier than usual, and it is imperative that all communications for the editorial department, except the latest items of special news should be sent in so that we receive them by Monday morning next, December 22nd.

The advertisement department announces that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than this morning, December 19th. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, 23rd inst.

The B.T.H. Operatic Society.—How Art may be allied with Science is well exemplified by the programme of the B.T.H. Operatic Society, which this week is producing "The Mikado," at the Rugby Hippodrome, and has issued a dainty souvenir of the performance. This is the third production of this highly talented amateur company, the members of which are all members, or the wives of members, of the B.T.H. staff or works. The orchestra is also recruited from the B.T.H. company, the whole of the performers, therefore, being amateurs; but if the production of "Pinafore" last year by practically the same artistes affords a true criterion, their rendering of the "Mikado" will compare favourably even with the work of professional companies. We trust that their success will again be as complete as they could wish.

Appointments Vacant.—Shift engineer for Buxton U.D.C. (30s.); distributing superintendent for Sunderland Corporation (£182). Cable jointer, for Salford Corporation. Particulars are given in our advertisement pages.

Inquiries.—Makers of a mechanical joint suitable for concentric lead-covered and armoured cable, having outer lead and armour earthed, are asked for.

Australian Labour Conditions.—Once more we are tempted to refer to the conditions prevalent in the Australian electrical business. Mr. Newbery, the chairman of the Iron and Shipbuilding Trades Group of New South Wales, has varied his previous award dealing with electrical workers. It is now arranged that a week's work is to consist of 48 hours, made up of 8¾ hours Monday to Friday, between the hours of 7.30 a.m. and 5.30 p.m., and 4¼ hours on Saturday between the hours of 7.30 a.m. and 12.15 p.m. Double time is to be paid for all Sunday or public holiday work unless otherwise specified. Foremen are to be paid 3s. per day more than electrical mechanics, but are not to be paid for overtime. Leading hands are to get 1s. 6d. per day over the ordinary rate. No improvers are to be allowed to enter the business, and those already serving in that capacity are to qualify as journeymen as soon as possible. Future entry into the business is to be through a period of apprenticeship. An interesting feature of the new regulations is that wherever the conditions are unfavourable to health or injurious to clothing, dirt money at the rate of 1d. per hour is to be paid to all men engaged in fitting, installing, repairing or overhauling electrical apparatus between ceilings and roofs or under floors. We think that if in this country a claim of 4s. per week were admissible for clothes becoming dirty, it would be asked for by the great majority of the men engaged in electrical engineering work.

National Illumination Committee of Great Britain.—A provisional Committee, formed of representatives of the Illuminating Engineering Society, the Institution of Electrical Engineers, the Institution of Gas Engineers, and the National Physical Laboratory, held a meeting on November 29th last, at which arrangements were made for the formation of a National Illumination Committee to be constituted according to the Statutes of the International Illumination Commission, with the primary object of affiliating Great Britain to that Commission. The provisional Committee recommended that the National Committee should consist of five representatives of each of the three technical Societies, and two representatives of the National Physical Laboratory. This recommendation has been adopted, and the following have been nominated as members of the Committee :—By the Illuminating Engineering Society: Mr. Leon Gaster, Mr. F. W. Goodenough, Prof. Silvanus P. Thompson, and Mr. A. P. Trotter (this Society has not yet nominated its fifth representative); by the Institution of Electrical Engineers: Mr. F. Bailey, Mr. W. Duddell, Mr. K. Edgcumbe, Mr. Haydn Harrison and Prof. J. T. Morris; by the Institution of Gas Engineers: Mr. E. Allen, Mr. J. Bond, Mr. W. J. A. Butterfield, Dr. H. G. Colman and Mr. H. Watson; and by the National Physical Laboratory: Dr. R. T. Glazebrook, C.B., and Mr. C. C. Paterson. The first meeting of this National Committee took place on the 2nd inst., when the following were chosen as officers :—Chairman: Mr. E. Allen, of Liverpool; Vice-chairmen: Mr. W. Duddell and Mr. A. P. Trotter, both of London; and Honorary Secretary and Treasurer: Mr. W. J. A. Butterfield, of London. Great Britain is entitled to two delegates on the Executive Committee of the International Illumination Commission, and Dr. H. G. Colman and Mr. W. Duddell were accordingly appointed by the Committee as the delegates from this country.

Electricity Supply Rifle League.—Representatives from the clubs composing this league recently met a representative team from the London and South-Western Railway Rifle Club, on the range of the Central Electric Rifle Club at St. John's Wood. The occasion was the return fixture between the two teams, whose first meeting took place at Clapham Junction in the early part of this year, when the railwaymen won a most exciting match by one point. The conditions were the same as in the initial encounter, viz., 10 shots at the S.M.R.C. match target at 25 yards (five bull); 12 men to shoot and 10 highest scores to count in the match. The result was :—Electricians, 965; Railwaymen, 938. At the conclusion of the match, which had been witnessed by Sir Alexander Kennedy, F.R.S. (President of the League), Mr. C. Newton Russell (a Vice-President of the League, and borough electrical engineer for Shoreditch) and Mr. Buckmaster (of the London and South-Western Railway) the company adjourned to the Eyre Arms for a knife-and-fork tea, with Sir Alexander Kennedy in the chair. It is hoped that a further match will be arranged in order to decide as to which is the better team.

Losses in Transmission Towers.—An article in the *Electrical World* describes experiments made to ascertain the hysteresis and eddy-current losses in steel towers, to be used for a 240-mile transmission at 150,000 volts, 50 cycles. The middle wire of the three-phase line passes through the centre of the steel framework. It was found that with 200 amperes the loss per tower was 28·8 watts at 60 cycles, and 18·0 watts at 25 cycles; with 100 amperes the losses were 5·9 and 1·8 watts respectively. The losses are insignificant compared with the power transmitted.

Boiling Carbon.—At a meeting of the Scientific Society of Breslau last week, Prof. Lummer, Director of the Physical Institute, gave a demonstration in which he brought carbon to the boiling point. He had previously made the discovery that carbon could be liquefied by manipulation of the current in an electric arc lamp, the carbon rods of which began to boil at a certain pressure. The product thus obtained proved to be graphite.—*Financial Times.*

Prosecution.—At Ton-Pentre Police Court, on December 8th, Arthur Hopkins, electrical engineer, was fined 40s. for having a cigarette in his possession at the Britannic Colliery, Gilfach.

Electric Steel.—It is stated that the United Burbach-Eich-Dudelingen Iron and Steel Works Co., of Luxemburg, which erected at its Eich works open-hearth furnaces in connection with the electrical production of steel some time ago, has now succeeded in transforming the early unfavourable results into satisfactory results, so that the plant is not affected by the downward tendency in the iron and steel trades. Apparently encouraged by the experience gained, the Gelsenkirchen Mining Co. now also proposes to erect open-hearth furnaces to the number of about 12, for the purpose of producing steel by electricity, the furnaces to be located at Esch, on the Alzette, and at other works belonging to the company. The specialities made from electrical steel, such as machine parts, curved rails, &c., enjoy an active demand, and are consequently less subject to the price fluctuations in the steel market.

Electric Vehicle Trial.—One of the Arrol-Johnston-Edison electric coupés, similar to the vehicle which made the run from Dumfries to London during the past summer, has just been submitted to a trial on Brooklands track, under the observation of the Royal Automobile Club, with the view of testing the distance that could be run on one charge of the Edison battery. The weight of the car was, approximately, 27¼ cwt. and, with passengers, about 30½ cwt. The car ran a distance of 54·85 miles without stopping, and at an average and even speed of 15·99 miles per hour.

Insulators made in Australia.—The *British Australasian* has the following paragraph regarding the recently placed orders for insulators :—"For several years Australian manufacturers of telephone insulators have endeavoured to obtain a share of the Postal Department's business, but they have been unable to compete with foreign firms on the question of price. However, in a recent calling for tenders for a further supply of insulators, so little difference was found in the quotations submitted by the Commonwealth Art Pottery and Insulator Co. and outside firms, that Mr. Wynne had no hesitation in patronising the local industry. The present order comprises 250,000 of the B type of insulator, 10,000 of the A type, and about 30,000 tubes, at a cost of about £3,000. The B type insulators have passed exhaustive Governmental tests, and the order for 10,000 of the A type is in the nature of an experiment."

The Electro-Harmonic Society (London).—A very successful Smoking concert was held on Friday last; the King's Hall was crowded, as usual, and the audience manifested cordial appreciation of the programme, which was both varied and enjoyable.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The tenth annual dinner of the Students' Section was held on Monday, December 8th, at the Trocadero Restaurant, about 40 Students being present.

In proposing the toast of the President and the Institution, Mr. R. E. Dickinson (Vice-Chairman Students' Section), who occupied the chair, spoke of the higher aims and dignity of the Institution, and thanked those Members of Council who, by attending Students' meetings, rendered such valuable assistance. He expressed the pleasure of the Students that one who had risen from their ranks should again be elected President of the Institution. The President (Mr. W. Duddell), in replying, said that every Student "had a baton in his knapsack," and he trusted that many of those present would reach the presidential chair. For the past 10 years, he had read every Student's paper, and, except in expression and arrangement, many of these were as excellent as the Members' papers. The object of the Students' Section was to afford practice in writing and discussion. As regarded the A.M.I.E.E. examination, most of the students were, or had been, in attendance at colleges, and college diplomas or university degrees would exempt them from the Associate Membership examination. Those who were not exempted need not fear the ordeal; the examination would be framed simply to determine the technical efficiency of candidates, and the Council were prepared to consider these in lieu of set examination papers.

The toast of the Students' Section was proposed by Mr. A. H. Seabrook (Member of Council) who commented regretfully on the rapid flight of time which so quickly made students into members of council, and members of council into "old fossils." The rising generation of electrical engineers should not neglect the commercial and financial aspects of their profession, but should pay close attention to the applications of electricity to every-day life. With regard to these, electricity was indeed still in its infancy. Lighting and power applications were well established, but a vast field, yet hardly touched in this country, included the application of electricity to automobiles, heating and cooking, metallurgy and chemical work. A matter which had been referred to this year by every Local Section chairman was the importance of gasifying coal before combustion, so that the valuable by-products might be conserved.

Mr. S. M. Hills (chairman, Students' Section), in replying, said that, in view of the many counter attractions in the metropolis, the progress of the Students' Section must be regarded as satisfactory. Engineering societies in the colleges retarded somewhat the growth of membership and activity of the Students' Section. There was a difficulty in obtaining students' papers in London. If a good paper were taken as an exemption from the A.M.I.E.E. examination, the problem would, he thought, be solved.

"The Colleges" was proposed by Mr. E. L. M. Emtage, who emphasised the necessity for co-operation to improve the status of electrical engineers. Isolated associations should not be necessary if all students rallied round the Institution. The colleges could

do much to improve matters by encouraging their students to participate in the social life of the colleges and more particularly in the wider activities of the Institution. Replying to this toast, Dr. S. P. Thompson (past president) stated that the industrial depression which had been reflected in the colleges a few years ago had passed and the colleges were now "healthy." In establishing the Associate Membership examinations, the Institution had followed the lead of the Civil and Mechanical Engineers, and it was a noteworthy fact that in the heterogeneous committee appointed by the Council to frame the examination regulations, the collegiate members were the most anxious that the examinations should not be academic. Examinations would be as simple, direct and practical as possible, and Mr. Hills's suggestion was already in effect adopted, for theses presented by candidates might be students' papers—possibly improved by aid of the discussion.

In proposing "The Guests," Mr. E. B. Driver (Hon. Sec. S. S.) welcomed the representatives from the sister institutions and looked forward to joint technical as well as social meetings. Civil, mechanical and electrical engineering were now so interdependent that such meetings could not fail to be beneficial. Mr. W. M. Mordey (past president), in replying, emphasised the debt of gratitude owed by students to Dr. Thompson for his technical teaching, and urged students to take vigorous practical interest and part in the work of the Section. He said the successful electrical engineer must now be a competent general engineer, with a special knowledge of electrical matters. An electrical engineer was more likely to make a mistake through not knowing how to mix concrete, than by not being able to design the winding of a transformer. Replying on behalf of the Students' Section I.C.E., Mr. P. G. Bowie (chairman) agreed that the root of most of the troubles of Students' Sections lay in insufficient social intercourse. Joint meetings would undoubtedly be most valuable.

An excellent musical programme was provided, and the work of the hon. secretary and the Dinner Committee was recognised by an enthusiastic toast.

The twelfth annual dinner of the SCOTTISH SECTION of the I.E.E. was held in the Grosvenor Restaurant, Glasgow, on December 11th, Mr. J. A. Robertson, of Greenock, presiding. Mr. A. B. Anderson, member of the Council of the I E.E., in the absence of the Very Rev. Provost Deane, St. Mary's Cathedral, proposed the "Imperial Forces." Commander Aklom and Sir George Beatson responded; the former, speaking for the Navy, said that about a month ago he was examining a modern battleship, and he was told that it had 378 motors for doing the work of the ship. The Navy had always been keen on electricity; 25 years ago a battleship cost half a million; the battleship of to-day cost 2½ millions, and the difference thus represented was largely due to the development of electrical science. Sir John Ure Primrose, Bart., proposed "The Houses of Parliament," Lord Rosebery replying for the Upper Chamber, and Mr. D T. Holmes, M.P., for the House of Commons. Dr. Ferranti submitted the "Corporation of Glasgow," pointing out that the city of Glasgow was of special interest to them in respect of its electrical activities. The electrical undertaking of the Corporation had this year reached its majority, and when they considered how successfully it had been carried on during the 21 years of its existence, they must wish to congratulate the Corporation in general, and their engineer, Mr. Lackie, in particular. Lord Provost Stevenson, who replied, recalled that three months ago he had been in America, and found that supply companies there were distributing carbon-filament lamps free of charge among their consumers. The reason of this was that the metal-filament lamp took only one-third of the energy taken by the carbon-filament lamp, and the companies induced their consumers to continue using carbon-filament lamps with a view to keeping up their revenue from the sale of electrical energy for lighting purposes. The T.C. were now supplying power at ¾d. and light at 3d. per unit; that seemed to indicate that in the immediate future electricity would enter to an increasing extent into all the affairs of their daily life, and enable them get rid of the smoke problem. At this stage the Chairman said that most of them would be aware that, after six years' service, their honorary secretary (Mr. Sayers) had felt himself compelled to give up that position to enable him to devote more of his time to his private business. All of those who had come into contact with Mr. Sayers knew of his courtesy, but they did not know of the untiring energy and hard work that Mr. Sayers had devoted to his office as their secretary. They felt they could not let the occasion go past without signifying in some tangible way their appreciation of Mr. Sayers's work. Mr. Sayers was not leaving them altogether. They were to retain him on the Section Committee, where they would get the benefit of his experience and advice. He asked Mr. Sayers to accept a gold watch for himself and a diamond pendant for his wife. Mr. Sayers briefly returned thanks, and commended his successor (Mr. Taylor) to the same kindly consideration which they had always shown him. The toast of "The Institution of Electrical Engineers," was proposed by the Rev. Bishop of Glasgow, who pointed out that one of the great purposes of their profession as electrical engineers was the transmission of power. He believed that the whole rural question depended upon the success of their activities. As civilisation advanced, they became less and less anxious to expend all their energies in bodily labour, and he believed that if they did not go too far in it, they were doing a very important work in securing the cheap transmission of power. They were doing much, too, to solve many of the social problems, and he wished they would not confine their energies altogether to the transmission of force. He would like if they would transmit force in terms of character. Mr. Duddell, the President of the Institution, in his reply, assured the Lord Bishop that they wished to push out the boundaries of the application of electricity as far as possible. They were particularly anxious to give the agricultural labourer cheap power for his work and by carrying their work into the country districts they would relieve their smoke laden cities. As to their work on the modern battleship he believed the members of their Institution would be willing and able to do their duty both in peace and war. They sought to transmit power, and they were also able by electrical energy, to transmit intelligence. With regard to the supply of cheap light, their station had recovered from the temporary setback, due to the introduction of the 1 watt lamp. The 1 watt lamp had enabled them to reduce the price of electrical energy for lighting and the ½-watt lamp would enable them to lower it still further. Mr. J. E Kingsbury gave the "Scottish Local Section," and the chairman, in acknowledging, said that by reading and discussing papers at their local centres, they had not only obtained a better knowledge of many subjects relating to their industry but they had developed a better understanding among the members in the different branches of the profession. Two years ago they had changed their name from the Glasgow Local Section to the Scottish Local Section, and since then they had divided their meetings between Glasgow and Edinburgh. Some of them felt that this broke the continuity of the session, and they therefore proposed to have two additional meetings in Glasgow this session, one of these meetings being in the nature of an informal discussion. It had been suggested that they should have permanent accommodation of their own in Glasgow, including a library of technical works, which would be open on certain nights of the week. With regard to the broader policy of the Institution which sought to bring into line all the various interests, scientific, technical, commercial, this appealed to them in Glasgow where they had shipbuilding, marine engineering, steel manufacture and coal mining, in all of which electricity was playing an ever more important part. If their Institution was to continue to be truly representative of the whole industry, it should be flexible enough to bring within its membership and control all the various applications associated with these different industries. While they should keep up the status of their membership, they would like all those associated with their industry to qualify themselves for membership in one or other of their various grades.

The annual dinner of the NEWCASTLE SECTION of the Institution was held in that city on the 16th inst. Mr. Charles Vernier, the chairman of the Local Section, presided, and the chief guest of the evening was Mr. W. Duddell, F.R.S., President of the Institution, while others present included the Lord Mayor (Mr. Johnstone Wallace), the Sheriff (Mr. H. Shaw), Sir Charles Parsons, &c. Mr. P. V. Hunter proposed "The Commerce and Industry of the North-East Coast." He said that while it was a fact that a number of industries had fallen into decay, more particularly the chemical industry, electrical engineers were looking forward to the development of the electrochemical and electrothermal industry for their next big advance. He had not the slightest hesitation in saying that in a few years' time those industries would rank as the biggest as regarded the number of men employed and the value of the products. The Lord Mayor, in responding, said if he could only lay hold of some gentlemen and induce them to introduce the electrochemical and electrothermal industries on Tyneside, then he thought they would earn the gratitude of everybody, because they wanted more industries there. The Sheriff proposed the toast of "The Institution of Electrical Engineers." Mr. Duddell, in reply, referred to the utilisation of electricity in other directions than those in which it was used at present, and said the question of the use of electricity in furthering the growth of plant life was a serious one, as well as a real one. Sir Oliver Lodge, who was really the first to put that matter on a firm foundation, had assured him that the evidence was cumulative that they could effectually stimulate plant growth by electrifying the atmosphere. It now remained for electrical engineers to show whether that would be a profitable way of increasing the produce of their country. The future of electricity in this neighbourhood was very bright, Tyneside had led the way in England in regard to the application of electricity to power purposes, and if the figures could be maintained they would lead the way in electrochemistry and electrometallurgy. Other toasts included that of "The Newcastle Local Section," proposed by Mr. J. S. Highfield, and responded to by the chairman, who referred to the progress that had been achieved.

The section of the new General Mine Regulations relating to the use of electricity was discussed at a joint meeting of members of the Midland branch of the NATIONAL ASSOCIATION OF COLLIERY MANAGERS and of the Notts. and Derbyshire branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS at Nottingham, on December 6th.

THE BRITISH ASSOCIATION. The Committee charged with the local arrangements for the recent visit to Birmingham of the British Association at its final meeting, reported that the number of persons taking tickets for the meeting was 2,635, compared with 2,504 at the Dundee meeting last year, and 2,453 at the Birmingham meeting in 1886. The extent to which the artisan classes availed themselves of the popular science lectures made them a notable feature of the meeting.

CONCRETE INSTITUTE.—In the course of his presidential address on November 13th Mr. E. P. Wells remarked that it had been the custom of several firms in this country to import what were known as foreign blooms, roll them, and sell them as English steel. It had been his lot to come across steel so made, and he found in every instance that it only came up to the foreign standard of 26 tons per sq. in., whereas the lowest limit of the British standard was 28 tons. In many cases the steel rolled in this country from foreign billets had been as low in tensile strength as 23 tons per

sq in. He desired to call the attention of all those who were interested in steel for structural work generally and for reinforced concrete work in particular, to the fact that the tests on steel should be carefully watched.

A paper was read by Mr. W. Laurence Gadd, F.I.C., entitled Some Fallacies in Cement Testing at the meeting on December 11th.

Association of Electrical (Station) Engineers.—A smoking concert was held at the Merchants' Hotel, Manchester, on December 10th, at which there was an excellent attendance. During the evening the members expressed their appreciation of the services to the Manchester Section of Mr. T. S. Wallis, vice-chairman, who is leaving shortly for abroad. Arrangements are being made to hold meetings at Middlesbrough and Plymouth early in the New Year for the purpose of forming branches of the Association, and dates and particulars of meetings will be announced as soon as possible.

London Electricians' Wages Movement.—A meeting of the Electrical Trades Union held on Monday at the St. Bride's Institute, was much more numerously attended than the meeting at Holborn on October 28th, and the dissentients from the resolution which was carried were those who wished for immediate action to be taken. The following is the reply which was addressed to Mr. L. G. Tate, secretary of the London Electrical Masters' Association :—

"This meeting of members of the Electrical Trades Union instructs the London District Committee that they cannot accept the terms of the letter of December 8th from the London Electrical Masters' Association, and cannot enter into negotiations excepting the questions to be discussed by the suggested conference are dealt with on their merits, without any previous conditions being exacted, and without prejudice."

I would point out that our letter of November 11th to the employers, stated in moderate terms our request for an advance of wages to 11d. an hour, with an agreed-on code of working rules, and that we were desirous of coming to an amicable understanding with a body representative of the said employers, if possible. The letter of December 8th, from the Committee of the L.E.M.A., if insisted on, entirely precludes such a possibility, and so far as my knowledge extends, have never been put before, or agreed upon, by any workmen's association previous to the questions at issue being discussed.

I am to add that we are quite prepared to meet your Committee to discuss any points upon which there may be a variance of opinion, in a just and equitable manner, and trust that such a meeting will be arranged at an early date.

J. Potter, *District Secretary.*

Manchester Electro-Harmonic Society.—To-night at 7.30 o'clock this Society holds the third concert for the present season at the Albion Hotel, Manchester. Mr. Geo. H. Fawcus will be in the chair, and an excellent programme, with the usual ample provision for intervals, has been prepared The artistes will be as follow :—Soprano, Madame Annie Walker; solo clarionet, Mr. Harry Mortimer; solo violoncello, Mr. Seth Lancaster; at the piano, Mr. Chas. Kelly; entertainer, Mr. Foden Williams; accompanist, Mr. A. H. P. Martin. Any of our readers who can make it convenient to be present may be assured of a very hearty welcome and a profitable evening. The Society continues to add to its membership, and is well worthy of patronage and support.

Strike.—With reference to the note appearing under this heading on page 967 of our last issue, we have received the following letter :—

"Our attention has been called to a note in your last issue concerning the wages paid to the workmen at the Pearl Assurance Co.'s building, and as we are the electrical contractors, we hasten to enter a complete denial of the allegation that the non-Union men are paid less than the Union men. As a matter of fact, we pay a higher rate of wages than that at present acknowledged by the Trade Union. The strike is merely one to coerce non-Union men into joining the Union.

"London, W. Duncan Watson & Co."

Fatality.—An inquest was held on 12th inst. in West Fife into the death of Wm. Laurenson, jun., pit roadsman, lately residing at Waverley Street, Lochore. According to the *Glasgow Daily Herald*, the evidence disclosed that in the Mary Pit, Lochore, of the Fife Coal Co., an iron girder used for roof support had been crushed down by a move in the strata, and in its descent it had fractured the sheathing of a cable used for electric lighting. Laurenson had come in contact with the girder, which became alive, and before the current could be switched off death had ensued. On behalf of the Home Office, Mr. Robert Nelson, chief electrical engineer, expressed the opinion that the voltage was far too high for a lighting cable. The jury, after retiring, brought in a verdict to the effect (1) that the present high voltage should be at once reduced; (2) that in exposed and dangerous places the cable should be so constructed as to prevent an accident such as had occurred; (3) that officials who were likely to be required should receive instruction which would help to prevent accident.

Physical Society Exhibition.—On Tuesday the ninth annual exhibition of electrical and other apparatus organised by the Physical Society of London was held at the Imperial College of Science, South Kensington. The exhibits again showed a decrease in number, but many interesting items were shown, and will be described in our later issues. Discourses were given by Mr. Louis Brennan on experiments with soap films, and by Prof. J. A. Fleming on the vibrations of strings. There was a good attendance.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. S. P. Cook, charge engineer at the Luton Corporation Electricity Works, has resigned his position, having obtained a similar appointment at the Regent's Park central station.

The Morecambe Council on Monday accepted the resignation of Mr. Lionel B. Hogarth, the borough electrical engineer and manager, with regret, he having been appointed borough electrical engineer at Whitehaven. Mr. A. W. Annetts, chief assistant, has been appointed borough electrical engineer, and Mr. Hogarth is to be retained as advisory engineer to the Corporation for a period of three months from January 1st next.

Mr. H. Wallis, of Northwich, has been appointed switchboard attendant at the Portsmouth Corporation electric lighting works, to fill the vacancy recently announced.

The Swinton and Pendlebury (Lancashire) D.C. has increased the salary of its electrical engineer (Mr. Busbridge) from £161 to £180 per annum.

The Great Yarmouth T.C. has increased the salary of the electrical engineer, Mr. Gordon Bryant, from £400 to £450, from September 29th last, with a further increase to £500 in September next.

Mr. Reginald F. Rampe is severing his connection with the Stoke Newington Borough Council in order to take a more responsible post with Messrs. Pearsons, Ltd.

Mr. W. Garner-McLean, chief assistant power and distribution engineer to the London United Tramways, has resigned his position in order to take up an appointment in India, and was on the 8th inst. presented by the staff with a case of drawing instruments, a pipe and cigarette tube.

Mr. R. Norman Cole has been appointed assistant engineer at the Fareham electric light station.

The Bristol electricity works staff has presented Mr. A. J. Ostler, station superintendent, with a smoker's cabinet, on the occasion of his marriage.

Tramway Officials.—The Ramsbottom D.C. has increased the salary of Mr. Jas. Wild, inspector in charge of the railless cars, and he is in future to be designated manager.

Mr. C. Lucey, of Messrs. Crompton & Co., Ltd., Chelmsford, has been appointed to take charge of the lighting department of the General Electric Co. at Manchester. He took up his duties on December 15th.

CITY NOTES.

Barcelona Traction, Light and Power Co., Ltd.

The interim report, as appearing in the *Financial Times*, states that the company was formed for the purpose of the development of hydro-electric powers in the north of Spain and the exploitation of electric light and power business in the Province of Cataluna and surrounding territory. This enterprise has for its basis the development of various water powers on the River Ebro and its tributaries, the Rios Segre and Pallaresa. The company was formed in September, 1911, under the laws of Canada, with a capital stock of $25,000,000 and an authorised bond issue of £5,000,000, which has since been increased and fixed at £8,000,000. In June, 1913, the capital stock was increased to $30,000,000, and at the present time there is $27,450,000 of ordinary stock outstanding. In July, 1913, preference shares were created to the extent of $12,500,000, of which $10,000,000 have been sold, and the proceeds, so far as the instalments are paid, applied to the development of the company. For the purpose of carrying out its programme in Spain, a company called the "Ebro Irrigation and Power Co., Ltd." was formed under the laws of Canada with a capital stock of $2,500,000, which is entirely owned by the Barcelona Co., and it is through this company that all of the Barcelona Co.'s operations are carried out in Spain. The Ebro Irrigation and Power Co., Ltd., has been legally protocolised in Spain, and is authorised to carry on business in that country by virtue of a decree on December 14th, 1911, under the name of "Riegos y Fuerza del Ebro, Sociedad Anonima." For the purpose of carrying out the enterprise, the Ebro Co. has acquired the rights enjoyed by the company called "Saltos del Segre," by virtue of a Royal Decree dated May 14th, 1912, and also has acquired the concessions of Don Domingo Sert Badia for the utilisation of the waters of the Rio Noguera Pallaresa, unified under a Royal Decree dated March 8th, 1910. These rights have been assigned to the Ebro Co. and directly vested in that company by Royal Decree dated November 28th, 1912. After dealing in detail with the progress of construction work, the report states that on September 30th, 1913, the various companies controlled by the Ebro Co. had the following business connected and under contract :—Barcelona Co., 30,432 contracts for 78,164 H.P., or 57,428 kw.; subsidiary companies, 15,079 contracts for 19,600 H.P., or 14,426 kw.; Tibidabo, 4,607 contracts for 5,569 H.P., or 4,099 kw. Total, 50,118 contracts for 103,333 H.P.,

or 75,953 KW, and it was estimated that there were at least an additional 50,000 H.P. that could be contracted for as soon as the company was ready to supply the power. The above figures do not include the power which will be supplied to the tramways company, and which it is estimated will amount to at least 4,000 H.P. in 1914, or that required for the operation of the Ferrocarriles de Cataluna, which it is estimated will amount to 3,000 H.P. The Ebro Co., in addition to these small contracts, has also an important contract with the Sociedad Iberica del Azoe for the supply of 75,000 H.P., of which 25,000 H.P. will be supplied in 1915 and the remainder in 1918 upon the completion of the Ebro installation at Fayon. The Ebro Co. should have at its disposal in 1914 for distribution the following amounts of energy:—Steam station, 60,000,000 KW.-hours; Seros, Publa and Talarn stations, 115,000,000 KW.-hours; total, 175,000,000 KW.-hours. The estimates of net revenue from operation from 1914 to 1917 are as follows:—1914, £546,000; 1915, £743,000; 1916, £1,050,000; 1917, £1,257,000. On account of the many unavoidable delays, due to the difficulty of getting the work started in Spain and securing the necessary permission and approval of plans from the various authorities and departments of the Government, to the time occupied in the expropriation of lands, and to the difficulties of transportation of machinery and materials, which was also a serious problem in the beginning and required some time to solve, the works in Spain are taking a longer time to carry out than was first contemplated, and consequently the earnings formerly estimated for 1914 will not be fully realised.

Prospectuses.—*Tramways, Light and Power Co., Ltd.*—The subscription list was to close on Wednesday in an issue of £200,000 5 per cent. debenture stock at 98 per cent. Just over a year ago the company issued 300,000 £1 6 per cent. preference shares, and the proceeds were applied in acquiring the properties then mentioned, and towards the construction of the Nottinghamshire and Derby-hire tramways and equipment and development of the power companies. On July 1st, 1913, the company acquired all the share capital of the Midland E.L. & P. Co., Ltd., who own the Leamington lighting undertaking. The prospectus states that the proceeds of the present issue of the debenture stock will provide sufficient funds to pay for the latter property, to complete all construction works now under contract, and to satisfy the company's obligations under all existing contracts. The total capital expenditure on the various properties, inclusive of the proceeds of the present issue, will be in excess of £750,000. Messrs. Balfour, Beatty & Co., Ltd., in whose hands is the operating management of the different properties, say that the present rate of earning is sufficient to cover the interest on the £200,000 debenture stock more than twice over.

Whitstable Electric Co., Ltd.—This company has recently issued a prospectus locally inviting applications for 14,000 £1 shares.

South Staffordshire Mond Gas (Power and Heating) Co.—£100,000 5 per cent permanent debenture stock has this week been offered at 95, and 7,500 6 per cent. cumulative preference £10 shares.

Blackpool and Lytham Tramways Co., Ltd.—The annual meeting of this company was held on December 15th. The annual report submitted showed a total income from traffic of £35,284. From this had to be deducted £6,895 paid to Blackpool Corporation, leaving £28,389. £757 was also received for advertising, bringing the total revenue up to £29,146. Traffic expenses amounted to £5,176; general expenses, £4,143; general repairs, £7,794; power expenses, £4,815; rent of leased lines, £2,161; leaving a balance of £5,056. The balance of profit and loss account was £34 103. The directors referred with regret to the death of the chairman, Mr. T. Blane, who had been a director of the company since its formation, and chairman for 11 years. The trustees for debenture-holders intimated their intention of paying 2½ per cent. interest on account of the arrears of interest due on debenture stock.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors have decided to pay, on account of the dividend accrued to December 31st, a dividend for the half-year on the 6 per cent. cumulative preference shares at the rate of 5 per cent. per annum, making 4 per cent. for the year.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a six months' dividend at the rate of 6 per cent. per annum on the preference shares, making the cumulative dividend paid up to June 30th, 1912.

Electrical Securities Trust, Ltd.—According to the *Financial Times*, the accounts for the year ended November 14th show a loss, after charging debenture interest, &c., of £1,061, increasing the debit balance brought forward to £69,086.

Marconi Wireless Telegraph Co., Ltd.—An interim dividend of 10 per cent. upon the ordinary shares has been declared on account of the current year, payable on January 31st.

Marconi International Marine Communication Co., Ltd.—An interim dividend of 5 per cent. is declared on account of the current year.

Eastern Telegraph Co., Ltd.—A third quarterly interim dividend of 1¼ per cent. on the ordinary stock is announced in respect of profits for the current year.

Manx Electric Railway Co., Ltd.

Colonel Sir Arthur G Rose-Cowen, M.P., presided at 5 Fleet Lane, E.C., on Tuesday, over the meeting of the company.

In moving the adoption of the report (see Elec. Rev., p. 972) the chairman first apologised for the absence of Sir W. H. Vernon, through illness, and of Mr. Ernest Schenk through a family bereavement. He congratulated the shareholders on a very good year—in fact, a record-breaking year. The cause of this to a great extent was the fine weather during the summer and partly also the fact that trade conditions in the North had been very good, and their patrons who came largely from those districts were well provided with money. Given those conditions their undertaking was, to say the least as popular as it had ever been, as would be seen from the figures. The passenger receipts amounted to £36,642, as against £30,290 in 1912 and £32,545 in 1911, which latter was the previous best year. Goods, live stock, quarries and sundries brought in £3,504 as against £4,062 in 1912 and £3,468 in 1911. They carried 704,185 passengers as against 574,187 in 1912, and 606,497 in 1911. Their mileage this year was 364,747, as against 325,647 in 1912 and 344,[illegible] in 1911. They earned 24·11d. per mile run from the passengers, as against 22·33d. in 1912 and 22·64d. in 1911, and they carried 1·93 passengers per mile, as against 1·76 in the two previous years. The number of visitors to the island, as officially indicated between May and September, was 629,617, which was 122,000 more than the previous year, and 78,000 more than in 1911. He had worked out the figures of the passengers carried in the season between May and September, and the number of visitors coming to the island, and it gave the curious result that there was hardly any difference during the three years in the amount they received from each visitor, and it was, therefore, mainly numbers which told. He believed he was right in saying that the island itself had participated generally in the good season. The Villa-Marina, which opened in the summer, had some effect on the results obtained, and he thought the Corporation of Douglas had been very wise in acquiring and laying out the property in the very attractive way they had done. So far as the company was concerned, they always heartily welcomed any scheme which was likely to attract and keep visitors. Their gross revenue amounted to £40,160, against £34,875 in 1912, and £36,013 in 1911. Their working expenses were £18,740, as against £17,669 in 1912, and £17,214 in 1911. The increase was over £1,000 more than last year, which was partly accounted for by the increased mileage run, but chiefly by the fact that their fuel was very much more expensive, and owing to the dry summer they had to run on steam to a greater extent than the year before. In spite of these adverse circumstances the ratio of working expenses to receipts was this year as low as 46·66 per cent., as against 51·4 per cent. in 1912 and 47·78 per cent. in 1911, which, he thought, they would agree was a more healthy and gratifying sign. After providing for the debenture interest and the interim dividends of the preference shares, they were left with a balance of £9,760, which they proposed to allocate as follows:—To the balance of the preference shares dividend, £3,580; reserve for special renewals, £2,000; dividend at the rate of 2 per cent. on the ordinary shares, £2,000; and to carry forward £2,179.

Mr. B. E. Greenwell seconded the motion.

Mr. Kidson congratulated the board on the results, and expressed the hope that they would have the same favourable weather conditions next year.

The report was then adopted, and the retiring directors were re-elected.

Official Announcements re Companies.—The following companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Auto Conveyors.
British Electrics (Moseley's Patents).
British Patent Tube Cleaning Syndicate.
Davies Patent Boiler.
Ecco Battery and Electrical Co.
Hunslet Electrical Pottery Co.
Madeira Electric Lighting Co.
Monitor and Ajax Traction.
Mutual Electricity Supply Co.
Premier Electric Lamp Co.
"Simplex" Arc Lamp Syndicate.
Towers Lift Co.
Westminster Automatic Telephone Syndicate.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 162,000 preference shares of £1 each fully paid, Nos. 1,838,001 to 2,000,000.

Lima Light, Power and Tramways Co.—The directors have declared a dividend of 1 per cent. for the quarter ended September.

Bullers, Ltd.—The directors' report for the year ended July 31st, 1913, shows a profit of £17,560, plus £498 brought forward, making £18,058. A dividend of 5 per cent. on the ordinary shares is recommended.

Globe Telegraph and Trust Co., Ltd.—A quarterly interim dividend of 2s. per share on the ordinary shares is announced.

Winnipeg Electric Railway Co.—A dividend at the rate of 3 per cent. for the quarter ending December 31st, 1913, is announced.

British Columbia Electric Railway Co., Ltd.

The directors in their report for the year ended June 30th, 1913, state that it has been one of difficulty and disappointment, mainly owing to the continued rise in the cost of operation and in the cost of all descriptions of supplies. Increased working expenses have absorbed practically the whole of the large increase in gross earnings, in spite of continuous effort on the part of the management and of the directors to economise. One of the causes of the increase in expenses has been the protracted and stubborn strike in the coal industry which existed throughout the year. This strike resulted in a considerable rise in the cost of coal, and necessitated the purchasing of supplies in the States and in Australia. The expensive working conditions still continue and are affecting the current year's earnings. Moreover, the gross receipts of the railway have fallen off owing to the depression which is prevalent in British Columbia. The directors have undiminished faith in the future of British Columbia, and consequently of the company, and meanwhile have confidence that, by a small increase recently made in the fares and by rigid economy, they will be able to maintain the present dividend basis. For the twelve months to June 30th, 1913, the gross receipts show an increase of $1,035,869, or over 17 per cent., and the net earnings, including income from investments and subsidiary companies, and after charging renewals, show an increase of $77,552, or 4 per cent., over the preceding year, but the surplus over the amount required to pay interest and dividends has fallen from £67,670 to £28,242. The money actually expended up to June 30th, 1913, amounted to $45,168,312, and the amount paid out in interest and dividends for the year amounted to $1,888,139, equal to 4.18 per cent. on the entire investment. The following charges have been made against the revenue account of the year, viz.:—Provision for renewals maintenance (from which £40,103 has been deducted for adjustments and expenditure on renewals during the year), £140,654; amount added to capital amortization, £2,361; the net profit of the year, after making the above deductions, amounts to, £381,425, plus £7,732 brought forward. Deduct interest on debentures and debenture stock to June 30th, 1913, £125,182, dividends already paid—on 5 per cent. cumulative perpetual preference stock for the year to June 30th, 1913, £60,000, on preferred ordinary stock for the year to June 30th, 1913, £72,000, on deferred ordinary stock for the six months to December 31st, 1912, £48,000, leaving available for further distribution and reserve, £83,974. From this the directors have recommended the payment of a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months ended June 30th, 1913, making 8 per cent for the year, £48,000. There is to be transferred to reserve fund, £26,455, and £9,519 is to be carried forward.

There has been added to the reserve fund £67,544, representing the premiums or amount by which the price paid into the company's treasury exceeded the par value of £1,320,000 new share capital issued during the year, less expenses thereon, and after deducting the expenses and discount on an issue of £750,000 4¼ per cent. debenture stock issued in January last. After the transfer now recommended by the directors as above, the reserve fund will amount to £553,000. The growth of the company's enterprise is indicated by the following figures:

Miles of Single Track in Operation.		Total Cars of All Classes.	
1909	97·74	1909	248
1910	141·65	1910	427
1911	233·65	1911	647
1912	285·75	1912	725
1913	357·82	1913	873

The number of passengers carried during the year was 71,973,822, an increase for the year of 9,819,656. The number of lamps in use at June 30th, 1913, was 920,916, an increase for the year of 185,490. In the monthly statement of earnings issued since the 1st July of the current year the actual profits of the subsidiary companies have been included in the total income. Owing to the practical completion of the hydro-electric installation at Lake Buntzen, it is now possible to ascertain with accuracy the cost of power. In the past the price charged to the railway for power by the Vancouver Power Company had to be fixed somewhat arbitrarily, owing to the continually varying amount of the capital invested in the hydro-electric installation. The railway has benefited at the expense of the power company, as the price charged was too low. This accounts to a large extent for the apparently unsatisfactory yield obtained by the company in the past from its investments in its subsidiaries. In June last Mr. Blundell Brown and Mr. Harvey paid a visit to British Columbia, and during a stay of nearly three months thoroughly investigated existing conditions and future prospects. They report very quiet conditions of trade in the province, and a noticeable reaction from the progressive prosperity which has been so marked a feature of the past ten years. They believe that the existing depression is almost entirely due to the prevailing stringent monetary conditions and that it will be dispelled by the return of confidence in Canadian undertakings and in the stableness of the market for Canadian securities resulting from the continuous adoption of careful methods of finance. The dam and other works at Lake Coquitlam, which have been under construction for three years, were completed in July last. The satisfactory construction of these works reflects the highest credit on Mr. Conway, the company's chief engineer, and on his assistants, and the directors are glad to take this opportunity of publicly acknowledging their valuable services. The completion of the dam marks an important epoch in the company's history, providing as it does an available reserve of over 57,000,000 k.w.h. of electrical energy. With the power secured from the Western Canada Power Company, referred to below, the company is now placed in an exceedingly strong position in this respect. The new power house at lake Buntzen has been completed, and the first of the three additional units to be installed therein is now in operation. The erection of the second and third units is being considerably delayed, owing to the difficulty of obtaining deliveries from the manufacturers, but it is anticipated that these units will be in operation during the early part of next year. As previously announced by the directors, a satisfactory contract has been entered into with the Western Canada Power Co., under which the company agrees to purchase a gradually increasing amount of power during the next twenty years. The extension of the Jordan river hydro-electric power installation has been proceeded with during the year. To secure the necessary water storage for supply to the additional units a permanent reinforced concrete dam of the Ambursen type has been completed. By the completion of this dam the total maximum available water storage is increased to 927,900,000 cubic feet, equivalent to a reserve of approximately 14,500,000 k.w.h. of electrical energy. The electric plant at Jordan river has at present a capacity of 12,000 h.p. A third unit is now in course of installation, bringing up the capacity to a total of 25,000 h.p., which is required to meet the demand in the city of Victoria and the surrounding districts. During the year the installation of the auxiliary steam plant, which at the date of the last directors' report was under construction at Brentwood bay, 12 miles from Victoria, has been completed and has a present capacity of 6,000 h.p. The plant has been designed on the most modern and up-to-date lines, and is held in reserve to meet the possible emergency of a breakdown in the other power plants of the company on Vancouver island. In June last the new Saanich suburban line was formally opened for traffic. Sir Richard McBride, the Premier of British Columbia, in the presence of a most representative gathering, performed the opening ceremony, and drove the last spike. The line, which is approximately 23 miles in length, runs as nearly as may be through the centre of the Saanich peninsula, and opens a very fertile tract of country hitherto without satisfactory connection with the City of Victoria. The directors again have pleasure in expressing their appreciation of the loyal and satisfactory services rendered by the management and staff in British Columbia.

Year ended June 30th.	Income after charging renewals maintenance.	No. of passengers.	No. of lamps in use.	Balance available for dividend.	Rate of div. paid per annum. Pref. ord. stock.	Rate of div. paid per annum. Def. ord. stock.	Amount taken to reserves.
1910 ..	226,803	34,476,801	439,315	139,391	6 %	8 %	108,765
1911 ..	302,993	46,541,448	563,542	198,455	6 %	8 %	158,571
1912 ..	385,846	62,154,166	735 426	257,670	6 %	8 %	197,391
1913 ..	401,836	71,973,822	920,916	256,242	6 %	8 %	196,911

Burmah Electric Tramways and Lighting Co., Ltd.

Mr. David C. Ellis presided on Friday, Dec. 5th, at the offices, 1, Queen Victoria Street, E.C., over the meeting of the company. He first apologised for the absence of Mr. E. C. Morgan, the chairman. The revenue account showed by far their best result for a year's working. The earnings, before setting aside any sum to reserve, amounted to £7,575, as against £3,748 for the previous year. This improved result was attributable to the increase in receipts from both traffic and light and power supply, and the saving in power generation expenses due to the use of the Diesel engine in the place of the steam set. Whilst congratulating the shareholders upon the improved results, and expressing the hope that this progress might continue, the extent of such improvement must depend upon a continuance of the generally good conditions which had prevailed for the past year. The company started without a penny of working capital, and it had been necessary to carefully husband its resources in order to reach the present position. As a consequence of this policy they would have sufficient funds in hand, after paying for the new Diesel set and the proposed dividend of 3 per cent., for current working capital, and subject, therefore, to the provision each year of a reasonable sum for depreciation, the balance will be available for distribution in dividend to the preference shareholders. The company's manager in Mandalay, Mr. A. C. Morgan, retired on the termination of his agreement, on the 31st October. Mr. Morgan joined the service at the commencement of the company's operations, as assistant manager, and since August, 1908, had been in charge. The directors desired to place on record their appreciation of the excellent services rendered by Mr. Morgan during the whole of this period. As the system was now thoroughly well organised, the directors had not filled the vacancy, and the duties in future would be carried out by their present chief engineer, Mr. A. H. Burbidge, under the title of chief engineer and manager. It had been their intention to transact the ordinary business of the meeting before dealing with the scheme put before the shareholders in connection with the arrears of preference dividend, but in view of the opposition to the scheme which had since developed among a number of the larger

shareholders who had lodged proxies representing £31,240 preference capital, sufficient to negative the resolution for carrying the scheme into effect, the board did not now consider it necessary to waste the time of the shareholders in holding the separate general meetings. He might add that they had received proxies representing £38,410 preference capital in favour of the scheme. They felt, however, that it was due to the shareholders, no less than to themselves, that they should give some further explanation of their reasons for putting forward the scheme, in view of the criticisms which had appeared in the Press suggesting that it was prepared in favour of the ordinary against the preference shareholders. In the first instance the object of the directors in dealing with the matter at all was to enable the company to start with a clean slate on its new career as a dividend paying concern. The proposed scheme might not be the best that could be evolved, but it was a genuine attempt to hold the scales evenly between the two classes of shares, and certainly, in their opinion, effected this object better than any of the alternatives that had been suggested to them. It was difficult in the small compass of a circular to set out the whole of the considerations dealt with, but shortly the position was this:—The preference dividend was in arrears eight and a half years, say 51 per cent. Under the articles the arrears of preference dividend ranked as capital on the sale of the business on liquidation or otherwise. The profits of the company to the 31st July, 1913, amounted to £7,575, and after providing for depreciation and renewals, there would have been left about £4,500 net profit available for dividend on the preference shares this year. The manager, in commenting on the year's working, pointed out that the improved result was to a great extent due to what he considered exceptional conditions, and warned the board not to anticipate a corresponding increase in the future. This warning was obviously given to prevent an exaggerated and unsafe estimate of the earning capacity of the undertaking being made. Under these circumstances, the possibility of the arrears of preference dividend being paid out of the earnings appeared remote, and consequently the chief value of these arrears consisted in the capital value provided under the articles. This value was preserved under the scheme. The net earnings of the company would have to show an increase of £1,500 above the profit made this year before the full interest of 6 per cent. would be available. There was no object in wiping out the arrears of interest if a further accumulation were to commence at once, and consequently it was suggested under the scheme that for the future the dividend on the preference shares should be non-cumulative, but in order that they should be entitled to receive the advantage of any exceptional profit that might be earned in any one year it was proposed that the interest should be increased from 6 per cent to 7 per cent. It would be seen, therefore, that under the scheme the capital rights to the arrears were protected and the preference shareholders would have received the whole of the net profit of the company in dividend unless the company should earn profits in the future far in excess of any estimate that could have been formed on the facts to-day. As he had already told them, the directors did not propose to put the resolutions set out in the notices, and they had decided that, under the circumsances, it would be better to let matters remain as they were for a year or two, in order that the earning capacity of the system might be more definitely ascertained.

Mr. F. C. Kennedy, C.I.E., seconded the motion.

Mr. Gaunt pointed out that the company had cut down its fuel bill by the installation of the Diesel plant, and it seemed to him that if they were to do anything with the company they must have savings in all directions. He had taken out the figures for the last six years in regard to the expenditure on cars and the electrical equipment of cars, and he found in six years it had cost £491 per car. This seemed to him enormous. When he drew attention to it before Mr. Morgan told him that the climate was such that it damaged everything, but he did think something might be done to lessen the outlay. He had come prepared to say some straight things about the scheme, but as it had been withdrawn there was no need to say anything.

Dr. Moody congratulated the board on the improved earnings of the company, and said he believed that the earnings in the current year were above those of the past year. He was glad the board had withdrawn the scheme, but regretted they did not do it earlier.

Dr. Pollan also expressed his feeling that the board had done well to withdraw the scheme. He knew something of the damage which the Indian climate did.

Mr. Fleming spoke at some length on the various suggestions which had been made for dealing with the arrears, and said that personally he had no objection to the scheme of the board. He felt that the preference shareholders ought to have control of the company, and that it would be a good thing if they could get a modern electrical tramway expert to join the board as the representative of the preference shareholders.

Mr. Clifford Johnson endorsed the suggestion of having an electrical expert on the board.

The Chairman said the board would take special care to enforce every possible economy. The cars were put on the road many years ago, and in a tropical climate they had to spend a good deal of money in keeping them up. The directors would give earnest consideration to the suggestions made, but as regards an electrical expert that would be an expensive matter, and he hardly thought an expert would give his time for the fees the directors received.

The report was adopted.

Replying for his re-election as a Director, the Chairman pointed out that the gentleman who had been appointed manager had had a thorough experience of electricity working in this country, and they had every confidence that he was perfectly up to date.

Melbourne Electric Supply Co., Ltd.

The fourteenth annual general meeting was held on Monday at the offices, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, p. 949), said that again he had to congratulate the shareholders upon the steady progress which the company was making. Last year he had to congratulate them upon what was really a record progress which he did not believe could be matched by any company in the world that he was aware of, certainly not in England or Australia, and one would hardly have expected that the progress for the past year would have equalled that of 1912. They would, however, see from the report that the past year had been a year of even greater expansion than its predecessor. When they came to think that in Melbourne every week during the past year they had rendered a supply available in two miles of additional streets, they would see the activity which had been going on in their mains extensions. They had an increase of nearly 56 per cent. in the number of consumers, which was nearly half as much again as the increase in the previous year. He did not think that any other company could show anything like an addition of 100 new consumers every week as they did. The power supply had increased by 28 per cent.; that again was very satisfactory, and owing to some revisions in the tariff which they had recently made, they were likely to secure in the future power consumers of a larger character. The figures showed how very closely the sale of current had increased with the increase in consumers; every new consumer had been an active consumer who had begun to take current from them. That expansion of business could not be conducted without further capital expenditure, and they had to spend considerable sums of money on the extension of the power house. They had put in two additional 5,000 k.w. turbines, which he believed were the largest units which had yet been established in Australia. The additional capital expenditure at Melbourne had been £140,154, whilst at Geelong, including the tramways, they had had to spend an additional £20,000, making their total capital expenditure during the year £160,000. If the present growth of business continued they would have to increase their capital outlay still further in the future. They had carefully considered the question, and at present their idea was to ask the shareholders to increase the capital by £300,000; £200,000 of which would be in consolidated ordinary stock, raising it to half-a-million, and £100,000 in 7 per cent. preference shares, raising them to a quarter-of-a-million. That would give them power to issue a further quarter-of-a-million consolidated debenture stock, which would enable them to energetically develop the business. In view of the fact that a large portion of the share capital was now held in Australia, they proposed to give such notice for the necessary increase of capital as would enable their Australian shareholders to give their opinions on the matter. They intended in the first instance to offer the new capital to the existing shareholders in proportion to their holding. With regard to the debenture stock they would adopt the same plan as last time, and offer the sum by cable to Australian shareholders in case they cared to take any. When the ordinary stock came along there ought to be a considerable profit to be made by taking it, and they would see to it that the Australian shareholders were given the chance of securing the benefit. They would see that the larger units of plant which they were now putting in, were securing larger economies in their works' costs, so that their net profits were more than keeping pace with the additional capital. Their profit during the last year from Melbourne and Geelong was £77,000, as compared with £56,000 the previous year, an increase of 37 per cent., or, to put it in another way, £21,000 more than last year on an additional capital expenditure of £160,000, all of which of course had not as yet become remunerative. Referring to the proposed addition of £5,000 to the general reserve, raising it to £60,000, the Chairman said it was their policy to create a general reserve, and not specifically allocate it for depreciation. The extraordinary growth of the business was clearly set forth in the tables in the report. In Melbourne the number of consumers had increased from 733 in 1904, to 13,571 last year; lighting in k.w. from 1,034 to 12,139; the motors in rated h.p. from 445 to 9,581; the total connections from 1,461 k.w. to 21,720 k.w.; the total units sold from 720,817 to 9,740,194, and the gross profit from £3,460 to £68,581. The same thing applied on a smaller scale to Geelong. There the number of consumers had increased from 330 in 1904 to 1,456; the lighting from 313 k.w. to 1,734; the motors from 297 h.p. to 1,846 h.p.; the total connections from 598 k.w. to 3,580 k.w.; the total units sold from 207,125 to 1,034,052, and the gross profit from £813 to £8,511. They had not yet been able to complete the tramway scheme in Geelong owing to various delays, but in spite of that fact they

had carried the whole population something like forty-two times over during the year, which was very satisfactory, showing that the tramways were being increasingly appreciated. He might say that they had 7 cars, 4 trailers and 3 motor 'buses, and the length of the track was about 4¾ miles. The total number of passengers carried was 1,074,000. When the track was finished, which they hoped would be very shortly, they were told that they might expect a very considerable increase in the receipts.

Mr. W. PARKER seconded the motion.

Mr. G. E. GOODHART said that he had come from Australia to voice the views of some of the colonial shareholders in regard to several matters affecting their interests. In the course of a long statement Mr. Goodhart said that the shareholders on the other side wished to have an assurance from the board that in the event of any further increase in the capital they should have a prior right to subscribe. The Australian shareholders would also be glad if in future they could receive notice of the meeting sufficient time beforehand to enable them to lodge proxies in London should they so desire. They would also like to know at what price the board proposed to issue the new stock.

The CHAIRMAN, in reply, said that he thought he had made it quite clear that in the issue of any fresh capital the present shareholders would have a prior right to subscribe. They could not at the moment expect him to say at what price the new shares would be issued, but he might say that their idea at present was to issue the ordinary stock at par, and with regard to the preference they might consider it their business to issue it at a premium. With regard to the other point raised by Mr. Goodhart, the board would consider whether it was possible to do as he suggested, but the difficulty was that their accounts did not close until August and they must hold the meeting sometime in December.

The report was adopted.

Costa Rica Electric Light and Traction Co., Ltd.

THE Directors' report for the year ended 30th June, 1913, says that the net earnings in Costa Rica, after charging all expenses incurred, amounted to £23,875, as compared with £22,034 for the previous year, being an increase of £1,842. The net surplus profit for the year was £7,338 (against £5,732 last year), and the directors propose to carry the whole of this amount to the credit of "Discount and Commission on Debenture Issues" account. The number of lamps installed in the lighting department increased by 10 per cent. during the 12 months, and the motor supply by 43 per cent. The power plant at El Brasil, inaugurated in December, 1911, has worked throughout the year without a hitch, and the second pipe line, referred to in last report, has been a great source of security in the continuity of supply. The machinery for the fourth 500 k.w. set is on order, and delivery is expected early in the coming year. The question of electrical cooking has occupied the attention of the board during the past year, and the directors hope that a considerable business will be built up in connection therewith. There are already 60 customers using electrical energy for cooking, and the number is increasing month by month. The management of the business in Costa Rica continues to give every satisfaction. During the year the gold premium has averaged 112¼ per cent., as against 112½ per cent. for the previous year. The general manager certifies that all buildings, machinery, plant, and permanent way, have been kept in good working order. The insurable buildings, machinery, and rolling stock are adequately covered against risk from fire.

The meeting will be held in London, next Monday.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS round the Stock Exchange cannot complain that they are being overworked. In fact, they have very good reason for a lament in the opposite direction. Consols keep on crumbling in uncomfortable fashion, although conditions in the money market are not as stringent as is usually the case at this particular season of the year, but at the same time, to wish a member of the Stock Exchange "A Merry Christmas" will be to invite reprisals, and this friendly hint is thrown out with a view to saving unpleasant consequences to well-meaning friends of the said members, who might be tempted otherwise to run into danger in their seasonable exuberance of sentiment.

The chief point of interest is that concerning the County of London Electric Supply Company's action with regard to the Bill which it intends to promote in next session's Parliament, upon modifications of the purchases clauses by the London County Council.

One enterprising newspaper early this week published most of the contents of a letter marked "private and confidential," which was circulated amongst the directors of the various London electric supply companies. Those who were acquainted with the contents of this letter before it went out were somewhat surprised to observe the excited manner in which it was served up to the public, and we wondered whether its publication was altogether calculated to assist the cause of those who consider that amalgamation between the various interests is a desirable thing. Put briefly, the idea is to establish a holding concern, into whose stocks the existing securities could be converted. Substantial economies and largely increased revenue are expected to result from such a combination, but at present the whole matter is so embryonic that even the discussion of its possibilities—save amongst the companies themselves—appears to be as superfluous as premature.

The Stock Exchange market remained unruffled and unenthused by the announcement. The prices of the leading shares are all firm. City of London Ordinary and County of London Ordinary have assumed the lead in the market at the present time, and the former rose to 17 buyers, upon quiet absorption of a few score of shares, although afterwards sellers came in at this price. County of Londons rose ⅛, and Brompton Ordinary and Preference both improved. The feature in the provincial list was a further rise of 15s. in Hove shares, the price jumping to 9.

Inquiries as to whether it would be possible to obtain lines of shares in the London undertakings—the suggestion being, of course, that there might be an Electric Trust Company on the horizon—did not stimulate prices. We seem to remember having heard of such inquiries upon former occasions.

The Railway market unsteadied again because of the recrudescence of labour difficulties, while a further drop in the price of Consols militated against the market. Support was forthcoming, however, and on the week the changes show little significance. Districts fell ⅜ to 30¼, thus shedding more than their previous rise. Underground Electric Railway shares are lower, and the company's 6 per cent. Income Bonds eased off to 89. Gains of a point occurred in the Assented stocks of the Central London Railway, which had no effect upon the quotations for the non-Assenting. The Tramway group is very quiet, and not a change worth mentioning has taken place for the past week or so. The Yorkshire (West Riding) Electric Tramways has declared a final dividend for the year on its 5 per cent. Preference shares, making 4 per cent. for 1913.

Mexican news unsettled the prices of most stocks and shares connected with the country. A good deal of exasperation is felt with President Wilson at the way in which he has handled the Mexican crisis. The opinion is freely expressed in the City that, had he recognised General Huerta at the start, and given him a certain amount of backing, the revolution would have been over long before this, and the country settled down to more normal conditions. Instead of which, affairs appear to be in a more chaotic state than ever.

This is reflected in sharp falls in Mexican Light and Power issues, and in Mexico Tramways shares, the falls ranging from 1 to 3½ points. Paradoxically, Monterey Debentures are better at 60½. The Latin-Canadian group, as a whole, tends to heaviness. Shawinigan Water reacted to 137, and there are small falls in various bonds connected with this group, although Rio de Janeiro Tramway bonds are strong. Brazilian Tractions have gone back on a further severe drop in the prices of Brazil Rails. Anglo-Argentine Trams are a better market, small rises being marked in the First Preference and in the 5 per cent. Debenture stock. The report of the British Columbia Electric Railway Company came as a sharp disappointment, the net profit being substantially less than had been expected, and the Deferred and Preferred Ordinary have lost 3 and 1 points respectively.

Telegraphs and Telephones are irregular. American "Tel. and Tel." fell 10 points on New York rumours that the 8 per cent. dividend may be reduced. New York Telephone bonds drooped slightly. On the other hand, Anglo-American Telegraph Deferred rose ½ on a revival of speculative interest; the price carries the full dividend of 1½ per cent. payable next February. Globe Ordinary and Preference, both *ex* dividend, are firm, especially the latter. Marconis advanced on the declaration of an interim dividend of 2s. per share, and the Preference hardened in sympathy. Canadian Marconis remain steady at 9s. 6d.

Willans & Robinson Preference rose another 7½ points, and the company's 4 per cent. Debenture stock is up 4. It is argued that the undertaking should now make good progress under its reorganised capital. Castner-Kellners are *ex* the dividend of 2s. 8½d. India-Rubber shares lost another 10s. The raw rubber market remains unsatisfactory from the sellers' point of view, and share prices are mostly dull and depressed.

Continental.—FRANCE.—La Société Electrique de Perrosguires is the name of a new company, which has lately been formed in Paris (157, Boulevard Periere), with a capital of £4,000.

RUSSIA.—A new company has just been formed in Paris with a capital of £1,000,000, and the title La Société Industrielle d'Electricitè pour la Russie.

AUSTRIA.—The balance-sheet of the Vereinigte Elektricitäts Gesellschaft, of Vienna, for the last financial year shows a net profit of £33,425, as compared with only £31,037 in 1911-12. The dividend is being increased from 6 to 6½ per cent.

SPAIN.—At the last meeting of the Compañia Barcelonesa de Electricidad, the capital of this society was increased from 18 to 40 million pesetas, by the issue of 44,000 new shares of 500 pesetas value, which have since been all taken up by the Canadian group.—*Electron.*

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 16th.	Rise + or Fall −	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8¾ — 9¼	+ ⅛	4 9 9
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	+ ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	−1	4 6 0
Charing Cross, West End & City	5	5	5†	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	+1	4 11 9
City of London, Ord.	10	9	6†	16¾ — 17¼	+ ¼	5 1 5
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	5	5†	11¾ — 12¼	+ ⅛	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104½ — 105½	..	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/8 — 7/8	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	8¾ — 9¼	+ ⅜	4 17 9
Kensington & Knightsbridge, Ord.	5	[illegible]				
Do. 4 % Deb.	[illegible]					
Kent Elec. Power, 4½ % Deb. ..	[illegible]					
London Electric, Ord. ..	[illegible]					
Do. 6 % Pref. ..	[illegible]					
Do. 4 % First Mort. Deb. ..	[illegible]					
Metropolitan	[illegible]					
Do. 4½ % Cum. Pref.	[illegible]					
Do. 4½ % First Mort. Deb. ..	[illegible]					
Do. 3½ % Mort. Deb. ..	[illegible]					
North Metropolitan Power Sup. Co., 5 % Mortgage (Red.)	[illegible]					
Notting Hill, 6 % Non-Cum. Pref.	[illegible]					
Oxford	[illegible]					
St. James' and Pall Mall, Ord. ..	[illegible]					
Do. 7 % Pref.	[illegible]					
Do. 3½ % Deb.	[illegible]					
South London, Ord. ..	[illegible]					
Do. 5 % First Mort. Deb. ..	[illegible]					
South Metropolitan, 7 % Pref. ..	[illegible]					
Do. 4½ % First Deb. Stock ..	[illegible]					
Urban, Ord.	[illegible]					
Do. 5 % Cum Pref.	[illegible]					
Do. 4½ % First Mort. Deb. ..	[illegible]					
Westminster, Ord.	[illegible]					
Do. 4½ % Cum Pref.	[illegible]					

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	+ ⅛	5 11 7
Calcutta, Ord.	5	8½	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	108 — 112	..	7 2 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	1/8 — 3/8	− 1/8	7 12 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½ xd	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	[illegible]	94½ — 96½	— ½	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	1/32 — 1/16	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	[illegible]	102½ — 104½	..	4 15 8
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	43 — 47	−5	8 9 6
Do. 7 % Cum. Pref.	$100	7	7	78 — 83	−3	8 8 6
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	−1	6 3 5
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	58 — 63	+3	7 16 0
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	19 — 20	−5	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	101 — 103	+2	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	100 — 102	+1	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	135 — 139	— 1	4 6 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ — 107½		4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	97½ — 99½	— ½	4 11 5
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 98 xd	−2	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	1/16 — 3/16	— 1/32	6 17 3
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	[illegible]	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	114 — 117	−10	6 16 9
Do. Collat. Trust	$1000	4	4	87 — 90	−1	4 9 [illegible]
Anglo-American Telegraph ..	Stock	3	3	63 — 66	+1	4 11 0
Do. 6 % Pref.	Do.	6	6	105 — 106	+ ⅛	5 13 9
Do. Def.	Do.	80/-	..	24⅜ — 24⅞	+ ⅛	5 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	[illegible]	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7⅞ — 7⅞	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	[illegible]	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6½ — 7½	..	6 18 0
Direct United States Cable ..	10	4	4†	6½ — 6⅝	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 — 127	..	[illegible] 10 3
Do. 8½ % Pref. Stock	Do.	8½	8½	76 — 77	..	[illegible] 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	[illegible]	94 — 96	..	4 8 4
Globe Telegraph and Trust ..	10	[illegible]	6†	10⅜ — 11⅛ xd	..	5 7 10
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜ xd	+ ⅛	4 18 0
Great Northern Telegraph ..	10	[illegible]	5†	80½ — 82½	..	6 2 8
Indo European Telegraph ..	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	[illegible]	79 — 83	+1	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	10†	8 7/16 — 8 9/16	+ 1/16	5 12 4
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅜ — 2½	+ 1/16	5 18 1
Monte Video Telephone, Ord. ..	1	6	[illegible]	¾ — 1	..	6 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	6 3 [illegible]
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	— ½	4 11
Oriental Telep. and Elec. ..	1	[illegible] 10	10	1¾ — 2	..	5 0
Do. 6 % Cum. Pref.	1	6	6	1 5/16 — 1 7/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1
Reuter's	10	10	10†	8½ — 9½	..	10 16
Submarine Cables Trust	Cert.	6	6	122½ — 123½	..	4 18
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 13 1
United River Plate Telephone	5	8	[illegible]	6⅞ — 6⅞	+ ⅛	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 [illegible]
Do. 4 % Debs., 1 to 1,500 guar. by Brazil. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	1½	2 1/16 — 2 3/16	..	4 13 7
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ — 10¼	..	5 17 [illegible]
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	[illegible] 6 4
Do. 5 % Debs.	100	5	[illegible]	98 — 100	..	5 0 0
Western Telegraph, Ltd. ..	10	7½	7	12¼ — 13½	..	5 5 [illegible]
Do. 4 % Debs.	Stock	4	[illegible]	93 — 95	−1	4 4 3
Western Union 4½ % Fdg. Bonds	£100	[illegible]	[illegible]	93 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 16th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	1 1/16 — 1 3/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10 — 12	..	..
Do. Do. Deferred	100	..	..	4 — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	84 — 87 xd	..	6 18 0
Do. 7 % Non-Cum. Pr'f.	100	3	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	+1	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	+1	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	+1	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼ xd	..	6 13 4
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	3/16 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	½ — ⅝	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	..	6 7 0
Metropolitan Railway Consol.	100	1⅜	1½†	43¼ — 43¾	..	3 14 3
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30 — 30½	— ¾	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 0
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South-Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3 3/32 — 3 5/32	— ¼	Nil
Do. "A"	1/-	..	..	1/32 — 15/32	—3/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	88½ — 89½	— ½	6 14 1
Yorkshire (West Riding). Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	4†	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 5/8 — 4 7/8	+1/16	5 17 4
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 7 0
Do 5 % Deb.	100	5	5	97 — 99	+ ½	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	101½ — 103½	..	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86½ — 88½	—1½	6 15 7
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7⅝	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	111 —115	—3	6 19 2
Do. Pref. Ord.	100	6	6	102 —106	—1	5 13 2
Do. 5 % Pref	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7⅓	5†	5 7/8 — 6 3/8	..	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	N
Do. 5 % A Deb.	100	5	5	85 — 90 xd	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	..
La Plata Elec. Trams, Ord.	1	..	..	3/16 — ½	..	..
Do. Pref.	1	4 3/8d.	6	⅛ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅜ — 1⅝	..	4 7 3
Do. 6 % Pref.	1	6	6	1 5/8 — 1 13/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	84 — 86	—1	5 16 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	74 — 76	—4½	9 4 2
Do. 5 % Bonds	..	5	5	80 — 85	—1	5 17 8
Do. 6 % Bonds	100	5	6	81 — 83	—1½	7 4 7
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅜ — 6¼	..	8 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Perth (W.A.) Elec. Tr., Ord.,	100	5	5	94½ — 96½ xd	..	5 3 8
Rangoon El. Tr. & Sup., Pref.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Do. 4½ % 1st Deb.	5	5	6	5⅛ — 5⅝	..	5 6 8
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	100	4½	4½	96½ — 98½	— ½	4 11 5
Do. 5 % Mort. Bonds	..	5	5	100½ — 102½	+ ½	4 17 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	100	5	5	90 — 92	+ ½	5 8 9
Singapore Trams, 5 % Deb.	$500	5	5	100 —103	+1	4 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Un. Elec. Trams Monte Video	100	5	5	93 — 95	..	5 5 3
Do. 6 % Pref.	5	7	7	4⅜ — 5⅛ xd	..	6 16 7
Do. 5 % 1st Deb.	5	6	6	4⅞ — 5¼ xd	+ ⅛	5 14 3
Winnipeg Elec. Rly., 4½ % Deb.	100	5	5	93½ — 96½	..	5 8 8
	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 11/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝ — ¾ xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2 13/16 — 2 15/16	..	5 8 11
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	93½ — 96½	+ ½	5 3 8
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1 1/16 — 1 1/4	—1/16	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb.	100	4½	4½	85⅞ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10⅞ — 11½	..	6 13 4
Do. Pref.	5	5	5	4 7/8 — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	3 1/16 — 3 3/16 xd	..	5 18 7
Do. Deb.	100	4½	4½	104 —107	+2	4 4 1
Crompton & Co., Deb.	100	5	5	68 — 73	+1	6 17 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16 — 11/16	..	7 5 6
Do. Pref.	1	7	7	1 5/16 — 1 7/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6⅞ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	7½	5	12 — 13	— ½	5 15 5
Do. Pref.	10	5	5	9¼ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	59 — 63	+4	6 7 0
Do. B 4 % Cum. Pref.	100	..	..	35 — 40	+7½	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 2nd, 1913.

THE PASSIVE STATE OF METALS.

At a recent meeting of the Faraday Society a general discussion was held on the subject of the "Passivity of Metals." The subject was introduced by Mr. S. G. Senter, who reviewed the various theories that have been put forward to explain the mysterious phenomenon of the passive state from the time of Faraday onwards, and a group of seven papers was then read and discussed, in which every aspect of the subject received careful and critical consideration. Dr. G. Grube, representing the very active physico-chemical school of Dresden, read the first paper, and other papers read or communicated, were by Dr. H. S. Allen, Dr. D. Reichinstein (Zurich), Prof. M. Le Blanc (Leipzig), Prof. G. Schmidt, and Dr. W. Rathert (Münster), Prof. Günther Schulze, of the Reichsanstalt, and Prof. E. P. Schoch (Texas). The discussion brought forth an excellent little supplementary paper from Dr. E. K. Rideal, one of our youngest recruits in the field of electrochemical research. The complexity of the subject, complex in spite of the apparent simplicity of its basic phenomena, makes it impossible to do justice to the discussion in the small amount of space at our disposal, and we must content ourselves with the briefest possible outline of the present state of our knowledge as put forward at the Faraday Society meeting. For this no apology is needed, even in a purely electrical journal, for the mechanism of the passive state, whatever it be, has the closest possible relation to the mechanism of electrolysis generally, and it is no exaggeration to say that a complete understanding of the one will throw a flood of light on the still more intricate and perplexing problems that cluster round the other. To the practical man even more, for it will lead him to understand what corrosion is, what determines it, and how it can be prevented; for what is a non-corrodible steel or ferro-alloy, for example, but a metal in a permanent state of passivity?

The simplest and best known example of passivity, and the one that was first discovered, namely by Keir, in 1790, is the fact that ordinary iron which is vigorously attacked by dilute nitric acid is not only unacted upon if immersed in strong nitric acid, but is subsequently rendered immune to the action even of the dilute acid. The first theories put forward, and still largely held, were that the "passivity," as Schönbein called it, was due to the protective action of a close, invisible film of oxide, or as Faraday with his usual perspicuity was careful to add, "that the superficial particles of the metal are in such relation to the oxygen of the electrolyte as to be equivalent to an oxidation." The meaning and suggestiveness of this pregnant phrase do not appear to have been properly appreciated until Hittorf began, in his experiments on passive chromium, to lay stress on the electrochemical aspects of the problem. Stated in electrochemical terms, passivity may be defined as a state of anodic polarisation which shifts the metal up the electrochemical scale in the direction of the so-called "noble" metals. In other words, a higher potential is necessary to drive a given current through a metallic anode in the passive state than when it is in the active state. Stating it thus one is easily led to the Le Blanc standpoint that passivity is not an absolute but a *quantitative effect*, namely the *retardation* of some chemical or electrochemical reaction. The experimental work of Professor Foerster and his pupils at Dresden, put forward by Dr. Grube, throws much light on and strengthens greatly the value of this conception, for they have shown that the kathodic deposition of the metals of the iron group, in itself a slow process, was further considerably retarded by the simultaneous deposition of small quantities of zinc or hydrogen. What happens at the kathode gives a key to what may happen at the anode, lending support to the view that the retardation of electrolytic action at an anode when in the passive state is due to the formation in it of alloys of oxygen, which it is imagined have a lower solution pressure than the pure metal. Such retardation of anodic discharge has been observed when halogen salts are electrolysed with platinum anodes under conditions that give rise to the deposition of oxygen; also there is evidence that the formation of alloys of platinum and oxygen brings about the retardation.

Interesting support was given to the oxygen-alloy, or oxygen-film theory of passivity by Dr. H. S. Allen, whose experiments in photo-electric activity (the dissipation of a negative charge by means of light) have shown that iron which was chemically active, was active in the photo-electric sense, while passive iron shows greatly reduced photo-electric activity. Now the existence of photo-electric fatigue, points unmistakably to the presence of a film of gas on the surface of the metal, and the connection between the two sets of phenomena may therefore be taken as affording weighty evidence in favour of the oxygen theory.

The old oxide-film theory, which supposes that the passive metal is merely mechanically protected from the action of the acid, or more generally, the electrolyte, finds few supporters nowadays, as some of the properties of passivity, such as its destruction by heat, and the fact that no alteration in reflecting power has been detected where an active metal is rendered passive, seem inexplicable on the oxide-film hypothesis. Where an oxide-film does form it is generally held to be a result, rather than the cause of passivity.

An ingenious theory that has been suggested as a rival to those already considered is that of Le Blanc himself, explained with exemplary lucidity in a paper he sent in to the meeting. According to the current conception of electrode action associated with the name of Nernst the primary reaction taking place when a metal is planged into an electrolyte is the dissolution to a limited and very minute extent of the metal in pure—of the electrode to form metallic ions or cations. These ions, however, are not free, but immediately unite with the solvent to form hydrates. If the essential reaction, namely water-combination be a slow one, the action at the electrode will be retarded, and it is this retardation which gives rise to anodic polarisation or passivity. The weakness of this theory is that we have no independent evidence that ionic hydration is so slow a process as the theory demands.

An alternative theory of Le Blanc is based on the view that the primary electrolytic action at the anode is not the formation of metallic ions, but a discharge on to the electrode of negative ions (anions) from the solution, much on the lines imagined long years ago. This secondary chemical discharge is instantaneous, but the effect usually the interposition between the discharged radicle and the metal, ought to be retarded under certain conditions, and if so this retardation would be the explanation of passivity. Much the same theory was favoured by Professor Schoch, who in his communication pictured the retardation somewhat as follows. When the current density at the anode exceeds a certain limit its surface will be covered with discharged ions and the necessary further anions to the surface will be impeded. From a study of the structure of aluminium anode films, as put forward by Prof. Günther Schulze, Schoch supposes that the complex ions which are prevented from reaching the surface of the anode will be dissociated and oxygen ions formed from them. These are discharged upon the anode and either an oxide or an oxygen film then forms upon its surface.

An altogether different conception of passivity was that put forward by Dr. G. C. Schmidt, whose theory is that the passive metals are normally so, only becoming active in the presence of some catalyst, of which the most important known is hydrogen, since it is dissolved readily and in large amounts by metals. Experiments described were claimed to show that metals may remain passive in the absence of oxygen, such as polishing in an atmosphere of hydrogen and nitrogen, and determining their potentials at once, although these experiments can hardly be regarded as conclusive in view of the known enormous tenacity with which air clings to ordinary metal sheets and the well-nigh impossibility of removing the gaseous films. Nor can the further ingenious experiments made by Dr. Schmidt, in which he has shown that hydrogen ions diffusing through passive iron and chromium activates these metals, be considered any more conclusive, for the original passivity might still have been due to the presence of oxygen or oxide films.

On the whole then it must be said that one result of the interchange of views that took place at the meeting was decidedly to strengthen the position of those who hold the oxygen film or oxygen alloy theory of passivity, and although in some cases actual oxidation takes place this is more probably a result than a cause of the initial passivation due to the presence and action of oxygen.

Between the afternoon and evening sittings for the discussion began at 5 p.m. and did not terminate until after 10 p.m.—specimens of passive irons and of non-corrodible steels and other ferro-alloys were exhibited by Sir Robert Hadfield (represented by Mr. S. A Main), Dr. J. Newton Friend, Mr. Robert Lennox, and Mr. John Evans. Mr. Lennox's very interesting alloy is called Tantiron, and is a hard, close-grained, silver-white alloy, melting at about 1,400°C. It neither rusts nor oxidises, and it is not attacked by ordinary corrosives to any marked extent. Some of the castings shown were portions of nitric acid plants. Mr. Evans showed an autoclave that had been used for distilling strong acetic acid, made of a French alloy called "Metalline," the invention of M. Jouve, of Paris. The composition of neither of these alloys was stated, but they are believed to consist largely, if not entirely, of ferro-silicon. Among the most interesting of Sir Robert Hadfield's specimens were some chippings from the famous Iron Pillar at Delhi, erected probably some 1,600 years ago, and which during this long period has shown extraordinary resistance to atmospheric corrosion. It is made of almost pure wrought iron.

APPLICATION OF ELECTRICITY TO AGRICULTURE AND LIFE.

The commercial possibilities of plant and chicken electroculture, and of the electro-destruction of blight and bacteria by high-frequency electric current, formed the subject of a paper read by Mr. T. Thorne Baker before the Royal Society of Arts on December 10th. The author referred to Lemstrom's classic researches and reviewed the methods employed and the results obtained by the Lodge-Newman system, with which much work has already been done in this country. The cost of a 25-30 acre equipment complete is £200, but £300 covers the total cost of a 60-acre installation. The U.S.A. and the Egyptian Department of Agriculture are at

present engaged in experiments with the Lodge-Newman system. Results obtained during the hot dry summer of 1911 led the author to believe that high-frequency alternating current would, in some cases, give better results than purely positive discharges from overhead wires.

The author finds that the upper portion of a living plant is negatively and the lower part positively charged, the plant generating in fact a few millivolts e.m.f. It is suggested that the hairs on the leaves and stem of the negatively charged part of the plant collect positive atmospheric electricity—the actual amount collected being very small. The mistake most frequently made in artificial electro-culture is that of employing too powerful a current. Every plant and organism demands carefully selected and graduated treatment.

The effluve discharge from a resonator coil appears to have valuable germicidal properties. If gooseberry bushes infected with red American blight are sprayed with a soluble sulphide and then treated with a high-frequency effluve, nascent sulphur is produced and this kills the blight. Cheese mites can readily be killed by the discharge from an Oudin resonator, but the black fungus which attacks Norwegian dried cod only suffers temporary inhibition, and then grows with every evidence of stimulation after treatment by an effluve discharge.

Up to one or two milligrammes of radium is contained per ton in the residual waste thrown out by radium works, and this material mixed with many times its own weight of ordinary soil is said to accelerate and increase materially plant growth. The recently evolved process for the preparation of radium from carnotite should provide an ample supply of "radium refuse," and the author estimates that the cost of treating land suitably with radio-active material should not exceed 10s. to 15s. per acre. The treatment would retain its efficacy for a number of years. Too great radio-activity is harmful.

In the author's opinion, the most profitable application of electricity to the farm is in rearing chickens. A coil yielding a 1-inch spark is sufficient for the simultaneous "electro-culture" of 1,000 chickens. On Mr. R. Meech's poultry farm at Poole, a chicken house consisting of six flats, each large enough to accommodate 75 chickens, was electrified by a helix of heavily insulated wire wound round it in turns about six inches apart. High-frequency current was applied for ten minutes in each hour of the day. Out of a total of 400, only six chickens died (1.5 per cent mortality) and the birds were ready for market in five weeks as against three months. A chicken grown under the influence of electricity will grow of normal weight with only two-thirds the normal amount of food; or with the full amount of food, it will grow from 33 to 100 per cent. heavier than normal. It is said that during treatment the birds are so highly charged that sparks can be drawn from their beaks and a distinct shock felt on touching them. Experiments are at present in progress on a batch of 4,000 birds, and on several complete generations (egg to egg). The results so far obtained appear to be extraordinarily successful, and we await further reports with keen interest.

In opening the *Discussion*, the chairman (Mr. Campbell Swinton) emphasised the importance of this field of research, and pointed out the great difficulty encountered in distinguishing electrical from purely mechanical, physical, or chemical effects. Mr. Newman referred to the practical difficulties encountered in applying electric stimuli to small test areas and the difficulty of establishing a reliable "control." High-tension continuous-current discharges had now been used for over eight years, and good results had been obtained fairly consistently. In a few years' time, Prof. Priestley would be able to tabulate the results of his wide researches, and the action, effects and commercial value of electro-culture should then be definitely established. Other speakers referred to the difficulty of interesting agriculturists in scientific apparatus and measurements, and emphasised the severely commercial basis on which electro-culture would always be judged. It was mentioned that four or five years ago, President Diaz's son erected a hydro-electrical plant in Mexico, and obtained from 17 per cent. to 70 per cent. increase in yield of various crops by the application of electro-culture over a wide area.

THE CHARACTERISTICS OF INSULATION RESISTANCE.

On Tuesday, December 2nd, the paper read by Mr. S. Evershed was discussed by the Manchester Local Section of the Institution of Electrical Engineers.

Mr. Welbourn referred to the curve for cotton showing the relationship between megohms and potential difference, of which the lower part was under investigation; this matter had attracted a good deal of his attention, and he suggested that the curve began to turn owing to the dispersion of moisture and subsequent rise in current density in the leakage paths causing charring, which ultimately caused breakdown. The common practice of measuring the insulation of absorbent materials after one minute's electrification was only to be regarded as a qualitative test, because of the limiting factors of time and space. He did not see what test could be substituted for the flash test in the case of an absorbent insulator which was required to withstand the pressure rises to which electric circuits were subjected.

Mr. A. P. M. Fleming said he presumed that the measurements had been made at a constant temperature, because one often found engineers making insulation resistance measurements on machines quite irrespective of temperature, unaware of the fact that a few degrees difference in temperature might alter the insulation resistance one hundred-fold. Some ten years ago, buyers of electrical machines measured everything by the number of megohms, and makers were called upon to show 20 or 200 megohms according to the ideas of the buyers. To do this the makers would dry the machines by heating until the insulation resistance was good enough and sometimes until all the nature had been taken out of the insulating material. To-day the counterpart of those machines would undergo no such test, and the insulation, if measured at all, would be found to be probably of the order of a megohm or less according to the size and voltage. A machine under those conditions was likely to run just as safely and have a far greater length of life.

Prof. Miles Walker agreed with a previous speaker that the puncture test was a very useful one. A surprising feature of the tests was the small amount of the total water which actually took part in the conduction. He could not see why the ratio should remain practically constant at about 2; one would expect to find it variable. Why should the capillary tubes used by the author give the same constant as the microscopic capillaries in cotton? If the author could explain why the co-efficient remained constant it would show more than the curves themselves. Curves of the character shown could be explained in a number of different ways. It was known that the conductivity of an electrolyte was due to ionisation, and it was supposed that if water could be obtained sufficiently pure, it would be an insulator. London water was comparatively full of ions, its conductivity being much greater than that of Manchester water, and it was of interest to know whether the blotting pad used in the experiments had been moistened by steam carefully prepared. If the author's theory were true, it would appear that water of lower conductivity would show increased insulation resistance. He felt that it did not depend particularly upon the purity of the water forming the films so much as on the action between the water and the material, setting up some form of ionisation and forming a conducting layer. Hysteresis could only occur when dealing with two elements which constituted energy; megohms and volts did not constitute energy, therefore the author's curve was not a hysteresis curve.

Mr. J. S. Peck asked how long a time elapsed after the voltage was applied before the resistance measurement was taken; he understood from Mr. Welbourn that if a certain voltage was applied to a cable and left on for a time, the resistance gradually dropped. Referring to the cotton curve, he asked whether, after the critical point had been passed and the voltage was maintained at 1,000, the insulation gradually dropped to zero. With regard to the barbaric flash test, it was always advisable to try the apparatus with a Megger or other indicating device in order to be fairly sure that the insulation was good before applying the flash test. If a machine tested out lower than usual with the indicating instrument, means should be adopted to clean or dry out the apparatus before applying the flash test.

Mr. C. J. Beaver said pressure tests consisted of either the application of a very high pressure for a short period (flash test) or a high pressure for a long time. It was not uncommon in the case of a cable that was going to break down, to find that the breakdown would occur within the last five minutes of the pressure run. In such cases the long high-pressure test had an advantage over the flash test. Contrary to the author's assertion, cable makers could get dry paper, and did get it. The great conclusion to be drawn from the author's paper was that absorbent insulators had their limits, as indicated by the curve. When the length of the time joining the first and second parts of the curve could be prolonged the condition was a happy one, as the moisture which got in could be driven out.

Mr. W. Cramp opposed Prof. Walker's remarks on "hysteresis"; the word simply denoted "lag," and had been dragged into connection with energy without any justification whatever. The author's denunciation of the one-minute electrification test might be sufficient to change entirely the tests on cables and machines, but he would like to know of an alternative. Notwithstanding the author's remarks concerning leakage at fittings being everything and leakage in the cable nothing, it remained necessary that cable should be tested in a manner to make sure that no conducting particles were present in the dielectric. The speaker agreed with Prof. Walker regarding the shape of the curves. In capillary tubes the spaces between the dormant masses were filled with vapour of the liquid, and since vapour conducted there was reason to suppose that this was a path for current as well as the films on the sides. If the conductors of a dynamo were enamelled before being otherwise insulated, would it not help to solve the problem which the author put forward?. The speaker recently received a motor stipulated not to exceed 75° Fah. rise in temperature. Actually the temperature rise was 94° Fah., and the reason was given that since the motor was intended for use in a

damp place, it had been designed with this temperature rise to counteract the atmospheric conditions.

Mr. Cunliffe thought it probable that the constant obtained by the author was due to the presence of water in the insulating medium. Would the same curve be obtained if a solution of a salt such as sodium chloride was used? He had conducted experiments on a tube containing dry sand with an electrode at each end. Plotting resistance against time, a curve was obtained which fell at first and then rose again, in direct opposition to the author's curve. When using moist sand it was also found that the potential gradient curve was straight at first and finally similar to the author's curve owing to the effect of endosmose. The shape of the curve also depended upon the polarity.

The Author, in reply, said that the current density in the films was so extraordinarily small that C_2R was measured in millionths of a watt in the whole insulator. Samples were purposely selected which did not give large C_2R losses, in fact the heating was never noticeable. All the tests were taken at a constant temperature. No doubt, in the second part of the curve, heating commenced to be a somewhat serious matter. Mr. Welbourn had suggested that ultimately the films got hot and charring took place; this was certainly a possible explanation, but another solution was the formation of brush discharges. The author was not disposed, however, to answer this question definitely before making further experiments. Regarding the time taken in the moisture curve tests, so long as the capacity current was allowed to die away steady readings were obtained. The author did not object to the "one-minute electrification" test; probably as a comparative test it proved what was intended to be proved. The objection to the flash test was that it was a blind test. High-pressure tests were necessary on all electrical apparatus, but it was always necessary to have an indicating instrument in circuit. A Megger testing set was being tested to 3,000 volts; when the pressure reached 1,500 volts a leakage was indicated by the indicating instrument, and had this instrument not been in circuit the Megger would probably have left the factory only to be returned faulty after being in use for a short time. Surface films were very difficult to experiment upon, owing to their instability. A moisture curve was only obtainable when there were drops on the surface of the insulator. It was an extraordinary fact that, notwithstanding that different insulators were used, the curves were practically alike. The results seemed to point to some extraordinary law between endosmose and surface conduction. Regarding the pad experiment, the purest paper obtainable was used, so that it should not contain anything to increase the conductivity of the water. One of the reasons for using London water was that the existence of ions would overpower any effects from the paper itself. Distilled water had been tried, but discarded on this account. Regarding Mr. Beaver's remarks that cable makers did obtain paper entirely free from moisture, another speaker had stated that when moisture was absolutely removed from paper, the paper became very brittle. The author agreed with Mr. Cramp concerning the definition of "hysteresis." In view of the possibility of some of the current passing through the vapour in the bubbles, it was interesting to note that the effect was still produced with as low a potential gradient as one volt per cm. Mr. Cunliffe's experiment with sand was well known as demonstrating the effect of endosmose at the positive electrode. When the water in the sand was uniformly distributed, the potential gradient was uniform, but as the water was driven away the curve changed entirely. This procedure could be carried on until perfect insulation was obtained.

CO-OPERATIVE CONTROL OF ELECTRIC SUPPLY UNDERTAKINGS.

By R. A. CHATTOCK.

The recent report of Sir Francis Oppenheimer, Commercial Attaché to His Majesty's Embassy at Berlin, upon "The Supply of Electricity in Germany by the Chief Works in which Private Concerns and Public Bodies are jointly interested," has given food for very serious thought upon this most important subject.

The use of electrical energy for light, power, heating, domestic requirements, and traction by rail, road and tramway, is being extended year by year at an extraordinarily increasing rate even at the present prices per unit. Especially is this the case with power supply for manufacturing purposes, whilst there is evidence of an enormous development in the near future in connection with the electrification of our railways, both suburban and main lines.

The welfare of the whole community depends upon the commercial prosperity of the country; in other words, upon our manufactories.

The life-blood of the manufactories is cheap power, and they are also enormously affected by cheap transit both of goods and workmen.

It therefore behoves all electric supply undertakings to strive for and obtain this one object if they are to justify their existence. Cheap electrical energy is vital to the whole country, and the supply of this should, therefore, never be exploited with the object of earning large profits and paying large dividends.

This economic truth is the real reason underlying the various changes that have taken place during the past 20 years in the methods of controlling electric supply undertakings.

Let us now consider what has been already done in this country, and compare this with what has happened in Germany as described in Sir Francis Oppenheimer's report.

In the early days, electric supply was confined practically to lighting only. Power supply gradually grew, the load factor of the supply was improved, and the cost of production was in consequence reduced, with the result that the price per unit of the current sold was also reduced. This process has gone on until the demand of the large industrial areas has called into being the large power stations and supply systems—some municipal and some company controlled—that are at present dealing with this demand.

In the London area, competition between two or more undertakings in the same area was tried in the early days with the object of cheapening the cost to the consumer. This has not proved more than transiently beneficial, as is shown by the better results that have been obtained by undertakings that are not subjected to competition. It would appear obvious that duplication of stations and mains in any area must have the effect of preventing that reduction in the cost to the consumer which should be the ultimate aim and end of all such undertakings. Competition, however, undoubtedly helped along the general cheapening of the supply at that period.

After the way had been indicated by these early ventures, the various municipal authorities in the country began to recognise the possibilities contained in this new industry; to some of them, unfortunately, the prospect of making large profits, which could be applied to the relief of the rates, was the chief inducement. This consideration has to no small extent interfered with the chief object of all electric supply undertakings, viz., the giving of the cheapest supply possible to the community. Many municipalities, however, have recognised the extreme importance of this point, and are developing their undertakings on sounder lines; they are realising that a cheap and efficient supply of electrical energy is one of the prime necessities of their well-being. On it depends their very existence, for without it the manufacturers will be driven elsewhere, and the workmen, who represent so large a part of their population, will be forced to go with them.

It has recently become the fashion to adversely criticise municipal undertakings, and to assume that power companies are going to cure all the ills to which municipalities are heirs. It seems to me that a general return to company control will, to a certain extent, reproduce the undesirable conditions that characterised the early days of the industry in London. The large municipalities have certainly shown that, in spite of the disabilities under which they work and the restricted areas they supply, they have been capable of developing enormous undertakings, which are giving a supply at a figure comparing favourably with that of the best of the power companies, whose areas are not so restricted.

The phenomenal growth of the larger municipal undertakings, such as Glasgow, Manchester, Birmingham, Liverpool, Leeds, &c., has shown the enormous importance of centralisation as a factor in the cheapening of the cost of production. The formation of the large power companies is undoubtedly due to the realisation of this point.

The smaller municipal undertakings are mostly handicapped by their restricted areas, and by their inability to supply at as low a price per unit as the larger undertakings and

show a balance on the right side. They can never take advantage of the benefits of centralisation, unless it is by co-operation in some form or other. It is true that some of the small undertakings are showing excellent results, but these can generally be traced to local conditions, such as concentration of the supply geographically, or a cheap supply of fuel being available. Co-operation, to be of any real use, must include the thickly populated areas as well as the smaller centres, and the only possible arrangement of this kind at the present time is with the power companies where these are available. There is undoubtedly jealousy between contiguous municipal supply undertakings which does operate against their working together, and which, in the case of a large number of such bodies, would practically prohibit co-operation.

Turning now to the development that has gone on in Germany, Sir Francis Oppenheimer's report makes it clear that the lines are very similar to those that have been observed in this country, and to which I have referred above.

Private company undertakings were the rule at first, and these apparently used their monopolies to the detriment of the consumer. A reaction in favour of municipal control followed, which has also not proved entirely satisfactory, owing to the machinery available for the management of these undertakings being too cumbersome and inelastic.

The outcome has developed into dual control under which the company manages the undertaking, and the municipalities concerned assist in financing it and are represented upon the supervising board.

The advantages claimed for this arrangement are: Company control appears to be more flexible. It is not subject to boundary restrictions, and can include large areas in its operations comprising many municipalities. Centralisation and its beneficial effect upon cheapening the cost of production can be taken full advantage of. Special tariffs can be better negotiated.

The undertaking can be extended more quickly and readily to meet industrial requirements.

Municipal finance can provide the capital required at a cheaper rate of interest.

Small as well as large municipalities can be interested in and can join in the same concern without allowing jealousy of each other to interfere. The procedure as regards opening streets for laying mains, and dealing with other municipal departments such as water, gas, tramways, &c., is made much easier.

This last phase of the industry in Germany is undoubtedly a step in advance of what has been done hitherto, and will help to improve the conditions governing electric supply, chiefly owing to the beneficial effect of centralisation.

It might form a partial solution of the difficulty that is being experienced with the smaller municipal undertakings in this country. I do not, however, consider that it goes nearly far enough. The arrangement certainly eliminates some of the disadvantages both of company controlled and municipal undertakings, but it retains the chief and serious disadvantage of exploiting the supply of electrical energy, with the sole ultimate object of earning profits, whether small or large, for the benefit of the shareholders.

This is laudable enough in a concern that is being run in the interests of a few individuals, but, where the well-being of the whole community depends so vitally upon a cheap supply, and upon husbanding the resources of the fuel supply, the result should never, under any conditions, be subject to such a powerful restriction.

The only alternative that I can see, therefore, is nationalisation of the supply, *i.e.*, control of the whole of the supply by a Government department, in a similar way to the control of the Post Office and of the telephone service. I am aware that the latter is not at the moment a very happy example, but it is only a question of proper organisation to put this service on a satisfactory basis. There is just as much, if not more, justification for this, as there is in the proposal for the State to take over the railways.

Such a course would meet all the disabilities under which the present supply undertakings are working, both in this country and in Germany, whether they are under municipal or company control, or both.

The country could be properly mapped out in areas, the boundaries of which would not be municipal or county, but arranged geographically to suit the industrial requirements of the country as a whole.

Existing undertakings would be purchased by the State, certain of the existing power stations would lend themselves to development, others would be dispensed with for generating purposes, and would form convenient centres for distribution. New power stations would be built conveniently for the two main requirements, *i.e.*, cheap fuel and ample water for condensing purposes. These would be of the largest capacity so as to take the fullest advantage of centralisation.

Overhead distribution could be developed on systematic and proper lines, and full advantage taken of the great economy in the cost of this method.

The scheme would lend itself admirably to supplying energy to the railways in bulk, as it would cover practically the whole of the country, and be on such a scale that there would be no danger in relying upon it for continuity of supply.

There would be no difficulty as regards opening streets and obtaining wayleaves across private property, or through the areas of local authorities.

The capital required would be raised on the best possible terms as regards interest and periods of loans. There would be no necessity for making any profits beyond a suitable sum for reserve and depreciation.

Rates of charge could probably be standardised within limits all over the country.

I am convinced that from an engineering point of view this scheme is the only one that can ensure proper centralisation, real economy, and the elimination of obstructive restrictions. It can be inaugurated now with a very much smaller expenditure than will be the case in, say, 20 years' time. There is no risk attached to it, as the enormous development now going on in all industrial countries indicates, whilst the return on the capital now invested is a proof that it would be self-supporting.

THE FUTURE OF MUNICIPAL ENTERPRPRISE.

By GEORGE OFFOR.

The existing conditions under which the electrical industry is carried on are by no means perfect, but in what way they can be successfully modified is a problem not very easily solved.

When the Electric Lighting Act of 1882 was passed, the policy of municipal control and the ultimate ownership of the undertakings, was provided for on terms which practically paralysed the embryo industry for many years, and although under the Act of 1888 the alteration in the purchase clause rendered the acquisition of capital possible, the business has always been more or less hampered by the contest between the principles of "municipal" *versus* "private" trading.

It is interesting to refer at this point to a speech by Lord Salisbury, who was Prime Minister at the time, which he delivered at Knightsbridge (see *Times*, May 21st, 1885). He said:—"Mr. Chamberlain has had in his hands a certain industry which at one time seemed promising, viz., that of furnishing electric light to the community. I tell you it is not a large matter, but you can study the action of laws on small matters as well as large. He was not content to allow it free scope to win its way as best it could. He was not content to trust to the results of free energy and exertion, but he thought that he would get ransom. And, therefore, he procured an enactment in Parliament that, after 21 years, any enterprise which these electric light companies set up should be confiscated for the benefit of the municipality under which they acted. What was the result? It shows you how this plan of exacting ransom from property answers. Bankruptcy has followed, I think, every one of those companies; the industries have been absolutely stifled, and an invention which in America is marching with gigantic strides, and contributing largely to the comfort of the population, is here entirely strangled."

I have before me a little pamphlet issued by the Municipal Electric Supply Co., about the year 1900, which sets forth proposals somewhat on the lines of the system referred to by Sir F. Oppenheimer, in his report upon German practice. The pamphlet states that the company is prepared to undertake the supply of electricity to towns on the municipal system, "the main idea being that the statutory powers shall be the property of the Council and the electric supply substantially a municipal undertaking, but that the capital expenditure for making the business successful shall rest upon the company until the Council see fit to take it over."

This suggestion did not take on, and the company ultimately organised a large and successful business in ordinary commercial undertakings, subject to the provisions for enabling the local authorities to become the ultimate owners.

The terms of purchase, under provisional orders, vary considerably, the following being examples of the bargains made with local authorities under agreements within my personal experience :—

1. Fair market terms as a going concern, giving two years' notice of intention to purchase, after 12 years from date of order.

2. Under Sec. 2 of the Electric Lighting Act, 1888, at the end of 42 years.

3. Alternative terms at the option of the local authorities : (*a*) At any time on two years' notice at fair market value as a going concern ; (*b*) on capital expenditure plus one-third.

4. Alternative terms at the option of the local authority, viz. : (*a*) Value as a going concern ; (*b*) a sum equal to 25 years' purchase of the average net profits during five years previous to expiration of the notice to purchase ; (*c*) capital expenditure, plus 25 per cent., if purchased within 14 years, 15 per cent. if after 21 years, and 10 per cent. after 28 years.

5. Under Sec. 2 of 1888 Act, after 1947, on giving six months' notice.

6. Valuation as a going concern within six months after $10\frac{1}{2}$ years from December 31st, 1899, and any subsequent period of two years. After 42 years under Sec. 2 of 1888 Act.

7. Under Sec. 2 of 1888 Act after 1942, and every 10 years thereafter, or as a going concern within six months after July 30th, 1914, and every seven years thereafter, on giving two years' notice.

8. The option of taking over the undertaking at any time on issuing to the company bonds of the local authority sufficient to pay 5 per cent. on the capital properly expended.

In a pamphlet issued by one of the companies with which I was associated some years ago, a proposal was put forward for arrangements with the local authorities on the following terms :—

1. The Parliamentary and legal expenses incurred in procuring the order to be borne by the company.

2. Upon the expiry of two years' notice given at any time after the end of 10 years, the Council shall be entitled to purchase the entire undertaking and goodwill at a value to be fixed by independent valuers.

Any arrangement under which the local authority should have a voice in the management of the business, would, I think, be quite impracticable.

The objection to municipal trading in electricity supply is not only based on the old principle of "every cobbler sticking to his last," but obviously those who do not understand the business and have no capital except what they borrow and pay interest upon, are not justified in speculating in such undertakings at the risk of the ratepayers. To permit such bodies to exercise any control over the management, which requires both commercial and technical proficiency, would be fatal.

I agree with you that "the time is not far distant when the inherent weaknesses of public ownership will lead to agitation for a change." While the option of taking over the companies' undertakings exists, there may be some grounds for argument in support of local authorities assisting in providing capital to enable them to provide sound extensions of the business, but in such a case the objection would still exist that they could not furnish the money without a guarantee of the interest and sinking fund, apart from any question of control over the expenditure, whereas capital raised by the company through its shareholders would only be paid for out of actual profits.

The legitimate business of a local authority is to manage the sanitary affairs of the town, its sewage works, &c., construct and maintain roads and streets, to administer the Building, Factory, and other Acts connected with the local management, all of which duties, and the financial arrangements arising out of them, they can properly undertake, but they should not interfere with ordinary trading, and especially in such a business as the supply of electricity.

In some towns the craze for trading has been carried to the extent of municipal ownership of both the electricity and gas supply, and not without obvious friction between the several Committees who are competing with each other.

Municipal trading in electricity supply has not been generally prosperous, even in many cases where contributions out of supposed profits have been made in relief of rates, which is analogous to a company paying a dividend out of capital. On analysing the accounts of many local authorities, it has been found that either no reserve has been made to cover depreciation or obsolescence of the plant, or else there is an altogether insufficient provision for those contingencies, and it has been argued that the sinking fund which provides for payment of the plant by annual instalments covers also the depreciation, which is a fallacy.

In a recent publication sent to me from the United States by the Municipal Ownership Publishing Co., a list is given of 208 defunct municipal lighting plants, and a map showing their distribution among the various States. It includes the sale, lease or abandonment of the undertakings, and appears to prove that municipal trading in lighting has had many victims.

TRAGIC END OF TWO ASPIRANTS TO ELECTRICAL KNOWLEDGE.

By ARNOLD LEWIN, A.M.I.E.E.

The writer has recently had to deal with two curious breakdowns on D.C. armatures. In each instance the trouble has been due to a mouse having entered the armature through the ventilating ducts in the core and then having wormed its way right up to the back of the commutator. The breakdown on the winding has occurred in each instance through the mouse's tail having caused a short circuit between the ends of adjacent armature coils, the flesh having rotted away and broken down the insulation. In the first instance, the man who was repairing the armature found a short on same and opened up the wires entering the commutator lugs at that point. When he had lifted up the bottom ends, he saw what appeared to be a broken end of wire projecting between the ends of two coils. He scraped at this with his knife, but could not make out what it was ; on further opening up the winding, some peculiar object was disclosed, and with some difficulty the whole body of a mouse was extricated in a somewhat advanced state of decay. Needless to state, on sending a report to our customer, the explanation was considered an excuse until the body of the victim was offered for examination. The second case occurred on another machine a few weeks later in exactly the same manner. In this instance, the body was so far decayed as to betray its presence immediately the wires entering the commutator lugs were lifted up.

The explanation for the mice entering the armatures is fairly obvious. When the motors had stopped and everywhere was quiet, the mice had come out, and attracted by the heat of the machine, had crept up the holes in the core, burrowed well into the windings and then found it impossible to extricate themselves. Then when the motor was started, they received an electric shock or else they were suffocated.

THE PRODUCTION OF NITRATES BY THE DIRECT ELECTROLYSIS OF PEAT DEPOSITS.

By GEORGES DARY.

The beneficial effects resulting from the use of nitrates for agricultural purposes are such that their employment is becoming more and more general. Not only do they give reliable results, but all who have employed them speak in high terms of their fertilising properties. The only drawback to their adoption by the large number of small agriculturists is the fact that the price in Europe is still high, for in spite of the great store of natural nitrate deposits, for example, in Chile, which country ships to Europe several million tons a year, and notwithstanding an ever-increasing output of artificial nitrates, the selling price, which ranges between 6½d. and 7½d. per lb. of pure nitrate, is still prohibitive. The question to be solved, therefore, is that of reducing the price as much as possible by improving the methods of extraction from the natural nitrates, and also of perfecting the industrial processes of manufacture.

The Birkeland and Eyde processes employed in Norway enable pure nitrate to be obtained at an average of 6½d. per lb. By the Philippe and Guye method, which produces calcic cyanamide, by separation from calcium carbide, the fixed nitrogen works out at an average of 7d. per lb. The Schonherr system, which gives sodium nitrites, and the Sending process of fixing the nitrogen of the atmosphere in calcium nitride, may also be mentioned. A large quantity of assimilable nitrogen in the form of sulphate of ammonia is also obtained from coal distillates resulting from the manufacture of gas. In this case the fixed nitrogen costs about 10d. per lb.

Sulphate of ammonia, as in the Buckle process, may also be obtained by distillation from dried peat, the cost of the fixed nitrogen being about the same as in the first cases above mentioned. The notable experiments of M. Müntz pointed to a modification of this method of extraction, in the direction of the lixiviation of the peat, followed by a purifying process and a concentration of the mother-waters. The cost and manipulation is, however, too high to permit the method to be adopted industrially.

M. Albert Nodon, well known as the inventor of the electric valve which bears his name, has continued the research work of M. Müntz, and, as a result of long and exhaustive tests, has recently discovered an extremely economical process of extracting nitric acid and nitrates by treating peat deposits electrolytically. The process has recently been patented in the United Kingdom, to which country it is especially suited. By its means, calcium nitrate, which is formed in considerable quantities and continuously in peat deposits can, in fact, be decomposed by electrolysis, the nitric acid passing to the anode, which is enclosed, whilst the lime accumulates about the cathode.

The operation is effected automatically and continuously by means of a simple and cheap plant installed in the open air directly on the peat deposits, this accounting for the fact that the cost of production is practically restricted to that of the current consumed. The Nodon process, in fact, renders the usual heavy expenditure for the extraction, transport and lixiviation of the peat entirely unnecessary, thus overcoming all the drawbacks which led to the rejection of the Müntz scheme.

The industrial arrangement of the Nodon method may be outlined as follows :—Porous pots, filled with coke, which is utilised as the anode, and a weak solution of nitric acid, are installed at equal distances directly in the peat deposits. The nitric acid obtained by the electrolysis of the nitrates of the earth is gathered into tanks, while the lime resulting from the decomposition into calcium nitrate is collected by the cathodes, which latter consist of iron rods sunk into the deposits.

Each element (fig. 1) consists of a cylindrical porous pot *a*, of coarse pottery, rendered porous by the addition, before baking, of a paste of combustible dust. The pots, which are 8 ft. 2 in. in height × 15¾ in. in diameter, are sunk into holes dug in the peat, care being taken to tightly ram the earth below in order that there shall be no movement in the pots.

Each of the latter is filled with washed coke, a large rod of graphite *c* being placed in the centre of the same, its object being to convey to, and distribute, the positive current through the coke. It is very necessary that a perfect joint should be made between the graphite rod and the electric cable, as in batteries; with the view of ensuring this, the upper end of the rod is coppered, lead being cast between this and the end of the copper conductor. Two glass tubes *d* and *e* project into the porous pot. The tube *d* extends practically to the bottom, while the other only penetrates just below the surface of the liquid. The object of the first tube is to draw off the water impregnated with

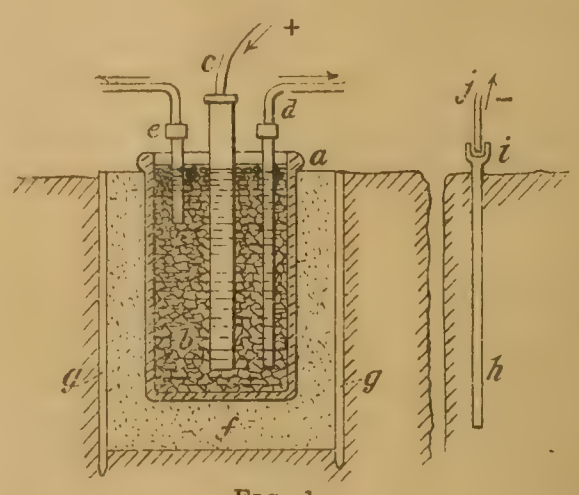


Fig. 1.

nitric acid; while the tube *e* serves to replenish the pot with an amount of water equal to the liquid drawn off. Round each pot a circular space *f* is left, which is filled with calcium carbonate, or simply broken limestone. Stakes of tarred wood *g*, separate the peat from the annular space, which forms a sort of cage for the limestone.

The cathodes or negative poles *h* are of rough cast-iron, and are of a square bar section, 8 ft. 2 in. in length. The upper end *i* is made of a cup shape, into which antimoniated lead is poured, in order to make a good connection with the conductor *j*. The whole is carefully tarred with the view of obviating any destructive action. The rods are located at a distance of approximately 4 in. from each other, and are connected to a common conductor *k* (fig. 2). In this way a cathode of a large surface is secured. The porous pots are

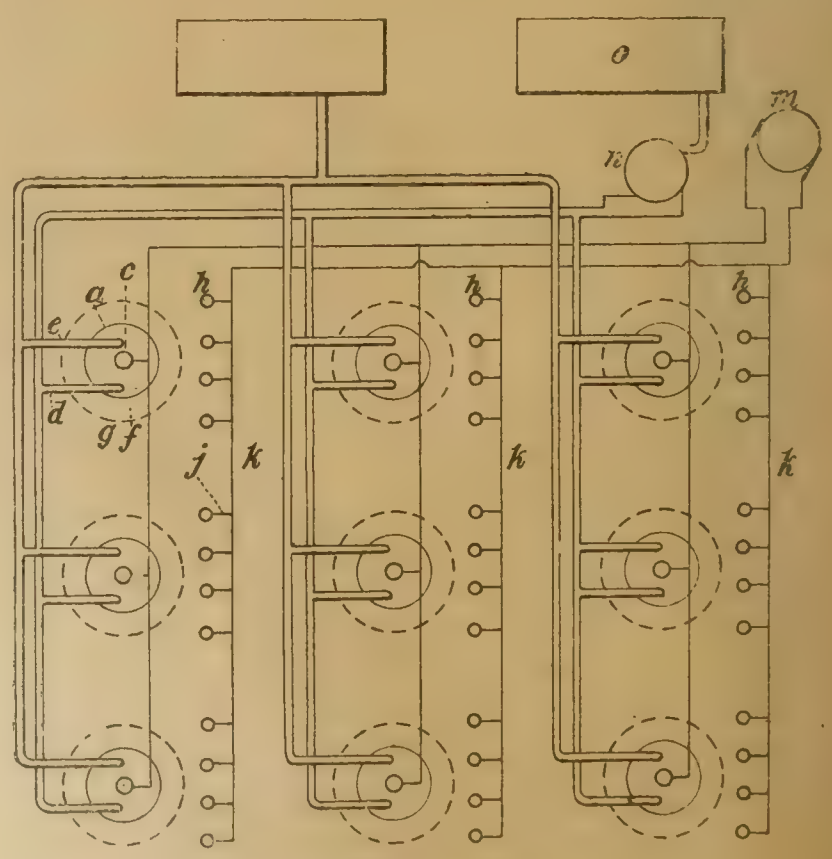


Fig. 2.

fixed at a distance of 3 ft. 3 in. from each other, the shortest space between any of the anodes and cathodes being 1 ft. 7½ in.

As soon as the current is switched on, the following phenomena are observed :—The ground of the peat bog may be regarded as an electrolyte, the specific resistance of which has been found equal to an average of 3 ohms per

metre cube. This resistivity necessitates the employment of a pressure of 10 volts in order to secure sufficient current density. Under the action of this current nitric acid is produced at the anode, and lime at the cathode in accordance with the reaction: $NCaO_2 + H_2O = NH_2O_3 + CaO$.

The nitric acid NH_2O_3 remains dissolved in the porous pots *a*; the solution is drawn off along the tubes *d*, and conveyed to a large storage tank by means of pumps *n*, water being admitted by tubes *e* to make up for the liquid extracted. The solution may be directly concentrated in sand-stone evaporators, in order to produce pure nitric acid, for which there is a large demand in connection with the manufacture of tinctorial products. Generally speaking, the free acid is usually saturated with calcium carbonate. The solution is evaporated in boilers fired with dried peat, a calcium nitrate, similar to that supplied for agricultural purposes, being obtained by crystallisation.

Peat is particularly adapted for the intensive production of pure nitrate; in fact, 2 per cent. of its weight consists of nitrogen capable of being converted into fixed nitrogen under the simultaneous action of the nitric ferments, the oxygen of the air contained in the porous mass of peat, the hygrometric water and the heat developed by the passage of the electrical current.

The flow of the current in the peat does not sensibly reduce the activity of the nitric ferments, so long as the density per unit of surface of electrodes is not too high. It is advisable to mix calcium carbonate with the peat, or, simply, a lime milk resulting from the lixiviation of the lime, which accumulates round the cathodes. Without this precaution, the peat becomes impoverished as regards calcium, and the nitric ferments will quickly commence to act on the ground rendered acid by the free nitric acid. It is also well to prevent the development in the nitrate bed of ferments capable of paralysing, as it were, the action of the nitric ferment; this can be done by distributing, by means of a pump, separately-prepared ferment solutions. All these operations can be effected economically by means of electrically-operated pumps and distributing pipes fixed on the peat deposit.

It has been found that the nitric ferment attains its maximum degree of activity at 25° C., while a continuously-flowing current at a pressure of 10 volts is amply sufficient.

A deposit of peat, having a depth of 6½ ft., and an average richness in nitrogen of 2 per cent., can produce between 800 and 900 tons of pure nitrates per year; while, according to the research work of M. Müntz, if the deposit is located near a town, and can be watered with liquid manure, it can be made to yield 6,000 tons of fixed nitrogen.

Presuming that a deposit of peat is worked under the best conditions of efficiency of output, it is found that about 2,500 porous pots, and 36,000 iron rods, weighing together about 13 tons per hectare (1 hectare = 2·47 acres), may be installed.

The industrial efficiency of such an installation, working day and night, works out approximately as follows:—

Current per sq. metre of anodes, 3·33 amperes
Current per porous pot, 7·5 amperes.
Current per hectare, about 18,000 amperes.

One gramme of nitric acid is produced per ampere-hour; thus, in 24 hours 24 grammes per ampere-hour are obtained, one hectare thus producing for 18,000 amperes approximately 432 kg., or 950 lb. The total electrical energy consumed will be 10 × 18,000 = 180 KW.

Current at 100 volts may be utilised, this being more economical than 10 volts; the peat deposit is divided in 10 parallel trenches electrically connected in series in such a way as to give a difference of potential at the two extremities of 100 volts, whilst only using 10 volts in each of the separate trenches.

Peat deposits, from which nitrates are to be obtained, should be located within reach of a supply of hydraulic power. There exist many such unworked deposits in the neighbourhood of abundant streams of water, where electrical energy could be generated at about 24s. per kilowatt. Under these conditions, the price per pound of pure nitrate would work out much less than has been possible by former methods.

In order to more clearly demonstrate the pecuniary profit that may be realised by means of an installation of plant of the Nodon type, some figures furnished by M. Nodon himself, may be quoted:

Estimate of cost of a plant for the electrolytic extraction of 100,000 tons of nitrates per annum from a peat deposit covering an area of 150 hectares (about 370 acres):—

Purchase of peat deposit (150 hectares at £20 per hectare)	£3,000
375,000 electrode elements at 24s. each	450,000
Cost of water rights and electric power station of 12,000-KW. capacity	400,000
Evaporating boilers and accessories	4,000
Electric pumps	2,000
Rights to use the process	4,000
Reserve fund	24,000
	£887,000

The interest and depreciation on this outlay, taken together at 8 per cent., would amount to £70,960 per year, or nearly £200 per day, work being taken as carried on day and night for 360 days per annum.

Estimate of daily expenses:—

Labour.

	£	s.	d.
Six stokers at 4s.	1	4	0
Two electricians at 6s. 6d.	0	13	0
Four electricians' labourers at 4s. 9d.	0	19	0
Two sets of 80 men for working boilers, tanks, transport, &c., at 4s. each	32	0	0
Twenty carters at 4s.	4	0	0
Ten clerks at 4s. 9d.	2	7	6
Two foremen at 8s.	0	16	0
An engineer-manager	1	4	0
Distributing carbonate of lime, 20 operations per day at 3s. 3d.	3	5	0
Six men for digging peat for boiler firing	1	4	0

Estimated Cost of Material.

Carbonate of lime, 100 tons per day, at about 4s. 9d. per ton	24	0	0
Purified carbonate of lime for saturating nitric acid, 200 tons at 6s. 6d.	65	0	0
Maintaining activity of ferments	8	0	0

General Expenses.

Upkeep of plant	12	0	0
Taxes and insurance	8	0	0
Interest on capital outlay and depreciation	197	0	0
Printing	8	0	0
	£369	12	6

Approximate Cost of Production.

Daily output of 278 tons of calcium nitrate, costing a total of £369	£1 6s. 6d. per ton.
As 2 cwt. of nitrate contains approximately 38 lb. of fixed nitrogen, the latter costs, roundly	0·84d. per lb.

Annual Profits.

Selling price of 100,000 tons per annum, at £8 8s. per ton	£840,000
Net cost of production, at 26s. 6d. per ton ...	132,500
Net profit	£707,500

The ingenuity of the Nodon process, and the expert knowledge on which it is based, is such that the greatest praise must be given to its inventor, and that it must attract the attention of both scientists and manufacturers, all of whom, without including agriculturists, are interested in the two questions of the manufacture of nitrates and the utilisation of peat deposits.

Moving Pictures and Trade Expansion.—The Moving Picture Exhibition of British Industries, Ltd., has initiated a scheme for assisting British manufacturers in their efforts to develop their trade in foreign countries and the Colonies. The scheme includes as its chief feature the arrangement of a number of tours, which are specified in a pamphlet that has been placed before us, of Europe, North and South America, South Africa and Australia. On these tours moving picture exhibitions will be given in principal cities, illustrating the methods of manufacture, establishments, and the finished articles and their use, of firms who enter into arrangements with the company. The publication and circulation of a commercial reference book is also included in the project. Any of our readers who may be interested in the movement will find particulars very fully set forth in the pamphlet, of which copies can be obtained on application to the company at 86, Leadenhall Street, E.C

ELECTRICAL EQUIPMENT AT AUCKLAND HARBOUR.

The Dominion of New Zealand is one of those Colonies where marine communication must be secured at any price. Difficulties of railway transit and its bi-insular configuration render coastal services important, and vessels of large draught also must be accommodated. At Auckland, one of its chief harbours and the Admiralty naval base, an extensive scheme of reconstruction and extension is in progress, and we are indebted to the *Engineering Magazine* for the following particulars, which are of interest.

About nine years ago when the present engineering staff took up its duties, a wooden wharf structure was in existence, but owing to the presence in those waters of a most energetic species of the teredo, a little shell-fish which can literally honeycomb the hardest timbers in a very small number of years, it was seen that the only satisfactory solution was the complete adoption of ferro-concrete for all reconstructions and extensions. After seven years' trial this has proved an entire success. The scheme decided on has been partly carried out, and is being completed at a rate which keeps the accommodation of the port well in advance of its requirements.

In the matter of the adoption of machinery, as no special plant existed previously, the choice between hydraulic power and electricity was unfettered in any way. The latter was chosen partly because the heterogeneous nature of the cargo to be dealt with, rendered desirable a source of power which should be uniformly economical at various loads.

The original wharf plan comprised side jetties branching from central piers, which, although satisfactory when first constructed, was open to serious objections as a permanent scheme, and it was decided to adopt a purely longitudinal arrangement of piers. Originally also a single line of sheds ran down the centre spaces and ships discharged into these from either side, whilst carts were admitted to them for loading and unloading purposes. Further, all cargo moving inside the sheds was done by hand.

The drawbacks to this manner of dealing with goods were many. Numerous vehicles caused congestion of the quay space and were a hindrance to speedy handling, and cargoes of different ships and of ships belonging to different companies became mixed. A solution of the difficulty was found in the construction on each pier of a double row of sheds with a roadway between. Inside these sheds the floors slope gently upwards from the quays on the outer sides, to cart level on the inner sides, and as the slope is an easy one for truckers, all vehicles are excluded. Vessels are berthed on both sides of the piers and each quay has two lines of railway, let in flush, so that carts may use the same roadway for direct removal of goods when required. The wharf sheds are single or double storey according to the pier capacity, except in one case where the original single-storey, single-shed principle, was considered sufficient to meet the requirements of a fleet of smaller coasting vessels. The complete scheme includes the reclamation of about 100 acres by means of sea walls and quays, and some 32 acres have already been roaded and let at high prices.

The machinery equipment of the port is closely associated with the design of the wharves. The decision was made that no crane of a greater lifting capacity than 5 tons should be installed, thus enabling wharf construction costs to be kept down to a very low limit. For excessive lifts a floating crane of 80 tons capacity is employed. The present equipment consists of 13 5-ton cranes, one 3-ton, and four 15-cwt. shed cranes. Most are "semi-portal" supported, thus leaving the quay space obstructed to the least possible extent, but four have their back legs on the quays.

In the "semi-portal" type one leg only runs on the wharf coping, the other being carried on a crane rail on the eaves of the single-storey sheds. In the case of the two-storey buildings, the rails run on the edges of special balconies. Their superiority has been so fully appreciated that all future additions will be of this type. Nine of the larger cranes are of the two-motor variety, by Messrs. Babcock & Wilcox—one motor of 60 B.H.P. controlling hoisting and derricking, and one of 5 B.H.P. for slewing. The former is geared to its two functions by means of the makers' "Crypto" sun-and-planet mechanism, and is accordingly compound wound, while the latter, being always in mesh, is series wound. Lowering is carried out by a powerfnl foot brake on the free-barrel system, and the hoisting speeds are 230 and 120 ft. per minute. On the four latest cranes by Messrs. Carrick & Son, all operations can be performed simultaneously, as three motors are provided—the extra one for derricking being of 15 B.H.P. The current supply is through plug boxes on the shed walls at 60-ft. intervals, by means of flexible cables.

The 15-cwt. shed cranes are by Messrs. Stothert & Pitt, and are each fitted with one 5-B.H.P. shunt motor, which, by means of friction clutches, performs the double duty of hoisting and slewing. They are moved from place to place by hand.

On the quays, capstans at convenient distances give a 1-ton pull at 200 ft. per minute, the motors being of 20-B.H.P. capacity, with pedal-operated entirely automatic starters, by the General Electric Co., of England.

In the two-storey sheds conveyers and lifts are necessary. For the former 15-H.P. motors, by Messrs. Scott & Mountain, are in use, and give a conveyor speed of 10 ft. per minute with a 1-ton load. For the lifts, which are by Messrs. Smith & Stevens, 10-B.H.P. motors are installed, and the carrying capacity is 1 ton 120 ft. per minute. On the top floors, Wadsworth hoists, fitted with 13-B.H.P. motors, are provided. These lift 1 ton at 120 ft. per minute, and can hoist from carts in the road, travel in to the centre of the shed, or handle goods through a well in the floor.

In the Dry Dock, two Rhodes 25-B.H.P. shunt interpole motors connected to Gwynne pumps in a single reduction, 750 to 100 R.P.M., raw hide to steel, spur gearing, have replaced a steam plant, and effected a great saving by reducing the working hours of the staff. A 30-B.H.P. compound-wound B.T.H. motor operates the 200-ton slipway.

The entire lighting system is electric. Originally 2,000-C.P. flame arcs, on revolving towers at the corners and eaves of sheds, for additional light, whilst vessels were working, were in use, but owing to the rapid action of the salt atmosphere on the regulating resistances these were superseded by tantalum lamp clusters. Inside lighting is effected by 800-C.P. Trafford enclosed arcs and 100 C.P. tungsten lamps, and as walls and ceilings are painted white throughout, the diffusion is excellent. The Queen Street Wharf, being a continuation of the main street of the city, will be specially lit by a central row of four 1,000-C.P. tungsten lamps, with seven 100-C.P. lamps to serve between 10 p.m. and dawn.

The operations of the time ball and various other functions, such as tug and dredger lighting, workshop lighting and driving, &c., are carried out electrically, and altogether some 1,500 B.H.P. is employed in the Harbour Board's Service. The new generating station of the municipality is erected on the approach to one of the wharves, and affords a convenient and cheap source of power.

It will be seen, therefore, that excellent progress is being made, and as the cost of the new wharving is no greater than that of the old, very great credit is due to the staff. With such management, the port must be one of the greatest factors in the success of the City and Province of Auckland.

BRITISH TRADE WITH RUSSIA.

Manufacturers who want to sell their goods in Russia must adopt no half-hearted measures. The Russian market is a very large one, and its possibilities in the future are incalculable. For the time will come when, through the development of industries, its purchasing power will no longer depend upon the harvest. Therefore if it is worth while entering the market at all it is worth doing so on a large scale. This means that money will have to be spent in gaining experience and in advertising, for which no immediate adequate return can be expected. Bearing on this subject the British Consul at Odessa in a recent report states that in view of the revision of the commercial treaty between Russia and Germany, the Minister for Trade and Industry recently enquired of the Chambers of Commerce for their opinion as to how the recent remarkable progress made by Germany in the Russian market was brought about. The Consul gives an extract from a reply to this inquiry which is copied below. He adds that it is probably exaggerated, for no doubt the perfect German traveller is still to seek, nevertheless it is of interest as exhibiting a high standard to which travellers should aspire. The extract referred to is as follows:—

"During the last ten years there has been noticeable increase in the number of German commercial travellers in the hardware and metal industries, that is for the sale of various machine tools, steel, belting, general tools, electrical appliances, stamped goods, lubricating products, emery goods, patented productions, paint, &c.

"The German traveller is distinguished by his thorough acquaintance with the goods he offers; he knows exactly how the article is produced, to what points he must direct attention, and what is likely to interest his customer; he is always well informed as to current prices and the quantity of goods in the market; in making offers he is guided by local conditions. The majority of German representatives have a fair knowledge of Russian and are of an intelligent class; compared with Russian travellers they stand higher. The latter has seldom any preparation for his task, and is often not competent to show the good points of his wares and to call attention to their peculiarities and advantages as compared with goods offered by his competitors. The majority merely hand in price lists showing the conditions of sale, not interesting themselves in the suitability of their goods to the place, or as to whether there is any novelty of recent improvement in the same line. Russian representatives are to be found travelling one day in paint, the next in hardware.

"German firms, in order to extend the sale of their goods, often send out gratis samples (particularly light ones) asking people to try them and report on them; they follow up by sending a traveller. They are exact and punctual in fulfilling orders, and careful as regards packing their goods. They often allow long credits, and with firms of good repute facilitate matters by not demanding acceptances. Many habitually deliver their goods duty free at buyer's doors, themselves paying all expenses. In order to bring their wares before the public they send copious advertisements, catalogues, placards, pamphlets, almanacs and gratuitious small samples, and show persistence in offering their goods. Any novelty is immediately brought to the notice of buyers and samples are sent, to be returned if

not satisfactory. German firms willingly open credits; they are evidently themselves not pressed for cash, often taking no interest in ready-money sales, and giving a minimum discount for cash as compared with Russian dealers; occasionally they have offered as low as 2 per cent., per annum, as discount for cash. Several German firms are opening branches in Russia in order to become better acquainted with the market.

"It is proper to add that English and French firms, notwithstanding the excellence of their merchandise, do not yet push their goods by the methods employed by the German."

Dealing with the question of credit the Consul states that before undertaking commercial enterprises in Russia British firms would do well to study the requirements of Russian law and the experience of business firms already established in Russia with regard to its working. The bankruptcy laws facilitate fraudulent bankruptcies, and the honest trader has a very hard struggle to make a living. The dishonest trader's modus operandi is as follows:—He works on a 5 per cent. profit for a few years, thereby getting the bulk of his special line of trade into his hands, and then goes bankrupt, eventually paying about 4s. in the £; sometimes a firm can escape liability for its debts by changing its name. The newly-named firm—which may be the same as the original firm in everything except name—cannot be sued for the liabilities of the former; there is no remedy unless it can be proved that the change has been made for fraudulent purposes, proof of which is probably very difficult to obtain, and even if obtainable the suitor must overcome endless legal stratagems and devices, with the probability that when the verdict is at least obtained the defendant may declare himself bankrupt and leave the plaintiff to pay his own costs. New legislation approved by the Council of Ministers is being introduced to remedy this state of affairs. On this subject the Vice-Consul at Kharkoff writes:—

"Much money has been lost by foreign merchants not intimately acquainted with the country, especially in dealing through agents of indifferent standing. Russian manufacturers suffer equally with the foreigner.

"For a number of years public bodies representing commercial interests have been pressing for legislation, and the draft of a new law that will prevent the more daring frauds and hasten proceedings in bankruptcy, has been presented to the Duma. The new law, coupled with the gradual improvement of trade references and a more perfect intelligence service, will considerably ease the British merchant's task. At present the number of trustworthy agents is very limited, commercial references require careful sifting, and exporters to Russia must be very watchful to preserve themselves from loss. Trade references must on no account be blindly trusted, as intelligence bureaux are not interested in curtailing a client's foreign credit.

"The Association of Moscow Manufacturers circulates among its members and banking institutions the names of defaulting firms, and these lists are appalling to a stranger. Similar proceedings are taken by the Odessa and Warsaw associations and by the Association of Russian Agricultural Engineers, which are in this matter affiliated. A general boycott, or concerted proceeding, follows such a publication and forces payment where funds still exist, or at least preserves other members from harm."

The Vice-Consul at Mariupol also deals with the question and points out that owing to the keen competition it is easy to obtain discounting credit, and thus firms with little or no capital are enabled to carry on a large business, quite out of proportion to their means, with the natural result that, immediately they incur even a small loss, they are unable to meet their liabilities. In most cases, in order to keep in favour with the banks, with a view to future business, the latter are paid in full, but private firms fare very badly and generally lose everything.

Another point which a capitalist should know before investing money in Russian enterprises is the system under which income tax is assessed. The tax is payable on the turnover, so that income tax may have to be paid when there has been a dead loss on the year's trading. To take another point which often requires immediate attention; when the head of a Russian firm dies and it is desired to continue business relations with his successor, it should be understood by the British firm that the Russian firm's financial position may have been considerably modified through the effect of the Russian law of succession. By this the firm's property may have been divided into numerous small parts and alienated from the common stock, so that the firm may be in a weaker financial position than before. Again, great care must be taken to use the correct revenue stamps for invoices, contracts, &c., as fines are heavy for contraventions of the law which, too, is very difficult to understand.

These warnings do not exhaust the pitfalls which may beset the unwary capitalist. They indicate dangers which may be either discounted in advance or avoided altogether, and are given, not with the object of preventing the investment of British capital in Russia, but to emphasise the necessity of making careful inquiries before entering upon commercial enterprises. In South Russia close inquiry is particularly necessary because all business is on a credit basis, so that a client's antecedents must be carefully investigated. This can be done through commercial information bureaux, but the safer plan is for representatives to be sent out to make inquiries on the spot and to establish personal relations with the heads of firms.

On the general question of British trade with Russia the Vice-Consul at Kharkoff points out that British goods imported into Russia show a gradual falling-off both actually and proportionally. British trade with Russia is really even less prosperous than the actual figures lead one to suppose because it is in manufactured goods that we are particularly losing ground. This is especially to be regretted in the case of machinery, because British manufacturers should and could compete in excellence of quality and in price if properly supported by a trade organisation. The Vice-Consul quotes the following as the causes to which he attributes our failure:—

1. Want of knowledge of the country, which makes it difficult to give the usual trade credits.
2. Want of British trading houses and of industries under British management in Russia, and the natural preference of merchants and manufacturers to purchase from the country to which they belong by birth and sympathy.
3. The less favourable transport facilities from the United Kingdom causing more expensive packing, higher charges for postal packages, and longer journey.
4. The high tide of the British industries in recent years causing manufacturers to be indifferent to the Russian trade, and also, in the case of machinery, preventing prompt execution of orders.
5. The erroneous information being spread, and very generally believed, that British industries are behind the times and are left in the background by Germany's progress.

THE ELECTRICAL STERILISATION OF MILK.

At a meeting of the Röntgen Society on December 2nd, a paper was read by Prof. W. G. Duffield on the sterilisation of milk by means of electrified gases. Prof. Duffield referred to the work recently done on the subject by Thornton and others, and notably by Priestly and Lee, who brought before the British Association in 1911 some experiments in which they had applied weak currents of electricity upon the "sour milk" bacillus of Metchnikoff. In one respect the conclusions of Priestly and Lee differed from those which he had to bring forward, for under certain conditions they got an increase of acidity after electrisation, whereas he had found that the acidity was greatly reduced or retarded. The apparatus used in his own experiments, in which he was assisted by Mr. T. Murray, was a 15-inch induction coil, with a fairly "fat" spark 4 centimetres in length. The poles were of brass. The spark discharge was passed through a closed glass tube, and air or nitrogen, which in certain of the experiments was filtered through cotton wool, was sucked in, and made to convey the products of the discharge into samples of milk. The acidity of the milk was then tested at intervals of hours, and compared with the acidity of a control sample, which had not been treated. The testing of the acidity was carried out by discovering the amount of alkali necessary to produce neutralisation in a given number of cubic centimetres of milk. It was at once found that the acidity of the treated sample was greatly retarded as compared with the untreated. The acidity in the former case appeared quickly to reach its maximum, and then to remain stationary, whereas in the latter case it ran up rapidly. In one instance in which the electrical discharge had run for 52 minutes, the relative acidities at the end of 64 hours (as expressed in c.c. of alkali necessary to produce neutralisation in 10 c.c. of milk) were 9 in the case of the control and 5.9 in the case of the treated sample. The effect seemed to be more pronounced the longer the electrical discharge had been allowed to run, notably in one case for 71 minutes, whereas very short exposures of one minute or five minutes gave little or no difference between the two samples. The cause of the reduction in acidity was still doubtful. Some tentative experiments seemed to show that it was chemical rather than electrical in nature. A bacteriological examination proved that when the samples were sown on plates of agar and of gelatine, the inhibitory action in the case of the electrified milk had been as pronounced as the acidity tests had suggested. There was a marked diminution in the germ colonies in the samples, and it even appeared that the germicidal or toxic effect remained for at least five days after the original discharge.

Asked by Mr. C. E. S. Phillips as to any scientific basis for the popular idea that thunderstorms soured the milk, Prof. Duffield said that his own work pointed in the opposite direction, but, of course, temperature effects had to be considered.

Dr. Horace Manders thought that some clue could be obtained as to the existence of the purely electrical influence if different metals were used at the positive pole, and the degree of destruction of the spore-bearing organisms was noted.

Mr. W. Duddell thought that since Prof. Duffield had used a spark discharge, it would be interesting to know whether similar effects could be obtained with a brush discharge, and if so this would seem to indicate that the action was due to chemical bodies formed by the discharge. He thought it possible that the decisive agent was ozone.

Mr. F. H. Glew said that the results might be explained to some extent if it were assumed that during the spark discharge portions of the metal were thrown off in a colloidal condition, and that these passed into the milk. The action of colloidal particles in various substances had been recognised now for some time, especially as a cause of certain fermentative changes.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,575. "Electric bell contacts and the like." A. H. Marsh. December 1st.

27,577. "Lamp lock for incandescent electric lamps." W. J. Cunliffe. December 1st.

27,578. "Electric indicating apparatus." R. Orme. December 1st.

27,582. "Electric arc lamps." A. H. Railing and A. E. Angold. December 1st.

27,590. "Cramp-belts adaptable as electrode contact cramps and holders, and for other purposes." J. S. Romanes. December 1st.

27,595. "Electric indicator that will denote to a driver or person in charge of a train when a distant signal is against him." C. H. I. Phillips and H. W. Brading. December 1st.

27,596. "Trolley wheel or sheave." A. E. Lineberg. December 1st.

27,599. "Method and apparatus for the regulation of gas pressure in Röntgen tubes, vacuum tubes, and the like." F. A. Lindemann. December 1st. (Convention date, December 2nd, 1912, Germany.) (Complete.)

27,611. "Application of electrical energy to motor-cars, motor-boats, and the like." F. A. Wilkinson. December 1st.

27,613. "Röntgen tube for excitation by high tension alternating or continuous currents." S. H. Wright. December 1st.

27,615. "Automatic regulation of electric circuits." C. A. Vandervell and A. H. Midgley. December 1st.

27,621. "Treatment of gases by electricity, and apparatus therefor, chiefly for the production of nitrogen compounds." A. G. R. Foulerton. December 1st.

27,633. "Absorption pyrometers." G. A. Alder and A. O. Cochrane. December 1st.

27,641. "Electric fuses." H. W. Young. December 1st. (Convention date, December 14th, 1912, United States.) (Complete.)

27,646. "Circuit arrangements for telephone systems." Siemens & Halske Akt. Ges. December 1st. (Convention date, November 30th, 1912, Germany.) (Complete.)

27,647. "Treatment of solid, liquid, or gaseous substances for purifying them or rendering them electro-active." R. Marcus. December 1st. (Complete.)

27,657. "Electric incandescent lamps." Progress Motoren-und Apparatenbau G.m.b.H. December 1st. (Convention date, October 14th, 1913, Germany.) (Complete.)

27,660. "Protection of electrical distributing or current-carrying systems." H. W. Clothier. December 1st.

27,661. "Protection of electrical distributing or current-carrying systems." P. V. Hunter. December 1st.

27,679. "Telephone instruments." E. A. Graham. December 1st. (Complete.)

27,684. "Automatic telephone system." W. D. Edwards. December 2nd.

27,707. "Telephone instruments." W. Aitken. December 2nd.

27,734. "Sleeve insulators for high tension." Akt. Ges. Brown, Boveri, & Cie. December 2nd. (Convention date, December 9th, 1912, Germany.) (Complete.)

27,746. "Commutators for dynamo-electric machines." H. Mensforth. December 2nd.

27,750. "Electric switches." D. K. Morris and Morris & Lister, Ltd. December 2nd.

27,753. "Telephone systems." E. A. Graham. December 2nd. (Complete.)

27,754. "Telephone exchange-boards." E. A. Graham. December 2nd. (Complete.)

27,764. "Shades for electric and other lights or lamps." J. Taylor (trading as Taylor & Co.) December 2nd.

27,771. "Electric glow lamps." E. A. Kruger and K. Sannig. Deeember 2nd. (Complete.)

27,793. "Gas and electric lamps or fittings." Evered & Co., Ltd. and J. E. Boxall. December 3rd.

27,824. "Relay arrangements for the automatic control of electric circuits or apparatus." Siemens-Schuckertwerke G.m.b.H. December 3rd. (Convention date, December 4th, 1912, Germany.) (Complete.)

27,852. "Method of maintaining a dynamo at a constant electromotive force." J. F. J. Bethenod. December 3rd. (Convention date, December 27th, 1912, Belgium.) (Complete.)

27,859. "Electro-magnetically controlled perforating apparatus." B. Soldatencow. December 3rd. (Addition to 14,658/10. Divided Application on 5,352/13. March 3rd.) (Complete.)

27,862. "Secondary battery plates." S. S. Galsworthy, C. A. Owen, and R. J. Fletcher. December 3rd.

27,870. "Electric switches." A. Bonnella and G. J. Bonnella. December 3rd.

27,875. "Electricity meters." Korting & Mathiesen Akt. Ges. December 4th. (Convention date, May 16th, 1913, Germany.) (Complete.)

27,876. "Arc lamps." Korting & Mathiesen Akt. Ges. December 4th. (Convention date, May 24th, 1913, Germany.) (Complete.)

27,877. "Electricity meters." Korting & Mathiesen Akt. Ges. December 4th. (Convention date, December 21st, 1912, Germany.) (Complete.)

27,878. "Arc lamps." Korting & Mathiesen Akt. Ges. December 4th. (Convention date, December 21st, 1912, Germany.) (Complete.)

27,900. "Methods of electrically welding steel." W. Andrews. December 4th.

27,905. "Telephone switching-mechanism." M. S. Conner. December 4th.

27,927. "Sparking-plugs." L. Hopcraft. December 4th.

27,945. "Method of maintaining a dynamo at a constant electromotive force." J. F. J. Bethenod. December 4th. (Addition to 27,852/13. Convention date, January 18th, 1913, Belgium.) (Complete.)

27,948. "Joints for metallic conduits and fittings for electric cables." Simplex Conduits, Ltd. and L. M. Waterhouse. December 4th. (Complete.)

27,973. "Means for controlling electric motors." J. E. Olvis. December 4th.

27,988. "Arrangements for starting and regulating direct-current electric motors." F. Cumont. December 5th. (Addition to 8,108/12. Divided Application on 7,983/13. April 4th.) (Complete.)

28,006. "Electric signalling-system for railways." C. C. Wilson. December 5th.

28,018. "Rubber substitutes for insulating and other purposes." J. F. Bennett and A. T. Masterman. December 5th.

28,019. "Electric starters and lighting and battery systems applicable to motor-vehicles and the like." W. H. Glaser and H. R. Lloyd. December 5th.

28,021. "Means for cleaning the ends of electrical conduit tubes." M. Railing and T. Taylor. December 5th.

28,024. "Electric lighting distribution systems." Cold Light (Dussaud Processes), Ltd., and G. E. Hales. December 5th.

28,025. "Electric lighting apparatus." Cold Light (Dussaud Processes), Ltd., and G. E. Hales. December 5th.

28,028. "Automatic mechanical cut-in and cut-out for dynamos." G. Pearson and Lothar Fielder. December 5th.

28,059. "Electric and vibratory horns or alarms and methods of operating same." E. V. Gratze. December 5th.

28,077. "Electric metering systems." British Thomson-Houston Co., Ltd. and E. Garton. December 5th.

28,111. "Tripping-devices for electric switches and the like." J. G. Statter. December 6th.

28,125. "Apparatus for the communication of indications electrically, on the step-by-step system, from a transmitting-station to a receiving-station." A. Barr, W. Stroud, and J. W. French. December 6th.

28,135. "Process of and apparatus for decolouring or bleaching textile materials electrolytically." D. A. Turnbull and L. G. Lawrie. December 6th.

28,141. "Telephonic transmitters." M. S. Conner. December 6th.

28,152. "Apparatus for electro-plating iron and steel plates with other metals." S. O. Cowper-Coles. December 6th.

28,159. "Ringing cut-off relay systems." Western Electric Co., Ltd. December 6th. (Franklin Tuthill Woodward, Belgium.)

28,162. "Electrical cooking or heating apparatus." R. S. Downe and W. Travis. December 6th.

28,178. "Electric penholder or penhandle." J. B. Furlong. December 6th.

28,179. "Electric rear and head light." J. Stally and H. Tibbs. December 6th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

Electric Wire Fuses. E. Weissberg. 11,298. May 14th.

Portable Electric Lamps. G. F. Hitzelberger and New British Ever-ready Co. 13,175. June 6th.

Switching Apparatus for the Inside Lamps of Motor Vehicles. E. Freitag. 14,306. June 20th.

Portable Light-projecting Apparatus. J. Y. Johnson. (F.I.A.T. Fabrica Italiana Automobili Torino and Soc. Anon. Officine Galileo.) 14,711. June 25th.

Wall Plugs or Fixing Sockets. I. B. Malaby. 15,180. July 1st.

Counting Trains for Electricity Meters. A. Mascall, and Chamberlain and Hookham, Ltd. 16,344. July 16th.

Sockets for Electric Leads. A. G. Bloxam. (R. Bosch (Firm of)). 16,709. July 21st. (Addition to 6,551/13.)

Electric Fuse. W. B. Boyd and J. B. Tannahill. 19,551. August 29th. (Addition to 12,273/12.)

Ozone and Public Health.—Referring to recent attacks on ozone by American medical authorities, Dr. C. P. Steinmetz wrote to the *Electrical World* of November 29th to say that some of the conclusions reported by the experimenters appeared to him inconsistent, so that it might be well to caution the reader against accepting them without further evidence. For instance: "Guinea-pigs were harmed and killed by a very high concentration of ozone, and from this the conclusion is drawn that an extremely low concentration of ozone is harmful. With the same reasoning, since guinea-pigs kept in pure oxygen are harmed and killed, the conclusion may be drawn that the 20 per cent. of oxygen contained in the air which we breathe is harmful and that we are all in imminent danger of death. Any corrosive non-poisonous agent in sufficient dilution becomes harmless, and while, for instance, the drinking of concentrated hydrochloric acid would be fatal, free diluted hydrochloric acid normally exists in our stomachs as an agent of digestion.

"Also, the report states, ozone in higher concentration destroys odours, while in low concentration it 'masks' them. It is hard to conceive, without very conclusive evidence, why the action of ozone should be different in one case from its effect in the other.

"The experiments with bacteria described are hardly remarkable. I believe any chemist would have predicted that under the conditions of the experiment ozone should have no effect on bacteria. . . . . The last number of *Chemical Abstracts* (November 10th) gives a list of nine European cities in which water sterilization by ozone is in successful operation, and abroad such public works are not constructed without previous comprehensive study of the process by competent scientific authorities. . . . It would, in the interest of the electrical industry, be extremely desirable if a comprehensive and impartial investigation on ozone and its industrial, domestic and medical use were made by a competent group of scientists. Such investigations, however, could not be carried out by men of one profession only without leading almost certainly to wrong conclusions caused by generalisations from special cases, as I pointed out above. A proper study of the problem, indeed, would require the co-operation of competent physicians, physicists and chemists."

THE

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ELECTRICAL REVIEW.

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CO-OPERATION.

FOR a journal having so considerable a proportion of its readers in other lands it is difficult to deliver one message on the eve of Christmas which shall be suited to the mood of all of its supporters. When these lines meet the eye of some of our Colonial friends four or five weeks will have elapsed, and the spirit of Christmas and the newness of the year will have gone. We may, however, be permitted to offer seasonable good wishes for the coming year to all, whether at home or abroad, who honour us by reading what we have to say.

Most of us are more inclined at the moment to be buying Christmas presents or entraining for the holidays than thinking deeply or writing energetically concerning any particular aspect of electrical affairs. But if there be one theme which should make its appeal to all of us in this period of peace and goodwill, it is that of co-operation for the good of the electrical profession and industry. We have repeatedly witnessed the success of organised unity within one particular section for the purpose of negotiation or contention with some other section, and we are hoping for excellent results to follow such movements as that which has been started by the Municipal Electrical Association, with a view to developing the electric vehicle industry in this country. Better far, however, than sectional movements would be one general advance movement in which everybody electrical would aid the progress of everything electrical.

We are not inclined to the view that trans-Atlantic methods, pure and unadulterated, can be applied with any great measure of success here, but the spirit and motive which have led to the adoption of those methods in connection with electricity supply are a subject for admiration and emulation. The pages of our American contemporaries are occupied pretty well every week with information concerning the progress that is being made in the States with the work of the Society for Electrical Development. This is a co-operative movement to which we have made reference on several occasions. It has for its object the promotion of electrical popularity, and is an organisation which has been described as a clearing house for original, effective ideas in selling electrical goods and extending markets. Apparently it has not been formed to be a profit-earning venture, but according to a description in an American exchange, members will stand to profit individually through the co-operation for business developments which it makes possible. The plan on which it has been promoted is said to be more comprehensive than that of any other similar movement in the electrical trade, and the opinion has been freely expressed that its influence will be felt later in other industries as its work becomes more firmly established.

The work which the society intends to carry out lies in such fields as the strenuous advocacy of the use of electrical energy for lighting, heating and power; of electric railways; of electrical appliances for agricultural purposes; of electric

cooking and the many different domestic uses that can be made of electrical energy. The society embraces three departments, although more may be added later. These are the advertising department, the publicity and editorial department, and the field department. The advertising department will be concerned with the placing of general advertising with the Press, whilst the publicity department will prepare the matter for publication, and collect and disseminate news which will assist in pushing the sale of electricity in various directions. The field department will have a number of duties, amongst which may be mentioned co-operating with architects, builders, &c., upon matters such as wiring and other specifications; conferring with Boards of Trade, Chambers of Commerce, and public authorities, to bring about better understandings upon disputed topics, and advising with such bodies as fire insurance companies as to commercial requirements, from the standpoint of the industry and of the consumer.

It is pointed out that later other important subjects may be brought into the province of the field department, such as advising central stations as to rates for energy, so as to increase profitable business, and especially day loads; the introduction of elementary electrical courses into public schools, and the enactment of equitable public utility laws and regulations.

It is interesting to note that when the Society recently offered a prize for a Slogan there were five winners who all suggested the expression, "Do it electrically." This may be taken as an indication of the widespread recognition among electrical men of the need for educating the public concerning the abilities of electricity to serve advantageously in every department of daily life. Further, the fact that as many as 2,675 replies were received competing for the Society's design prize, may be cited as an indication of the haedway that the movement has already made in American electrical circles.

In view of the larger place that the cinematograph is today taking in the life of the people, the Society is availing itself of this means of getting its teaching home. Arrangements have been made with a moving-picture concern for one 1,000-ft. film, telling the story of the uses of electricity in the factory and the home, which can be used by central-station members in the popular picture theatres, and which is rented from the moving-picture concern at the rate of five dollars per day, with a minimum of two days' use.

The opinion has been expressed, an opinion with which we are disposed to agree, bearing in mind the conditions which obtain in the United States, that the mere existence of the society is practically a guarantee of its success, since it implies a universal recognition on the part of the electrical interests of a fundamental truth. It will aim to clear away the obstacles which stand in the way of further expansion of the whole electrical business, whether these are set up by the ignorance of the public or by internal dissensions, and manufacturer, central-station engineer, and contractor alike stand to gain by its efforts.

The German Lighting Appliances Tax.

As is already known, the German export trade in incandescent mantles, glow lamps and arc lamp carbons to Canada, and of mantles and glow lamps to the United States, has been greatly prejudiced by the inclusion by these countries of the amount of the German tax in calculating the values for the assessment of the import duties. The result is that the German manufactures in question are subject to a considerably higher charge than similar exports from other countries to Canada and the United States. In this connection, an association for the protection of the common economic interests of the German electrical trades points out that the possibility of ousting German industry from the United States, by embodying the tax in the computation of the duty, has induced the Government of the latter country, under the new tariff, to levy an *ad valorem* duty on carbons for so-called flame arc lamps, whereas formerly these carbons were subject to a duty according to their length. As a consequence, it is considered that this particular business will be entirely lost in a short time—a fact which constitutes a heavy blow, as 15·4 per cent. of the total exports of carbons has hitherto been forwarded to the United States. Any representations to the Government of the United States, judging from previous experience, would appear to have no prospect of bringing about an alteration in the present state of affairs, and the association suggests that the only remedy for the destructive results of the lighting appliances impost lies in the abolition of the tax.

Municipal Officers as Arbitrators.

It is interesting to notice that the *Justice of the Peace*, a legal journal which gets into the office of nearly every local authority in the kingdom, recently took up the question of municipal officers acting as arbitrators—a question which has frequently come before the Courts during the last few years. The attitude of members of the local authority on this matter can be easily understood. Arbitration is preferred to litigation, because it is less notorious; arbitration conducted before one who happens to be the paid official of the county or town council concerned is very likely to have a satisfactory termination. The "County Councillor's Legal Guide," if we may so describe our esteemed contemporary, draws certain very important conclusions from the various cases which have been decided on the subject.

While the rule that a judge should not hear cases in which he might be *suspected* of having a bias in favour of one party does not apply to an arbitrator named in a contract, and chosen by the parties, principles of law are very elastic, more so than the written Act, and the arbitrator, notwithstanding the formal exclusion of the above-mentioned rule, soon finds himself surrounded with every part and application of the old rule which has not been expressly rendered nugatory by the contract. His judicial discretion is rigid, and is rigidly construed, and confers very little freedom of will.

Thus, although a mere suspicion that he may be biased will not impeach his appointment, a probability that he will, in fact, be unduly influenced, disqualifies him from acting. Again, although he may adjudicate upon his own work and skill performed professionally under the contract, he may not adjudicate upon any allegation made by the other contracting party that his own conduct has been wrong according to the contract, or that he has acted tortiously in regard to the other party. There is a special relationship between an arbitrator and a contractor "from the point of view of the contract," which may raise substantive questions of delay, indecision, &c., in carrying out the engineer's professional duties under the contract. Another rule is that if, acting for a local authority, an arbitrator is charged with obstructing a person who is under a contract with the authority, the charge may be carried by the contractor into court. A third distinction may be noticed. It was decided in a case heard in 1902 that the arbitrator may adjudicate upon his employer's interests. In that case Lord Justice Mathew said that the arbitrator, as architect, surveyor, or engineer, is bound to do his best for his employer and look sharply after the other contracting party, and as arbitrator he is entitled to determine differences between the two, which the contract evidently anticipates. On the other hand, he must not be influenced by his employer personally, or allow his judgment to be overborne by what the employer demands. Neither will an action on the contract be stayed if the arbitrator has proceeded on the assumption that he was bound to take his orders from his employer.

THE RUSHMORE ELECTRIC ENGINE STARTER.

Although it must be admitted that we have somewhat lagged behind America, indications are not wanting that the serious attention of British motor manufacturers and motorists has at last been drawn to the advantage of engine-starting arrangements, whereby the old-fashioned starting handle of petrol cars and its attendant inconveniences are rendered things of the past. Thus at the recent Motor Show at Olympia it was found that such devices had been adopted on quite a number of cars, while among the exhibits in the Accessory Section there were a number of engine starters on view, some of a mechanical and some of an electrical character. Prominent among the latter was the new Rushmore electric starter, which is being introduced into this country by Rushmore Lamps, Ltd., of 46, Brewer Street, Piccadilly Circus, London, W.

There is some division of opinion amongst experts as to the advisability or otherwise of combining the functions of a car-lighting dynamo with that of an engine starter—such machines requiring to be constructed as combination generators and motors—but Mr. S. W. Rushmore, who is responsible for the new starter, and who has had over 25 years' experience in the design and manufacture of electric motors and dynamos, emphatically holds the view that the functions of generating current for the lamps and storage battery, and of starting the engine can never be satisfactorily performed by a single machine. It is, therefore, almost needless to say that the Rushmore starter is a separate unit, specially designed for the purpose for which it is intended, and one of its great features, apart from



Fig. 1.—Rushmore Starting Motor

its lightness and compactness, is its simplicity and freedom from auxiliary mechanism, such as reducing gears, clutches and ratchets.

The starter is arranged to act directly on the engine, through the medium of a pinion and a toothed ring formed on the periphery of the fly-wheel. The means adopted for the throwing in and out of the gear are extremely interesting, the operation depending on the application of a well-known electro-magnetic principle, namely, that an armature will

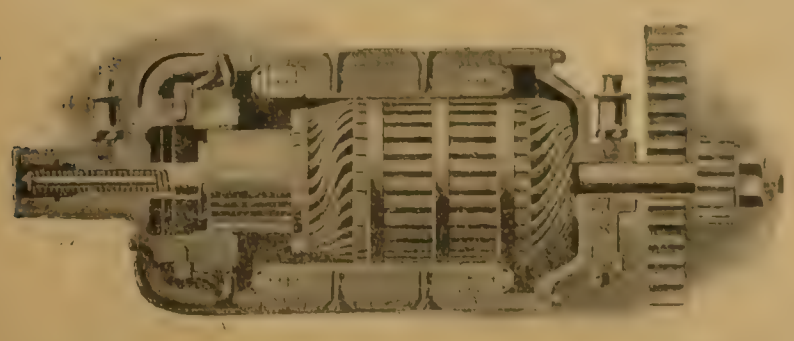


Fig. 2.—Sectional View, Rushmore Starting Motor.

always adjust itself symmetrically in the magnetic field created by the field magnets—the armature, in other words, being pulled into a central position. Thus, from the accompanying sectional view, it will be noted that the spindle on which the armature and driving pinion are mounted is made somewhat longer than usual; normally, the armature is held out of line with the pole pieces by means of a compression spring located within the commutator end of the spindle, the pinion, in this position, being out of mesh with the fly-wheel gear. To start the engine, a foot button switch is pressed down, this allowing current from the battery to pass to the pole pieces; becoming energised, the latter exert a powerful endwise pull on the armature, which, overcoming the power of the spring, pulls the pinion into gear with the fly-wheel, and by rotating the latter, starts up the engine. The armature is made a little longer than the pole pieces, so that even when the former is rotating, a sufficient pull is exerted on it, to overcome the spring action.

To enable the pinion to be brought into mesh quietly and without danger of damaging the teeth, the operating switch is provided with two active contacts, the first one of which causes the contact arm to close the circuit between the battery and the motor, permitting a comparatively heavy current to flow through the field windings to pull the armature into position, the latter, meanwhile, due to the provision of a shunt circuit, only rotating slowly, so that the gear teeth are drawn together by a combined pulling and twisting movement. The method of operating the switch is easily acquired, it being only necessary to give it two sharp jerks by the foot, with a quarter of a second's pause between, to give the armature an opportunity of making the 1¼ in. end movement required to bring the gears together, before the motor exerts its full power.

Presuming the engine to be started, the next question to be considered is that of the disengagement of the starter, and it is here that Mr. Rushmore has brought his long experience into service. At first sight, it would appear that the disengagement is effected merely by the end movement of the armature. Apart from the fact that such an arrangement is, in itself, not new, it would obviously be impossible to rely on the switch movement to cause the disengagement of the gears after the engine has started, for the acceleration of the fly-wheel is generally so rapid that the motor would probably be destroyed by centrifugal action, while the noise would be altogether too great. Closer inspection reveals the fact that the operation depends not so much on this simple mechanical arrangement as in the electrical principles involved. The natural tendency of the starter, like all series motors, is to "race" when the load is removed. At the instant of first explosion, the motor, therefore, accelerates as rapidly as the engine: the resulting increase in the counter electromotive force that takes place instantly reduces the starting current to a comparatively small amount, so that the field poles can no longer hold the armature against the pressure of the spring, the pinion thus slipping quietly out of engagement before any increase in the speed of the fly-wheel can be noted. The motor then continues to run in the disengaged position until the switch button is released; this operation being performed by the driver as soon as the car is under way. The current consumption under this condition is too small to enable the pole pieces to exert a pull greater than the strength of the spring, so that the latter maintains the pinion out of mesh when the motor is running idle, but to prevent any risk of it being brought back into contact with the rapidly-moving fly-wheel, the switch is so arranged that on its return movement, the connection to the battery is broken before the circuit across the armature is again restored.

The starter is essentially a series-wound motor arranged to deliver for brief intervals only the maximum amount of power with maximum efficiency, it being consequently in no way hampered by temperature-rise considerations. It is of the ironclad type, with four poles and four brushes. Furthermore, as the motor only runs when the engine is being started, the wear on the commutator and brushes is reduced to a minimum, the latter being constantly and automatically lubricated.

Two sizes of the starter are being made: the standard one is the Model B, which weighs 47 lb. without the switch, and is able to drive a 60-h.p. six-cylinder engine at 80 r.p.m., using less than 600 watts, while it will turn a 4-in. bore engine sufficiently fast to start it directly on the

magneto. The Model A starter, which weighs 62 lb., is intended for engines which, owing to their size or high compression, require a more powerful motor. Owing to the high efficiency of the device—the motor being claimed to deliver to the fly-wheel, in actual horse-power, 75 per cent. of the energy received from the battery—and partly to the absence of gears, it is stated that a battery from 20 to 30 per cent. smaller than is customary can be used. For the starting of average touring car engines, a 6-volt battery of 120-180 ampere-hour capacity is recommended, larger or smaller sets being, of course, employed with higher or lower powered motors.

We understand that although the Rushmore starter has only recently been introduced on the market in this country, a number of British motor-car manufacturers are already experimenting with the device with the view of its adoption, and that it will form a standard fitting on the 1914 Lancia cars. Before arriving at this decision, a series of exhaustive trials were carried out at the Lancia factory in Turin on a 30-60-H.P. engine ; notwithstanding the high compression of the same, the starter, in over 1,000 tests, never failed to start the engine, running it at 96 R.P.M., and consuming only 110 amperes from the 5·8-volt battery.

REVIEWS.

Electric Lighting. By W. S. Franklin. 1912. London : Macmillan & Co., Ltd. Price 10s. 6d. net.

Usually the title of a book informs one of the subject matter which is to be found within its pages, but in the case of the work now before us it does not by any means indicate the ground covered. Certainly four chapters of the nine, which this book contains, relate to illumination, but the remainder treat of operating costs, electrical distributions, batteries, and telegraphs and telephones.

It is very difficult to understand the class of reader for which the book is intended, in spite of the information that it is a "Text-Book for Technical Schools and Colleges," but we believe that it could be adopted with success into the curriculum on this side of this Atlantic ; a revision of its contents for English readers would no doubt be of service, and it would also be necessary to supplement it with other works.

The first chapter deals with costs and selling price and makes more interesting and concise reading than some recent works published in this country. A few paragraphs only are devoted to meters in this chapter, so little ground being covered, that anyone depending on this work for general electrical knowledge can have but elementary ideas of the most important instruments now in use.

The various systems of electrical distribution are discussed in a brief manner, which should be of great use to anyone learning the subject. A somewhat peculiar paragraph appears under the heading of Mechanical Stresses in Aerial Wires and their Supports, reading :—"A coating of ice one-eighth of an inch thick is seldom exceeded, and it is cheaper to repair the line after an excessively severe sleet storm, than it is to make it strong enough to sustain one-eighth of an inch of ice on the wires" ; fortunately, in this country such storms are of infrequent occurrence, but it is doubtful whether this argument would be countenanced, since the question of reliability is usually of far greater importance to us, and such delays would speedily cause a company to seek the Bankruptcy Court. The calculations contained in this chapter are indeed useful, and are quite handy to have by one, but again one's attention is drawn to the country of origin of the work. Alternating-current lines are concisely but well treated of in the next chapter.

Not until we reach Chapter IV do we come upon the real subject of the title, and here under the heading of photometry and illumination the author deals with the fundamental ideas upon which modern illumination is based. The units are very fully discussed, and the definition of the lumen, usually the greatest stumbling block, is very clear, especially when the diagram relating thereto is utilised. The law of inverse squares is well explained, and one or two problems dependent upon it will be found to be most instructive. We cannot do other than congratulate the author upon this section of his work. Reflection and absorption are fully discussed in connection with the subject of lenses. A brief description of the Bunsen photometer leads one on to the distribution of light around a lamp and calculations usually associated with photometry. By dealing with the subject in this way, the author enables one the better to understand the matter following, which discusses complete photometers of the modern type.

The next chapter is devoted to the description and consideration of the various types of electric lamps, their shortcomings and adaptabilities. The variation of candle-power of the numerous filament lamps is diagrammatically illustrated, as well as their useful life, &c. The polar curves are of great interest, and since comparative costs are given very fully the commercial side of the question is not lost sight of. The fact that the costs given are American is a drawback, since the corresponding figures in England will not be identical, such items as labour charges being totally different. The modern reflector problem is carefully explained, and the possibilities of the numerous materials which may be utilised in this direction are well set out.

In the following chapter the considerations for interior illumination are dealt with, and we can recommend the matter contained therein, since there are few books which treat of this portion of the subject in such a useful way. The intensities of illumination suggested for various classes of service are exhaustive, and are not on the high side, as is usually found with such tables as emanate from the States. The table of lumens, however, is distinctly American, for the lamps are obviously rated at a higher "efficiency" than is attained here.

Street lighting is an important subject, and a whole chapter is allowed for it, but it is very doubtful whether much of this is of value in England, since "series" lighting with glow lamps is nowhere in vogue to any large extent save abroad.

Chapter VIII treats of electrolysis and batteries, so that the author has now left the subject of his title, but the matters discussed are dealt with in a very able manner, methodically leading on to storage cells and the booster. It has been our experience that the average electrical student has very hazy ideas on these subjects, and we therefore recommend the perusal of these pages to all those whose intention it is to understand the applications of electricity in a practical and everyday manner. Similar remarks may be made regarding the miscellaneous applications which form the subject of the next chapter, for generally the telegraph and telephone are considered to be outside the sphere of the electrical engineer, ; however, we believe that every student should have at least some acquaintance with modern methods, which enable many messages to be transmitted over the same wire. Mr. Franklin certainly writes so that all may understand ; even railway block signalling and track circuiting are introduced, and in view of the publicity lately given to such subjects they should prove of interest to all engineers.

The appendix on dielectric stresses should enable one to perceive more clearly the why and wherefore of many insulating devices which may not be apparent at first sight.

The volume concludes with numerous problems which the keen student will endeavour to master in order to satisfy himself that he has fully understood the author's meaning ; these problems are far from being entirely theoretical, in fact, this work is to be commended before many of the so-called text-books on account of the practical way in which it is generally written. It is quite refreshing to pick up such a book, and our only regret is that only the author did not cover more ground and give the work a more befitting title.

The Working of Steam Boilers. By E. S. Hiller. Fifth Edition. Manchester: Taylor, Garnett, Evans & Co., Ltd. Price 1s. 6d. net.

This is the publication of the National Boiler Insurance Co., of Manchester, being a series of notes and instructions on steam boilers, their appurtenances, fittings and working for the use of owners, engineers and firemen. These notes are good and valuable, both from an immediate money point of view and from considerations of safety. Thus, one note says that coal prices do not by any means always agree with calorific values. A small coal may have a high calorific value, and yet be useless if it cannot be burned sufficiently fast to raise the amount of steam wanted. This fact may be used with advantage by the man who has sufficient grate surface to enable him to surmount the difficulty of slow combustion, or who has a tall roomy chimney, or a fan or other aid. Again, a high calorific value may not be a true criterion of value, for some coals are productive of difficult clinker, and so on.

The advice to close the pores of flue brickwork by some paint is pleasing to us, because when put forward by the reviewer many years ago such advice was described in Lancashire by language not fit for publication. All the same the advice was good, and it is still worth printers' ink, for not everyone follows it who should do, and might do with advantage. Cautions are given as to the treatment of water and the use of chemicals. Notably alumino-ferric is apt to produce corrosion, and so is ammonia. Boiler compounds, too, are often dangerous. There are numerous illustrations of exploded boilers, sufficiently horrible, one would think, to frighten any steam user from playing the fool with his boilers by neglecting the insurance company's warnings in the way so many do.

When an internally-fired boiler is short of water, it is difficult to judge what is best to be done. In any case, fling the fire-doors wide. Do not draw the fires. If the crowns are not yet very hot, it may, perhaps, be still possible to throw wet coal or ashes upon the fires, but this is risky to the man who does it, and shows unselfish courage. It is safer to keep away from the boiler front and to turn on the feed. It is advised to close the dampers. May it not be even better to open them wide, if the furnace doors are also wide open? But with mechanical stokers there can be usually no wide opening of doors, for there are no such large fire-doors. It may be possible to turn on a heavy feed of fuel and close the dampers. This might produce great volumes of smoke, besides cooling the fires by the latency of heat consequent on heavy gas production. It has been said that a fireman requires muscle and no brains, but we venture to say that a fireman with an elementary knowledge of chemistry and thermophysics would, by pondering over these subjects, acquire so much power of judgment when in a tight corner, that he would be able to strike a tolerably correct course of action. Uneducated men are made afraid of the sciences because they are not presented to them properly. Yet what is more simple than elementary chemistry? A simple statement of the atomic theory, for example; an explanation of the phenomenon of heat by means of the thermometer and the gradual reduction of ice to steam with heat supplied continuously, and the thermometer at one time steadily rising, at another period standing still, while the solid water is passing into the liquid form and later into vapour.

Let the man grasp the joint idea of the concurrent change of state and stationary mercury, and then teach him that these same changes and heat variations pertain to other bodies—metals, coal, &c.—and his powers of observation will have been raised and refined fifty-fold. And who will contend that such an elementary knowledge will not help a man to fire smokelessly, when he understands the serious chilling of a fire that latency of heat, due to the distillation of green fuel, brings about? We think a little of this teaching might go into the next edition of this book. And is the author certain that when he sends it forth it always finds its way into the boiler house, where it should be?

Swiss Exports to Spain.—According to a return lately issued, electric machinery to the extent of £56,388 was last year imported into Spain from Switzerland.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents cannot expect immediate publication at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Concerning a Review.

I have bought a small book, entitled "Safeguarding and the Control of Electric Light and Power Circuits," by A. G. Collis, which has been favourably reviewed in your columns. It seems incredible that any reviewer could recommend it. There are 44 diagrams, in 72 pages, many being practically full-page ones, and some of them are hopelessly inaccurate and misleading, although obviously intended to be self-explanatory.

The book is only a small one, price one shilling, but frequently one's decision to buy more expensive books is clinched by the perusal of a review; I take it that reviews are published to this end. This being so, it is surely not too much for book buyers to expect reviews to be reasonably accurate.

In the present case, if the reviewer read the book without reference to the figures, he certainly could not understand it, and if he did refer to the figures, and had a copy of the book similar to mine, it is equally certain that he did not follow it. In fact, the view most flattering to the reviewer is that he did not read the book at all, but took its utility and accuracy for granted.

It is to be hoped that the diagrams are not simply taken from the author's larger book referred to in the preface; if they are, I pity the purchasers of the latter.

R. Rankin.

Ilford, *December 18th*, 1913.

Reviewers as a class are fairly well acquainted with objections from authors whose works they have been compelled to criticise, but an objection from a person who has bought a book on the strength of a review is somewhat of a novelty.

The objections in this case appear to be (1) that the book consists of *only* 72 pages and 44 diagrams, many being practically full-page ones; and (2) that *some* of the diagrams are hopelessly inaccurate and misleading.

The reviewer's answer to (1) is:—What do some people expect for a shilling? and to (2) that while the reviewer makes no claim of being infallible, or even of being a professional proof reader, he certainly does claim that whatever errors do exist in the book are few in number and easily detected by a mere tyro. Presumably the book is not intended for use in a kindergarten school. Further, it was pointed out that the meanings of various symbols were not explained.

The gratuitous insult contained in the last paragraph but one of the above letter is not considered by the reviewer to be worth criticism.

By the way, is Mr. Rankin sure that he threw his shilling away (in his own opinion) solely on the strength of the review in the Electrical Review, and was not influenced by a very favourable review of the book—by another reviewer, of course—in a contemporary?

The Reviewer.

Heating Elements.

We note in your current issue a description and illustration of a heating element which Messrs. Bastian Electric Heating Syndicate, Ltd., are introducing as a novelty, under the title of "Rodolite." This type of heating element may be new to the firm referred to, but we may be permitted to point out, as a matter of fact and in the interests of the electrical heating industry, that this particular device is a somewhat old pattern.

We have been using these elements for some years, and they are referred to in the Electrical Review of October 6th, 1911, page 543, also in the *Journal* of the Iron and Steel Institute for June, 1908, and other technical papers.

Standard Electrical Heating Co.

Newcastle-on-Tyne,
December 19th, 1913.

Profit-Sharing and Co-Partnership.

I see you have done me the honour to comment upon some remarks of mine at the recent meetings of the Labour Co-partnership Association at Leeds.

I agree it is highly desirable to have working definitions. What are profit-sharing and labour co-partnership?

Profit-sharing is the giving by the employer to his employés, in addition to the standard wages of the trade, of a proportion of any profit he makes beyond bare interest on capital. Under labour co-partnership, which is a natural outgrowth of profit-sharing, the profits given to workers are usually given in scrip representing shares (in the business employing him) entitled to future dividends in cash.

An essential feature, either in simple profit-sharing or in labour co-partnership, is that the profit given to (not bought by) a worker is given to him as a worker, not as a shareholder. Under the Furness scheme the worker got facilities for buying shares bit by bit out of his wages. Under a labour co-partnership scheme the worker gets given shares, not facilities for buying them. The difference need not be laboured.

"Co-partnery" is an ugly synonym for "co-partnership."

Theo. C. Taylor.

Batley, *December* 18*th*, 1913.

Co-operative Control of Electric Supply Undertakings.

There is no doubt that the number of men who firmly believe in the superiority of this method is rapidly increasing, not only in this country, but abroad as well.

It appears to me to be the only common-sense method. It adequately protects the public and the consumer, and gives the advantage of the freedom of private company management. I am quite as much opposed to uncontrolled company management of public utilities as to municipal or State management.

Mr. Chattock's article on this subject contains a dangerous heresy in the following words :—

> The arrangement certainly eliminates some of the disadvantages both of company-controlled and municipal undertakings, but it retains the chief and serious disadvantage of exploiting the supply of electrical energy, with the sole ultimate object of earning profits, whether small or large, for the benefit of the shareholders.
>
> This is laudable enough in a concern that is being run in the interests of a few individuals, but, where the well-being of the whole community depends so vitally upon a cheap supply, and upon husbanding the resources of the fuel supply, the result should never, under any conditions, be subject to such a powerful restriction.

Surely Mr. Chattock is not becoming an avowed Socialist, for think what his sentiments mean!

If he really means what he says, he believes in the public control and management of all commodities and services essential and semi-essential to the community. Electricity supply is a semi-essential service—exceedingly useful but not indispensable as compared with food supplies—and if the electric service is to be municipal or State managed in order to avoid its being exploited on behalf of shareholders, we must agree to the principle of municipal and State farms, flour mills, bakeries, milk farms, dairies, dispensaries, doctors, and so on, *ad nauseam*; in fact, we are to accept *in toto* the entire Communist programme.

I really cannot imagine that Mr. Chattock means this, but it absolutely follows upon his statement.

There are most serious evils inseparable from the Nationalisation and Municipalisation of anything. I will put them as briefly as possible; I *must* put them, because they cut at the very roots of our national commercial prosperity :—

> (*a*) Extinction of individual initiative, naturally followed by a
> (*b*) Decline in improvements and progress, resulting in
> (*c*) Other countries which do not suffer from State and municipal interference in business getting ahead of us.
> (*d*) Decline in personal and financial responsibility of directors, resulting in inevitable loss of efficiency. (What personal responsibility, for instance, has our Postmaster-General?—Merely a political responsibility to the particular political party in power for the time being, who will generally sell their very souls for votes.)
> (*e*) The object is the altruistic carrying-on of business in the sole interests of the community, a perfectly hopeless endeavour at perfection, because it is ingrained in the vast majority of men to work for reward in some shape or form.
>
> It is unnatural to 95 per cent. of human beings to work at the same efficiency regardless of the remuneration of their services.
>
> This is one of the idealistic rocks upon which unpractical Socialism comes to grief.

I believe these to be the principal objections; there are innumerable minor ones.

Then Mr. Chattock goes on :—

> The only alternative that I can see, therefore, is nationalisation of the supply, *i.e.*, control of the whole of the supply by a Government department, in a similar way to the control of the Post Office and of the telephone service. I am aware that the latter is not at the moment a very happy example, but it is only a question of proper organisation to put this service on a satisfactory basis. There is just as much, if not more, justification for this, as there is in the proposal for the State to take over the railways.

The premises are faulty: there is no justification for the nationalisation of railways. The only point in its favour is the importance of railways in time of war; then I agree that for the time being the State must control them, and it should always be in a position to demand and have carried out at all times arrangements providing for that contingency.

Further, the present inefficiency of the telephone service is not a question of proper organisation; the necessary organisation cannot come from national management; proper organisation is hopeless until the business is managed by people who are placed in such a position that the greater the facilities they give the public in the way of lower cost of the service and excellence of service, the more money they are to be allowed to put into their own pockets as remuneration.

I believe strongly in altruism in business, but it is not coming of its own accord so long as human nature is what it is; but it can be induced by a prospect of reward simply because honesty, if I may be excused the truism, is the best "policy."

To my mind, in connection with true co-operative control of electric supply undertakings, methods could quite easily be devised by which the public interests would be fully safeguarded and the business not unduly hampered.

A. Hugh Seabrook,
General Manager.

St. Marylebone Electric Supply,
December 20*th*, 1913.

ELECTRIC UNDERTAKINGS AND WATER-POWER IN CATALONIA.

It is generally accepted that the industrial position of Catalonia and district is destined to undergo very rapid development in the near future, and that this development will largely depend on the rational and economic use of electric power. The province of Barcelona, especially, which is the centre of the important Spanish textile industry, is destined to gain enormously by the use of the vast potential resources for the development of electric energy and the consequent cheapening of power.

In this connection a recent Austrian Consular report states that this impetus to the industrial life of Catalonia is primarily due to the enterprise of Dr. Pearson, who has also operated in a similar way in Brazil and Mexico by the establishment of the Rio de Janeiro Tramway Light and Power Co. and the Mexican Light and Power Company. The exploitation of Spanish resources by Dr. Pearson began with the formation in Toronto, on September 12th, 1911, of the Barcelona Traction, Light and Power Co., Ltd., with a capital of 25,000,000 dollars, chiefly subscribed by English, Belgian, French and Spanish interests. One of the first steps taken by the company in Barcelona was the purchase of the electrical works of the Sociedad Barcelonesa di Electricidad, as well as the taking over of the electric railway Barcelona-Sarria. A new issue of shares following these acquisitions, brought up the capital to £7,000,000, and the original title of the company was changed into the Riegos y Fuerza del Ebro S.A. (Ebro Irrigation and Power Co. Ltd.). The said company, which is known in Spain as La Canadiense, has more and more extended its operations as time has passed. In the first place Dr. Pearson has succeeded in overcoming the keen competition of the Sociedad Electrica Energia de Cataxaña. This company worked chiefly with French capital, and had a number of valuable falls in the Pyrenees. Dr. Pearson acquired 49 per cent of the shares with the option of acquiring the remainder in succeeding years. Further, an arrangement

was made for the establishment of spheres of influence for the two companies, which would ensure a lack of competition. In addition the Canadian company has bought up the Sociedad Anonima El Tibidabo, and has secured a considerable influence in the electric tramways of Barcelona and the district. Leaving out of account certain suburban lines, there are two tramway companies; the company Los Tranvias de Barcelona (formerly English, now Belgian) and the Compania General de Tranvias (originally German, founded by the A.E.G.). Dr. Pearson has now come to an arrangement with these companies whereby a dividend increasing from 11 to 15 per cent. will be guaranteed to the shareholders. This guarantee will have effect from 1913 to 1945, the period which the chief concessions have to run. It remains to be seen whether Dr. Pearson will succeed in developing his undertakings on a profitable basis. On this point there is much doubt in business circles, as there is distinct evidence that he will have to contend with financial difficulties.

Of the most important works of the Riegos y Fuerza del Ebro (which has concessions for the appropriation of water power in the Noguera-Pallaresa, Segre, and Ebro) the following are in contemplation :—

The installation of an electric station in Aytona, near Seros, on the river Segre, with four generators which will make possible a development of 56,000 H.P. This installation is expected to be ready at the end of the year.

The main station of "Los Terradets," with two sub-stations on the Noguera-Pallaresa river, will provide 83,000 H.P., and should be finished by the end of 1914.

In Pobla de Segur a power plant of 4,000 H.P., which has been put into operation.

The works for the regulation of the Segre river which are rapidly progressing.

From both the electrical works at Seros and Los Terradets, which are about 140 kilometres from Barcelona, two transmissions will be carried on high iron towers, and the electric current, at a tension of 110,000 volts, will be delivered at the stations near Barcelona. The total length of these lines is 369 kilometres, and in addition 340 kilometres of line at a tension of 25,000 volts, and 137 kilometres at a tension of 5,000 volts, will be erected.

A large waterworks on the Ebro is also projected, which will enable a plant of 150,000 H.P. to be erected at Fayon.

The supply of the Compania Barcelonese de Electricidad will be increased from 44,000 to 60,000 H.P., which will be sufficient to supply the Barcelona demand.

Since January 1st, 1912, "La Canadiense" has also supplied current for lighting and power purposes in the manufacturing towns of Tarragona, Reno, Tarrasa, etc. The company estimate the productive capacity of the first of the projected hydraulic plants at 100,000 H.P., of which 85,000 H.P. are already contracted for. A further contract for delivery of 75,000 H.P. has also been made with the Sociedad Iberica del Azoe, to come into operation when the reserve hydraulic plant of the Ebro concession is finished.

The works for the extension of the Barcelona-Sarria railway to Sabedell and Tarrasa are being pressed forward, and it is hoped that traffic on these extensions will be possible next year. The newest enterprise of the Canadiense is the taking over of the three electrical works in Valencia, viz.: the Hidro-electrica del Turia, the Electrica Valenciana, and the Sociedad Valenciana de Electricidad. To illustrate the extent of the operations of Dr. Pearson, it may be stated that the works already carried out or in prospect comprise a total hydro-electric power of 170,000 H.P.

PHYSICAL SOCIETY EXHIBITION.

The Cambridge Scientific Instrument Co., Ltd.

One of the features of this company's exhibit was the electrostatic oscillograph, devised and perfected by Profs. H. Ho and S. Koto, of Japan. For high-voltage work such an instrument embodies important advantages over the electromagnetic oscillograph, perhaps the chief advantage being that the large series resistances necessary for use with the electromagnetic type are not required with the electrostatic instrument, their place being taken by comparatively small and inexpensive condensers.

The vibrator, which we illustrate in fig 1, has approximately the same dimensions as the vibrator of the Duddell oscillograph. The instrument was described in our issue of November 14th.

Some indication of the performance of this instrument may be gained from the following figures. With a natural period of 1/3,300th second, a wave of 2 cm. amplitude was produced at a distance of 70 cm. by a voltage of 2,000 volts effective, the total E.M.F. of the charging battery being 300 volts. By using a high-pressure battery, or an influence machine, extremely small and rapidly-varying currents may be satisfactorily recorded.

Fig. 2 shows the standard coil, designed by Mr. W. Duddell, F.R.S. The special feature of these coils is that porcelain insulation is used both externally and internally in place of the more usual ebonite insulation. The whole coil is enclosed in a metal case filled with selected petroleum oil and hermetically sealed; in this way the coil is made independent of any variation in the relative humidity of the atmosphere. The coils are wound non-inductively with selected silk-covered manganin wire on brass formers, and are insulated by means of porcelain sleeves. The wire is wound in a single layer so that a maximum cooling surface is obtained and any heat generated by the current through the coil is rapidly dissipated. The accuracy of the coil is within 0·005 per cent. at a temperature of 25° C., the unit being the international ohm. The temperature coefficient is about [illegible] per



Fig. 1.—Vibrator of Electrostatic Oscillograph.



Fig. 2.—Duddell Standard Coil.

degree C. With ordinary use the thermo-electric effects between the copper connections and the manganin of the coil are negligible.

The Coblentz linear thermopile, the result of recent researches by Mr. W. W. Coblentz, of Washington, U.S.A., is shown diagram-

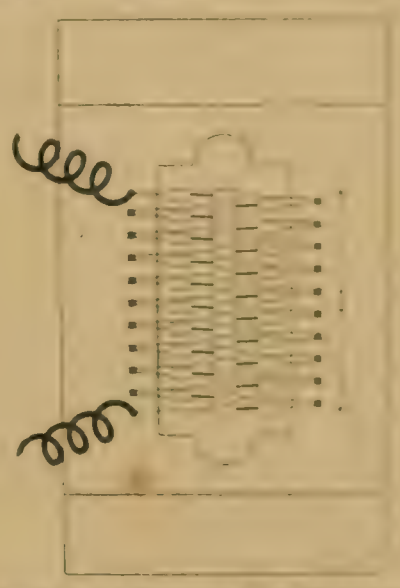


Fig. 3.—Arrangement of Couples in Coblentz Thermopile.

matically in fig. 3; it is said to be far more sensitive than other thermopiles. The instrument consists of a series of 20 silver-bismuth thermo-couples, with the junctions hammered flat and arranged in the receiver so that all the "hot" junctions lie in a straight line. They are coated on the exposed side with a mixture of lamp-black and

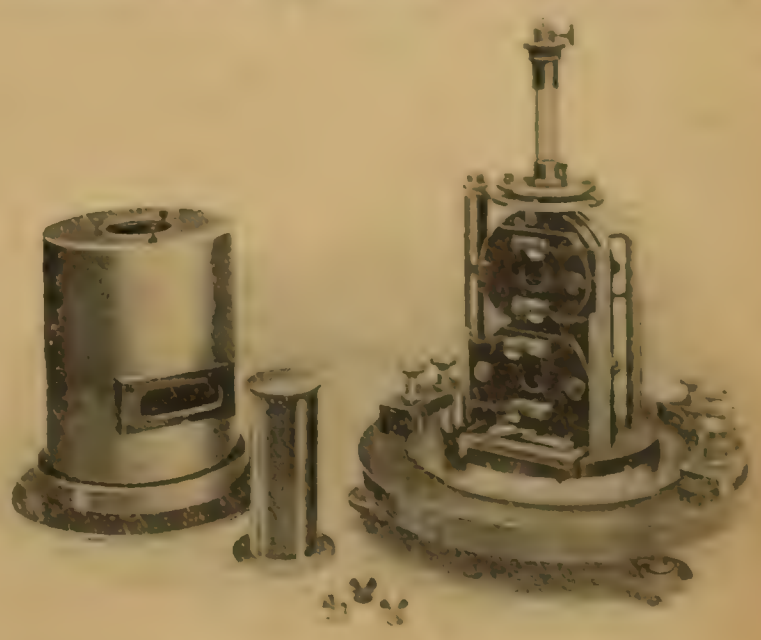


Fig. 4.—Paschen Galvanometer.

chemically-prepared precipitated platinum-black, this mixture giving greatly improved results as regards absorptive power, sensitivity and thermal conductivity in comparison with those produced by a coating of plain lamp-black. The black receiving area is about

12 mm. × 1·3 to 1·4 mm. The respective diameters and lengths of the bismuth and silver wires are arranged to give a maximum sensitivity, the cold junctions occurring alternately on either side of the hot junctions and being protected from external heat rays. The couples are firmly mounted in an ivory frame. Fig. 4 shows the Paschen galvanometer, which was primarily designed for radiometry measurements, and forms with the Coblentz thermopile an exceptionally sensitive and useful combination for radiometry measurements of every description.

Other instruments exhibited were the Lucas contact breaker, designed to open in succession electrical circuits used in physiological investigations at definite short intervals of time, and the Lucas rotating drum, on which records maybe obtained in physiological investigations.

ELLIOTT BROTHERS.

Among other instruments shown by this firm were the latest pattern of their well-known Century standard testing set, a D.C. moving-coil instrument, which can be used either as an ammeter or a voltmeter. The standard pattern has an overall range of from ·001 to 750 volts and ·0002 to 600 amperes. Examples were also shown of their latest pattern of dynamometer movement indicating instruments, for single, two and three-phase balanced or unbalanced working. The movement in these instruments has been entirely re-designed, with the result that a much longer and clearer scale is obtained, and the instruments are now absolutely dead-beat. Examples of chart-recording ammeters and voltmeters were shown, indicating switchboard instruments of various types and patterns, the Century mains testing set, the Wimperis recording and indicating accelerometers, and a variety of Wheatstone bridges and galvanometers, &c.

EVERSHED & VIGNOLES, LTD.

Various recording instruments were shown fitted with the Murday patent pen, which gives rectangular co-ordinates on the chart instead of curved lines; the records can, therefore, be integrated in the ordinary way. When disk charts are used the travel of the pen is radial, giving true polar curves. The "Megger" testing sets were exhibited in operation, the "Bridge Megger" being used to localise faults on an artificial line. Various portable instruments and the "Ducter" potential ohmmeter were included in the exhibit.

GRAHAM & LATHAM.

This firm showed a variety of apparatus for wireless telegraphy, including variable air condensers, receiving sets, detectors, inductances, &c.

PHILIP HARRIS & CO. (1913), LTD.

Galvanometers, resistance boxes, bridges, &c., for use in schools were the electrical features of this exhibit.

LUDGATE WIRELESS CO.

A working exhibit of Mr. L. Miller's wireless transmitter for amateur installations of small power was shown, as well as mercury breaks, induction coils, transformers, &c.

NALDER BROS. & THOMPSON.

The latest type of the "Ohmer," with vibrating reeds to indicate the speed and voltage, was shown together with a number of portable standard instruments of the dynamometer type, for both A.C. and D.C. Fixed instruments of this type were also exhibited, and a large circuit-breaker embodying an improved form of mechanism in the form of a collapsible parallelogram with a light tripping action was a prominent feature of the stand. Great advantages are claimed for this form of gear as compared with the "dead-centre" principle generally employed.

(*To be continued.*)

THE BRITISH STANDARD SPECIFICATION FOR CONSUMERS' ELECTRIC SUPPLY METERS.

AT a meeting of the YORKSHIRE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, on Wednesday, December 10th, at Leeds, Mr. S. H. Holdon read his paper on the above-named subject (for abstract of paper see ELECTRICAL REVIEW, November 21st, page 810).

MR. T. ROLES said that where strength and shielding from external fields were the main considerations, it was undoubtedly an advantage to have meter cases of cast-iron or pressed steel, but on the adjustment of A.C. meters, it was often convenient to have cases of non-magnetic metal, as the meters could be calibrated without having to replace the cover after each adjustment. The proposed alterations to Clause 6 were urgently necessary. It would greatly facilitate the connecting up of meters if a uniform system of marking the terminals were adopted. Terminal lugs should certainly be provided for meters over the size of, say, 50 amperes. The use of terminal lugs often got over the difficulty experienced in coupling up a small circuit of, say, 3/20 along with a cable of very much larger capacity. The suggestions for modifications in Clause 10 were excellent. However carefully the drilling of the meter cases was done, particles of iron clung to the magnets, and their removal presented such difficulties that it often necessitated readjustment. Much better would it be for the manufacturers to drill the holes before the meter was assembled. He was in agreement with the proposed alteration of Clause 11. He had found so many inaccurate records due to inefficient cyclometer dials, that at present he was not ordering meters with such dials. He preferred the term "kilowatt-hour" to that of unit. He would like Mr. Holden's opinion on the proposed use of the word "Kelvin" in place of unit. He shared the author's opinion as to the permissible losses in the main circuits, and regarded it as a debatable point whether or not a reduction in the pressure coil losses in meters should be obtained at the expense of the meter torque. He regretted that the question of the insulating material had not been taken up. In his opinion, no ebonite whatever should be used. The main insulation should consist solely of mica and steatite, and the use of presspahn should be restricted to positions in which little or no moistnre was met with. In cases where moulded insulators were used for the terminal blocks these should be of a standard pattern, and composed of material of approved insulating qualities capable of withstanding high pressures. The speed of 150 R.P.M. was excessive; it would facilitate the work of testing and reduce friction if it were stipulated that the speed should not exceed 80 R.P.M., and that any speed adopted should be a multiple of 20. The gearing between the rotors and the dials of meters of the same make and size should be uniform; the use of different ratios led to confusion when meters were being tested.

MR. NEVILLE said with regard to Clause 6, that it would be of very great advantage if all the makers would give the same arrangement of terminal blocks and boxes. His experience was that the only makers who made any provision with regard to the labels were the foreign firms, who, presumably, were not covered by the British standard specification; but to put two holes into the meter case would be a very bad practice, because not everybody fixed the label on, and if there was no label fixed on there was a serious temptation to tamper with the meter. The best arrangement was to put the label on the lid of the terminal box. That avoided particles getting on to the magnets.

MR. R. N. CAMPION said he hoped that makers would come more into line, and that the Engineering Standards Committee would complete its investigations. He was not troubled very much with meter errors, because he had found it the best practice to stick to a meter which he found to be reliable, until some fault was found with it. He thought cyclometer dials were more useful than the ordinary dials. He had always been surprised at the liberal design of the manufacturers with regard to the overload of meters.

MR. LONGMAN said there should be a general specification to cover all the meters, and a sub-division distinctly into A.C. and D.C., because when they got on to polyphase they were on quite different conditions altogether. As to the cases, he thought that glass should be retained as a material. With the soft metal case, the Chinaman used to drill a hole and put a hair in, which was so fine that it could not be seen, and then the trick was done, and in future the manufacturers had to supply glass cases. In connection with terminal blocks, he thought that the first thing that should be standardised was the direction of rotation of the armature and the path of the current through the meter, so that they should in all cases be in the same order. There were at present such differences in the arrangement of the terminals that often enough a short circuit was got from the start when fixing. He did not think that more than 500 volts should be allowed upon any meter. If the pressure was above 500 there should be an extra resistance box. He did not think any meter would stand a pressure test of 2,000 volts for 15 min., which was suggested by a gentleman in the discussion at Birmingham. He thought 1,000 for 1 min. was enough. The accuracy of any meter should not be affected more than 1 per cent. by a conductor carrying 2,000 amps. at a distance of 1 ft. away in any possible position. He preferred to use cast-iron or pressed-steel cases for all meters, unless glass was used. They should not go beyond 100 R.P.M., and there, again, there should be a distinction between A.C. and D.C. meters. Forty or fifty R.P.M. was high enough for single-phase meters.

MR. BLAND, as one concerned in the manufacturing interest, said that the B.S.S. was useless for modern practice. Many of the figures were quite wild compared with what at the present time the engineer would demand from the manufacturers. The latter were most anxious to have the co-operation of the engineers in the movement for the revision of the specification. Under present circumstances, the manufacturer who incurred large expenditure in the effort to improve, stood just on the same level as he who made no effort at all. There was room for both cyclometer and clock dials. As to the temperature coefficient, to put it on the front of the case was a most foolish thing, tending to open the eyes of the consumer to a very grave source of error.

The CHAIRMAN (Mr. Woodhouse) said he had been curious to find the basis upon which Mr. Holden had settled the sizes of the holes in his terminals, and had turned to the Institution ratings for that purpose, and been rather surprised to find that Mr. Holden's figures in that respect did not agree with the ratings.

MR. HOLDEN, in his reply, said he thought Mr. Roles did not quite fully appreciate the dangers of non-magnetic cases for meters. An aluminium case could be squeezed with one hand to touch the armature. The case should always be very strong, for the "ingenious Chinaman" was not by any means confined to China. The faking of meters was carried to the point of a fine art in South America, where people went so far as to advertise in the papers devices for making meters read slow. He quite agreed with the importance of a uniform system of position and marking of the terminals, and thought that, for polyphase meters in particular, this was important. With regard to the suggested use of the word Kelvin, instead of kilowatt-hour, the difficulty about adopting that was that he wished to make the British standard specification one of world-wide application. Kilowatt was known everywhere. With regard to what was lost in the pressure circuit, his suggestions were based upon what he believed to be approximately the best standard practice at present. Some provision should be made in the specification limiting very carefully the

range of the insulating materials which should be used. The limitation to 80 or 100 revolutions would be a very good thing, and the manufacturers would soon fall into line with this. A suggestion that had been made for the abolition of the change-wheel in ampere-hour meters was rather a counsel of perfection, though manufacturers would be very glad to get rid of it. He had not wished to suggest that the manufacturers should always put holes in the cases for the customer's label, but only that there should be a standard size of label and a standard position for it. Mr. Longman's suggestion as to subdividing the specification for different classes of meters was a very good one. He would carry it even further, and have other sections for D.C. watt-hour meters and for switchboard meters. As to moulded glass covers, his firm had supplied them, but did not find that there was a very great call for them. The standard direction of rotation and standard direction of current and arrangement of terminals on polyphase meters which had been suggested were most important. He considered it most necessary that a limit on temperature coefficients should be imposed by the B.S.S. As to the defect suggested by Mr. Woodhouse, he did not doubt that Mr. Woodhouse was right.

The discussion then closed.

LEGAL.

Edwards *v.* Brixham Gas Co.

(*Concluded from page* 997.)

Evidence having been given by a number of people residing in the neighbourhood of the gasworks as to their experiencing no inconvenience from the working of the engines, Mr. W. H. Hellyer, the electrical engineer in charge, spoke to the tests made with the engines, and their working. He took up his duties, he said, in September, 1911, and the generating station was completed shortly after that date. Engine No. 1 was fixed when he went there. No. 2 was there, but its erection was not finished. No. 1 was first run in September, 1911, but the actual trials commenced on December 13th, 1911, and continued until January 2nd, 1912. During that time the engine was run continuously for 60 hours. It was found that the positive battery was not satisfactory at the trial, it had been damaged by sea water. It was taken out and a new set of plates put in. No. 1 engine was then worked for six hours a day on two days a week for the purpose of supplying current to the picture palace. A second trial was started on February 13th, and lasted until the 16th continuously. The negative battery was then charged, and from that day the engine was worked regularly on two days a week. On February 27th they had a further trial with that engine, which lasted until March 1st, and they then charged the new positive battery. The trial of the No. 2 engine began on January 16th, 1912, and after the end of February both engines were worked alternatively for the supply to the picture palace and one or two other places. The exhaust pit was left unfilled in until January 15th, 1912, and, in the meantime, was covered with sheet iron. After that there was practically no noise from it. At the early stages they had some trouble and consequently some noise, but he might safely say that they were all over by March. He had experimented in the engine house by standing coins on edge, while the engines were running and the vibration was not sufficient to cause them to fall. On a glass of water there was just a slight motion discernible.

Mr. W. A. Schultz, the chairman of the defendant company, who said he was the director of 10 gas companies, secretary of one electrical company, and director of four others, gave evidence as to the poor nature of the property in the vicinity of the defendants' works. He said he had made tests, but had been unable to detect vibration on the plaintiff's property even while both engines were running. When the electric light plant was installed they employed Messrs. Bridges, and, in his opinion, they could not have engaged better engineers.

Evidence having been given by architects as to the nature of the property and the soil in the neighbourhood of the gas works, Mr. William Henry Patchell spoke to the tests he had made on the plaintiff's property and the defendants' works. He had practised as a consulting engineer since 1906, and in November last he visited the defendants' works, and he got right to the motor house before noticing any signs of vibration. As a result of the tests he had made for vibration on the plaintiff's property, he found it was absolutely undetectable until tests were made by a magnet with mercury.

This concluded the evidence.

Mr. Palmer summed up the case for the defence, and submitted on the authorities that plaintiff's remedy, if any, was in damages, and not by way of injunction.

Without calling upon plaintiff's counsel to reply, his Lordship granted the injunction as asked, holding that there was evidence of an actionable nuisance. He, however, stayed the operation of the injunction for three months, to enable the defendants to make the alterations in their plant necessary for complying with the order, with liberty to apply if three months should be found to be too short.

The defendants were ordered to pay the costs of the action.

The National Telephone Assets

On Thursday, December 18th, Mr. Justice Sargant had before him a summons in the matter of the National Telephone Co. taken out by the liquidator for the direction of the Court in dealing with a balance in his hands.

Mr. Percy Wheeler who represented the liquidator, said that the matter was before the Court last July, when it was held that the surplus assets were distributable amongst the deferred stock holders. They had been so distributed with the exception of about £65,000 which still remained in the hands of the liquidator, who was anxious to part with the fund to the deferred stockholders, but felt it was not quite safe to do so without the direction of the Court, on account of possible claims that might be made against him. A representative of the deferred stockholders had been appointed and was now represented by Mr. Younger, K.C. The claims that the liquidator felt might be made against the assets were in respect of

(*a*) Deposits that had been made by subscribers for a telephonic service and had not been returned;

(*b*) Deposits that had been made for the use of trunk lines to avoid payments at the terminal stations;

(*c*) Dividend warrants not presented for payment; and

(*d*) Cheques that have been drawn by the company in favour of creditors and had not been presented for payment.

There were also certain outstanding claims that were now barred by the Statute of Limitations. An order having been made in the winding up requiring all creditors to come in and prove their debts before August 25th last, the necessary advertisements were duly inserted, but some creditors had come in since, and the liquidator having funds in his hands had paid them. Of course, after thedistribution of this £65,000 the liquidator would have no fund remaining.

His Lordship referred the matter to Chambers for inquiry, and directed advertisements of the proposed distribution to be issued.

Birmingham Private Telephone (New System) Co. *v.* Herbert Terry & Sons.

On December 16th and 17th, Mr. Justice Bray and Mr. Justice Lush, sitting as a Divisional Court of King's Bench, heard an appeal from a judgment given in the County Court of Redditch in an action in which plaintiffs, a Birmingham firm, sued defendants, spring manufacturers, of Redditch, for balance of accounts alleged to be due under an agreement for rent of their private installation of telephone instruments, &c., and for damages in respect of alleged breach of an agreement, under which the plaintiffs claimed the right to install 20 instruments. They complained that Messrs. Terry & Sons had only allowed them to provide 17. The defendants entered a counterclaim, contending that they were induced to sign the agreement by misrepresentation on the part of one of the plaintiff company's travellers—a Mr. Ernest Harlow—and they asked for a recission of the agreement. The special jury who in the County Court heard the case returned a verdict which favoured the defendants, but his Honour Judge Ingham granted an application by counsel for the plaintiffs asking for a new trial. From this Messrs. Terry & Sons now appealed.

Mr. Hollis Walker, K.C., and Mr. Gandy were for the appellants—the defendants; and Mr. Maddocks appeared for the respondents.

Mr. Hollis Walker said that the action, which was a curious one, ended in a verdict for the defendants, and Messrs. Terry and Sons' complaint was that his Honour not only refused to enter judgment accordingly, but there and then granted an application by counsel for the plaintiff company for a new trial. The plaintiffs, who install telephones and things of that kind, sued the defendants, who had entered into a contract for the installation at their works of a telephone system. There were to be 17 or 20 telephones of an intercommunicating character as distinct from a service with the outside world. Messrs. Terry & Sons, Ltd., paid the contract price of about £25, and subsequently a final bill was delivered containing an entry of something like £65 in respect of "extras." Then it was that the defendants discovered the reason for this apparently extraordinary state of things, and they not only refused to pay the extra charges, but asked that the contract between the parties should be set aside on the ground of alleged fraud. The contract was dated January 24th, 1912, and by its terms the plaintiffs' company undertook to erect and maintain, and the defendants agreed to hire, a telephone installation of 20 instruments, with all accessories. With each instrument the plaintiffs agreed to provide 150 ft. of "single wire" free, and the defendants were to pay for any additional wire required. But what happened, apparently, was that the plaintiffs supplied cables of 22 strands, so that instead of the wire reaching 150 ft. from the instrument, it only ran to the extent of about 7 ft. In this connection the defendants' case was that when they entered into the contract, Mr. Harlow (the traveller) made a statement to the effect that practically no additional wire would be required, and he was alleged to have said this after visiting the works and ascertaining what was contemplated in the way of a telephone system there. On this point, which was an important one in the case, there were really only two witnesses—Mr. Harlow, who declared that he made no such statement, and Mr. Terry (one of the principals in the defendant firm), who asserted that the statement was made, and mentioned the circumstance to show that if it was made it was false. On that the case went to the jury, and Judge Ingham summed up perfectly fairly, telling the jury that it was a case of oath against oath, and properly warning them that they must be satisfied before returning a verdict in favour of the defendants, that the onus of proof

which was upon the defendants had been discharged. The jury found for the defendants, and then the learned Judge, without more ado, and, as he (counsel) submitted, without any proper grounds for so doing, granted an application by the plaintiffs for a new trial.

Mr. Maddocks submitted that the Court had no jurisdiction to vary the decision of the County Court Judge in granting a new trial. There were, he said, some differences of opinion amongst members of the jury on certain points, and his Honour, after hearing arguments, had granted a new trial. He (Mr. Maddocks) contended that the County Court Judge applied a right principle in acting as he did, and quoted authorities in support of his point.

Mr. Walker argued that unless the verdict of the jury was perverse, there was no material on which his Honour could act as he did. He submitted that the County Court Judge did not apply a right rule of law in granting the application for a new trial.

Their Lordships dismissed the appeal, Mr. Justice Bray observing that if they could see that the County Court Judge had acted upon a wrong principle of law, they could set his decision aside because he had gone wrong in the law. But if he had applied a right principle, the Court could not question it, as his Honour had decided a question of fact. In his (Mr. Justice Bray's) opinion, the learned judge did apply a right rule of law, and therefore the appeal could not succeed.

Mr. Justice Lush said he had reluctantly come to the same conclusion, and he only did so because he did not think it was open to the Court, having regard to the authorities, to come to a different conclusion.

Leave to appeal was granted.

BUSINESS NOTES.

Consular Notes.—Japan.—An Austrian report from Japan states that with the increasing installation of gas plants in both the larger and smaller towns in the country there is a profitable business to be done in gas-power engines for the production of motive force. In smaller motors, that is, up to 25 H.P., the Japanese machinery industry is able to supply the demand, and in consequence of the high rates of import duty to shut out foreign competition. In medium sizes, that is from 25 to 50 H.P., there is a keener competition between the home industry and foreign productions. In the larger motors, that is, more than 50 H.P., foreign trade is predominant. In the year 1912, the Japanese imports of gas motors amounted to 1,400,000 yen (about £140,000), and came chiefly from Germany, Sweden, United States and France. The imports from Great Britain were greater than in 1911, and the imports from Germany suffered a diminution.

Montenegro.—The Austrian Consul at Antivari reports that one of the projects which it is intended to carry out as soon as conditions become settled, is the installation of electric light in the town by the Italian harbour and railway company, the "Compagnia di Antivari."

Egypt.—A German Consular report states that there is a considerable demand in Egypt for small motors (petrol motors, Diesel engines and gas engines), small electric motors for works, such as printing works, pumping, &c., dynamos for lighting purposes, and large motors for cotton spinning works and large pumping plants. The imports of these machines in 1911 amounted to £E.414,082, and in 1912 to £E.418,494. Great Britain is the leading supplier of electric, gas and petrol motors, but there is keen competition from Switzerland. German competition in these lines is of comparatively recent date. In other machinery the United States is the chief supplying country. The imports from the United States in 1912 amounted to £E.41.893, as against £E 74,998 in 1911. Whether this decrease is due to the fact that buyers have learned by experience that the cheapness of American productions is off-set by cost of repairs and spare parts made necessary by defective working, and are therefore more disposed to purchase European machinery, or whether the decrease is only temporary, it is, as yet, rather difficult to say. In any case, American firms are taking active steps to recover the lost ground by enabling repairs to be made as cheaply as possible in the country itself, and by endeavouring to educate the native to an expert working of the machinery in order to avoid unnecessary breakages.

Spain.—The British Consul at Seville reports that the Sociedad Catalana de Alumbrado por Gas, which has now changed its name to La Catalana de Gas y Electricidad, after much opposition obtained permission from the Ayuntamiento to lay the electric cables in connection with their proposals to become suppliers of electricity as well as gas. The contract for the supplying and laying of the necessary cables was given to a British company, and work has been steadily progressing. The power station is making progress, but some little time must elapse before the company can supply electricity. As the German company has at present a practical monopoly of the electric lighting, the prospect of competition and a possible fall of prices is an agreeable one for Seville householders.

The Vice-Consul at Cadiz reports that the Puntales station connected by telegraph with the local offices of the Eastern Telegraph Co. and the French Submarine Cable Co., through the Spanish Government telegraph service, is becoming increasingly active, particularly as a large number of vessels, both men-of-war and merchant ships, have during the last year been installed at Cadiz with Marconi apparatus.

The Vice-Consul at La Linea reports that the Compania Peninsula de Telefonos have opened an office in La Linea, and it is now possible to telephone direct to Madrid and many important places in Spain.

Costa Rica.—The British Consul in a recent report refers to the installation of a hydro-electric power plant capable of developing up to 10,000 H.P., by Messrs. Felipe J. Alvaredo & Co., on the Virilla River at San Antonio de Belen, a village 6 miles west of San Jose. Its purpose is the supply of electricity for power, lighting, &c., in the cities and districts in the interior of the country.

Italy.—In reporting on the industries of Turin and district, the British Consul points out that the Province of Novara, which lies north-east of the Province of Turin, possesses some remarkably powerful electric installations. The Conti Electric Power Co. has, besides its installations in Lombardy, generating stations at Cerano, Trecate, Foppiano, Goglio and Novara, utilising powerful waterfalls and provided with machinery of the most modern type. The total power thereby obtained amounts to some 50,000 H.P., which is conveyed to the transforming station at Novara for conversion and distribution in the province and other districts in Lombardy, mains diverging in all directions. The Conti Electric Co. is building another large generating station at Verampio, which is expected to be ready about the beginning of 1915, making use of the Devero waters by a fall of 565 metres, the power obtained being a further 20,000 H.P. When the Verampio installation is in full work, the annual production of electric power at the company's works will be some 200,000,000 KW.-hours.

Mexico.—The American Consul at Acapulco reports that an electric light and power plant has been completed in Acapulco by E. Colima & Companhia, who purchased the equipment in Mexico City, except the poles, which came from San Francisco. Its initial capacity is 2,000 lights of 16 C.P. The municipality has contracted for lights for the streets. The company announces that the wiring and installation of lights will be installed free, but it appears that the high cost of the service will preclude a very general patronage. The cash-in-advance rates per month for lamps run from 8s. 4d. for a 16 C.P. to 33s. 4d. for 100 C.P., and £5 4s. 3d. for 400 C.P., with discounts of 5 per cent. for 5 to 10 lamps, 7 per cent. for 10 to 20 lamps, and 10 per cent. for 20 to 50 lamps. However, the company will probably realise that a meter system will prove more popular. The new plant will provide a market, restricted at first, for many electrical devices. Correspondence should be in Spanish to the company named.

Canada.—The American Consul at Moncton (New Brunswick) reports that the Moncton Tramways, Electricity and Gas Co., Ltd., assumed control in March of the gas and electric light plants, previously operated by the city of Moncton, which were leased for 40 years at an annual rental of about £2,000. New mains were laid throughout the city and from the gas wells, 12 miles away. Natural gas was first used on March 12th; it is now used in about 1,200 households and by 12 industries in developing power in both gas and steam boilers, with satisfactory results. The company uses gas in generating power for the electric light plant and for the street railway. The tramways department operates 3 miles of street railway in the city and 2 miles of the Moncton and Buctouche Railway, which has been electrified to Humphreys Mills, a suburb. Other extensions are contemplated, but are not yet definitely determined. Gas mains were laid from the wells to Hillsboro, New Brunswick, where nearly 500,000 ft. per day are consumed by 175 domestic consumers and two manufacturing plants. It is proposed to lay mains from the wells to Dorchester and Sackville, New Brunswick, and Amherst, Nova Scotia, in the near future. This company imported from the United States during the year three additional street cars, several carloads of gas-burning heaters, stoves and ranges, and meters, tools and fittings. It purchases the gas produced by the Maritime Oilfields, Ltd.

Catalogues and Lists.—Messrs. R. H. Patterson and Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—Catalogue of new and second-hand machinery on sale or hire.

The Hughes Label Co., Ltd., 34, Great Titchfield Street, London, W.—Several lists giving illustrations of labels such as they supply in ivory, celluloid, brass, aluminium, &c., for electrical apparatus, switches, machinery, &c.

Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, Westminster, London, S.W.—Leaflets giving illustrations and prices of flat-type tumbler switches and bayonet lampholders.

Messrs. Lead, Ltd., 1 and 2, Old Pye Street, Westminster, S.W.—Leaflet tabulating the cost of depositing lead in varying thicknesses up to $\frac{6}{100}$ in., taking current at 1d. per unit and lead at £22 per ton.

Messrs. James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.—20-page pamphlet containing a number of illustrations showing Keith dust removal plant for use in woodworking and other factories.

The Sirius Autogenous Works Co., 85-87, High Street, Stratford, London, E.—24-page illustrated catalogue fully describing, with the aid of detailed line drawings, their standard and portable acetylene generators for oxy-acetylene welding and cutting.

Messrs. Alfred Herbert, Ltd., Coventry.—December review and stock list of various machine tools.

A.E.G., Berlin.—Leaflets illustrating their steam turbo-pumps dynamos for coupling to Diesel engines, and the "Nitra" lamp consuming ½ a watt per candle.

Holiday Announcements.—Messrs. Ferranti, Ltd., announce the closing of their works and offices from Christmas eve, to Monday morning next, December 29th, and on January 1st, for the Christmas and New Year holidays.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham, announces that his works and offices are closed until Monday morning next.

The Edison & Swan United Electric Light Co., Ltd., will open their premises as usual at College Hill and Queen Street, E.C., on Saturday, the 27th inst., for the convenience of their customers.

Installation Contracts.—Amongst the orders recently booked by Mr. H. Moss, Bradford, are the following:—Complete installation for country house, for Mr. W. Briggs; extensions to electric heating arrangements at Bagden Hall, for Mr. T. Norton; extensions to installation in mills, for Messrs. J. Brownhill & Co., Ltd.; power and lighting switchboard, balancers and motors, for Messrs. E. Reed & Co., Ltd., and power, heating, lighting and telephone installations, for Messrs. Tee Bros. & Co.

Calendars and Diaries, &c.—The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, have again sent us one of their serviceable desk blotting pads.

From the Deutsch-Australische Dampfschiffs-Gesellschaft, of Hamburg, we have received a wall calendar for 1914. The pictorial feature is a representation, in colour, of the *Australia*, and beneath it is fixed a block of daily tear-off slips with bold figuring.

Messrs. Ferranti, Ltd., of Central House, Kingsway, London, W.C., have sent us a useful advertising novelty in the form of a desk paper weight, embodying on the front a calculator for determining the equivalent value of shillings and pence in decimals of a pound, or *vice versâ*, and on the back a mirror, for obvious purposes.

Messrs. Alfred Graham & Co., St. Andrew's Works, Crofton Park, London, S.E., have sent us one of their very handy desk blotting pads with a diary, interleaved with blotting, on the left-hand side. Calendars for 1914 and 1915 are given.

From Messrs. Chas. Clifford & Son, Ltd., Fazeley Street Mills, Birmingham, we have received a phosphor bronze paper knife, which will continuously call our attention to their specialities in phosphor bronze, manganese bronze and gun metal for some time to come, and incidentally will assist us in opening our letters. A postcard from any reader interested in these metals will bring one of these knives along immediately.

Tramcars for Russia.—H M. Commercial Attaché for Russia (Mr. H. Cooke) reports that the Council of Ministers has approved of the proposals of the Minister of the Interior to authorise the Municipalities of St. Petersburg and Samara to purchase electric tramcars from abroad, if necessary. The orders, however, must be given to Russian works if their prices do not differ considerably from the prices tendered by foreign works.—*Board of Trade Journal.*

Annual Dinner.—The staff of Messrs. J. H. Holmes & Co. held their annual dinner on Friday, 12th inst. There was a large and representative gathering, including several former members of the staff. The toast of the firm was proposed by Mr. W. Crosier, foreman, who is the oldest employé at the present time, and during the course of his remarks, some very interesting instances were given of the methods of doing electrical work in the olden days. The toast was responded to with great gusto. Mr. John H. Holmes, when replying to the toast, gave a brief outline of the history of the firm and some interesting reminiscences of work, particularly in connection with installations which were carried out in early days, stating that the first ship to be lighted electrically on Tyneside was ss. *Nonpariel*, this being one of the earliest installations carried out by the firm. As this year is the 30th of the firm's existence, a peculiar interest was attached to the remarks of the chairman. When the new works were first occupied in 1887, the number of hands employed was 42, but this has steadily risen until at the present time employment is found for 670 persons. The illustrated programme and menu, designed by a member of the staff, made a humorous comparison between present-day apparatus and that in use 30 years ago.

Bankruptcy Proceedings.—Roger W. Wallace, K.C., Campden Hill Gardens, Kensington.—Debtor appeared for his public examination on 16th inst. The statement of his affairs showed liabilities £91,987, and an estimated surplus in assets. Debtor, in the course of his examination, gave full information respecting his career, and the profits and losses incurred in connection with the various undertakings. His losses included £30,000 in the Gas Traction Co., Ltd, £10,000 in Dunderland Iron Ore Co., Ltd, £4,000 in Peat Industries, Ltd., and £20,000 in the British Aluminium Co., Ltd. His connection with the Westminster Electric Supply Corporation, Ltd., brought him a profit of £30,000. His directors had brought him as much as £5,000 in one year. Since 1908 he had devoted himself to chemical experiments, registering many patents which were valued in his statement at £73,000. Mr. Wallace mentioned that he had submitted a scheme of arrangement vesting all assets in a trustee for realisation and distribution, with a view to payment being made in full. The examination was concluded.

Charles Blake (Bilston Electrical Co.), 4, Church Street, Bilston.—Receiving order made December 17th at Wolverhampton, on debtor's own petition.

Wire Lamp Patents in Austria.—It is stated that as a result of the objections raised by the Westinghouse Metal-Filament Works Co., the Austrian Patent Office has declared the Austrian patent of the Siemens & Halske Co. in relation to the employment of drawn wire in tungsten lamps to be invalid. The so-called "angle patent" has in part met with a similar fate.

Liquidations.—Universal Cable Cord (Patent) Co., Ltd., 22, Henrietta Street, Covent Garden, W.C.—Winding up order made December 16th.

Prested Miners' Gas Indicating Lamp Co., Ltd.—At a meeting of creditors and shareholders held on 17th inst. at Carey Street, the Official Receiver reported that the liabilities were £2,329, and the assets £1,779, showing a deficiency of £[illegible]. The matter was left in the hands of the Official Receiver.

Book Notices.—*Moderne Wechselstromzähler*, a brochure issued by the A.E.G., Berlin, is an exceptionally handsome production, dealing with the new type of meter introduced by the company to suit the new conditions obtaining in connection with the development of the "overland" system of distribution of electricity. It is beautifully illustrated, not only the details of the instrument (type LJc) being separately shown and described, but also views of the various departments of the meter factory being given. The paper and printing employed are of the highest class, and the brochure, as a whole, is an admirable example of what such a work should be.

The Christmas number of the *Asteroid*, the official organ of the B.T.H. Social Club, contains a great deal of humorous matter in verse, in prose, and by caricaturist, which will be appreciated by those interested in Rugby affairs. The humorous side is allowed to predominate because in their everyday callings "so many of our workers are kept busy at the serious side."

Mechanical World Electrical Pocket Book for 1914. Manchester: Emmott & Co., Ltd. Price 6d. net.—This year's issue contains new sections on a variety of subjects, while others have been completely re-written, and the matter generally has been revised and extended. Even the half-watt lamp, which is not yet on the market, is described, and the book is excellent value for the trifling cost.

Practical Engineer Electrical Pocket Book and Diary for 1914. London: Technical Publishing Co. Price 1s. net.—This pocket-book now deals solely with electrical matters, steam engineering having been eliminated from its pages and new electrical information substituted. A useful feature is the insertion of lists of books at the ends of the sections, which enables readers to follow up a subject if desired. A large portion of the book is devoted to Acts of Parliament, Board of Trade Rules, and the regulations of the Home Office, Lloyd's, the I.E.E., &c. Altogether the pocket-book contains a remarkable amount of information, covering a very wide range.

"Mine Accident Prevention," by D. E. Woodbridge; "Safety in Tunnelling," by D. W. Brunton and J. A. Davis; "The Approximate Melting Points of some Commercial Copper Alloys," by H. W. Gillett and A. B. Norton; "The Use and Care of Miners' Safety Lamps," by J. W. Paul. Washington: Government Printing Office.

"Phase Compensation." By V. A. Fynn. St. Louis, Mo.: From the Author.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 12. December, 1913. New York: The Institute. Price $1.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 2. December, 1913. Newcastle-upon-Tyne: The Institution. Price 5s.

"*Journal* of the Franklin Institute." Vol. CLXXVI, No. 6. December, 1913. Philadelphia: The Institute. Price 50 cents.

"*Bulletin* of the Massachusetts Institute of Technology." Vol. XLIX, No. 1. December, 1913. Boston: The Institute.

Private Arrangements.—Mrs. A. E. Moore (trading as Henry Moore), ironmonger and electrician, 8 and 9, Longford Buildings, Oxford Road, Manchester, and 38, Wilmslow Road, Didsbury, Manchester.—A meeting of the creditors was held last week, when a statement of affairs was presented which had been prepared by Messrs. Edward Lawton & Son, chartered accountants, 14, Brown Street, Manchester. The statement disclosed ranking liabilities of £659. The assets were estimated to realise £316, less £86 for preferential claims, leaving net assets of £230, or a deficiency of £429. The business was an old-established one, having been commenced some 87 years ago by Mr. Henry Moore's father. The debtor's husband died in September, 1905, and since that time Mrs. Moore had continued to trade. A balance-sheet was prepared in 1905, and it showed a surplus, while all the creditors at that time were paid in full. A complete set of books had not been kept, but it was stated that the records showed that the turnover in 1908 was in excess of £1,500. Since that date the sales had declined, and during 1912 they amounted to £1,280. During eight months of the present year the sales had been £620. Owing to pressing creditors a deed of assignment had already been executed to Mr. G. H. Lawton. In the absence of an offer by the debtor it was decided to confirm the deed already executed, and a committee of three of the principal creditors was also appointed.

The Argentine Republic.—The imports of "electrical material and goods" into the Argentine Republic during the nine months ending with September last, are returned at £1,527,000, as compared with only £1,388,000 in the corresponding period of 1912.

LIGHTING and POWER NOTES.

Aberdeen.—The T.C. has decided to supply electricity for power to Messrs. Richards, Ltd., Broadford Works, at ordinary rates up to 100,000 units per half-year, and at ½d. per unit beyond that amount, the agreement to commence in 1914.

Argentina.—The Rosario City Council has, after 14 months' discussion, accepted the tender of Messrs. Colson, Brookhouse & Pyne for a supply of electricity. The concession is for 40 years, after which all the property of the company erected in the first five years of its contract, is to revert to the Council. Direct current at 440 volts is to be supplied for a minimum of 1,000 arc lamps for public lighting. The central station is to have a capacity of 2,500 KW., and the company is to deposit $100,000, returnable when station is opened. The maximum charge for public lighting is to be 34 cents gold per KW.-hour: for private lighting, 15 cents gold; heating and power, 10 cents gold; public buildings, 7 cents gold for light and 5 cents for heating. The Council is to receive 5 per cent. of the gross revenue from private lighting. As the original conditions have been modified, it is not certain that the company will accept them.—*Review of the River Plate.*

Australia.—The Albury Council has accepted an advance of £10,500 for the purpose of an electric lighting scheme. —*Sydney Daily Telegraph.*

Belfast.—Workhouse Lighting.—The B. of G. has referred the recommendation of the Watch Committee, that the Workhouse be lighted by electricity on the "Selas" system, at a cost of £4,000, to its engineer for report.

Brymbo.—Public Lighting.—The P.C. has accepted the offer of the Brymbo Steel Co., for electrical street lighting, at £66 per annum.

Buxton.—The U.D.C. has decided to extend the lighting cable to Wye Head, where land is being developed, and houses fitted for E.L. are being built.

Continental Notes.—Switzerland.—The new 13,000-H.P. hydro-electric generating station of the Bernische Kraftwerk Gesellschaft at Kallnach-au-der-Aare has just been put in operation.

Spain.—The municipal authorities of Campdevano (province of Gerona) have invited tenders for the concession of the electric lighting of the town.

A private company has been formed at Ochandiano (province of Vizcaya) to supply electricity for lighting and power purposes in that town, and at Olaeta and Ubidea.

La Sociedad Hidroelectrica Espanola is adding to its capital with a view to increasing the capacity of its plant for supplying electricity for lighting and power purposes in Madrid, Valencia, Alcoy and Carthagena, by acquiring the right to utilise the Dos Aguas and Villora Falls, on the River Cabriel, near the town of Villora, in the province of Cuenca. It is estimated that nearly 10,000 H.P. is available.

Delabole.—During the past year a company has been formed for the purpose of supplying Delabole, North Cornwall, with electric light; considerable progress has been made with the works, and it is now probable that the date of opening will be January 10th.

Gelligaer.—The D.C. has decided to apply for a prov. order to supply Bedlinog and Fochriw with electricity, at an estimated cost of about £5,000, if a supply is taken from the South Wales E.P.D. Co., and £3,600 with overhead wires, or £4,000 with underground cables, if taken from the Merthyr Traction and Lighting Co.

Glasgow.—The Electricity Sub-Committee on Works has agreed to recommend that the hiring of electric motors to engineering firms, &c., for use in their works, which had been the practice in the former Burgh of Govan, should not be extended within the Glasgow area of supply, and that the hiring of existing motors be discontinued as opportunity occurs.

Ground plans showing the new generating station buildings proposed to be erected at Dalmarnock, have been approved by the Sub-Committee on Works, and the engineer has been instructed to prepare detailed drawings of the first section of the works. It is proposed that the plant should consist of ten units of 13,000 H.P. each, or a total of 130,000 H.P. The present two generating stations are capable of meeting a demand of 55,000 H.P. Electrical energy is generated at 6,500 volts, and transmitted to sub-stations, where it is transformed to low pressure at 250 and 500 volts.

Harrogate.—Premises in Swan Road are to be opened by the electricity department as a showroom for heating and cooking utensils and general electrical apparatus.

Hinckley.—Prov. Order.—Under an agreement with the U.D.C., the Midland E.L. and P. Co. is to apply for a prov. order for electric lighting in the district, which will be transferred to the Leicestershire and Warwickshire E.P. Co.

Hindley.—New Loan.—The U.D.C. has decided to apply for an additional loan of £600 for a sub-station, making the total sum to be borrowed £3,100.

Hornsey.—New Loans.—The B.C. is making application to the L.G.B. for sanction to borrow a further sum of £6,000 for mains extensions.

Itchen.—Prov. Order.—The U.D.C. has decided not to sell its prov. order for E.L.

Japan.—It is reported from Tokio that the Fuji Gassed Spinning Co. is in negotiation for the purchase of the electricity undertaking of the Sagami Water Power Co.

According to an official report, the available water power for industrial purposes in Japan is estimated at 3,500,000 H.P., of which only about 200,000 H.P. is at present utilised, but schemes are at present under consideration with regard to a further 1,000,000 H.P.

Mexboro'.—The U.D.C. has decided to charge 1½d. per unit for the first 200 units per quarter, and 1d. per unit above, for heating and cooking.

Newmarket.—Public Lighting.—The U.D.C. has decided to have electric lamps erected in that part of the Avenue taken over by the Council, and the remaining portion of the thoroughfare will be similarly lighted by the owners of the Cheveley Estate. The Newmarket E.L. Co. will supply the posts, &c., and light the lamps for 26s. each per annum.

Rawtenstall.—Public Lighting.—At the T.C. meeting on December 18th, it was resolved at a cost of £2,000 to light by electricity the whole of the main roads in the borough, co-extensive with the tramways, and that a scheme and estimate of cost be submitted; 146 gas lamps will be superseded.

Rochdale.—Proposed Loans.—In consequence of the constantly-growing demand on the electricity department for current for power purposes, it has been decided to recommend the T.C. to apply for L.G.B. sanction to borrow between £50,000 and £60,000 for a further extensions at the works. In the event of the T.C. agreeing, the new application will bring the total outlay decided upon in less than two years to more than £100,000.

Southend-on-Sea.—New Loans.—The T.C. has applied to the L.G.B. for a loan of £30,000 for cables, feeders, mains, connection boxes, &c., for the purpose of suppling electricity in the borough and for a further sum for sub-stations in Leigh and Thorpe Bay.

Stirling.—The T.C. has received a petition from users of electricity in the burgh urging that if the Council is unable to grant the benefits offered by Mr. Balfour—who desires to acquire the electricity station and to institute a system of electric tramways—then the best possible terms should be concluded through Mr. Balfour.

Walsall.—New Generating Station.—The T.C. is, says the *Birmingham Daily Post*, considering the scheme, prepared by Mr. E. M. Lacey, for a new generating station. The cost of the new works is estimated at £40,000 to £45,000, and the ultimate cost of reorganisation is reckoned at £70,000. The question has been deferred for the consideration of alternative sites.

Watford.—An agreement between the R.D.C. and the U.D.C. for the supply of electricity within the parish of Aldenham, has been sealed, and the R.D.C. has decided not to consent to the proposal of the Colne Valley E.L. Co. to apply for a prov. order for the supply of energy to the Rickmansworth Rural District.

Weymouth.—New Plant.—The T.C. has decided to install a Diesel engine and generator at the electricity works.

Willesden.—The Electricity Committee has revised the proposed new conditions of supply, which provide for the reduction of the flat-rate charge from 4d. to 3½d. per unit as from the Christmas readings. The Committee has decided to create a reserve fund in connection with the undertaking by the investment of five sums of £1,000 each in various Government or Trustee securities, and will make additions thereto annually until the fund reaches the statutory limit; £3,500 is also to be transferred and designated "Working capital account," and will serve the purpose of preventing overdrafts at the bank in the early periods of each quarter.

On December 13th a number of members of the Council visited the new sub-station at Acton Lane, Harlesden, where three B.T.H. rotary converters, totalling 1,000 KW., with high and low-tension switchgear, have been installed. One of the 300-KW. machines was started up by the chairman of the Electricity Committee.

U.S.A.—The Lake Spaulding dam of the Pacific Gas and Electric Co. has been completed to a height of 242 ft. above the river bed; it is intended to raise it to the enormous height of 320 ft. The water will be used six times in successive power developments before its final use for irrigating some 75,000 acres of fruit land.

In the suits which are being brought by hundreds of manufacturing and engineering firms against the New York Edison Co., it is stated that many New York landlords have a secret system of rebates with the company, by which they purchase electricity at 2½d. per unit and sell it to their tenants at 5d., the object of the supply company being to forestall the installation of individual plants in large buildings. It is claimed that unless this practice is discontinued, manufacturers of individual plants might as well go out of business, as the Edison Co. is thereby able to enjoy a monopoly.—*Daily Telegraph.*

The *Electrical World* recently mentioned that the Commonwealth Edison Co., of Chicago, was supplying the Universal Portland Cement Co. with some 5,000 KW. on an 80 per cent. load factor. This customer is supplied on an off-peak basis, and its requirements amount to about 35 million KW.-hours a year.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Tramway Loans.—The T.C. has approved of the draft prov. order for powers to construct additional tramways, run trolley vehicles and motor-omnibuses, &c., and proposes to seek powers to borrow £65,000 for the tramways undertaking.

Argentina.—The Legislature of San Luis has granted a concession for 60 years to Mr. Antonio Gamberini for an electric tramway in Villa Mercedes.—*Review of the River Plate.*

Belfast.—It has been decided to go to Parliament for a Bill to sanction the expenditure of £15,000 on the Bellevue Gardens, which are run in connection with the Glengormely line of the tramway system.

Birmingham.—It has been previously mentioned in these columns that the Corporation Tramways Committee had practically arranged to buy up the Birmingham and Midland Omnibus Co.'s undertaking so far as it related to Birmingham.

Recently it has been sought to come to some agreement with the company, by which the country 'bus services between the city and neighbouring towns, which the company proposes to inaugurate next year, shall not compete with the Corporation tramways to the city boundaries. It is believed that the matter will come before the City Council in January.

The Tramways Committee has had under consideration a report on the question of ½d. fares; no recommendation will be made until the close of the financial year.

Bury.—The B. of T. has informed the T.C. that it is now too late to apply for a prov. order in the ensuing session for the tramway extensions, and the Tramways Committee has decided to interview the Board with a view to obtaining consent to the laying of a track in connection with the Limefield extension while certain paving is in progress.

Canada.—In connection with the Mount Royal Tunnel and terminals of the Canadian Northern Railway in Montreal, six 2,400-volt D.C. trolley locomotives are proposed, two coupled together to haul heavy trans-Continental trains of 1,130 tons, and one for freight trains of 1,000 tons, and local trains of 500 tons trailing load. The locomotives are of the box-cab articulated running gear type and will weigh about 83 tons. Four 1,200-commutating-pole motors and a double end multiple-unit control equipment, with air-brake apparatus, are included in the equipment. The signalling system provides for automatically cutting off the power from the motors and applying the brakes, in the event of a driver over-running a signal at danger.

Colwyn Bay.—The U.D.C. has had before it a communication from Mr. A. G. Balfour, general manager of the Electric Railway Co., suggesting consideration of the question of running a single line through into Penrhyn Avenue, to be used as a down track for the trams, the cars running only in one direction on the promenade. The Council is to interview Mr. Balfour.

Continental Notes.—Turkey.—At the recent meeting of the Electric Light and Power Investment Co., held in Berlin, Herr von Gwinner, of the Deutsche Bank, referred to the tramways in Constantinople, and the projected underground and elevated electric railway. He stated that the first section of the tramways in the main street of Pera was opened to traffic some time ago, and the receipts at once increased by two and half times, as compared with those when horse traction was used. The company's interest in the tramways was inconsiderable at the present time, as its share in the concession was disposed of some time ago to the Société Financière, of Brussels, at a profit of 50 per cent., the Belgian company having amalgamated the tramway concession with those for the proposed underground and elevated railway and the electricity works, and that appertaining to the old Stamboul Gas Co. The construction of the railway had not yet been commenced, but the work would be begun as soon as the negotiations in regard to the details of the route had been concluded.

Austria.—A preliminary concession has been granted in connection with a projected electric tramway in the Town of Lemberg, Galicia.

Croydon.—The B.C. has resolved to double the track on the Norwood and Penge route between Selhurst Station and Princess Road, at a cost of £2,550. Councillor Addison alleged that £200 per week was being lost on the route: Ald. Allen (Chairman of the Tramways Committee) said that on November 1st the balance was just on the right side. The motor-'bus competition on this route is very severe.

Dewsbury.—Tramway Extensions.—The T.C. has decided to apply for powers to construct a tramway across the Market Place, and to secure running powers over the lines now leased to the National Electric Construction Co., and the B.E.T. Co., from Wakefield Road to Leeds Road, and from the Market Place to Willans Road; and over other sections of the B.E.T. Co.'s lines as may afterwards be determined.

Newcastle (County Down).—Proposed Tramways.—A very important project is on foot in connection with the opening up of the Mourne Mountains by an electric tramway. The Mourne Mountains are one of the finest tourist areas in Ireland, but they are extremely difficult of access by foot. The Urban Council is thinking of putting the project into more tangible form and has had a prolonged discussion of the matter.

South Africa.—In discussing a paper read before the South African Institute of Engineers, it was stated by Mr. J. H. Dobson, general manager of the Johannesburg municipal E.L. department, that the experience gained with their petrol omnibuses showed all-in costs of 1s. 4d per car-mile, taking the life of the bus at only four years. No road maintenance cost or taxes were included in the figure mentioned. He further mentioned that Messrs. A. H. Johnson & Co., of Johannesburg, were placing a battery-driven tramcar at the Corporation's disposal for trial purposes.

South Lancashire.—The South Lancashire Tramways Co. is negotiating with the Salford Tramways Committee with a view to linking up its tramways at Newtown, Clifton, with the Corporation's system at the corner of Station Road, Pendlebury. There is a stretch of 200 yards at this point still unconnected.

Southend-on-Sea.—New Loans.—The T.C. has applied to the B. of T. for loans amounting to £8,750 for doubling the tramway track in Southchurch Avenue, the Broadway, and for £6,000 for laying tramways at Leigh.

U.S.A.—Sir Guy Granet, general manager of the Midland Co., with members of the company's engineering staff, is at present on a tour of railway inquiry in the States, the principal matters of interest being electric traction, freight handling, and, apparently, train lighting.

According to Sir Guy, the Midland is faced (as is known) with the electrification of the Tilbury line, also as a future possibility with the electrification of the 50 miles of main line from London to Bedford, on account of the rapidly-growing suburban traffic. Another attractive proposal mentioned was the substitution of electric for steam traction on hilly sections dealing with heavy goods traffic, with a view to running longer trains than are at present possible.

Sir Guy further pointed out that it might be desirable near London to adopt a system of electrification which could be used in connection with the local underground railways.

West Hartlepool.—New Cars.—The Tramways Committee decided on the 15th inst. to purchase five new tramcars for use on the Park and Seaton Carew route. The estimated cost of the cars, with the necessary spare parts, is £4,480.

TELEGRAPH and TELEPHONE NOTES.

Canada.—About £400,000 will be expended by the Alberta Government on telephone extension work during 1914. This will include the erection of a large number of exchanges.—*Canadian Electric News.*

New Cable.—A contract has been entered into between the Portuguese Government and the Europe and Azores Telegraph Co., Ltd., under which the latter is empowered to lay a submarine cable between the Azores and the coast of North America, and another cable between the Azores and the United Kingdom or some point on the European continent.—*Board of Trade Journal.*

New Telephone Cable.—A new telephone cable is being laid between Howth (Co. Dublin) and North Wales, which is expected to improve the service very considerably. Hitherto, telephone subscribers in Dublin and the South of Ireland, who wished to speak to London, had to do so *via* Belfast and Glasgow, whereby numerous delays were occasioned. The new cross-channel cable is estimated to cost £78,000.

United States.—At the suggestion of the Department of Justice, the American Telephone and Telegraph Co. has agreed to give up its interests in the Western Union Telegraph Co., and to effect a reorganisation, to conform to the department's interpretation of the Anti-Trust Law.

The Postmaster-General, in his annual report, recommends Government ownership of the telegraph and telephone lines.

At midnight on December 31st (by American time), the powerful station near Washington, U.S.A., will issue a wireless message, for which all receivers are invited to listen, with a view to recording long-distance reception.

West Indies.—Last week Mr. Samuel announced that the cable rates between this country and the West Indies would shortly be reduced from 3s.-5s. 6d. to a uniform rate of 2s. 6d. a word; the rate would be halved for Press and deferred plain language messages.

CONTRACTS OPEN and CLOSED.

OPEN.

Ainsworth (near Bury).—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

Australia.—Sydney (New South Wales).—March 18th.—For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

Adelaide.—February 11th.—P.M.G. 50 cable terminals. See "Official Notices" to-day.

Melbourne.—February 17th.—P.M.G. Cable boxes. See "Official Notices" to-day.

Bedford.—Corporation. One hand-operated overhead travelling crane. See "Official Notices" December 19th.

Belgium.—December 30th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels, is inviting tenders for the supply of the bronze wire for overhead conductors, required during 1914. Specifications can be obtained for one franc from the address given above.

January 3rd. The Belgian Post and Telegraph Authorities in Brussels (Salle de la Madeleine) are inviting tenders for the supply and laying of a quantity of telephone cables in the Liége and Brussels districts.

January 19th. Antwerp Municipal Authorities (1) for the supply and installation of electrical equipment for two transformer cabins, (2) 70 electric contacts, and (3) armoured electric cables. Tenders to the Burgomaster, Hotel de Ville, Antwerp; deposit 2,000 fr. (£80) in the case of (1); 1,000 fr. (£40) in the case of (2); and 7,000 fr. (£280) in the case of (3). The cahiers des charges may be obtained, price 50 centimes each, at the Hotel de Ville, Antwerp. Copies (in French) may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

Bradford.—January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

Carlisle.—December 31st. Corporation. Two 1,250-kw. high-pressure turbo-alternators; two sets of surface-condensing plant; two 600-kw. rotary converters; and high-tension switchgear. See "Official Notices" December 12th.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Southend-on-Sea.—Council. Three single-deck open tramcars which can be covered in during bad weather. The Electrical Engineer, Mr. R. Birkett.

Spain.—Tenders are at present being invited by the municipal authorities of Salamanca for the concession for the supply of electrical energy for lighting and power purposes in the town.

January 1st. Tenders are being invited by the municipal authorities of Umbrete (province of Seville) for the concession for the electric lighting of the town during a period of 20 years.

Swansea.—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" December 19th.

CLOSED.

Admiralty.—The Edison and Swan United Electric Light Co., Ltd., has secured the contract for Royal Ediswan drawn-wire tungsten-filament lamps for H.M.S. *Tiger.*

Australia.—N.S.W. Public Works Department:—

Two electric goods lifts, in Argyle Bond, £1,000; two temporary lifts, £55. Standard, Waygood, Hercules, Ltd.—*Tenders.*

The following tenders have been accepted by the Postmaster-General's Department:—

Western Australia:—

Telephone material.—Western Electric Co. (Aus.), Ltd.
Condensers, 27,000 porcelain insulators, 5½d. each; 15 miles two-twisted, tinned copper wire, £3 7s. 6d. per mile.—J. C. Fuller & Son (Leslie and Co., Perth).
3 miles silk and cotton-insulated, light lead switchboard cable, taped and braided, 42 conductors, £63 9s. 6d. per mile.—Malloch Bros.—*Tenders.*

Barnes.—The U.D.C. has accepted the tender of Messrs. Pooley & Austin, for a 10-kw. steam set with Reavell engine and Mawdsley dynamo and switchboard, for the clinker-pressing plant, at £141.

Germany.—The municipal authorities of Bremen have lately placed a contract with Messrs. Sulzer Gebruder, of Winterthur, Switzerland, for the supply of two 5,000-H.P. Diesel engines for the extension of the electricity supply undertaking in that city. The engines will be of the six-cylinder vertical type, and will be direct-coupled to 7,000-volt, 50-period alternators. The plant at the generating station at Bremen at present comprises two steam and two water turbines, with generators of a total capacity of 7,500 kw.

Glasgow.—The Tramways Sub-Committee on Works and Stores record the acceptance of the following tenders:—

Telephones.—James M'Millan & Co.
White lead.—Hird, Hastie & Co.
Adhesive tape.—A. Avtsine.
Car bells.—Standard Electric Co., Ltd.
Car brake chains.—Weldless Chains, Ltd.
Trolley cord.—W. C. Yuille & Co.; W. G. Black.
Rubbers for snow ploughs.—George M'Lellan & Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.
Travelling cranes.—Cowans, Sheldon & Co., Ltd.
Dynamos.—Siemens Bros.
Generating set.—W. H. Allen, Son & Co., Ltd.
Telephone sets and parts.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. and Co., Ltd.; Walter's Electrical Manufacturing Co., Ltd.; West London Scientific Apparatus Co., Ltd.

Post Office.

Telegraphic apparatus.—Gell Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Silence cabinets.—British L.M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—Callender's Cable, &c., Co.; W. T. Henley's Telegraph Works Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Dry and Leclanché cells.—Siemens Bros. & Co., Ltd.
Earthenware ducts.—Doulton & Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.; T. W. Lench, Ltd.; E. Lewis and Sons.
Bronze and copper wire.—T. Bolton & Sons, Ltd.
Enamelled copper wire.—B.I. and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.
Galvanised iron wire.—Rylands Bros., Ltd.; Whitecross Co., Ltd.
Electric lighting at Leeds New Telephone Exchange.—G. E. Taylor and Co., Ltd.
Manufacturing, supplying, drawing-in, and jointing cable; Eastern, South-Eastern and London Engineering Districts.—Callender's Cable, &c., Co., Ltd.; Siemens Bros. & Co., Ltd.; Johnson & Phillips, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Private branch exchange extension at Harrods, Ltd., Brompton Road, S.W.—Western Electric Co., Ltd.
Telephone exchange equipment at Greenwich.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment extension at Worcester.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment (trunk) at Leeds G.P.O.—Siemens Bros. and Co., Ltd.
Laying underground conduits, manufacturing, supplying, drawing-in and jointing cable at Scotland Engineering Districts.—W. T. Henley's Telegraph Works Co., Ltd.; B.I. and Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.; Callender's Cable Co., Ltd.

India Office, Store Department.

Dynamos.—J. Stone & Co.
Electrical plant.—British Thomson-Houston Co.
Motor alternator.—Lancs. Dynamo, &c., Co.
Wire.—R. Johnson & Nephew.

London.—Hampstead.—The B.C. has accepted the tender of Messrs. E. Foster & Co. for 10,000 tons of Ibstock deep small peas, at 13s. per ton.

Southend-on-Sea.—The T.C. has accepted the following tenders in connection with the new motor-'buses:—

W. A. Stevens, Ltd., Maidstone.—Three petrol-electric chassis £690 each.
Straker & Squier, Ltd., Blackfriars.—Three petrol chassis, £680 each.
Brush Electrical Engineering Co., Ltd.—Three front-seating car bodies, £180 each; and four with side seats, £180 each.
Edison Accumulators, Ltd.—Electrically-driven chassis, £825.

The Council has also accepted the tender of Messrs. Edgar Allen and Co., Ltd., for cross-over materials for the tramways, at £620.

Weymouth.—The T.C. received the following tenders for wiring for the E.L. the premises at 3, Devonshire Buildings:—

J. H. Rankin	(accepted)	£20
C. Tett		23
W. D. Orchard		41

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Friday, December 26th. At 6.15 p.m. At the Institute. Annual Social.

Royal Institution of Great Britain.—Saturday, December 27th. At 3 p.m. At Albemarle Street, W. Juvenile lecture, first of a series on "A Voyage in Space," by Prof. H. H. Turner.

Electro-Harmonic Society.—Friday, January 2nd. At Holborn Restaurant. Smoking Concert.

Junior Institution of Engineers.—Friday, January 2nd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Electric Cooking." By Mr. E. J. Hazelton.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leay.

The following orders have been issued:—

Monday, January 5th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9.30 p.m. Special class on Crossley engine, 7 to 8 p.m.

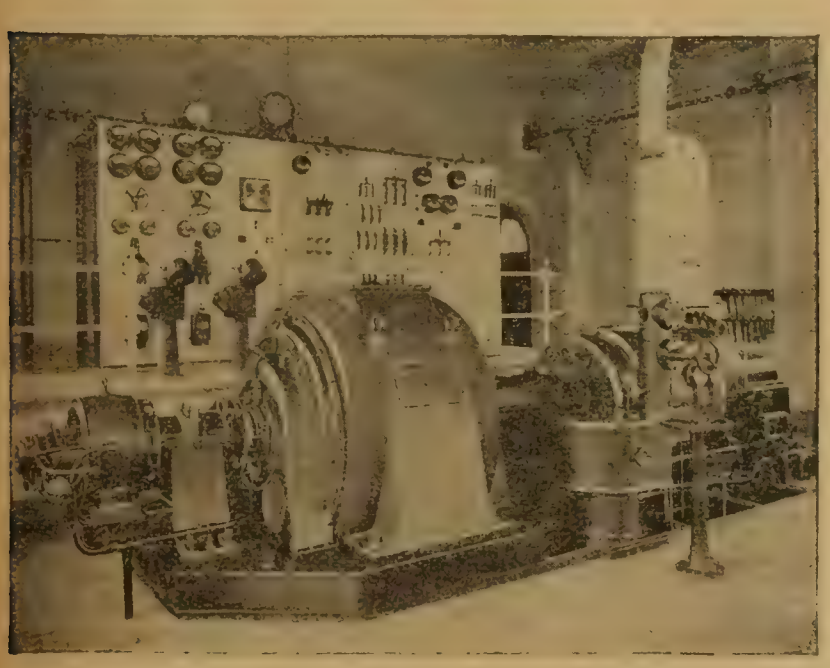
Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Colliery Exhaust Steam Plant.—There has recently been installed at the Manners Colliery, Ilkeston, a steam turbine plant to utilise the exhaust steam from various main engines, which steam had previously blown to atmosphere; practically the whole of the electrical power required in the colliery is now obtained by this means. The accompanying illustration gives a view of the power house which contains a 300-kw. Witton-Belliss turbo-generator, generating three-phase current at 440 volts, 25 cycles, and running at a speed of 1,500 r.p.m., and a small reciprocating set comprising a 150-kw. Witton alternator driven by a Belliss engine at 375 r.p.m., which takes the lighter load at nights and at times when the plant which ordinarily supplies the exhaust steam is not at work.

The exhaust steam is led to a central reservoir consisting of a number of old boilers which have been turned to account. The condensing plant consists of a Ledward & Beckett ejector condenser with a spray cooling pond; the generators supply power to



300-kw. Witton-Belliss Exhaust Turbo-Generator, and G.E.C. Switchboard, Manners Colliery, Ilkeston.

an open-type G.E.C. marble switchboard, which includes, amongst the usual complement of instruments, a leakage indicator and a voltage regulator. The colliery works with an insulated neutral. A small cloth filter has been included to filter the air for ventilating the generating plants. The power house electrical equipment was supplied by the General Electric Co., of Witton.

An Acid-proof Material.—According to an article by Prof. Matignon, in *La Technique Moderne*, Dr. Carlo Rossi, manager of a nitric acid works at Legnano, has produced with the aid of the electric furnace a new substance, which he calls Elianite, and which is proof against all acids. Compared with cast-iron, élianite has about three-quarters the tensile strength and a quarter to three-quarters the resistance to compression; its electrical and thermal conductivities are 20 per cent. lower, but its hardness is 1·6 times that of cast-iron. Its density is slightly less. The melting point of élianite is 1,400° C. The new material casts well, and is suitable for the construction of apparatus of large dimensions for the concentration of nitric acid in vacuum pans by steam heating, a process which will facilitate the production of fuming nitric acid required for the manufacture of explosives. Prof. Matignon states that the new substance probably consists essentially of a ferro-silicon, and, therefore, is readily attacked by alkaline solutions; but to the acid manufacturing industries it will be of the greatest importance, enabling many processes to be adopted which have hitherto been impracticable for want of a suitable material.

Chambers of Commerce and Income Tax.—The Executive Council of the Association of Chambers of Commerce of the United Kingdom some time ago appointed a special Committee to consider what representations should be made to the Board of Inland Revenue as the outcome of certain resolutions that were passed at the annual meetings in 1912 and 1913 with regard to depreciation and other matters. The result of the deliberations is that the Committee agreed that representations should be made on the following questions:—

1. Allowance for depreciation of buildings and other structures.
2. Allowance for depreciation of wasting assets, shaft sinking and development, furniture, fixtures and fittings.
3. Allowance for expenses of removal and rearrangement of plant and machinery.
4. Increased allowance for depreciation in respect of machinery in operation day and night.
5. Regularisation of rates of depreciation allowed in different trades.

The Committee also suggest for the consideration of the Board of Inland Revenue:—

1. The consolidation and amendment of the Income-Tax Acts in force and incorporating either in the Act or in the rules and schedules the instructions issued from time to time by the Inland Revenue to its officials as to their duties and the rules for calculating deductions from depreciation.
2. Assurance in all districts of continuity of policy in practice and administration.
3. All earned incomes, whether from trade or employment, should be assessed under Schedule D.
4. The allowance of formation expenses of joint-stock companies and expenses incurred in issuing further capital as deductions, as well as all expenses or losses incident to carrying on a business, and which either by law or commercial usage must be met out of profits before dividends can be declared to shareholders.

An Interesting Electric Motor Fire Engine.—Like most of the leading fire brigades in the world, the equipment of that of New York is being rapidly converted from horse to motor traction. In connection with the change, the New York authorities have carried out an interesting experiment—that of converting one of the old horse-drawn steam fire engines to electric traction. The vehicle, which had previously seen 10 years' service, was converted by the Couple Gear Freight Wheel Co., of New York, who removed the old front portion of the machine and replaced it with steering gear and a front axle with two hub electric motors, and an 80-cell storage battery divided into two sections. The vehicle, for the accompanying illustration of which we are indebted to the "Edison Monthly," was put in service in April, 1912, and during the ensuing 12 months, it was called out to 319 fire alarms, covering approximately the same number of miles. No mileage record was kept, but a mile for each alarm is considered a fair average.



Horse-drawn Fire Engine, converted for Battery Traction.

During the 12 months, energy to the extent of 1,965 kw.-hours was consumed in charging the batteries, the cost of the same being £24 10s. Added to this was £14 15s. for sundries, and £40 for depreciation, making the total cost of motive power for the apparatus for the year just under £80. For comparison, the fire department officials prepared a table showing the cost of horses for a similar vehicle. The principal item is that of feed—£85 11s. Added to this is £4 7s. 6d. for veterinary service, £17 14s. 6d. for shoeing, and £28 16s. 6d. for depreciation, making a total of £136 9s. 6d. These figures, which are based on the performance and cost of keeping three horses, show that there was an economy of roundly £56 in favour of the electromobile. During its first year there was not a single instance of damage to the electrical equipment of the machine, although street accidents necessitated some repairs to the mechanical portion. More than 14 hours were spent at fires during the 12 months, and approximately 230,000 gallons of water were pumped.

The World's Hydroelectrical Resources.—From statistics collected by De la Brosse, it appears that the water powers available for electric generation in France range in the aggregate between 4,000,000 H.P. in the lowest water period, and

3,000,000 H.P. in the highest water period. These are distributed in the three chief regions of France. The following figures give the water-power in H.P. at lowest water :—

Alps and Pyrenees	2,300,000
Middle and East	900,000
Other regions	1,400,000
Total	4,600,000

The extent of the present utilisation is 600,000 H.P. Installations under construction, or contracted for, represent 145,000 H.P. and projected, 635,000 H.P. These are allocated to the various regions as follows :—

—	Utilised H.P.	Employed for			Sundry H.P.
		Electro-chemistry. H.P.	Electro-metallurgy. H.P.	Light and power. H.P.	
Alps	473,000	60,000	210,000	195,000	8,000
Middle region...	51,000	—	1,000	50,000	—
Pyrenees ...	55,000	10,000	10,000	35,000	—
Other regions...	21,000	—	—	21,000	—
	600,000	70,000	221,000	301,000	8,000

The value of the water power installations is shown by the amount of share and bond capital of the several concerns. It appears that power and railway companies stand for 430,000,000 francs. The value of the electro-chemical and electro-metallurgical undertakings totals 110,000,000 fr. The value of French undertakings consequently aggregates 540,000,000 fr.

These figures compare with the available and utilised powers of foreign countries as under :—

Country.	Water-power capacity at the turbine axles. Available.	Used.	Percentage of utilisation.
Great Britain	963,000	80,000	8·3
Germany	1,425,000	445,000	31·2
Switzerland	1,500,000	380,000	25·0
Spain	5,000,000	130,000	2·6
Italy	5,500,000	510,000	9·2
France	5,587,000	600,000	10·3
Austria-Hungary	6,460,000	515,000	8·0
Sweden	6,750,000	550,000	8·2
Norway	7,500,000	550,000	7·3
Europe, total	40,955,000	3,760,000	9·2
United States	30,000,000	2,000,000	6·6
Japan	—	65,000	—

The stimulus which electricity must prove to the industrial development of countries barren of coal resources is very evident from the above statistics.

Peat as Station Fuel.—The generating station on the Wiesmoor in East Friesland, which has now been in operation for a period of about two years, and which has been referred to on former occasions, was designed for the purpose of utilising peat as the boiler fuel, and at the same time to open up the moorland to agricultural operations. The nearest locality to the station is Aurich, which is nearly 14 miles distant, and not a single district exists in the vicinity which promises to become a good customer for the supply of electrical energy for its industries. According to an article in the *Technische Rundschau*, by Prof. J. Teichmüller, the peat has to be kept in considerable quantities in a very dry condition ready for use, if there is not to be a shortage of fuel at the end of the winter, when the beginning of the peat production campaign commences. In addition to large stacks of peat briquettes which are accumulated, a peat shed having a storage capacity of 2,000 tons is provided in the station, and a second shed adjoins the boiler house. At the outset the conditions attending the firing of the boilers did not permit of the utilisation of the fuel so as to obtain a high degree of efficiency, but after trials extending over a considerable period, it was found possible to reduce the consumption of peat first to 5·9 lb. per KW.-hour, and finally to 5·5 lb. per KW.-hour. With peat at a price of 5s. per ton, these figures represent a cost of ·156d. per KW.-hour for fuel, which is held to afford proof that a peat fuel generating station can be worked successfully on an economic basis.

The generating plant comprises four steam turbo-dynamos, each of 1,500 KW., and generating energy at 5,000 volts, which may be transformed up to 20,000 volts. The overhead network is carried on wooden masts which have been bedded in the sub-soil of the moor—an operation which was extremely difficult to carry out, in consequence of the nature of the soil. The peculiarity of the undertaking lies in the cultivation of the moor simultaneously with the winning of the peat. For the former purpose the drainage of the moor comes first into consideration, and wide and navigable canals are being made which receive the water collected by a network of drains, and which convey the water to public canals. When sufficiently drained, the moor land is ploughed, and harrowed and fertilised, and then sown with the first seed. The drainage canals are excavated by two peat dredgers, and 12 so-called peat machines. After the top layer of "white moor peat" has been removed by hand labour—it is of no use as fuel—the dredgers are brought into operation, the buckets being driven by an electric motor, whilst a second motor provides for horizontal movements. The wet peat is conveyed to an electric press, and the cakes made are placed on the surface of the drained moor to dry. The cakes are subsequently cut by machinery into briquettes, and, when completely air-dried, although still containing from 20 to 30 per cent. of water, they are transported on a field railway equipped with benzol locomotives, for direct use in the power station, or for storage in the sheds.

The peat machines work in connection with elevators, similarly to the dredgers, but deliver the peat from the presses in the form of briquettes, which are laid out by labourers on the drained moor to dry. Only the months of April to August are available for the collection of the peat, as frozen peat is unserviceable as fuel. If wet weather prevails about the end of the summer the laid-out peat absorbs water, and if it does not become dry again before the arrival of frost, the latter renders it useless. On the other hand, completely air-dried peat does not freeze and does not absorb water, and it can, therefore, be arranged in stacks for the whole of the winter. The Wiesmoor has an area of about 15,000 acres, and the peat a thickness on an average of 8 ft. But even from the canals alone, which have a length of 36 miles, it is calculated that the available peat will suffice to supply the electricity works with fuel for a period of 20 years, if the disposal of electrical energy in this time should grow to an average of 20,000,000 KW.-hours per annum, or to two and a half times the amount of the present production. On the completion of the canals the remainder of the area, which in the meantime will have been under cultivation for agriculture and fruit and cattle raising, will be worked for the peat deposits. But the final goal is the cultivation of the moorland when stripped of the peat. It is considered that settlers will be easily obtainable for the winning of the peat and its remunerative sale to the electricity works, and that an area of from 12 to 17 acres will provide a living for a family of five persons without requiring outside assistance.

Electric Vehicle Committee.—The third meeting was held on December 11th. A letter was read from the Chief Commissioner of Metropolitan Police, regretting that he was unable to accept the invitation of the Committee to become a member of it. A letter was read from the Incorporated Motor Users' Association, asking that they might be represented on the Committee, and as a result Mr. E. S. Shrapnell-Smith, the treasurer of the Association, had been appointed for this purpose. The Sub-Committees appointed are as follows :—

Technical.—R. A. Chattock, F. Ayton, J. E. Edgcome, R. E. Mossay, E. S. Jacob, Conway Jenkins, J. Christie, W. H. L. Watson, and a B E.A.M.A. representative of the Dynamo and Motor Section and of the Switchgear Section.

Commercial.—R. A. Chattock, F. Ayton, F. E. Gripper, E. S. Shrapnell-Smith, A. H. Seabrook, A. C. Cramb, H. Faraday Proctor, W. S. Naylor, J. F. Monnot, W. R. Rawlings, J. S. Highfield.*

The following matters were referred to the Technical Sub-Committee :—

1. Arrangements to recommend for Charging Batteries.
2. To decide upon the most suitable sizes of a line of charging outfits : (A) for D.C. systems ; (B) for A.C. systems.
3. Instructions for Charging Batteries.
4. Rules for use in maintenance of Electric Vehicles.
5. Standard Ratings for Motors.
6. Standard Battery Voltages.
7. Standard Ratings for Commercial Vehicles.
8. Wiring Details.
9. Standard Charging Plug and Receptacle.
10. Standard Battery Units.
11. Electric Lighting on Vehicles.

To the Commercial Sub-Committee the following matters were referred :—

1. The drafting of a circular letter to Electric Supply Undertakings in regard to Provision of Charging Facilities, Tariffs, Publicity, &c.
2. Insurance Rates.
3. Parades and Exhibitions.
4. To collate information and publish same.
5. Taxation Matters.
6. Issue of Maps and Lists giving information *re* Charging Stations.
7. Preparation and publication of Publicity Matter, Advertising.

As it would be an advantage in the future if the standard plug and receptacle could be made an international one, the secretary was directed to get into touch with the German and French Institutions of Electrical Engineers, in order to ascertain whether such a proposal would have their support.

Ozone.—Writing to the *Times* of December 16th, Dr. Leonard Hill refers to the adverse criticism of certain American scientists, and says that animals exposed for nine hours each day for a fortnight to a concentration of ozone much higher than is used in ventilation, suffered no harm and put on weight like control animals.

The health of the Central Tube Railway men shows that the weak concentration of ozone there used has had no ill effect. The proved fact remains that ozone abolishes our power to smell almost all the evil trade smells, and in a concentration which does no harm. The American authors are perfectly right in insisting that ozone should not be used in schools, &c., in place of an adequate

* Elected to represent Inc. Assoc. of Electric Power Companies.

supply of fresh air. Fresh cool moving air is essential for the maintenance of vigorous health. But there are, unfortunately, numerous places in our cities where the unpleasant smell and monotonous depressing quality of the air cannot be remedied wholly by ventilation.

"It does not matter in the least whether ozone destroys the smell or prevents our smelling it; if it takes away a monotonous and depressing sensation it does good. The other day I had a he-goat in my laboratory, and its smell was overpowering and most unpleasant. A few minutes' run of an ozone apparatus freed the room from smell, and made it pleasant. There can be no doubt that the unpleasant smell of the Central London Tube Railway has been very largely removed by the use of ozone, and having determined, and insisted on, the provision of a safe concentration there I can see no harm in its employment."

Institution and Lecture Notes.—Derby Society of Engineers.—The syllabus of the Society for the current session includes an item for February 10th entitled "Notes and Experiments in Wireless Telegraphy," by Messrs. S. G. Taylor and A. T. Lee. The booklet containing the rules of the Society also sets forth particulars regarding the Derby Wireless Club (there are about 30 stations in the district) and a number of other local societies, with an engagement memorandum book, quite a useful combination.

Asociacion Argentina de Electro Tecnicos.—On October 18th last, this society was constituted, with a list of 200 adherents, to bring together all those connected with or interested in electrical enterprise in Argentina.

Institution of Electrical Engineers.—At the opening meeting of the Students' Section, on November 26th, an address was delivered by Dr. C. V. Drysdale, on "Food Supply and the Electrical Engineer." Dr. Drysdale said that the Birkeland-Eyde system now utilised about 300,000 H.P. of water power, fixing about 35 million pounds of nitrogen annually. Another process was the production of calcium cyanamide by the Franck Caro method. About 90 million pounds of nitrogen were now annually fixed by this process, making about 125 million pounds in all. This amount was only sufficient to increase the world's harvest of cereals by less than 1 per cent., and the needs of an unrestricted population would demand a present increase of 30 per cent., and a 4 per cent. further increase each year. There was, therefore, little likelihood of supply equalling demand. Suggestions were made as to the utilisation of electrical power for ploughing and subsoil treatment for "dry farming," for increasing rainfall, electrolysing the soil, supplying ultra-violet radiation, &c. The possibility of employing the solar energy directly for the fixation of nitrogen was also considered.

Cornish Institute of Mining, Mechanical and Metallurgical Engineers.—On December 13th the Institute discussed two papers, recently read—one by Mr. L. A. Hards on "The Application of Electricity to Mines," and one by Mr. R. D. Gill, on "Comparisons of Costs of Mine Power."

Junior Institution of Engineers.—A paper was recently given on the subject of "Efficiency of Production," by Mr. H. N. Munro, who pointed out that England's supremacy as a manufacturing country depended upon her status in the world's market. The factors influencing this status, which is dependent on our efficient production, were discussed seriatim.

Institute of Metals.—The annual general meeting will be held at the Institution of Mechanical Engineers, Westminster, on March 17th and 18th, 1914. The annual dinner will take place on March 17th, 1914. The Fourth May Lecture is to be delivered by Prof. E. Heyn, of Berlin, early in the month of May, and will deal with the subject of "Internal Strains in Cold-Wrought Metals and Some Troubles Caused Thereby." The Institute has just published a volume entitled "The Second Report of the Corrosion Committee," which contains, in addition to the report, a verbatim account of the discussion that took place at the recent Ghent meeting, together with many additional contributions to the discussion made subsequently by correspondence.

A paper on "The Desirability of Electrification of Railways" was read by Mr. W. T. Wardale, of Sheffield, at a recent meeting of the Huddersfield Engineering Society. Mr. Wardale urged the electrification of railways to cope with the greater speeds required, the safety of passengers, and heavier trains which had to be hauled, whilst he also pointed out that a matter of great importance was that the signalman would have apparatus to hand which would control trains in the section governed by his signals. The driver, under the electric system, would be able to devote his whole attention to watching the signals.

Society of Engineers (Incorporated).—The annual general meeting of the Society was held on the 8th inst. It was announced that Mr. H. C. H. Shenton was elected President. The report of the Council dealt with the many activities of the Society, and referred particularly to the consideration that was being given to the status of the engineering profession.

Strike at Schenectady.—The *Electrical World* states that on December 1st the employés of the General Electric Co. returned to work. There was no disorder during the strike, or rather the "demonstration," as the men called it. The employés' committee was satisfied that there was no intentional discrimination against individuals, and admitted that the strike was due to a misunderstanding.

B.E.A.M.A.—At the Council meeting held on the 18th inst., the following firms were elected members of the Association:—Fraser & Chalmers, Ltd.; Johnson & Phillips, Ltd.; Thomas Kesnor & Co., Ltd.; and the Record Electrical Co., Ltd.

Rubber.—The commodity market has been quietly steady on the whole, but the last auctions provided a complete sufficiency of raw material for the use of consumers and as the tendency on the part of users was rather to hang back for the time being, there was a slightly easier tone as the sales progressed, and the best figures were not fully supported at the end. There was, nevertheless, a pretty good tendency at the close of the sales. Buying will naturally remain of a restricted order now until the way is clear into the New Year. The fact that 1914 will probably witness a considerable further increase in the quantities of rubber coming forward available for disposal at the periodical sales appears in no way to weigh upon the position. With the final sales of the year, held on December 31st, the new conditions of sale agreed upon come into force, and these, which mean that all prices will be net, involve a difference of about 3 per cent. on all grades. There is a good deal of curiosity as to the way in which matters will shape during the New Year, and opinions are rather divided as to the effects which may be expected to follow from the changes in contemplation regarding the handling of the material offered at the sales, and as to the standardisation proposals. A further point is that the future of supplies may be affected materially by the reduced duties on rubber from the Acre district, which come into operation at the beginning of the New Year. It is the firm impression that these will have the effect of greatly stimulating the exports of rubber from this district to Europe and the United States, and no doubt this will prove to be the case, but it is yet to be remembered that at round to-day's selling rates the collection of wild rubber can hardly present many inducements, and that taking the Amazon Valley as a whole there can hardly be expected to be any substantial expansion in the total gathered. The cost of producing the wild article is far ahead of that involved in the scientific cultivation and preparation of rubber as practised on the better class plantations in the Middle East, while in the matter of reliability and actual yield of rubber, the plantation product is steadily taking a higher and higher place. The standardisation proposals are very much to the fore now, and there is not the least doubt that some important results will accrue from the deliberations regarding the investigations which have been made into the question. The main thing which it is sought to ensure is the uniformity of quality of the plantation product, one of the chief drawbacks to its use having been its extremes of variability, and any common action which may reduce this to narrow proportions, and thus allow the buyer to know that in buying he is obtaining an article suitable to his requirements and agreeing in its properties with apparently similar material purchased by him, is a boon. That irregularity in quality is preventible there can be no serious doubt, and that it must be removed and a standard type article substituted, there is equally no question. The only thing is, how long the methods now being condemned by force of public opinion can be permitted to survive. The chief reform desired is without question the standardisation of the rubber. When once this is settled there will be time and opportunity to take other matters of a less urgent nature in hand, though with standardisation there must also be reform as regards grading. The New Year will certainly see big strides made in these matters, and greatly to the benefit of the plantation industry at large.

Electric Cooking at Victoria, B.C.—Mr. Halls, manager of the light and power department of the B.C. Electric Railway Co., writing, in response to a request, in the *Journal of Electricity, Power and Gas*, says the accounts of 20 customers selected at random, but representative of the rest, were analysed. They show a total connected load of 74·5 KW., or an average of 3,725 watts per customer, the maximum load being 4·5, and the minimum 2 KW.

From January to June of this year, both months inclusive, their average monthly consumption was 86 KW.-hours per customer, the highest individual average being 184 KW.-hours, and the lowest 45 KW.-hours per month, with an average monthly consumption of 23·2 KW.-hours per connected KW. The lowest amount paid during that period, was a bill for $1.75, the minimum charge on a small connected load and the highest, $12.45, the load being 4·5 KW.

On account of the minimum charge made, the average price over the period and for the customers considered was 5·44 cents per KW.-hour. The highest earnings per month per connected KW. was $3.00 on a load of 2 KW., and the lowest 65 cents on a connected load of 4·5 KW., the average earnings per connected KW. being $1.26 per month. The smaller connected loads show the best average earnings.

There seems to be but little influence of the seasons upon the current consumption. The highest monthly total was in January, the next highest in June, and the lowest in May, although February, being a short month, was not less than the average.

The average KW.-hour consumption per customer by months in 1913, was as follows:—

January	97	April	82
February	80	May	79
March	87	June	90

The cooking rate which is 5 cents per KW.-hour, with a minimum charge of 75 cents per connected KW., has met with universal favour.

Appointments Vacant.—Assistant engineer for Southern Nigerian Government (£300 +). Particulars are given in our advertisement pages.

Inquiries.—Makers of, or British agents for, "Vita" electric liquid heater; makers of Maclean's patent electric hair brushes are asked for.

Humphrey Pump Tests.—The official tests of the Humphrey pumps at the Metropolitan Water Board's Chingford works have been carried out, with very satisfactory results. The large pumps were specified to lift 40 million gallons a day, and in practice lifted 47·5 millions on the average; the smaller 20-million-gallon pump discharged 26 million gallons. The average fuel consumption of the four large pumps was ·93 lb. per W.H.P., and of the small pump ·8 lb.; the fuel was anthracite, and the tests covered six-hour periods. It may be noted that the valve area of the small pump is relatively greater than in the case of the large pumps.

Electricity at $111 per KW.-hour.—The central station customer who thinks he is paying a high rate for his electricity might, with profit, follow the calculations sent us by a correspondent who has figured $111 per KW.-hour to be the cost of the energy consumed in the average pocket flash-lamp. Such a flash-lamp is sold at 50 cents, while a renewal of the three miniature dry cells usually costs 25 cents. The little filament takes about 0·25 ampere, and the battery supplies 3 volts. Used daily such a battery will be found to be exhausted in, say, two months, or after a total of 180 minutes or three hours' operation. The output of the cells has, therefore, been 3 volts × 0·25 ampere × 3 hours, which equals 2·25 watt-hours. At this rate of 25 cents for 2·25 watt-hours, the cost of a kilowatt-hour would be 11,100 cents, or $111—which is more than a thousand times the average rate paid for central station electricity. Applying the same scheme of careful calculation to the service performance of a pair of dry cells used for door-bell ringing, an even higher cost per kilowatt-hour will be obtained, for here the draft of current taken from the battery is smaller, while the extremely short periods of use result in a distressingly low "load factor."—*Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Aberdeen Corporation electricity department held their annual "At home" on 12th inst. at the Bon-Accord Hotel. Between 50 and 60 couples were present at the supper and dance. Mr. Bell presided.

We regret to learn that MR. C. TURNBULL, M.I.E.E., borough electrical engineer of Tynemouth, underwent an operation for appendicitis last week, but we are glad to hear that he is now progressing favourably.

Tramway Officials.—The Glasgow Corporation last week, after considerable discussion, in the course of which amendments were proposed and defeated, adopted the following proposals of the Tramways Committee, with reference to the fixing of maximum and minimum salaries for heads of the tramways departments:—The scale to be:—General manager—Minimum salary per annum £1,000, maximum salary £1,400, annual increment each year until the maximum is reached £50; salary of present holder of the office, £1,100. Traffic manager—Minimum £400, maximum £700, annual increment £25; present salary, £625. Chief engineer—Minimum £400, maximum £700, annual increment £25; present salary £625. Electrical engineer—Minimum £400, maximum £700, annual increment £25; present salary, £575. Secretary and treasurer—Minimum £400, maximum £700, annual increment £25; present salary, £425.

General.—The Electrical Apparatus Co., Ltd., announce that MR. TRAVIS, of their Manchester office, has recently been appointed general sales manager. He will, in future, be stationed at their works in London, and will supervise the whole sales organisation of the company. Mr. Travis's position in Manchester has been taken by MR. H. A. BAILEY, late of the Adams Manufacturing Co. MR. H. B. ECCLES, late of the Isaria Co., has also recently joined the Electrical Apparatus Co.'s Manchester office staff as special meter salesman.

MR. A. B. RANDALL has been appointed to succeed the late Mr. A. R. Malden as secretary to the Salisbury E.L. and Supply Co., Ltd.

Obituary.—MR. J. W. WILKINS.—We regret to learn of the death, at the advanced age of 86 years, of Mr. J. W. Wilkins, who, between 60 and 70 years ago, was engaged with Mr. Fothergill Cooke in railway telegraph work. In addition to a great deal of important work of this kind, it is also stated that he was one of the earliest workers in connection with wireless telegraphy. For the last 60 years he had devoted much attention to railway and other engineering work. The *Times* says that in spite of his great age, Mr. Wilkins had for some months past been occupied in experiments on the utilisation of waste products, with a view to producing an improved material for the manufacture of electric insulators.

According to *South Africa*, news has been received of a tragic event at the Kleinfontein Mine, whereby MR. G. S. CROSS, the chief electrical engineer, lost his life. His body was found lying on the property, and his motor car near by. Presumably Mr. Cross was returning home, and ran into a spruit on the side of the road.

MR. JAMES DUFFY, who has carried on business as an electrician in Darwen for 20 years, died last week at the age of 53 years.

The death is announced from Yokohama, Japan, of MR. R. ABBEY. The deceased, who was 72 years of age, was one of the first Englishmen who went out in 1874, at the request of the Japanese Government, to give instruction in telegraphy to the Post Office officials of that country. In the 12 years he was in the service, Mr. Abbey introduced the duplex telegraph system in Japan, and had the honour of sending the first telegram from Yokohama to Kobe when the system was inaugurated.

Wills.—It is stated that the late SIR WILLIAM PREECE, K.C.B., F.R.S., left £32,320 gross and £22,074 net personalty.

The late MR. ARTHUR CHAMBERLAIN left £143,588 gross and £125,660 net personalty.

NEW COMPANIES REGISTERED.

Newcastle-upon-Tyne Motor Co., Ltd. (132,723).—Registered December 11th, by Waterlow & Sons, Ltd., London Wall, E.C. Capital, £60,000 in £1 shares. Objects: To take over that part of the business of Sir Wm. Angus, Sanderson & Co., Ltd., which relates to the manufacture and sale of the "Newcastle-upon-Tyne" or "N.U.T." motor cycle, and to adopt agreements (1) with the said vendor company, T. Sanderson and F. H. Sanderson; (2) between Edison & Swan United Electric Light Co., Ltd., and T. Sanderson; and (3) with H. Mason. The signatories (with one share each) are:—G. A. France, M.P., Newbiggen Hall, near Newcastle-on-Tyne; T. Sanderson, St. Thomas Street, Newcastle-on-Tyne, director of Sir Wm. Angus, Sanderson & Co., Ltd.; F. H. Sanderson, St. Thomas Street, Newcastle-on-Tyne, director of Sir Wm. Angus, Sanderson & Co., Ltd.; G. F. Tweedy, Jesmond Park East, Newcastle-on-Tyne, engineer; R. Doxford, Grindon Close, Sunderland, shipbuilder; H. Mason, Burn Villas, Spital Tongues, Newcastle on-Tyne, motor cycle engineer; W. S. Burton, Pilgrim House, Newcastle-on-Tyne, solicitor. Minimum cash subscription, 25,000 shares. The first directors (to number not less than five or more than seven) are G. A. France, M.P., T. Sanderson, F. H. Sanderson, G. F. Tweedy, R. Doxford and H. Mason; qualification (after statutory meeting), £1,000; remuneration, £50 each per annum (chairman, £100) and a percentage of the profits. Secretary, J. Hamilton; solicitors, Watson, Burton & Corder, Pilgrim Street, Newcastle-on-Tyne. Registered office, St. Thomas Street, Newcastle-on-Tyne.

Sun Power Co., Ltd. (132,640).—Registered December 8th, by Woodhouse & Davidson, 10-11, Lime Street, E.C. Capital, £600,000 in £1 shares (282,464 6 per cent. cumulative participating preference). Objects, to acquire any inventions relating to the utilisation of solar heat and apparatus connected therewith, and particularly the rights for the Eastern Hemisphere in certain inventions of Frank Shuman, of Philadelphia, U.S.A., and to adopt an agreement with the Sun Power Co. (Eastern Hemisphere), Ltd. The subscribers (with one share each) are:—Segar R. Bastard, The Friars, Chigwell Road, Essex, solicitor; A. J. King, Elleray, Windermere, bleacher and finisher; G. G. Denton, The Grange, Littlemore, Oxford, late Governor of Gambia; F. S. Gandy, 13, Defoe Road, Stoke Newington, N., accountant; W. S. Last, 111, North Hill, Highgate, company registrar; L. C. Beckwith, 382, Brixton Road, S.W., clerk; A. J. Culley, 68, Arthur Road, Brixton, S.W., secretary. Minimum cash subscription, seven shares. The first directors (to be not less than three or more than eleven), are Segar R. Bastard, A. J. King and G. G. Denton; qualification, one share; remuneration, £50 each per annum (chairman, £150; vice-chairman, £100), and a percentage of the profits. Registered office, Friars House, New Broad Street, E.C.

British Arc Welding Co. (Bristol Channel), Ltd. (132,707).—This company was registered on December 11th, with a capital of £20,000 in £1 shares, to take over a process for electrical welding under a grant or licence proposed to be given by the British Arc Welding Co., Ltd. The subscribers are:—F. Shearman, Bute Docks, Cardiff, engineer, 200 shares; J. Elliott, Bute Docks, Cardiff, engineer, 200 shares; R. S. Kennedy, 41, Howett Road, Belsize Park, N.W., engineer, 200 shares; A. J. Marquand, 2, Dock Chambers, Cardiff, engineer, 200 shares; W. E. Howlett, Tydvil Place, Roath Park, Cardiff, secretary, 100 shares; C. Jones, Trydraw Road, Roath Park, Cardiff, engineer, 100 shares; F. E. Lewis, 39, Stanwell Road, Penarth, company secretary, 200 shares. Minimum cash subscription 2,000 shares. The directors are to number not less than two or more than six. The British Arc Welding Co., Ltd., and John Shearman & Co., Ltd., may each nominate one director; qualification, £200. Secretary, F. E. Lewis. Registered office: 2, Dock Chambers, Cardiff.

W. S. Jeal & Co., Ltd. (132,643).—This company was registered on December 8th, with a capital of £550, in 500 preference shares of £1 each, and 1,000 ordinary shares of 1s. each, to carry on the business of electrical engineers, designers and manufacturers of, agents for and dealers in motor-cars, motor-cycles and accessories, electrical storage batteries and apparatus, &c., and to adopt an agreement with W. S. Jeal. The subscribers (with one preference share each) are:—C. N. Murphy, Mindaroo, Garrads Road, Streatham, S.W., merchant; F. Hill, 7, Braxted Park, Streatham, S.W., builder; J. E. M. Tyler, 3, Braxted Park, Streatham, S.W., builder; W. S. Jeal, 17, Chryssell Road, North Brixton, S.W., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are C. N. Murphy, F. Hill, J. E. M. Tyler and W. S. Jeal; qualification £10. Registered office, 17, Chryssell Road, North Brixton, S.W.

Ledbury Electric Supply Co., Ltd. (132,276).—This company was registered on November 20th, with a capital of £4,000 in 300 cumulative preference shares of £5 each, 1,000 preferred ordinary shares of £1 each, and 1,500 ordinary shares of £1 each, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; Seymour Williams, 38, Parliament Street, S.W., solicitor. Private company. The number of directors is not to be more than six; the subscribers are to appoint the first; qualification, 50 shares. Registered office, 127, Victoria Street, Bristol.

Magnetos, Ltd. (132,721).—This company was registered on December 11th, with a capital of £1,000 in £1 shares, to carry on the business of magneto experts, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—C. Godfree, 45, Broad Street, W.C., electrical engineer; R. P. Glanville, 9, Gray's Inn Square, W.C., managing clerk. Private company. The number of directors is not to be less than two or more than five; the first are C. Godfree and R. P. Glanville. Registered office, 45, Broad Street, Bloomsbury, W.C.

Railway Appliances Co., Ltd. (132,816).—This company was registered on December 16th, with a capital of £1,000 in £1 shares, to carry on the business of agents for, manufacturers, installers and users of, and dealers in appliances and mechanical and engineering devices for use upon railways, apparatus and appliances used in connection therewith, and with electricity and compressed air, &c., and to adopt an agreement with J. P. O'Donnell. The subscribers (with one share each) are:—F. E. Jones, Eden Lodge, Beckenham, solicitor; J. Groom, Palace Chambers, Westminster, secretary. Private company. The number of directors is not to be less than two or more than seven; the first are F. E. Jones and J. Groom; qualification, £1; remuneration, £50 each per annum. Registered office, Palace Chambers, 9, Bridge Street, Westminster.

OUTDOOR AIR-BREAK SWITCHGEAR.

By W. A. COATES, A.M.I.E.E.

Within the past few years great changes have been made in standard switchgear practice, and probably the most radical change of all has been the introduction of air-break switchgear for outdoor service.

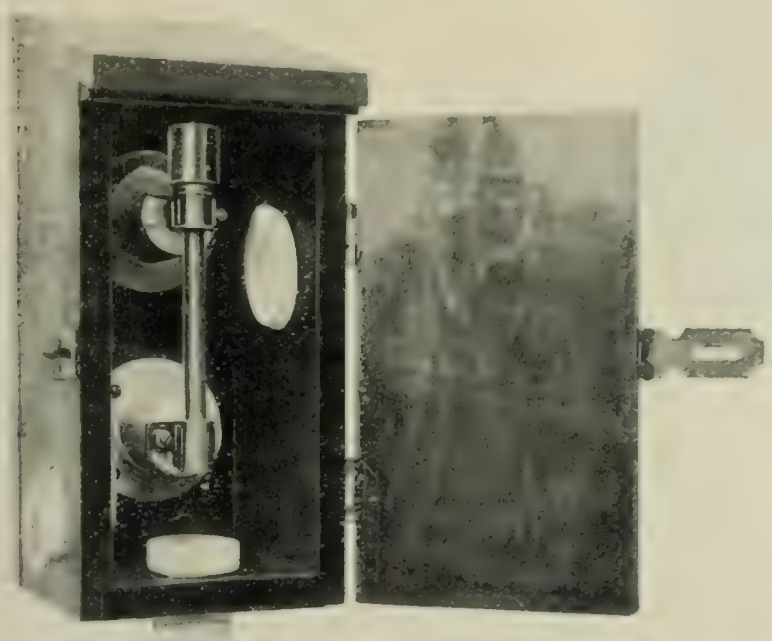
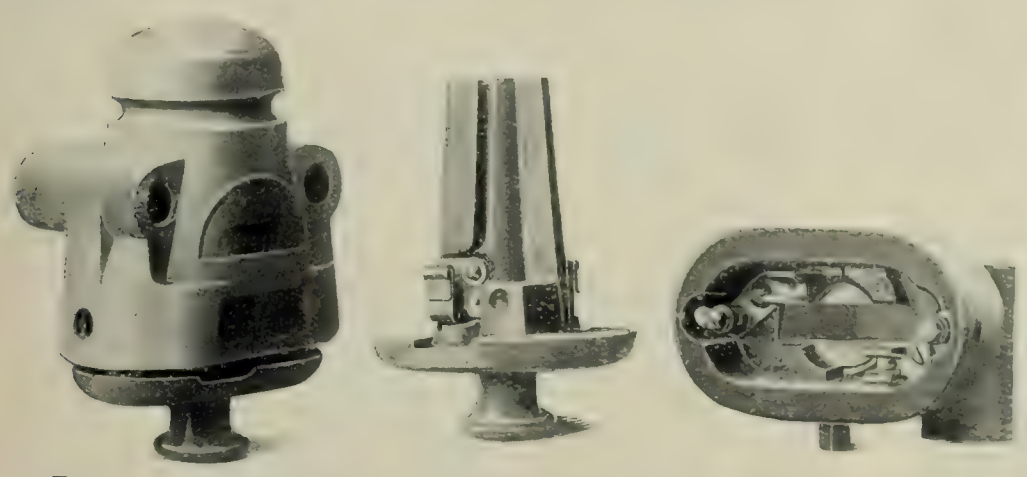


Fig. 1.—6,600-volt Fuse Enclosed in Wooden Box.

This apparatus has yet to make its appearance in England, but that it is well out of the experimental stage in America will be clear, when it is stated that air-break outdoor switches are now in use on systems right up to 150,000 volts and of large capacity.



Figs. 2 and 3.—3,300-volt Porcelain Plug-Type Fuse, Closed, and Taken Apart to Show Construction.

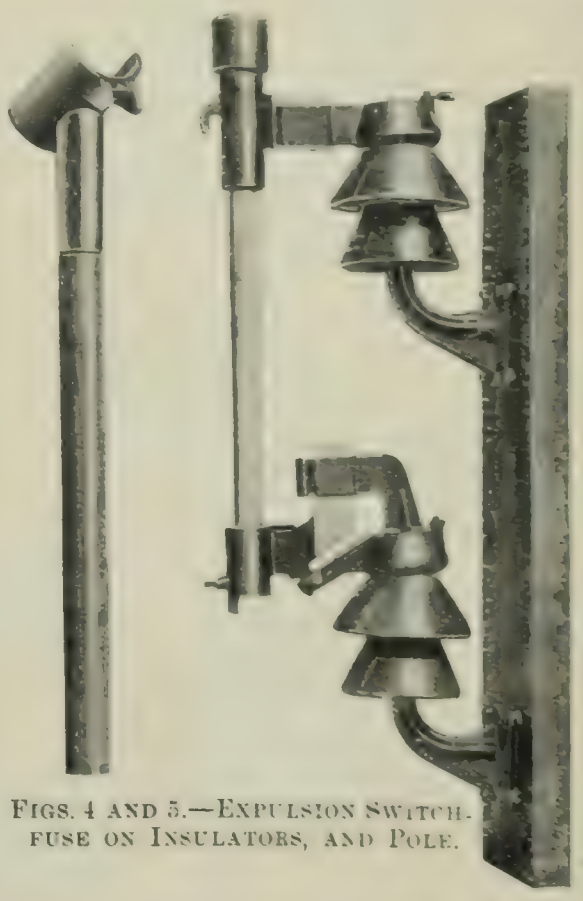
As is probably well known, power and lighting distribution in America is usually carried out with overhead feeders, and the first application of outdoor switch apparatus was to the protection of the step-down transformers, which, for capacities up to 50 K.V.A., are usually suspended from the pole cross-arms by hanger irons.

For small transformers the only protection deemed necessary (and, indeed, commercially feasible) is to have a primary fuse, and in its elementary state an indoor type of fuse was enclosed in a suitable wooden box, which could be mounted on the cross-arms with the transformers (see fig. 1). Although quite a workable proposition, such an arrangement is clearly open to improvement, and nowadays it is customary to use either a porcelain plug-fuse (figs. 2 and 3) for small capacities, or for larger transformer circuits an expulsion fuse on outdoor insulators, so arranged as to serve as a link switch (fig. 5).

The former type is so designed as to keep the live contacts properly shrouded, and the fuse is easily renewable. It can be made so cheaply that it does not become a matter of importance if the whole thing is burst by lightning troubles, as is frequently the case. This type of fuse is capable of carrying a normal load up to 30 amperes at 3,300 volts, and is by far the most popular form at present used.

The link fuse is intended to be handled by means of a pole shod with a special device to carry the fuse tube (fig. 4).

As a general thing, such devices as these are only used with transformers up to about 50-K.V.A. capacity, above which limit it is usually permissible to spend a little more money on elaborating the switchgear.



Figs. 4 and 5.—Expulsion Switch-fuse on Insulators, and Pole.

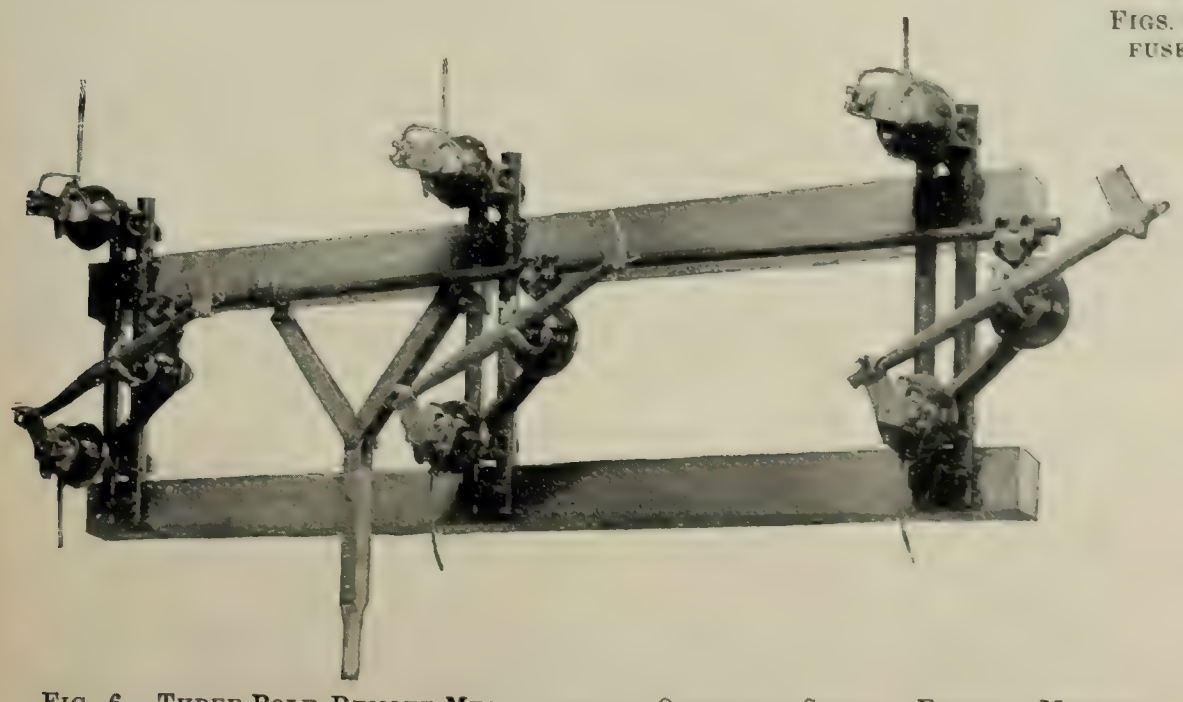


Fig. 6.—Three-Pole Remote-Mechanically Operated Switch Fuse of Medium Capacity for Mounting on Cross-Arm.

Moreover, the weight of a 50-K.V.A. transformer is just about the maximum which can conveniently be suspended from the cross-arms by hanger irons, especially when a single-pole construction is used.

Above 50 K.V.A. it is more usual to use two or more poles, suitably braced and provided with a special bracket or platform to carry the transformer. Such construction necessarily provides greater space for the accommodation of the switchgear, and more elaborate equipment is, consequently, practicable. Fig. 6 shows a simple form of three-pole switch fuse with link operation. By this means the H.T. apparatus can be located high on the pole, well out of harm's way

and the operating lever located at the ground level, so that the circuit can be isolated without the lineman having to climb the pole. A padlock is, of course, provided to

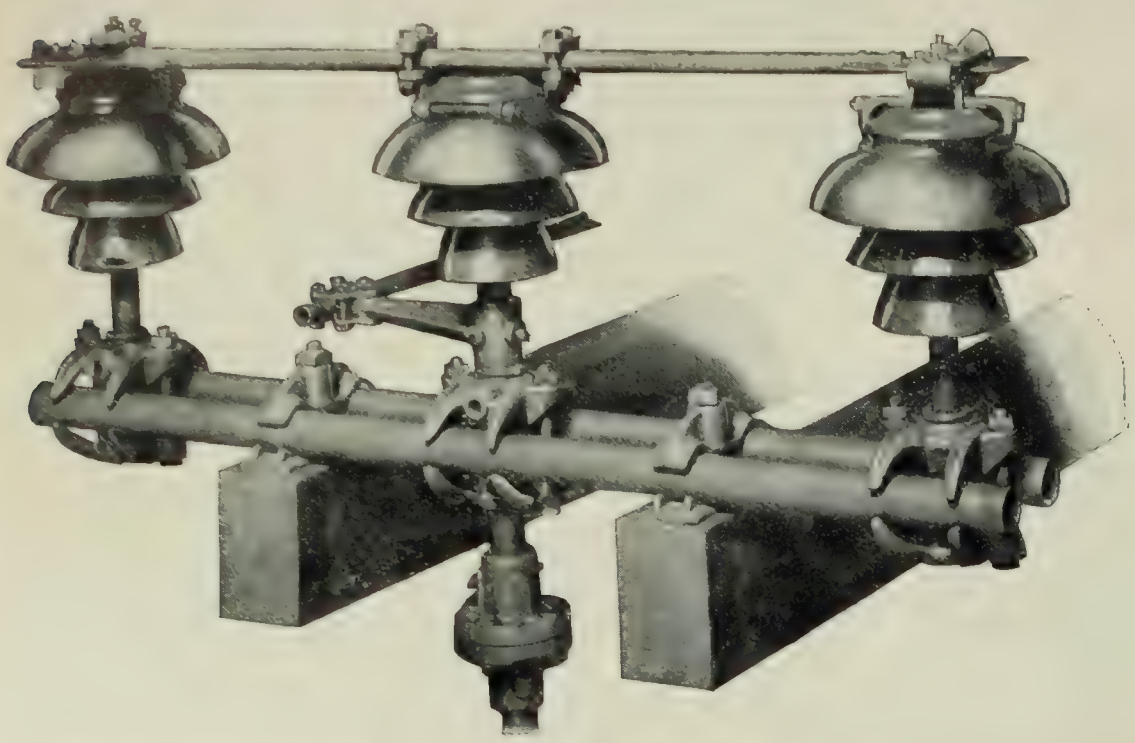


Fig. 7.—One Pole of a Three-Phase "Baum" Swivel Contact Switch.

prevent interference by unauthorised persons. In this particular design the link is of wood, through the centre of which the fuse wire is passed. By this means the "expulsion" effect is still retained, while the wood tube makes a sound mechanical job.

This type of fuse has actually been built up to 22,000 volts, with a contact spacing of 16 in. While this is really sufficient to allow safe handling when renewing a fuse wire, yet it is more usual on the higher voltages to use separate switch and fuse units.

Fig. 7 shows one pole of a somewhat ingenious switch designed for use in this manner. The two contact blades are so mounted as to swivel with relation to the main

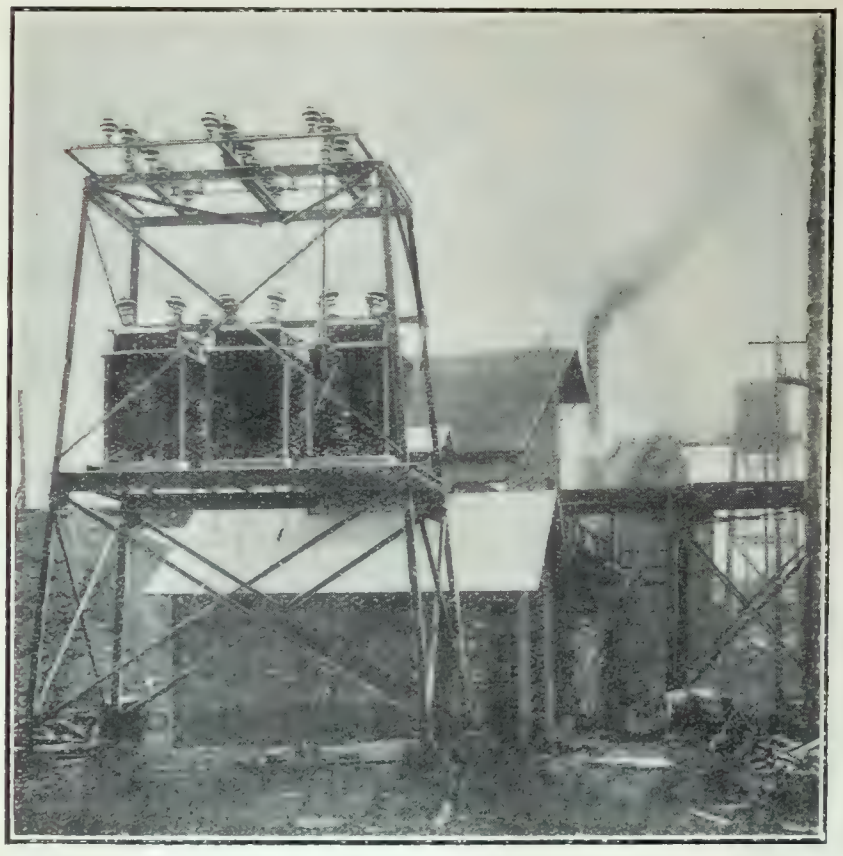


Fig. 8.—33,000 volt Outdoor Sub-Station on a Colliery Plant. The small shed contains the secondary switchgear.

contact cross-arm, and, consequently, as the switch opens, the contact blades are first wrenched round in the jaws, and thus break any ice which has frozen on to the contacts.

In Great Britain such precautions are, perhaps, unnecessary, but in America, where the winter temperature may drop to 60° below zero F., and is subject to very severe fluctuations, ice trouble is a very real factor to be considered.

Experience shows that a wooden pole construction with a high transformer platform is not as stable as might be desired, and in exposed positions it is especially noticeable that the poles soon work loose in the ground, no matter how carefully the soil has been tamped around them.

This has led to the development of outdoor sub-stations mounted on light steel towers, which lend themselves much better to stiff mechanical construction, and are at the same time capable of being shipped in parts, and easily and quickly assembled in the field.

In figs. 8, 9 and 12 are shown three sub-stations of this type, designed and built by the Transmission Engineering Co., who have probably done more towards the development of the cheap outdoor sub-station than any other firm.

It will be noted that in all cases the line wires can be dead-ended on the switch insulators, which, together with the steel structure, are made extra stiff for this purpose so as to avoid the necessity for using additional strain towers on the line.

The particular sub-stations illustrated are in service on 33,000-volt systems, and similar apparatus has been made for all pressures from 6,600 up to 66,000 volts.

The switching apparatus on all these towers is of the design patented by Mr. A. W. Burke, a consulting engineer of Pittsburg. The incoming line is first brought to a three-pole horn-type switch, thence to a triangular choke coil and horn gap, and finally through a horn-type open fuse to the transformers which are located on a platform immed'ately below the switchgear.

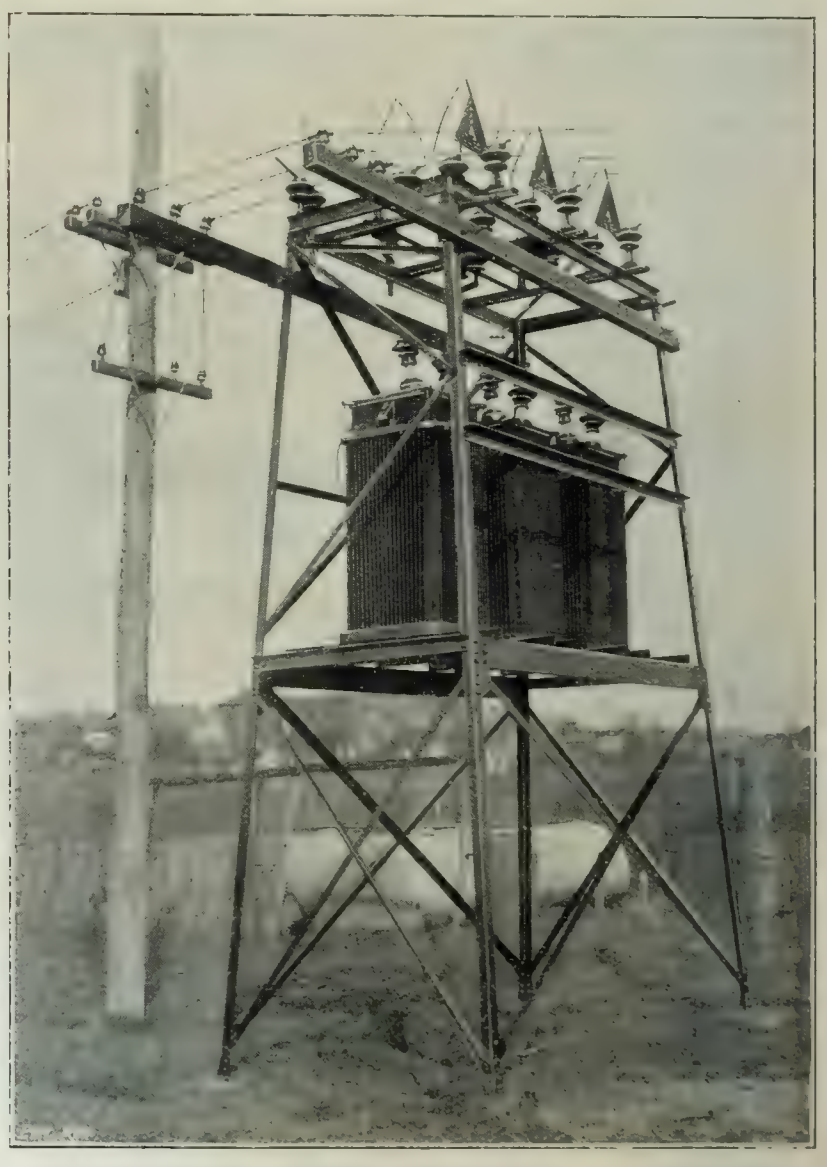


Fig 9.—Complete 33,000-volt Outdoor Sub-Station, showing "Burke" Horn Gaps and Choke Coils, and Line Pole.

The details of the switch are well shown in fig. 11, which shows the switch in a half-open position. The moving portion is carried on two insulators mounted on a common swivel pin, which moves in a brass bearing bush. The moving horn is connected to the contact blade after the manner of the flicker blade on a conventional knife switch, and consequently the chief current-carrying parts are well separated before any arc is drawn across the horns.

There is a widespread idea that rupturing an A.C. system in air must inevitably give rise to surges far more violent

than would be the case if oil switches were used. In fact, this would not appear to be the case. In fig. 10 we reproduce an oscillograph record taken across a "Burke" horn-

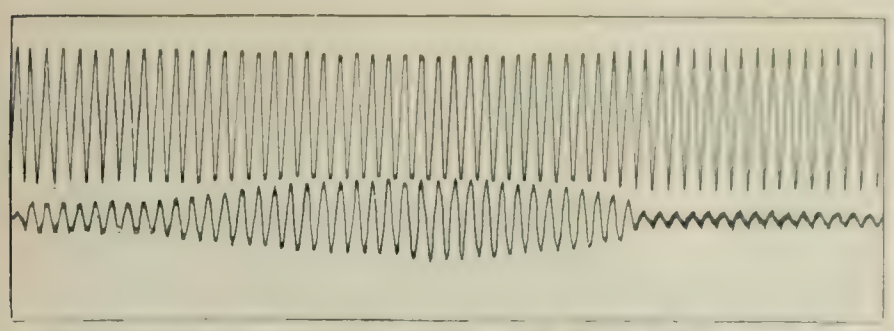


Fig. 10.—Oscillogram of "Burke" Switch opening on a 33,000-volt System with Maximum Load of 1,000 kw. passing. Upper Curve, Voltage; Lower Curve, Current.

type switch when rupturing 1,000 kw., at 33,000 volts, 60 cycles, and from this it is clear that the effect on the voltage wave is extremely slight, although the switch occupied practically one second in opening. It will be noticed that the arc "hung on" for some time after it had been drawn out to so great a length as to choke the current down to a small value. It is generally found that the arc on a horn gap "hangs on" from one to two seconds. This same "Burke" switch was subsequently tested on short-circuit, and successfully ruptured a load of 8,000 kw., which is a far greater figure than is ever likely to occur on consumers' premises.

On the system of the Sierra and San Francisco Power Co. it is even stated that the kick due to opening air-break switches on their 105,000-volt lines, is scarcely noticeable, whereas when oil switches are operated in like positions the kick is so pronounced as to cause arresters to spill over and to show a 25 per cent. variation on a graphic recording voltmeter. Unfortunately, however, the writer has not been able to secure any oscillograph records supporting these statements.

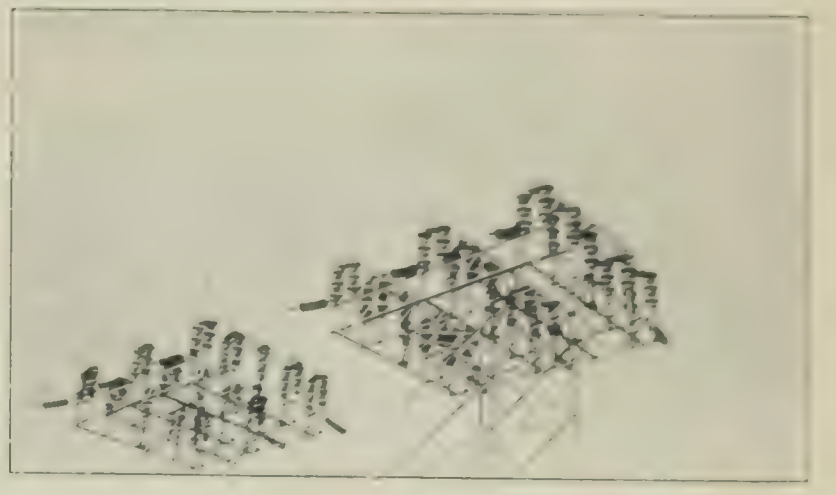


Fig. 13.—Two Three-Pole 150,000-volt Horn Switches, Southern Sierras System.

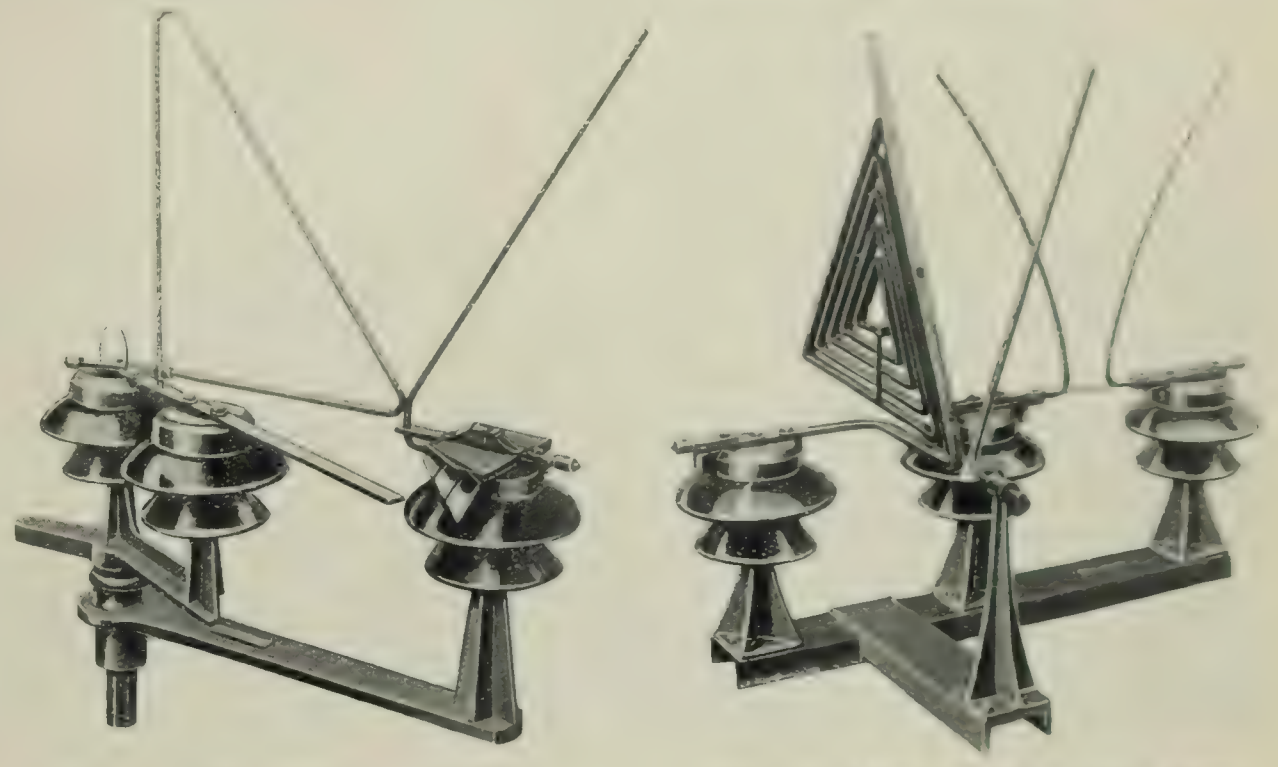


Fig. 11.—One Pole of a "Burke" Horn-Type Switch.

Fig. 14.—"Burke" Choke Coil, Horn Gap Arrester and Horn-Type Fuse.

The Burke lightning arrester, choke coil and horn fuse are shown in detail in fig. 14. It will be noticed that one side of the arrester horn is actually part of the choke coil, and as the coil is angular there will be maximum tendency to spill over just at the lower corner in the triangle.

It is claimed that due to this construction the accurate setting of the gap on low voltages is no longer of primary importance, as for the same spill-over voltage, the gap is some 50 per cent. greater than is the case with a simple horn.

The designer further claims that with dynamic current flowing exceeding 25 amperes the resulting magnetic field in the horn is so great as materially to assist in rupturing the arc, and he even goes so far as to advocate operating with no series resistance in the ground circuit.

Sub-stations such as we have described can be built for little more than half the cost of the usual form of station. We tabulate below some approximate figures based on pole-supported transformers, protected on the primary with switch fuse, choke coil and horn lightning arrester.

Approximate Net Cost per kw.

	Line voltage.		
kw.	13,200.	22,000.	33,000.
75	11s.	13s.	16s.
90	10s.	11s.	13s.
120	7s. 6d.	10s.	11s.
150	6s.	7s. 6d.	10s.
300	4s.	5s.	6s.

The steel tower type of sub-station is of necessity more expensive than those tabulated



Fig. 12.—33,000-volt Outdoor Sub-Station, Showing Secondary Strain Insulators and Switch-Operating Lever.

above, but even in this case the cost is only increased by some 2s. 6d. per KW.

It should be pointed out that in making these estimates average American prices have been taken, and in England the cost of the wood pole structure would possibly be somewhat higher.

Doubtless equipments just as illustrated would not find unqualified favour with the Home Office or the Board of Trade, but, at the same time, it is not difficult to conceive a few minor changes in design which would render them sufficiently safe for English conditions.

These high-voltage outdoor equipments are finding extensive favour in America, as they enable supply to be profitably given to small villages, individual farmers, mines and other consumers situated along the route of main feeder lines.

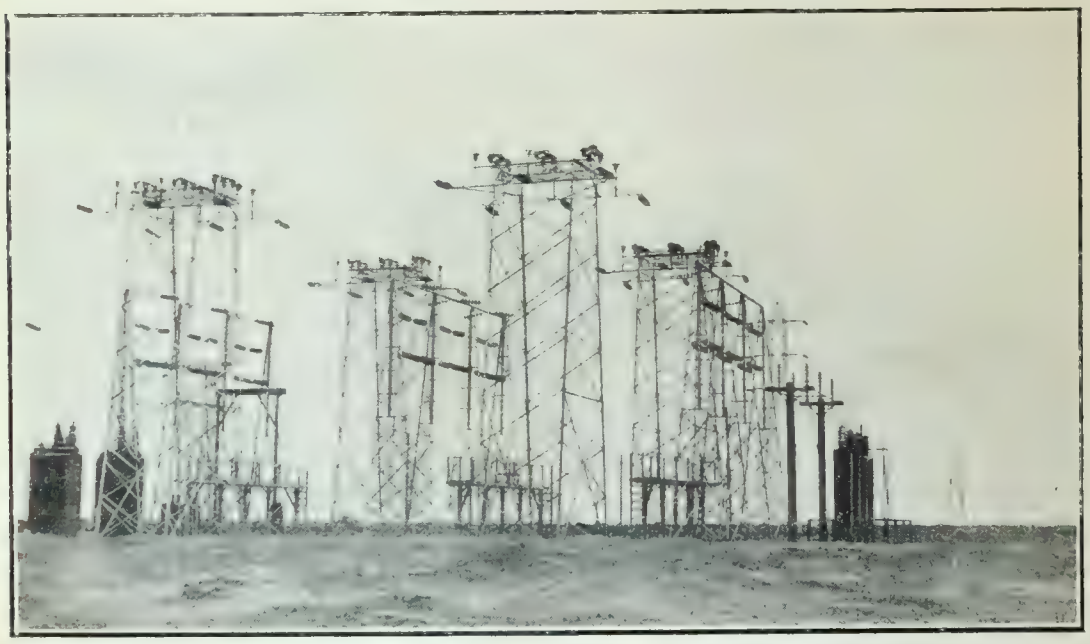
Such small loads would not be profitable if the ordinary type of brick sub-station with oil-break switches, &c., had to be provided.

Farmers are probably the most important class served in this way, and although at first one is apt to regard this business as mostly small lighting, yet experience goes to show that once the farmer has realised the possibilitie of the electric motor, he quickly enlarges his demand.

In statistics taken by five large power companies, it was found that their farm load was over 66 per cent. power; and as the principal demand is during the day, such business is eminently useful from the load factor point of view.

Although extremely high voltages are never likely to be employed in Great Britain, yet an article such as this would be incomplete without reference to the remarkable equipments recently put into operation on their 150,000-volt lines by the Southern Sierras Power Co.

In figs. 13, 15, 16 and 17 are shown various views of sub-stations on this system. Power is transmitted from Bishop Creek to San Bernardino, a distance of some 238 miles, the generating plant being of 36,000-KW. capacity.



Each circuit has two Type K three-pole, 60,000 volt manually operated Bowie circuit-breakers, and cross-over switch for interconnection.

FIG. 16.—SWITCHING STATION FOR TWO CIRCUITS; SOUTHERN SIERRAS POWER CO.

It is now generally conceded that on high-voltage systems it is advisable to conduct all switching operations on the L.T. side of step-up transformers, thus avoiding the risk of damage to insulation due to surges. At the same time, to deal with emergency conditions, it was deemed desirable on this system to use switches which could safely be operated on load if necessary.

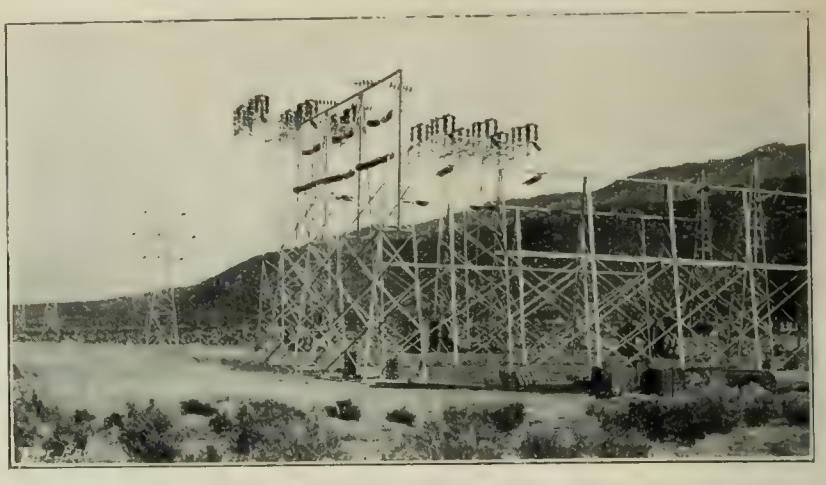


FIG. 17.—CONTROL STATION NEAR BISHOP, CALIFORNIA, SHOWING TWO DOUBLE-BREAK 150,000-VOLT THREE-POLE PNEUMATICALLY OPERATED SYNCHRONISING BOWIE CIRCUIT-BREAKERS; SOUTHERN SIERRAS POWER CO.

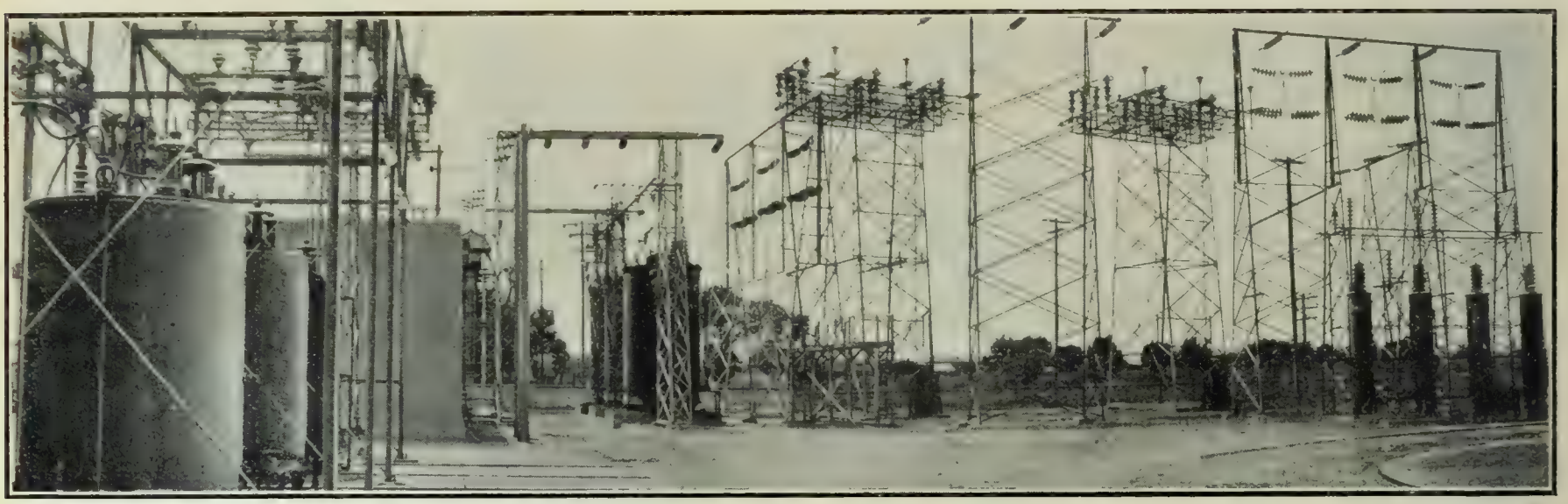


FIG. 15.—SAN BERNARDINO RECEIVING STATION, SHOWING TWO 150,000-VOLT SINGLE-BREAK ELECTRICALLY OPERATED BOWIE CIRCUIT-BREAKERS. OUTDOOR SUB-STATION OF 12,000 K.V.A. CAPACITY.

Each set of switches consists of two breaks in series, and has knife blades 3 ft. long, pivoted at one end and rising in opening, thus transferring the arc to the horns. The latter are located at both ends of each blade, and are of galvanised iron tube, tapering from 1 in. diameter at the bottom towards the top.

Although no oscillograph records have yet been taken, it is stated that the switches have already been frequently operated without causing the least trouble in operation.

Up to the present in England we have only seen the oil-break form of weatherproof switchgear, and that but rarely, but the writer is of opinion that, by adopting some such radical departure from accepted practice as has been indicated above, much load, at present deemed unprofitable, could be connected up with advantage. Although such action necessarily implies overhead feeders, yet in the sparsely populated districts these should not be objectionable, and, in fact, we already have the example of several power companies, such as the Clyde Valley and Yorkshire Electrical Power systems, which distribute by overhead feeders quite satisfactorily.

The writer wishes to acknowledge assistance in preparing this article, and in providing illustrations, from the Bowie Switch Co., the Pacific Electrical Manufacturing Co., the Transmission Engineering Co. and the Westinghouse Electric and Manufacturing Co.

"ZIG-ZAG" WINDING DIAGRAMS.

By HUMPHRY MacCALLUM, B.Sc., A.M.Inst.C.E.

A very large number of "series" or "wave" wound direct-current armatures are in use nowadays, but there is reason to believe that this type of winding is not always thoroughly understood. It has been the writer's experience, in fact, that the subject is one with which the average man has a certain amount of difficulty, and reference to the text-books, as a rule, does not give much help, mainly for the reason that the essential matter is so frequently "swamped" by much that is out of date, and of little or no practical value.

The usual method of approaching the subject is by means of the circular winding diagram in which all the conductors are set out and numbered in such a way as to suggest, more or less completely, the actual arrangement upon the armature. Such diagrams are drawn for purposes of demonstration with a number of conductors very much smaller than would be used in practice, in order that the

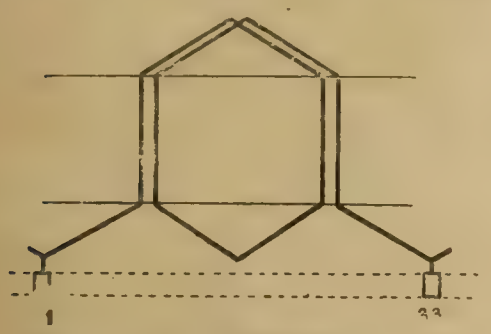


Fig. 1.—Coil Consisting of One Section of Two Turns.

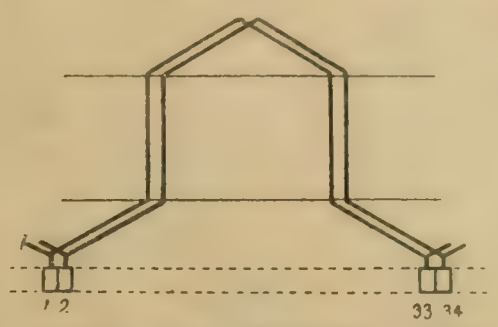


Fig. 2.—Coil Consisting of Two Sections of One Turn Each.

circuits may be more easily traced, and though by this means the general principle of wave winding is very clearly shown, these abbreviated diagrams are somewhat difficult to reconcile with practice, and it is probable that one or perhaps two rounds of the diagram would fulfil the purpose equally well. Apart from the important question of available space, the full circular diagram corresponding to a normal modern machine would be too complicated for the man of average patience, owing to the large number of conductors included therein.

In actual practice, however, it is not necessary to consider the individual conductors or to number them individually, or in groups, since each section of the winding may be regarded as belonging to one commutator plate, and the commutator plates only need be numbered. This mode of procedure may be made use of in the diagrammatic representation of armature windings, and a further and greater simplification is brought about if the sections are

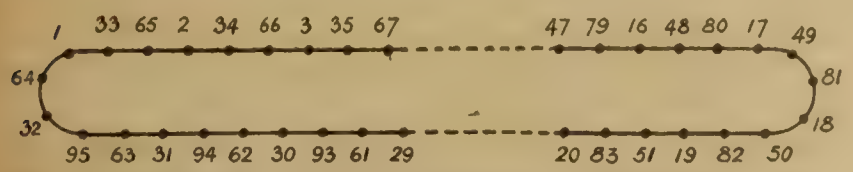


Fig. 3.—Part of a Plain Diagram of Connections for a Two-Circuit Wave Winding.

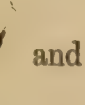
represented, as in ordinary diagrams of connections, by lines which do not necessarily bear any resemblance to the actual armature coils. For example, we may represent the section fig. 1 thus 

, or fig. 2 thus 

, putting numbered dots for commutator plates, and if any simple two-circuit wave winding be taken and set out in this way, a closed loop of lines and dots, as in fig. 3, will be obtained.

Now, although it is helpful to look at any given winding from this point of view, the setting-out of the numbers first hand requires a thorough knowledge of the principle of the winding. The loop may be "zig-zagged," however, in such a way that the commutator plates come together in numerical order, and the whole then forms a new type of diagram which is easy to set out, has the advantage of being easily followed, and which, with slight modifications, is applicable to all wave windings.

As an illustration, fig. 4 is an ordinary circular diagram for a six-pole, two-circuit wave winding, having the impracticably small number of 28 conductors, or groups of conductors, arranged in 14 sections. Fig. 5 is the corresponding "zig-zag" diagram. The comparative simplicity of the latter is evident, and as the addition of any number of sections does not complicate, but merely lengthens the diagram, it is clear that the representation of practical windings, having a large number of conductors, presents no difficulty. For example, fig. 6 is the armature winding of an existing 440-volt, 200-kw. six-pole d.c. machine. The corresponding circular diagram very closely printed would cover two full pages of the Review. The index figure at the left-hand end of the above diagram forms a convenient means of showing that the number of turns per section is in this case one only. Many modern windings are built up of sections, each of which consists of one turn, *i.e.*, two conductors per section, but in small machines of normal speed and voltage, it is economical to use more than one turn per section, and for such work this has become the usual practice. Where there are two turns per section, the index figure will resemble fig. 1, with three turns per section the index figure will have three turns, and so forth.

The windings so far considered are "right-handed"* six-pole windings, and the corresponding "zig-zags" are built up of a series of vees, thus 
, each of which represents one "round" of the armature. In a four-pole diagram the vees would have only two dots thus, 
and in an eight-pole four dots thus 
, or in general, since in going once round the armature $p/2$ commutator plates are touched upon, there are $p/2$ dots on each vee (p = number of poles).

Figs. 7 and 8 are the "left-hand" diagrams corresponding to figs. 4 and 5, and it will be seen that whereas

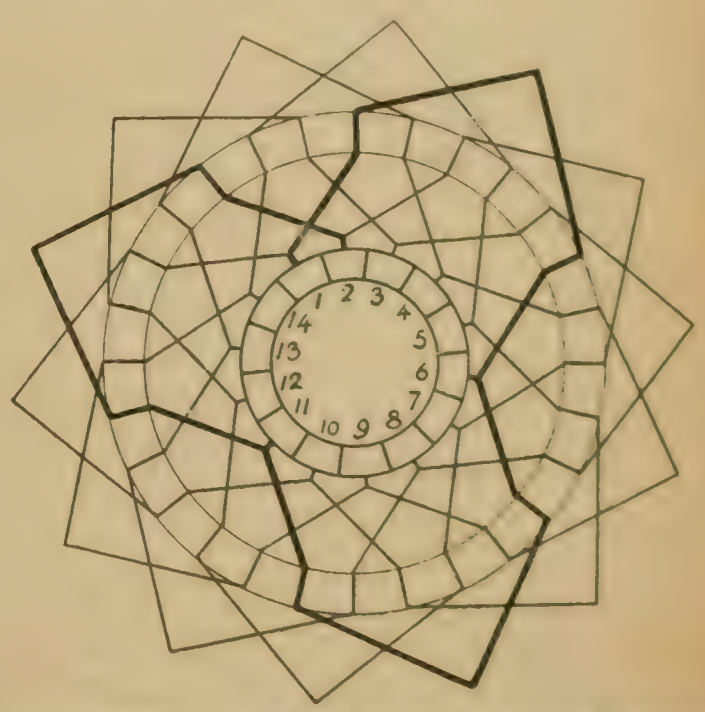


Fig. 4.—Circular Diagram for Right-Handed or Progressive Six-Pole Two-Circuit Wave Winding having 28 Conductors only.

the former is composed of a series of complete vees, in the latter the first and last vees have been mutilated by the removal of the end sections. The system of numbering also is different in either case, but all right-haud windings, and all left-hand windings respectively, are numbered in the same way, and in every case the number of dots n, in the

* For definition of "right-handed" winding see fig. 13 at end of article, or more fully by reference to article by the present writer in the Electrical Review of September 19th, 1913, page 477.

second row from the top of the diagram, is equal to the winding step at the commutator.

With the above "zig-zag" arrangement the total number

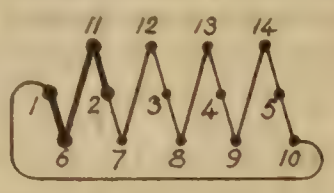


Fig. 5.—Zig-Zag Diagram Corresponding to Fig. 4.

of dots or commutator plates K is obviously equal to the number of rows multiplied by the number in a row *plus* per section, a value which is usually fixed on a "reactance voltage" basis, as suggested by Hobart. The value of K being known, a few minutes will suffice for the drawing of a diagram in accordance with the following rules, which will give correct coupling, right or left-handed as the case may be :—

1. Commutator plates are represented by numbered dots.

2. Sections of winding between commutator plates are represented by lines (curved or straight), and the number of turns in a section is shown by the index figure at the side of the diagram.

3. A right-hand or progressive winding is one in which a right-handed or C.C.E. direction of rotation gives positive brushes opposite the N poles, and in this hand of winding the ends of a round cross one another.

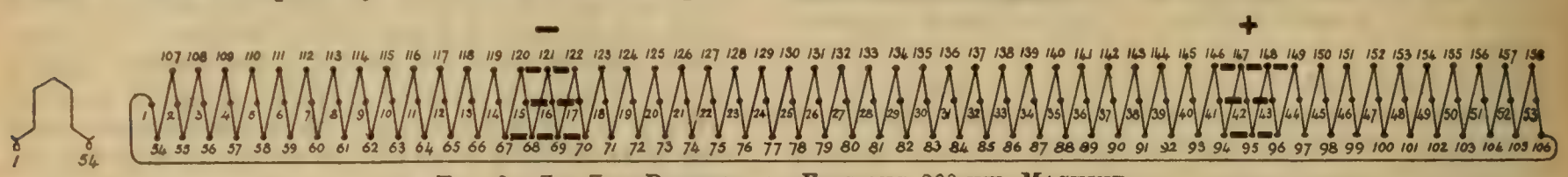


Fig. 6.—Zig-Zag Diagram of Existing 200-kw. Machine.

one, if there are complete vees only, or *minus* one if the end vees are incomplete. There are $p/2$ rows, so that we have—

$K = n\,p/2 - 1$ for the right-hand or progressive windings, and $K = n\,p/2 + 1$ for the left-hand or retrogressive windings.

The above are the conditions for re-entrancy in two-circuit wave windings.

Multiple circuit (series-parallel) wave windings, or double, treble, &c. (independent series) wave windings, are but little used, but it may be of interest to examine them in terms of the "zig-zag" diagrams. Such windings must agree with the formulæ—

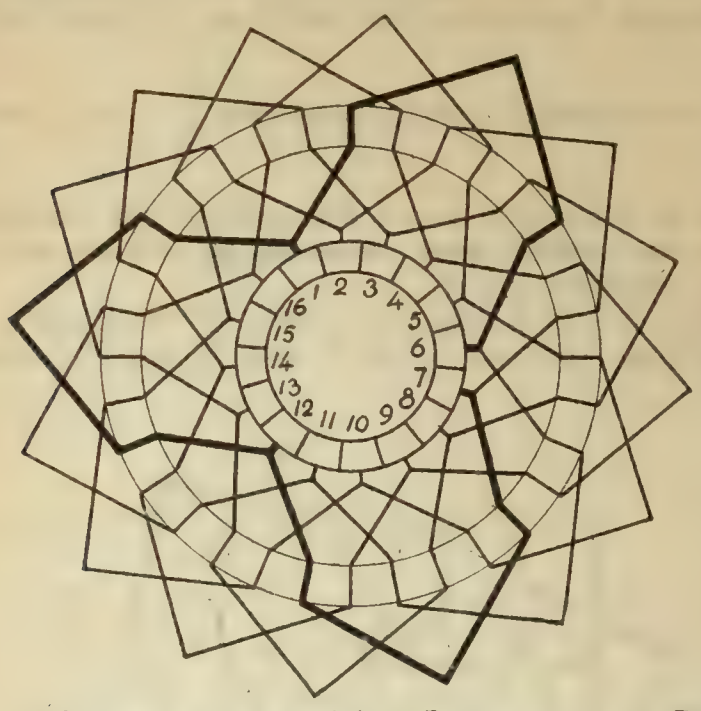


Fig. 7.—Circular Diagram for Left-handed or Retrogressive Six-Pole Two-Circuit Wave Winding having 32 Conductors only.

$K = n\,p/2 - c/2$ for the right-hand or progressive windings, $K = n\,p/2 + c/2$ for the left-hand or retrogressive windings, where c is the (even) number of circuits required.

The winding will be an independent series ($c/2$ separate

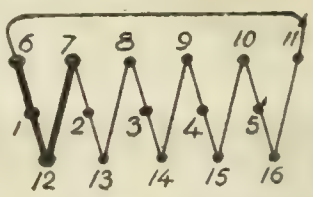


Fig. 8.—Zig-Zag Diagram Corresponding to Fig. 7.

windings) or a series-parallel according as n *is* or is *not* a multiple of $c/2$. Figs. 9, 10, 11 and 12 will serve to illustrate the point.

The total number of active conductors required in any winding is, of course, a matter of speed, magnetic flux and E.M.F., and the number of sections, and therefore the number of commutator plates K for a given number of conductors depends upon the permissible number of conductors

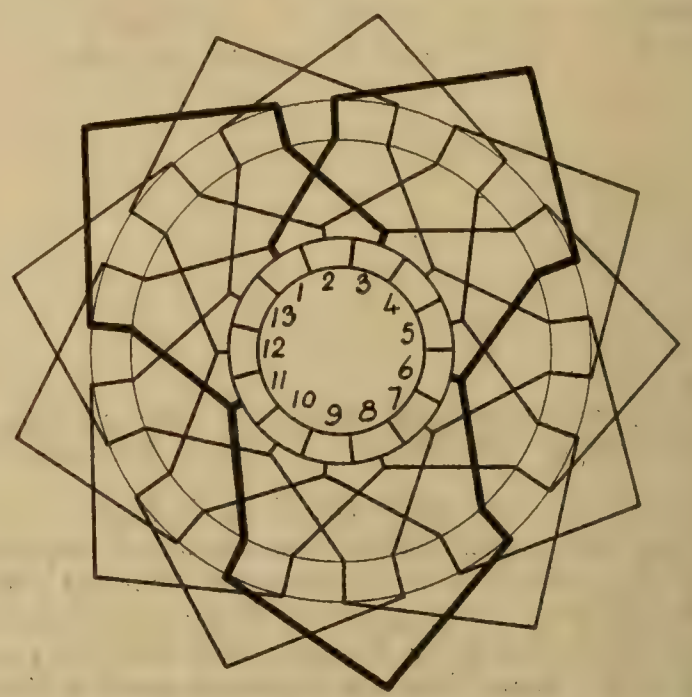


Fig. 9.—Circular Diagram for Right-handed or Progressive Six-Pole Series-Parallel Winding. $c = 4$; $n = 5$.

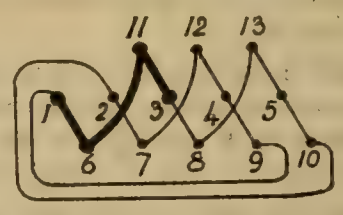


Fig. 10.—Zig-Zag Diagram Corresponding to Fig. 9.

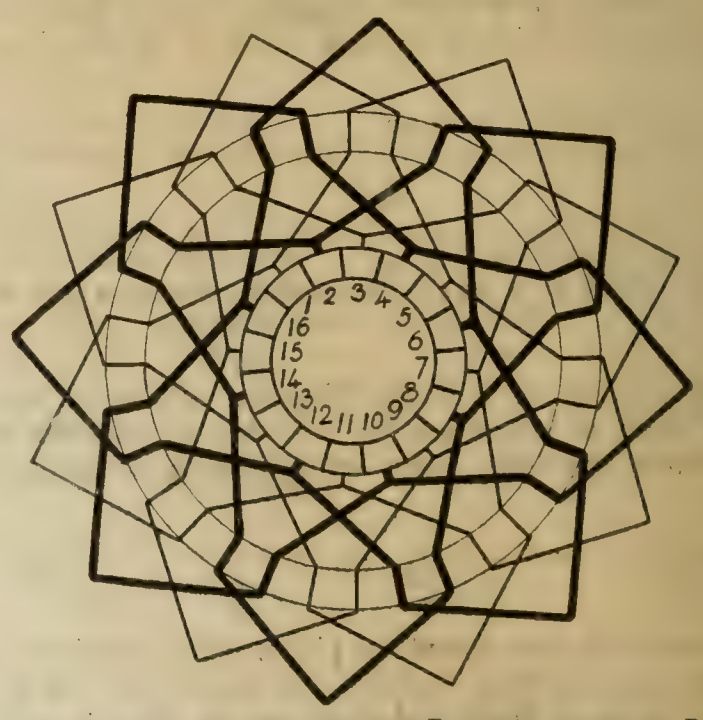


Fig. 11.—Circular Diagram for Right-handed or Progressive Six-Pole Double Winding. $c = 4$; $n = 6$.

4. Left-handed "zig-zag" diagrams consist of a series of complete vees. In right-handed diagrams the first and the last vees are minus one section. In all cases the right-hand limb of a vee is devoid of dots.

5. The number of rows in the diagram is equal to half the number of poles of the machine.

6. The numbering is from left to right, and commences in the second row from the top. The first step, *i.e.*, from 1 to $(n + 1)$, is in the left-hand limb of the first vee, and upwards if possible.

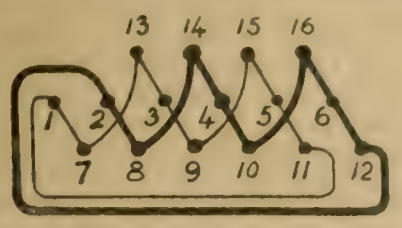
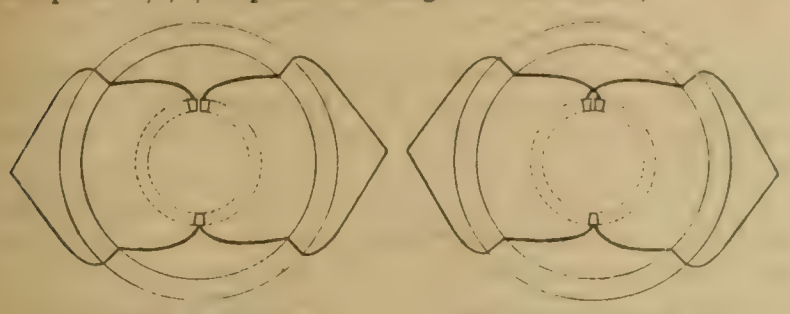


Fig. 12.—Zig-zag Winding corresponding to Fig. 11.

7. The commutator winding step n is in all cases equal to the number of dots in the second row.

8. In a simple series (two-circuit) winding n may have any value, but in multiple-circuit series windings if n is made a multiple of $c/2$, $c/2$ separate windings will be formed.



Left-hand or Retrogressive. Right-hand or Progressive.

Fig. 13.—One Round of a 4-Pole Series Winding.

It may be pointed out that brushes are shown on the "zig-zag" diagrams by a heavy black line joining neighbouring commutator part dots, as at + and — (fig. 6). There being six poles in this case, but only two circuits, it is possible of course to collect the current at two brush sets only. In other words, if one set can carry the whole current, two positive and two negative sets can be removed without affecting the output of the machine, as can be clearly seen by reference to the figure.

Mistakes in coupling, which usually lead to somewhat puzzling results, are easily followed with the help of the appropriate zig-zag, which may be drawn out in a moment on a scrap of paper when and where the occasion arises.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Edison & Swan United Electric Light Co., Ltd. (18,984).—Return dated November 25th, 1913. Capital, £888,071 in 150,000 "A" and 26 436 "B" shares of £5 each, and 23,564 "B" shares of 5s. each. 99,261 "A," 17,139 £5 "B" and 23,564 5s. "B" shares taken up. 10s. per share called up on 89,261 "A," £5 per share considered as paid on 17,139 "A," 5s. on 23,564 "B," £2 10s. on 89,261 "A" and £3 on 10,000 "A." Mortgages and charges: £449,474.

Keighley Electrical Engineering Co., Ltd. (44,893).—Return dated September 24th, 1913. Capital, £10,000 in £1 shares (3,000 pref.). 4,200 ord. and 1,800 pref. shares taken up. £1 per share called up on 2,588 ord. and 1,400 pref. £1 per share considered as paid on 1,612 pref. and 400 ord. Mortgages and charges: £5,000.

Electro-Metals, Ltd. (110,432).—Return dated July 7th, 1913 (filed November 11th). Capital, £30,000 in 4,000 pref. shares of £5 each and £10,000 ord. of £1. 102 pref. and 10,000 ord. shares taken up. £1 per share called up on 102 pref. £1 per share considered as paid on 10,000 ord. Mortgages and charges: Nil.

Cleveland and Durham Electric Light and Power Co., Ltd. (89,539).—Return dated November 3rd, 1013. Capital, £700,000 in £1 shares (350.000 preference), 333,705 preference and 157 600 ordinary shares taken up; £1 per share called up on 331,995 preference and 79,068 ordinary; £80,302 considered as paid on 1,770 preference and 78,532 ordinary. Mortgages and charges: £495,000 (including £25,000 collateral security).

Church Stretton Electric Supply Co., Ltd. (80,857).—Return dated August 11th, 1913. Capital, £10,000 in £1 shares; 8,154 shares taken up; £1 per share called up on 154; £1 per share considered as paid on 8,000. Mortgages and charges: £5,000 first mortgage debentures and £1,075 mortgage.

Rhondda Tramways, Co., Ltd.—A memorandum of satisfaction to the extent of £400 on November 28th, 1913, of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Drake & Gorham, Ltd. (70,275).—Return dated October 30th, 1913. Capital, £125,000 in £1 shares. 125,000 shares taken up. £1 per share called up on 85.000. £1 per share considered as paid on 40,000. Mortgages and charges: Nil.

Cape Electric Tramways, Ltd. (54,636).—Return dated November 19th, 1913. Capital, £500,000 in £1 shares. 491,222 shares taken up. £1 per share called up on 91,222. £1 per share considered as paid on 400,000. Mortgages and charges: £440,300.

Woking Electric Supply Co., Ltd.—Charge on certain property, in Woking dated December 2nd, 1913, to secure all moneys due, or to become due, from the company, to Barclay & Co., Ltd., 54, Lombard Street, E.C.

Javal Patents, Ltd.—Issue on December 3rd, 1913, of £200, part of a series of which particulars have already been filed.

CITY NOTES.

Costa Rica Electric Light and Traction Co., Ltd.

The annual meeting was held on Monday at Dashwood House, Old Broad Street, E.C., Mr. Frederick Davies presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., page 1012) said the past year had been an uneventful and at the same time a very satisfactory one. There had been an increase in the net earnings at Costa Rica, they having amounted to £23,875, as compared with £22,033 last year, which was in itself a considerable increase over the previous year. The net surplus profit, after paying all expenses in London and debenture interest, amounted to £7,000, against £5,700 last year, which was again an increase over 1911, when the net surplus was £3,600. It was proposed to put the whole of the net surplus to the credit of the discount and commission on debenture issues account, which would thereby be reduced to a matter of £7,000, so that another year of similar progress would see the extinction of that account. The business of the company, as well as the profits, progressed satisfactorily. The number of lamps installed showed an increase of 10 per cent. in the year, which was again an increase of 18 per cent. over the previous year, and the motor supply showed an increase of 43 per cent. over last year, which was an increase of 55 per cent. over 1911. The power plant at El Brasil, which was inaugurated in December, 1911, had worked throughout the year without a hitch, and it was contemplated to effect an immediate installation of the fourth unit which would enable them to utilise to the full the second pipe line at the earliest possible moment. The machinery was now on order, and they were expecting immediate delivery. The cost which would amount to about £4,000 would be defrayed out of the revenue for the current year. There was ahead of them a certain amount of expenditure, and no doubt some of the shareholders would be a little surprised, in view of the favourable figures which they were able to present, at receiving an offer of debentures at the low price of 65. As they were aware, they had incurred obligation by way of loan from a financial house, amounting to £13,400, which, during the year under review, had been increased to £14,277. It was anticipated that that loan might have run on until other matters had absorbed it, and therefore no definite date was fixed for repayment; and the best terms they were able to arrange in order to induce the lenders to allow the loan to remain on hand until next March, was to deposit the unissued balance of their old debentures with them, and authorise them to sell sufficient of the debentures to repay themselves, and to call them at the price of 60. That option extended over the whole of their unissued 5 per cent. debentures. They were very loath to give such an option, but they had no choice in the matter. The option expired at the end of this year, except as regarded sufficient debentures to cover any unpaid loan which might exist at that time, and he supposed it was obvious that the offer to the debenture-holders at 65 was the result. As far as the directors were concerned, they were only anxious to make it clear to the shareholders that the action of offering them at such a low price was forced upon them. They had in the future to look forward to certain expenditure in the way of additions and reparations to their plant. It would be necessary before very long to contemplate the re-modelling of the overhead mains, and there were various other matters which would entail a total expenditure of some £10,000 or £12,000. None of those things, however, required immediate attention, and their idea was to discharge them as they became necessary out of the revenue for the year. The balance of profit this year—£7,337, was a very handsome one—and if the business progressed during the remainder of the year as it had done since the accounts were closed, they thought there would be a still better result at the end of the current year. They should have a surplus of probably £10,000 instead of £7,000, but, on the other hand, they must not lose sight of the fact that at present they were enjoying a suspension of the sinking fund for the debentures, which was to be re-instated in June next. At the same time they had the competition of the plant which formerly belonged to Mr. Mendiola Bozza, and which had now passed into the hands of Mr. Alvarado. That undertaking during the past year had developed a very large water power some short distance above the company's, and it remained to be seen to what purpose that new power was to be devoted. They did not look upon the situation with any trepidation, but at the same time they faced the fact that their sole competitor had thought it worth while to develop very large power, and it might result in their having to reduce their rates in order to meet competition. The situation did not fill them with any alarm, but they hoped to be able to deal with any necessity that might arise.

Mr. C. A. Vanisttart seconded the motion.

Replying to questions, the Chairman said that the option to which he had referred expired at the end of this month, and so far it had not been exercised to any considerable extent. As he had said, the terms were very onerous to the company, but there was no help for it, and he could only hope that the option would not be exercised.

The report was adopted.

Prospectus.—*Calgary Power Co.*—Last week £156,400 5 per cent. first mortgage bonds were offered for sale at £90 per cent.

Shawinigan Water and Power Co.—The directors have declared a dividend at the rate of 6 per cent. per annum on the common shares for the quarter ending 31st inst

Crompton & Co., Ltd.

A meeting of the debenture-holders was held on Thursday, December 18th, at the offices, Salisbury House, E.C., Mr. C. F. Tufnell presiding.

The Chairman said the meeting had been called because Mr. Ivor Bevan, the surviving trustee, had expressed the wish that they should invite the debenture-holders' attendance in order to give them some further information as to the company's prospects, and also to give them an opportunity of asking any questions. Those present were doubtless aware that the company had been through rather troublous times, and whereas profits were made in past years, in the last two or three balance-sheets a loss had been shown. The outlook for business was better, but it became necessary that the company should put their balance-sheet in order, and get further moneys for the purpose of working capital which was urgently needed. A reconstruction scheme was put before the shareholders and successfully carried through last June. That scheme brought into the company some £50,000 odd of additional working capital. The result to the company arising out of the reorganisation and reconstruction and from the issue of additional capital had, he was glad to say, been very beneficial and more than justified what the directors told the shareholders. At the time of the reconstruction in June the accounts for the year ending March 31st were not completed, but the result of the trading for that year was a profit sufficient to pay the debenture interest, directors' fees, the full depreciation which it had been their custom to provide for, and to leave a balance over. A very satisfactory profit had been earned for the half-year ended September 30th last, and the directors confidently expected that the result of the year's working to March 31st next would justify their recommending to the shareholders the payment of a dividend upon the new capital. It might interest them to know that the orders received since April 1st showed a gratifying increase on the previous year, and although there were signs that the boom in the trade of the country had reached its limit, and that therefore there might be some diminution in trade activity in the coming year, they anticipated that the changes they had effected, and the economies in manufacture which their new arrangements provided, would more than compensate for any possible decrease due to the falling-off in trade. Turning to the question of the position of the debenture-holders, the original trust deed and each debenture contained a provision to the effect that the debentures were not repayable in the event of a winding-up for the purpose of reconstruction. The debentures were due for repayment in 1920, and what the directors would have liked would have been to suggest to the debenture-holders that they should exchange their debentures for debentures in the new company, possibly extending the date for repayment, but there was a difficulty in the way. The very general three-fourths majority clause was not in the trust deed. Consequently, in order to carry through an exchange of that sort they would require the individual consent of every debenture-holder, and it was found in actual practice impossible to do that. In the circumstances the only course open to them was to follow the letter of the trust deed and to keep the existing debentures in force, taking whatever steps were necessary to protect the interests of the shareholders. The freehold land and premises had been transferred to the new company, subject, of course, to the charge in favour of the debenture-holders, and the new company had given a charge on all its property, present and future, including any uncalled capital, in favour of the trustee for the debenture-holders. Of course they would at once recognise that the position of the debenture-holders was thereby very considerably improved. That was shown in the market price of the debentures, which had gone up something like 18 points since the reconstruction. Like most of the debenture-holders, he (the chairman) had received a circular letter from the Quoted Investment Trust, in which it was suggested that the company was trying to ride rough-shod over the debenture-holders. There was no foundation whatever for that suggestion; on the contrary, their contention was that throughout the interests of the debenture-holders had been most carefully guarded. More than that, it was the debenture-holders who would benefit most by the reconstruction, and if they wanted evidence of that they had only to look at the market price of the debentures and the way they had risen in price since the reconstruction. The suggestion that when the debentures became due for repayment in 1920 the holders had no security that the company would not make some effort to postpone the date of payment seemed to him to be merely childish. The company had no option in the matter. They were bound to repay in 1920, or at any rate to give the debenture-holders the option of taking cash or exchanging for new debentures. If the Quoted Investment Trust, or any other debenture-holder, chose to apply to the Court, of course the company could not prevent it, but he could only tell them that the directors had obtained the best legal advice that they could possibly get in regard to the procedure which had been adopted throughout, and they had no doubt whatever as to what the result of any application to the Court would be.

Mr. Gilbert Player inquired whether the assets had been handed over to the new company.

Mr. Underwood asked whether it was intended to appoint another trustee.

Mr. Weston, a director of the Quoted Investment Trust, in the course of some lengthy remarks, said that while they had no desire to injure Crompton & Co., they intended that the rights of the debenture-holders should not be interfered with. The debenture-holders had lent the company £100,000 under terms and conditions as to interest and repayment which were set out in the trust deed. Their legal advisers had taken counsel's opinion as to what the trust deed meant, and he advised them that the holders of the debentures were entitled to receive back the sum of money which they had lent to the company, and to receive it now. Seeing that the price of the debentures in the market was in the neighbourhood of 70, it was perfectly obvious that it must be to the interests of the holders, who were not shareholders, to be repaid now, rather than allow their debt to run on for a series of years. The chairman had told them that the company had taken legal advice, and had obtained a contrary opinion. That being the case, the only thing to do was to obtain the opinion of a judge, and that would be done.

Mr. Ivor Bevan, the surviving trustee, said that another trustee would be appointed. He could not see what advantage it would be to the debenture-holders to be repaid immediately. If a man had got a good debenture, and he was perfectly sure that his security was of value, he did not see any advantage in his wanting to be rid of it.

Mr. Weston said that that was just the point; the debenture-holders, as far as he was aware, were not satisfied with their security.

Mr. Player said that, as a shareholder and a debenture-holder, he agreed with Mr. Weston that the debentures should be paid off. He could not see that the trustees had any power whatever to hand the debenture-holders over to a new company.

The Chairman said that the assets had been handed over to the new company. With regard to the gentlemen who held debentures in connection with the Quoted Investment Trust, he thought they were to be congratulated on their investment. £650 of their holding of £750 was acquired by them apparently in August or September last, some months after the reconstruction was carried through, and the average price paid by them for their holding was £58. Not content, however, with 40 per cent. profit in a few months, those people had approached the liquidator with a proposal that they should be bought out at par or a trifle under. The liquidator quite properly, in his opinion, refused.

Mr. A. P. Meers said that, as representing some old debenture-holders, he would like to know whether they were fully protected. He presumed the trustee would see that a clause was put in the deed that the debentures must be repaid in 1920.

Mr. Ivor Bevan: They are repayable then, and I cannot alter it.

Mr. Studholme then proposed a resolution approving of the scheme, and expressing the opinion that, in the circumstances, no action by the trustee was called for.

Mr. Andrews seconded this proposition, which was carried with two dissentients.

Douglas Southern Electric Tramways Co. — The directors report, according to the *Financier*, that the total traffic receipts for the season were £6,492, against £5,204 last season, an increase of £1,288, due to the fine and seasonable summer, which attracted a large increase of visitors to the Isle of Man. The passengers carried were 265,763, against 212 528 last year, an increase of 53,235. The tolls payable to the Douglas Head Marine Drive, Ltd., amounted to £1,082 and a commission of £324. After deducting these amounts and adding receipts from discounts and transfers, there is a total of £5,096 net receipts, against £4,082 for the previous year. The net profit is £2,435, against £1,733, and makes, with £177 brought forward, a disposable balance of £2,612. The directors recommend the full dividend on the 7 per cent. non-cumulative preference, and a dividend of 3¼ per cent. on the ordinary shares, absorbing £2,321, carrying forward £291.

Continental.—France.—The report of the *Société Industrielle d'Energie Electrique*, of Paris, for the year ending June 30th last, shows a net profit of £38,200, as compared with £39,780 in the preceding 12 months. A dividend of 6 per cent. is being declared, and, after making allowance for depreciation, &c., £9,054 is carried forward.

Germany.—A company has lately been formed in Strasburg, with a capital of £50,000, and the title Die Kraftversorgung Gesellschaft Lothringen, to undertake the supply of electrical energy for power purposes throughout Lorraine.

Belgium.—La Société d'Electricité de Seraing proposes to increase its capital to the extent of £120,000, with the view of extending its electricity supply system. The company is already supplying current to no less than 22 communes, and is in negotiation with a number of others.

Stock Exchange Notices.—Applications have been made to allow the following securities to be quoted in the Official List:—

Cuban Telephone Co.—$2,000,000 preferred stock in shares of $100 each in lieu of the scrip.
Metropolitan Railway Co.—Further issue of £504,216 3½ per cent. "A" debenture stock.

Official Announcements re Companies.—The following companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Anglo-Russian Refuse Destructor Co.
Electricity Generating Co.
Ferabin Lamp and Electrical Accessories.

W. & T. Avery, Ltd.—The directors have declared an interim dividend for the six months ended September 30th last at the rate of 5 per cent. per annum on the ordinary shares.

British Columbia Electric Railway Co., Ltd.

Mr. G. P. Norton presided on Friday at the Great Eastern Hotel, E.C., over the seventeenth ordinary general meeting of this company, in the absence of Mr. R. M. Horne-Payne through illness.

Mr. T. Blundell Brown read the speech which had been prepared by Mr. Horne-Payne, in which he said the board regretted the delay which had taken place in submitting the annual statement and in holding the meeting, but year by year the work of preparing and auditing the accounts and of analysing, considering and adjusting them grew heavier and heavier, and this year, in spite of every effort, it had been impossible to submit them at an earlier date. They also regretted that the report was not of a more satisfactory nature. He knew that a number of shareholders had been somewhat alarmed at the decrease which was occurring in their earnings. He thought they were needlessly alarmed. Unfortunately he could not tell them that this period of hard times was over. He did not expect to see any improvement until the end of the Canadian winter, that was to say, until April or May next, but he did think they would then see a gradual general improvement in commercial conditions, which would be reflected in the earnings, and that there would be a complete return of prosperity and progress in 1915. He gave that merely as his personal opinion, but his considered opinion for what it was worth. If he was right it meant that next year's report might be even less satisfactory than the present one, but that they would have good results to show in 1915. He believed that this period of halt would in the end prove good for the country and for the company, and that it would result in cheaper conditions of living and a very sound economic position in British Columbia. Meanwhile, they must exercise patience and be thankful that owing to the prudent policy of re-investing portions of their profits in the past they were now able to face one or two slack years with equanimity. They had, perhaps, been a little spoilt with too much prosperity. They had enjoyed increase upon increase in earnings month by month for 16 years, and had become so accustomed to this happy state of affairs that they were inclined to be unduly alarmed by a comparatively unimportant decrease. They could not have all sunshine and no shadow. There was nothing in the situation to justify the very heavy fall in the price of the securities and stocks, which had been brought about by the selling of stockholders whose fears had been aroused by the general fall in Canadian and all other securities and by the decrease in the earnings, and especially by the newspaper reports of an agitation in British Columbia to induce Parliament to enact certain measures restricting their rights to fix fares and charges. Again, he believed he could safely say that these fears were needless. Their rights were regulated by the conditions contained in Acts of Parliament and municipal agreements which constituted a solemn and frequently reaffirmed bargain made by the people of British Columbia to induce them to invest their money in the country. They could only be changed by an Act of Parliament, which, whether it directly restricted their rights to make certain maximum charges, or empowered a public commission to do so, would constitute a complete breach of faith. They rested confidently in the hands of a responsible British Government and a responsible British Parliament who were not in the least likely to lend themselves to such a dishonest proceeding, which would destroy the good name of the province throughout the financial world and stop the raising of capital for any purpose in British Columbia for years to come. As might be seen from the attitude of the leading British Columbia newspapers, there was no body of responsible public opinion behind this agitation, which was the work of certain noisy and ill-informed individuals who, by correspondence in the Press, and sometimes in public speeches, gave expression to statements which were misleading and generally absolutely false, and so made it difficult to raise capital for expenditure in British Columbia. He mentioned this in order to allay the fears that some of the shareholders might entertain on the subject, and to point out to the public in British Columbia that these irresponsible utterances did serious harm to the province, and particularly to working men. If the introduction of capital for new works and enterprises ceased, employment for the working classes necessarily diminished. The publicity given to this agitation had had its effect in curtailing the inflow of capital into the province, and there was in consequence less demand for labour. The agitation referred to arose out of a slight rise in certain fares, which was absolutely necessary in order to maintain the financial stability of the company, and was mainly supported by fatuous statements to the effect that the company had been coining untold wealth. Their critics never tired of stating that they were paying 8 per cent. upon their share capital, but they omitted to say that they were only paying 8 per cent. on the par value of their deferred share capital, and that the deferred share capital had been subscribed at a large premium, and amounted to little more than one-seventh part of their investment, and that the deferred shareholders had taken all the risks of a pioneer enterprise, from which the people of British Columbia had benefited enormously. The money actually expended on the enterprise amounted to $45,000,000, on which the interest and dividends paid out last year were equal to less than 4¼ per cent. They had from time to time voluntarily reduced their charges, and should be only too pleased to do so again when the profits justified it. They were at present charging a very great deal less than the maximum they were entitled to charge, and which, in some cases, they could charge with reason. For instance, they should, owing to the high price of coal, have been entirely justified in increasing their price for gas throughout this year but they had not done so as they hoped the unfortunate strike of the coal miners would end and they had tried to avoid increasing the expenses of their customers during the prevailing bad times, but if the strike continued they might be forced to adopt this course. On the subject of further capital expenditure, although the directors were asking for power to create additional share capital, they had no intention of issuing it at present, nor did they expect to issue it during the next year, but it was necessary that they should have power to issue additional shares as and when that course became desirable. Meanwhile, he could give the shareholders the most definite assurance that capital expenditure had for some time past been cut down to the very lowest possible amount, and that they would continue to limit it to absolute necessities until they received greater encouragement, and the pressure of genuine demand for their various services proved that it was necessary, and would be remunerative. He must not be understood to suggest that any of their capital expenditure in the past had been unwise or unnecessary. In looking back over the record of the past 10 years, he saw very little expenditure that had not been entirely justified, and that would not prove remunerative. Their great water-power installations at Lake Buntzen and Lake Coquitlam and at Jordan River, on which large sums of money had been spent, were practically completed. They were assets of great and permanent value, and would, they anticipated, meet any increase in the power requirements of the company for some years. They had no new enterprises or railway extensions of an extensive character in contemplation. He had received a number of letters from shareholders urging that they should not invest any further money at all in British Columbia. This, of course, was neither desirable in the interests of the company, nor possible. New householders in their districts were entitled to have their lighting and heating services extended to them. New industries were entitled to be supplied with power, and the travelling public were entitled to have their increasing needs provided for. All this required a certain amount of capital expenditure, but, as they had already said, they would limit their expenditure to what was absolutely necessary to carry on their business efficiently. In conclusion, he said again that he looked to the future of the company with confidence. The future of the British Columbia Electric Railway was bound up with, and inseparable from, the prosperity of British Columbia, and of the future of British Columbia with all its mineral, agricultural and forest wealth, and its rapidly increasing shipping trade, there could be no doubt. He would urge them in their own interests not to allow their confidence in the future of British Columbia or Canada, or in their Canadian investments, to be in the least degree shaken by present discouraging circumstances, which were almost exclusively due to disturbed financial conditions. Canada had this year again amply justified every claim that had been made for her. Her production of wealth from field crops and farm produce, and from mineral and other natural resources, had been greater than ever before, and the only trouble had been of a monetary nature, a recurrence of which it was hoped would be prevented in the future.

The Chairman, in moving the adoption of the report, said there was a slight error in the figures. The miles of single track in operation during 1913 should have been 334·02 miles instead of 357·82.

Mr. E. L. Evan-Thomas seconded the motion.

A Lady Shareholder asked if the board thought it wise to increase the capital in the present state of affairs.

Mr. Dyer Edwards suggested that the board might add several local advisers. The enterprise was growing by leaps and bounds, and required an enormous amount of attention. They had plenty of officers, but, as a large shareholder, he would like to see an advisory committee.

Mr. Davenport said he had a large stake in the company, and he had every confidence in it. One benefit in the depreciation of their capital had been pointed out to him—that they would have to pay less in death duty. One matter he would point out was that when the company issued the prospectus of the Victoria Power Co., they gave no hint of the falling off in the company's receipts. With regard to the suggested issue of further capital, they had received the directors' assurance that it was not intended to issue it, and that being so, he did not see why they should not wait until the next year before bringing forward the resolution.

Mr. C. W. Butler asked the board for particulars as to their purchase of land in the Saanich Peninsula.

The Chairman said that Mr. Horne-Payne had informed them emphatically that it was not the present intention to issue further capital, but they were taking the opportunity of getting the power, because they must have some capital powers in hand. He thought they might rest content with the assurance of the chairman. They did have several local advisers for a number of years, but the fact that this had been discontinued was sufficient answer that it did not serve a practical purpose. At the time the Victoria Power Co. prospectus was issued there was no information of a definite falling off of receipts. The land in the Saanich Peninsula was acquired under very favourable terms, and could now be disposed of with advantage if necessary.

The report was adopted, and, on the motion of Mr. T. Blundell Brown, a hearty vote of thanks was accorded to the staff.

The Chairman then proposed that the capital of the company be increased to £5,000,000 by the creation of 400,000 new shares of £1 each, and this was seconded by Mr. E. M. Harvey.

On a show of hands, the resolution was declared carried, but Mr. Davenport said he would demand a poll. Several shareholders appealed to Mr. Davenport to have confidence in the board, which had served them so well in the past, and Mr. Davenport agreed to withdraw his demand, and said he meant to cast no reflection whatever on the board.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Leonard Darwin presided, on December 18th, at the offices, 106, Cannon Street, E.C., over the fiftieth ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 969), said it was with very great regret that the board had to announce the retirement, on account of ill-health, of Mr. R. K. Gray, so long the managing director of the company, a post to which he succeeded in 1901 on the retirement of his father. Mr. Gray devoted himself unremittingly and unsparingly to the service of the company for the whole of the 44 years he was connected with it, and the board would feel his absence keenly, not only on account of his business ability, but also because of the esteem which his character inspired in all directions in a remarkable degree. They were glad to say, however, that Mr. Gray had consented to become an extraordinary director, thus enabling them to consult him on the many matters concerning which his advice would be of value. The board had appointed Mr. C. H. Gray and Mr. W. E. Gray as managing directors, both of whom had spent their business lives in the service of the company. They had, moreover, elected to their board Mr. Nigel Hanbury, of the firm of Wood, Field & Hanbury, whose family had been considerable shareholders in the company for over 33 years. The general business of the company had been well maintained, and the results obtained at Silvertown have been satisfactory, both as regarded outputs and profits. With reference to their special lines, the reputation of the Palmer tire, which they alone manufactured, stood, they believed, deservedly high, though they were constantly engaged in efforts to improve their patterns and to extend their markets. In view of these satisfactory conditions affecting the year's trading profits, the directors had hoped throughout the year for a better result than that actually presented. During the period under review the price of rubber kept falling slowly, and this fact somewhat adversely affected the valuation of the stock in hand at the end of the year, as it had to be written down to the value calculated on the price of rubber of the day. Their French factory had not responded as quickly as was anticipated to the reorganisation which had there been adopted. This matter was engaging the serious attention of the board, and it was hoped that the improvements in progress would be materially accelerated. The same condition of things might be said to apply in a lesser degree to some of the foreign agencies. In the National Insurance they had a new item of expenditure, amounting in the past year to £2,340, and the rates this year had reached the figure of 11s. 2d., as compared with 9s. four years ago. Such an increase of rates, if it continued for long, would drive all industry out of West Ham. But though the manufacturer in these days had a good many difficulties to contend with, it was true that they could not assert that they had got more than their proportionate share to face. The obstacles that did stand in their way they would endeavour to overcome to the best of their ability.

Lieut.-Col. A. Weston Jarvis seconded the motion.

Before putting the motion, the Chairman said that that was the jubilee meeting of the company, and he was glad it was a happier meeting than the one two years ago. He hoped the improvement they had had would continue in the future. He never liked to prophesy unless he was certain, and in the case of a manufacturing business, it was impossible to be certain ; but he did look with hopefulness and assurance to the continuance of the progress made.

The report was adopted, and the retiring directors and auditors were re-elected.

Mr. F. H. Sulley proposed a vote of thanks to the directors and staff, and Mr. Atkinson, in seconding, asked the chairman if he was hopeful of keeping up the present dividend, or did he hope they would go on to the large dividends that they used to have.

The motion was carried, and the Chairman, in reply, said that if he replied to the question put, he would get into the region of prophesy, which he had already said he would not indulge in. All he would say was that he was very hopeful of the future. The whole staff was energetic and loyal, and worked in the interests of the company.

German Electrical Companies.

The *A.E.G.-Lahmeyer Werke of Frankfort-on-Maine,* after placing £2,360 to depreciation in 1912-13 as compared with £2,340 in 1911-12, record net profits of £34,300 as against £31,900. The directors recommend the payment of a dividend of 6 per cent on share capital of £500,000, being the same rate as in 1911-12.

The *Deutsche Elektrizitats Werke, Garbe, Lahmeyer and Co., of Aix-la-Chapelle* realised net profits of £32,000 in 1912-13 as compared with £40,000 in the preceding year; and a dividend at the rate of 5 per cent. has been declared, being the same as in 1911-12. The sum of £10,000 has been passed to the account of the dividend equalisation fund as against £15,000 in the previous year, and the carry forward amounts to £14,000 as contrasted with £12,000 in 1911-12.

The Report of the *Telephonfabrik A.G. vorm. J. Berliner of Hanover* states the turnover substantially increased in 1912-13 and the Company had and has an abundance of government orders on hand. The branches were employed and the participation in the foreign business continued to yield satisfactory profits. After allocating £10,000 to depreciation as compared with £12,000 in 1911-12 and making provision for reserve fund, the accounts exhibit net profits of £40,000 as against £24,000. It is proposed to distribute 12 per cent., this comparing with 8 per cent. in 1911-12.

The *Kabelwerk Rheydt,* which has declared a dividend of 12 per cent. for 1912-13 as against 8 per cent. in 1911-12, reports that the value of the turnover exceeded £1,000,000. The constant concern of the directors was to perfect the plant, and the copper rolling mill dealt with 10,000 tons of copper and was extended so as to cope with profitable orders. As a result of further combination of the cable-making firms in other branches of manufacture than hitherto, it was possible to obtain adequate prices in accordance with the situation of the market. The gross profits reached £84,000 as compared with £60,000 in 1911-12, the dividend absorbing £30,000 on a share capital of £250,000 and the sum of £15,000 being carried forward.

The report of the *Elektrische Licht und Kraftanlagen A.G. of Berlin,* which is an investment company having a scope of activity in regard to undertakings in various countries, states that the circumstances prevailing during the year caused the company to exercise increased reserve in relation to new transactions involving considerable capital, and business was therefore substantially limited to the advancement of existing enterprises. The gross profits in 1912-13 amounted to £218,000 as compared with £208,000 in 1911-12. After defraying general expenses, taxes, interest on loans, etc., the accounts indicate net profits and balance forward of £137,000 as contrasted with £136,000. The directors propose a dividend of 7½ per cent. on share capital of £1,500,000, being the same rate as in the preceding year.

The *Gesellschaft fur Elektrizitats Anlagen of Berlin,* which belongs to the group of the before-mentioned Elektrische Licht und Kraftanlagen, either owns or is financially interested in various supply works and tramways. According to the directors' report for 1912-13, the surpluses realised by the company's own undertakings experienced a further increase over the preceding year. The accounts indicate gross profits of £64,000, as compared with £61,000, and after providing for general expenses, interest on loan capital of £300,000, and placing £4,000 to the renewal and redemption fund, as compared with £61,000, and after providing for general expenses, interest on loan capital of £300,000, and placing £4,000 to the renewal and redemption fund as contrasted with £3,250 in 1911-12, there remain net profits and balance forward of £44,000 as against £32,000. It is intended to pay 8 per cent. on share capital of £500,000, being the same rate as in each of the two previous years on less capital.

The directors of the *Bayerische Stickstoff Werke A.G. of Munich* in their report for 1912-13 state that the year was the first in the course of which the plant was uninterruptedly in full operation, and the plant stood the test notwithstanding the fluctuations in the water supply of the Alz. The situation of the market for the principal produce—cyanamide—was favourable, and the whole of the output was disposed of through the Sales Association for Nitrogen Fertilisers. In the case of sulphates of ammonia very satisfactory prices were realised during most of the year, business having only become more difficult towards the close. The extension of the plant was begun during the year, and would presumably be completed in the current financial year. The net profits permit of the payment of a first dividend amounting to 9 per cent. on share capital of £330,000, which is now proposed to be increased to £400,000.

THE SIEMENS-SCHUCKERT GROUP.

The financial statement of the *Siemens-Schuckert Works Co.* for the year ended on July 31st, 1913, indicates net profits of £692,000, as contrasted with £673,000 in 1911-12. It is intended to distribute among the two proprietary companies—the Siemens and Halske Co. and the Electricity Co. formerly Schuckert and Co.—a dividend at the rate of 10 per cent. as in the preceding year. The sum of £125,000 has been allotted to the reserve fund as in 1911-12, £25,000 has been placed to the contingency fund as against £17,500, and £75,000 to the payment of bonuses to officials as compared with £65,000, and £17,000 has been carried forward as contrasted with £15,000 in 1911-12.

The accounts of the *Elektrizitats Gesellschaft vorm. Schuckert of Nuremberg* show gross profits of £484,000 for 1912-13 exclusive of the balance forward amounting to £62,000, these figures comparing with £428,000 and £62,000 respectively in the previous twelve months. After meeting general expenses, interest charges, taxes, etc., and placing £142,000 to ordinary depreciation as against £130,000 and £35,000 to extraordinary depreciation, there remain net profits of £364,000 as contrasted with £352,000 in 1911-12. The sum of £5,000 has been allocated to the special reserve fund, and £16,000 has been allotted to the directors, managers and officials as their share. Out of the balance it is proposed to pay a dividend of 8 per cent. on share capital of £3,500,000, being the same rate as in the previous year; and to carry forward £63,000 as against £62,000 in 1911-12.

The accounts of the *Siemens and Halske Co.* for the year ended with July, 1913 show net profits of £625,000 as compared with £620,000 in the preceding year. It is proposed to pay a dividend of 12 per cent., being the same rate as in 1911-12; to place £100,000 to the special reserve fund as in the previous year, and £25,000 to the contingency fund as contrasted with £17,500; to apply £45,000 as in 1911-12 to the payment of bonuses to officials and workmen, and to carry forward

£60,000 as compared with £63,000. The progress of the company in the past ten years has been as follows:—

Year.	Profit.	Dividend %.	Capital.
1903-04 ...	£276,000 ...	7 ...	£2,725,000
1904-05 ...	349,000 ...	9 ...	2,725,000
1905-06 ...	398,000 ...	10 ...	2,725,000
1906-07 ...	435,000 ...	11 ...	2,725,000
1907-08 ...	484,000 ...	11 ...	2,725,000
1908-09 ...	571,000 ...	12 ...	3,150,000
1909-10 ...	575,000 ...	12 ...	3,150,000
1910-11 ...	616,000 ...	12 ...	3,150,000
1911-12 ...	620,000 ...	12 ...	3,150,000
1912-13 ...	625,000 ...	12 ...	3,150,000

CAPITAL EXPANSION IN GERMANY.

The *Elektrizitats Gesellschaft vorm. W. Lahmeyer and Co. of Frankfort-on-Main* proposes to increase the share capital from £1,250,000 to £1,500,000 for the purpose of satisfying the financial requirements of several subsidiary companies, which have arisen from the progressive development of the latter. The Zurich Bank for Electrical Enterprises, which holds £1,086,000 of the total share capital of the Lahmeyer Co., will take over the new issue and offer the shares to existing proprietors at a fixed price which has yet to be settled.

The *Siemens Elektrische Betriebe A.G. of Berlin*, which owns or leases various supply undertakings and is also financially interested in others, now intends to raise fresh capital for the development of the enterprises. At present the company has a share capital of £875,000, and loans amounting to £1,053,000, the latter being of the 4½ per cent. class. On the present occasion, however, the money market conditions have rendered it necessary for the company to have recourse to bonds bearing interest at 5 per cent. The loan is divided into two parts. The first comprises a sum of £225,000 which is to be offered in Germany, and the second the sum of £10,000,000 fcs. (£400,000) which is being placed in the Swiss market at the price 99½ per cent. and redeemable in 25 years at 103 per cent.

The *Deutsche Ueberseeische Elektrizitats Gesellschaft of Berlin*, which owns supply works at Buenos Ayres and in other South American cities, has caused some surprise in the financial world by coming forward with a new proposal to raise fresh capital so soon after the last loan issue of £1,250,000 which was made last April. Already its share capital amounts to £6,000,000, apart from loans of £5,500,000, but further money is required to repay the bank debt of £500,000 and provide for extensions at Buenos Ayres, Santiago, Valparaiso, Montevideo and Mendoza. It is now intended to create a new class of share by the emission of £1,500,000 in the form of 6 per cent. cumulative preference shares redeemable at any time at the price of 110 per cent. The company's banking syndicate has undertaken to take over the issue at par, bear the cost and stamp charges, and offer the shares for subscription at the price of 107½ per cent.

Cordoba Light, Power and Traction Co., Ltd.

The directors' report to September 30th, 1913, states that since the date of the last report, the company has acquired the outstanding shares of the Cordoba Light and Power Co., and now owns the whole of that company's share capital, together with the whole of the share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd. The balance of profit, after meeting all charges, is £20,926, plus £12,631 brought forward, making a total of £33,557. £10,055 of this has been absorbed by the payment of the dividend on the preference shares to 31st July, 1913, leaving a balance of £23,502. In the circumstances mentioned below the directors recommend that this sum be carried forward. Although the gross receipts have shown a satisfactory increase, the expenses of operation of both the subsidiary companies were greater than was anticipated. The receipts have also been affected by local competition, necessitating an active campaign which has already met with considerable success and will be continued unless satisfactory arrangements can be made. Some of the additional operating expenses were occasioned by a strike of tramway employees; while others, such as the removal to more convenient offices and the appointment of additional canvassers, should have a beneficial effect on future returns. A representative of Messrs. J. G. White and Co., Ltd., is now in Cordoba investigating the present methods on behalf of the Board with a view to bringing about increased efficiency and economy. The new hydraulic station of the Power Company has worked satisfactorily during the year. There is now a large balance of power available in the combined hydraulic stations of the company to meet the growth of the business. Additional boilers are being put in at the steam station as a precaution against any temporary suspension of working at the hydraulic stations due to accident or shortage of water at the San Roque Dam. The Tramways Company now has 26¾ miles of track in operation, another 2¼ miles constructed but not in operation, and a further extension of about 1½ miles is in course of construction. The debenture stock now ranks as a first charge on the properties of both the subsidiary companies, the £100,000 of 5 per cent. bonds of the Power Company having been redeemed on 1st January, 1913. In accordance with the trust deed securing the debenture stock, £5,200 has been redeemed during the year. The directors record the death, on 30th September last, of their chairman, Mr. Frame Thomson, who had been most closely associated with the company since its formation, and whose services to the company were of the greatest value. Mr. G. A. Touche, M.P., has been elected chairman.

The fifth annual meeting was held on December 7th at Winchester House, E.C., Mr. G. A. Touche, M.P., presiding.

The Chairman, in moving the adoption of above report, after referring with regret to the untimely death of the late chairman, Mr. Frame Thomson, said that he had only consented to occupy the chair temporarily at the earnest request of his colleagues. Proceeding to review the present position, the chairman said that since the last meeting the company had acquired the outstanding shares of the Cordoba Light and Power Co. They had a concession to supply electric energy in Cordoba for a period of approximately 40 years, expiring in December, 1948. They also had a concession granted on October 11th, 1910, to construct and operate tramways in Cordoba for 75 years. The company had constructed 29 miles of track, of which 26¾ miles were already in operation, as compared with 25½ miles a year ago, and 2¼ miles were expected to be put into service in a few days. Another 1½ miles were in course of construction. The Tramway Company was authorised to supply light and power in the City of Cordoba. The capital expenditure to date of the two undertakings amounted to £1,850,430, of which £1,330,481 was in respect of the power undertaking, and £519,949 in respect of the tramway. The capital raised amounted to £1,799,800, and adding sundry creditors £27,667, and £23,501 balance on profit and loss, they got a total of £1,850,968. That practically balanced their investments in, or the indebtedness of, the local undertakings, which amounted to £1,850,430. During the year the capital expenditure had amounted to £250,696. Of this £112,800 was attributable to the Power Co., and £38,000 was for the Tramway Co. The further expenditure authorised, so far as could at present be estimated, was about £116,000, which was expected to be spread over a period of two years. The growth of capital expenditure required close supervision, and was carefully watched by the directors. Where such expenditure was not absolutely essential, he thought it would be the wish of all of them that it should be held in check until the large expenditure already incurred had become more fruitful. He must admit that the present net revenue afforded no adequate return to shareholders. Turning to the accounts for the past year, he said it would be noted that the gross receipts amounted to £79,983 as compared with £86,052 a year ago. The result therefore looked worse, but it was really better, as the previous year's receipts were not really a reflection of the underlying companies' operations, but were swelled by interest and other receipts which had not occurred this year. This year's receipts represented the net earnings of the undertakings, and comparing them with the previous year, they were about £17,000 better. They had had to contend with the tramway strike, there had been extraordinary expenditure, and they had also had to meet competition. The net revenue he admitted was disappointing and the expenses had exceeded the estimate, which was made by Mr. Frame Thomson some time ago. It had been the intention of Mr. Thomson to go out to Cordoba in order to see what economies could be effected, and the board had sent out a representative of Messrs. J. G. White and Co., who were operating the tramways, to see what could be done in that direction. They had not yet received that gentleman's report, but he had no doubt that when they did it would be satisfactory to the shareholders. The total result of the year was a revenue balance of £7,871. They had a balance of £12,630 last year, so that they were able to carry forward the substantial sum of £20,501. In all the circumstances of the case, he felt confident that the proprietors would approve the policy of the board in carrying that amount forward, much as they would have liked to have declared a dividend. A shareholder had written asking him to enlighten the meeting upon the working of the two companies—the power and the tramway—and he was able to give them the figures up to September 30th. Taking the light company first, their gross receipts for 1913 were £83,100, as against £75,300, an increase of £7,800. The expenses were £30,300, as against £35,000, a decrease of £4,700, and the net profits were £52,800, against £40,300, an increase of £12,500. The percentage of expenses to gross receipts had been 36.5, as against 45.5 last year. The company's net receipts represented at present about 4 per cent on the amount at which the power undertaking stood in the books. At regards the tramway company, the number of passengers carried was 7,755,800, against 6,804,600, an increase of nearly a million. The gross receipts were £70,900, as against £62,600, an increase of £8,300, and the expenses were £42,900, as compared with £39,100, an increase of £3,600. The net receipts were £28,000 against £23,500, an increase of £4,500, and the percentage of expenses to gross receipts was 60½, as against 62½ for the previous year. The net result of the tramway undertaking represented about 5½ per cent on the amount at which the shares stood in the balance sheet. Although the results were disappointing, when he looked back upon what had been achieved, he felt that the difficulties before them were relatively small, and that the shareholders were entitled to hope for better results in the early future.

Mr. George Kitchin seconded the motion, and the report was adopted.

STOCKS AND SHARES.

Saturday Afternoon.

The events of the past few days have certainly not been calculated to make the season any the merrier for the Stock Exchange, unless it be for those fortunate individuals who have sufficient strength of mind to remain short of shares for a length of time. Heavy falls have occurred in most Brazilian, Mexican and Canadian securities, while the shrinkage in Consols goes on with a persistence worthy of a better cause than that of playing directly into the hands of the bears.

Further consideration of the details connected with the proposed rearrangement of capital in the London electric supply companies does not flatter the idea that the scheme is likely to bring about any particular change in the prices of the shares. This, as we have said before, is so much to the good, and it is fortunate that the Stock Exchange market declined to be excited over the sensational way in which the details were at first served up. One can well understand, in fact, that the promoters of the scheme may experience more than a transient feeling of annoyance that the matter, after all a purely domestic one up to the present, should have been made the subject of journalistic fuss.

City of London shares are a trifle lower on balance, and most of the principal shares show no change at all since the beginning of the week. More effect has been wrought upon the Debenture stocks, a demand for which was a feature before the scheme was published, and which have been sought after still more keenly during the past few days. The most interesting point in the situation, as well as the most piquant, at present, is the attitude likely to be adopted by the London County Council when the County of London Bill comes before Parliament next session. The L.C.C. investigation now in progress will probably be hastened, and its report will certainly attract a good deal of attention.

Brazilian Traction shares are flat in consequence of a heavy fall in the prices of various Brazilian securities, Government, Railway and others. Fears are revived lest the difficulties connected with the slump in rubber and coffee should seriously embarrass the Brazilian Government. In addition, there are financial difficulties in Brussels, which are said to have brought about the downfall of one or two houses in that city, where, of course, Brazil Tractions and Brazil Railways are largely held. The Common fell 2 points. Manaos Tramway Debenture dropped 3. Rio Tramway bonds receded a point.

The feature in the Mexican group, so far as electrical issues are concerned, is weakness in Mexico Tramways, which have fallen from 2 to 3 points. The 6 per cent. 50-year mortgage bonds have dropped to 79½ middle. At 80 the yield is exactly 7½ per cent. on the money, but in addition, there is £3 coupon payable on January 1st, so that if the position were a little more promising, the bonds would certainly look tempting. Mexican Light and Power varieties are dullish, and almost everything connected with the country has been further depressed this week, the news being regarded as more grave than ever, and as offering small gleams of hope that the situation will right itself rapidly.

The Home Railway market made quiet headway in spite of the adverse circumstances against which it has had to contend. Metropolitans, Districts, and Underground Electrics gave way, but rallied to some extent, although the last-named, so far as the £10 shares are concerned, are ⅛ lower at 3⅜, the 1s. shares receding to about 8s. Metropolitans went back to 42⅞, hardening later on to 43½, and Districts are steady at 30¼. In the Home Traction group there has been little fresh movement since our last report, and this part of the market is almost stationary.

Part of the heavy fall has been recovered already in American Telephone and Telegraph Capital stock, the directors declaring the quarterly dividend at the regular rate of 8 per cent. per annum—an effective retort to the rumours that the distribution was to be reduced at once. The American Railroad market, after pronounced flatness, has rallied sharply, and most of the things affected by its sphere of influence followed suit. Telegraph and cable issues, as a whole, are quietly steady. The exception is West India and Panama Ordinary, which have dropped 3/16 to 2⅜ upon two or three sellers coming into the market simultaneously. Marconis have gone back, after their recent improvement.

The manufacturing group is irregular. The feature is a rise in Brush 7 per cent. Preference shares, which has lifted the quotation to 5s. middle, while the Prior Lien Debenture stock at 75 is two points higher. Edison & Swan Debenture eased off, however, and Electric Construction shares are 1/16 lower. Castner-Kellners drooped a little; but Willans & Robinson Debenture continues to advance, showing another rise of two points this week. India-Rubber shares remain weak, following up their previous fall of half-a-sovereign with another of similar amount.

The speech of Mr. Arthur Lampard at the United Serdang Company's meeting on Thursday was couched in the usual hopeful vein to which rubber shareholders have become accustomed. It had practically no effect upon the market, where share prices remained dull under the influence of rumoured increases of capital by one or two of the leading companies in the near future. The price of the raw stuff clings closely to 2s. 3d. per lb. After all the talk, correspondence, and literature which has been poured out of late on the subject of some improvement in the methods of selling rubber, it is scarcely astonishing that some people should be growing restive at the masterly inactivity displayed by those who ought to be in a position to take decided steps.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Tuesday, December 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	8d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£22 10	..
a Lead, Nitrate	,,	£29 10	..
a ,, White Sugar	,,	£28	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	92/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10 5	..
a ,, Chlorate	per lb.	8⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£98	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£121 6 8	..
b ,, Sheet, in ton lots ..	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	⅛d. dec.
c ,, Tube (brazed)	,,	9½d.	..
c ,, ,, (solid drawn) ..	,,	8½d.	⅛d. dec.
c ,, Wire, basis	,,	7⅝d.	⅛d. dec.
c Copper Tubes (brazed)	,,	10½d.	⅛d. dec.
c ,, ,, (solid drawn) ..	,,	10½d.	..
g ,, Bars (best selected) ..	per ton	£82	..
g ,, Sheet	,,	£82	..
g ,, Rod	,,	£82	..
d ,, (Electrolytic) Bars ..	,,	£67	£1 dec.
d ,, ,, Sheets ..	,,	£85	£1 dec.
d ,, ,, Rods	,,	£72 10	£1 dec.
d ,, ,, H.C. Wire	per lb.	8⅞d.	⅛d. dec.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/-	6d. dec.
b India-rubber, Para fine	,,	8/1	½d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	50/-	5d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 5 to £18 10	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0¾ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2⅝ to 1/5⅛	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	⅛d. dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£170 10 to £171 10	£3 10 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/5	1d. dec
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 12 6	17/6 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

The R.A.C. Trials of Electric Lighting Sets for Motor-Cars.—Early in the present year the rules and regulations with regard to a series of certified trials, extending over a distance of 2,000 miles, of dynamo-electric lighting sets were issued by the Royal Automobile Club, in connection with which the proprietors of *Country Life* offered a £50 cup, to be awarded to the entrants of the lighting set whose performance was the best. Not having heard anything as to the results of the trials, we made inquiries of the R.A.C. and find that it has never taken place, for the simple reason that no entries were received for it. In view of the increasing adoption of electric lighting on motor vehicles, and the useful information to motorists which the tests would have brought to light, it would be interesting to learn the reason for the abstention of makers of car electric lighting sets from these particular trials.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 19th.	Rise + or Fall −	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	6	5†	9½ — 10½	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	9†	8⅝ — 9⅛	..	4 9 9
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4⅛	..	6 9 1
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	+1	4 11 0
City of London, Ord.	10	9	6†	16½ — 17½	— ½	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 101	..	4 9 1
County of London, Ord.	10	6	5†	11⅜ — 12¼	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104½ — 105½	..	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅝ — ⅞	..	Nil
Do. 6 % Cum. Pref.	5	5	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	8†	8¾ — 9¼	..	4 17 9
Kensington & Knightsbridge, Ord.	5	5	5*	7⅛ — 8⅛	..	4 17 6
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅜ — 4½	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	98 — 99	+1	4 0 0
Metropolitan	5	4	4*	3⅛ — 3⅜	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 12 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10½	..	5 11 7
Oxford	5	7	6*	6 — 6⅜	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10*	8⅝ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅞ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	3	5½	..	2⅝ — 2¾	..	6 15 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	+1	4 19 9
South Metropolitan, 7 % Pref. ..	1	7	7	1⅞ — 1⅞	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 2
Urban, Ord.	£3	Nil	..	⅞ — 1⅛	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	£3	10	10*	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	— 1/16	4 6 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	5	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$ 00	7	8	108 — 112	..	7 2 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ — 104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	43 — 47	..	8 9 6
Do. 7 % Cum. Pref.	$100	7	7	78 — 83	..	8 8 6
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	..	6 3 5
Do. 5 % 2nd Mort. Bonds ..	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	58 — 63	..	7 16 0
Montreal, Lt., H. and Power ..	$100	9	10†	216 — 223	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	5	5	101 — 106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	100 — 102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	135 — 139	..	4 6 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ — 107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	96½ — 98½	..	4 11 5
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref. ..	1	6	6	⅞ — 1	..	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 106	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6⅝	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	96 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	116 — 119	+2	6 14 6
Do. Collat. Trust	$1000	4	4	88 — 91	+1	4 8 0
Anglo-American Telegraph ..	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105 — 106	..	5 13 9
Do. Def.	Do.	30/-	..	24⅜ — 24⅞	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	— 1/16	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	5	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14⅜ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8½ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6⅝ — 7½	..	6 13 0
Direct United States Cable ..	10	4	4†	6¼ — 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 — 127	..	5 10 3
Do. 8½ % Pref. Stock	Do.	8½	8½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11⅛ xd	..	5 7 10
Do. 6 % Pref.	10	6	6	11⅜ — 12⅛ xd	..	4 18 0
Great Northern Telegraph ..	10	20	5†	80½ — 82½	..	6 2 8
Indo-European Telegraph ..	10	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph ..	1	20	10†	3 5/16 — 3 7/16	— ⅛	5 13 8
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2½ — 2⅝	— ⅛	6 3 8
Monte Video Telephone, Ord. ..	1	3	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	⅛ — ⅜	..	6 3 1
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97½ — 98½	..	4 11 5
Oriental Telep. and Elec. ..	1	10	10†	1⅝ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9¼	..	10 16 2
Submarine Cables Trust	Cert.	6	8	122½ — 125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6¾ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅛	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	1½	2½ — 2¾	— 1/16	5 0 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10½	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 — 100	..	5 0 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 18½	..	5 5 8
Do. 4 % Debs.	Stock	4	4	92 — 94	— 1	4 5 0
Western Union 4½ % Fdg. Bonds	$100	4½	4½	93 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	5/8 — 8/8	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12⅛	+ ½	..
Do. Do. Deferred	100	..	..	4 — 5⅛	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	84 — 87 xd	..	6 18 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼ xd	..	6 13 4
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 3 5
London and Suburban, Ord.	1	..	..	3/16 — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ⅝	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	..	6 7 0
Metropolitan Railway Consol.	100	1⅝	1¾†	43¼ — 43¾	..	3 14 3
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	30 — 30½	..	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	93 — 95	..	4 4 3
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3½ — 3½	— ⅛	Nil
Do. "A"	1/-	..	..	3/8 — 7/16	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 — 113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	6	6	88 — 89	— ½	6 14 10
Yorkshire (West Riding). Ord.	5	Nil	..	½ — ½	..	Nil
Do. 6 % Pref.	5	5	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	81 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 15/16	+ 1/16	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 5
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	..	4 7 0
Do. 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Auckland Trams, 5 % Deb.	100	5	5	101½ — 103½	..	4 16 7
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	97 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	84½ — 86½	—2	6 18 7
Brisbane Trams Invt., Ord.	5	8	8	7½ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4 7/8 — 5 3/8	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	110 — 114	—1	7 0 4
Do. Pref. Ord.	100	6	6	102 — 106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 — 105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 — 104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	5 7/8 — 6 3/8	..	5 17 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	95 — 98	— ¼	4 11 10
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90 xd	..	5 11 1
Do. 6 % B Deb.	100	8	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	3/8 — ½	..	..
Do. Pref.	1	4 3/8 d.	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 15/16 — 1 13/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
,, Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	81 — 84	—3	5 19 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	71 — 74	—2½	9 9 2
Do. Gen. Con. 5 % Bonds	..	5	5	77 — 82	—3	6 2 0
Do. 6 % Bonds	100	6	6	78 — 81	—2½	7 8 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5¾ — 6¼	..	8 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	94½ — 96½	..	5 3 8
Perth (W.A.) Elec. Tr., Ord.,	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅛ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99½ — 101½	—1	4 18 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 — 100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5	— ⅛	7 0 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	— ⅛	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝ — ⅞ xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2 13/16 — 2 15/16	..	5 8 11
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	+ ½	5 3 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 — 103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	3	Nil	..	1 1/16 — 1 3/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	⅛ — ⅜	+ ⅛	Nil
Do. 5 % Prior Lien Deb.	100	5	5	72½ — 7 1/2	+2	6 9 0
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10½ — 11½	..	6 13 4
Do. Pref.	5	5	5	4 7/8 — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	22½	3⅝ — 3¾	— 1/16	6 0 0
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1
Crompton & Co., Deb.	100	5	5	68 — 73	..	6 17 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	—1	6 11 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½ — ⅝	— 1/16	7 5 6
Do. Pref.	1	7	7	1 5/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¾ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	100 — 102	..	4 8 3
India-Rubber, G. & T.	10	7½	5	11½ — 12½	— ½	6 0 0
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	61 — 65	+2	6 3 1
Do. B 4 % Cum. Pref.	100	..	..	35 — 40	..	..

* Unless otherwise stated all shares are fully paid. † Interim dividend.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1913.

THE returns of electrical business for the eleventh month of the year show, in the case of the exports, one of those periodic jumps in value which can be traced to a large telegraphic export. In this case Ceylon is credited with a submarine telegraphic purchase, valued at £625,000, and, as a result, the exports for November amounted to £1,135,402 in value, as compared with £554,769 in the previous month.

It may be noted, however, that even excluding telegraphic exports, the remaining general business of November was still some £30,000 to the good, as compared with the preceding month.

Turning to the imports, these amounted to £258,937, as compared with £265,414 in October showing an appreciable decrease; this also applies to the re-exports, which with a total of £27,277, show a heavy decrease compared with the £39,357—an unusually big total recorded for October.

The exports of cable and machinery reached very satisfactory totals, the former being some £30,000 above the value recorded in the previous month; this improvement also applied to telephone exports, and in a less degree to the lamp section. The values of cable, carbons and lamp imports were somewhat above those for October, but this was more than counterbalanced by the falling off in other directions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,709	67	97	171	4,144	504	11,569	593	468	75	90	3,677	23,164
Germany	2,236	1,175	23	...	73	...	2,729	...	29	...	10	141	6,416
Netherlands, Java and Dutch Indies ...	751	1,225	101	13	...	32	1,436	38	180	196	2	1,132	5,106
Belgium	505	235	60	...	71	39	4,674	...	17	12	1,047	40	6,640
France	409	...	3,382	34	...	112	16,467	44	101	...	240	435	21,230
Portugal	243	27	...	15	...	100	265	...	...	...	27	837	1,514
Spain, Canary Isles and Spanish N. Africa...	1,021	1,027	661	11	...	403	4,619	370	...	20	126	220	8,478
Switzerland, Italy and Austria-Hungary ...	170	64	258	...	100	...	3,655	20	...	809	145	2,693	8,212
Greece, Roumania and Turkey	460	526	217	48	...	48	96	17	...	36	18	6,384	7,850
Channel Isles, Gibraltar, Malta and Cyprus...	95	128	95	21	...	...	253	920	...	...	...	360	1,872
U.S.A., Philippines and Cuba	1,260	...	27	18	...	34	547	...	26	4	...	139	2,055
Canada and Newfoundland	1,031	1,130	949	1,028	12	2,633	10,524	87	952	...	547	698	19,601
British West Indies and British Guiana ...	475	30	...	87	...	4	214	...	...	...	112	38	960
Mexico and Central America	54	...	93	...	...	...	661	...	...	...	575	2,771	4,154
Peru and Uruguay	954	...	...	77	...	140	4,634	...	693	60	114	4,059	10,731
Chile	638	100	225	290	35	50	2,595	...	16	29	586	80	4,650
Brazil	1,956	1,067	646	937	171	105	8,459	1,249	83	...	68	3,436	18,177
Argentina	3,719	15,409	686	2,361	629	496	20,742	2,125	2,433	60	779	171	49,610
Colombia, Venezuela, Ecuador and Bolivia...	89	183	67	...	...	...	889	...	...	...	63	158	1,449
Egypt, Tunis and Morocco	509	235	213	17	...	19	2,914	32	...	...	96	1,143	5,178
British West Africa	94	14	51	...	...	199	117	...	246	8	55	119	901
Rhodesia, O.R.C. and Transvaal	1,552	3,032	683	327	...	150	1,654	244	353	50	...	...	8,045
Cape of Good Hope	1,426	7,930	2,006	248	...	279	5,460	3,534	251	22	5,666	85	26,907
Natal	1,696	6,489	193	120	76	38	3,986	...	271	21	288	58	13,236
Zanzibar, Brit. E. Africa, Mauritius & Aden	165	62	142	130	70	56	965	72	438	14	241	516	2,871
Azores, Madeira and Portuguese Africa ...	244	273	71	25	...	255	4,928	...	137	...	82	134	6,149
French African Colonies and Madagascar ...	...	...	...	...	23	...	...	...	...	...	...	39	62
China and Siam	1,453	987	1,769	160	91	788	2,187	797	37	...	90	360	8,719
Japan and Korea	1,602	51	905	...	3,480	851	8,225	667	3,186	36	11,738	2,725	33,466
India	4,030	10,571	4,407	2,813	142	55	29,061	2,787	1,118	213	1,414	2,767	59,378
Ceylon	336	459	313	91	...	2,891	97	...	145	...	168	625,577	630,077
Straits Settlements, Fed. Malay States, and Sarawak	376	757	689	79	...	637	4,097	357	58	33	773	392	8,248
Hong Kong	548	1,832	233	...	12	...	1,837	...	91	...	84	...	4,637
West Australia	504	1,141	271	358	61	109	272	3,912	29	...	854	16	7,527
South Australia	390	7,387	290	406	20	605	1,101	15	95	4	30	144	10,487
Victoria	1,817	8,870	431	979	99	87	6,356	152	1,476	37	26,310	2,133	48,747
New South Wales	1,815	8,722	707	1,006	931	611	7,156	1,101	871	59	657	7,036	30,672
Queensland	767	616	85	291	...	348	773	30	143	...	2,143	655	5,851
Tasmania	82	...	...	...	...	...	...	...	...	...	...	...	82
New Zealand and Fiji Islands	1,136	3,498	473	1,008	252	846	3,718	397	493	...	10,222	250	22,293
Total, £	38,317	85,319	21,519	13,169	10,492	13,524	180,172	19,560	14,446	1,798	65,462	671,624	1,135,402

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	23	65	...	3	...	...	7,200	...	953	...	5,160	13,404
Germany	3,392	28,191	1,943	20,453	8,547	1,781	42,235	1,300	11,913	12,044	3,084	134,883
Holland	...	569	...	3,550	1,276	4	262	250	...	202	105	6,318
Belgium	563	3,007	16	139	21	35	4,437	...	58	110	4,799	13,185
France	1,417	61	1,427	2,055	292	2,146	757	...	1,101	3,498	368	13,122
Switzerland	300	1,489	172	7	20	106	2,756	...	11	250	...	5,111
Italy	20	13,342	...	...	105	247	...	...	...	...	148	13,862
Austria-Hungary	...	1,403	8	453	274	...	8	...	917	148	172	3,383
United States	4,805	562	671	46	144	60	14,898	30,362	246	597	2,563	54,954
Total, £	10,520	48,689	4,237	26,706	10,679	4,379	72,553	31,912	15,199	16,849	16,399	258,122

Additional imports: Spain, carbons £415; Canada, arc lamps, £260, machinery £140

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	12,729	583	...	3,935	199	...	7,886	...	470	526	999	27,277

TOTAL EXPORTS: £1,135,402. TOTAL RE-EXPORTS: £27,277. TOTAL IMPORTS: £258,937.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

WORKS SHOP ORDER SYSTEMS.

By A. E. BREWERTON, A.M.I.E.E.

How often does it happen in a works when a set of parts come to be assembled, that one all-important component is missing, and the work has to stand whilst it is being made? If we refer to certain classes of mechanical manufacture, the answer might be—"Never"; and truly so, since there are many firms making articles which have been standard for the last ten years or so, where work goes through automatically in its tens of thousands, and, by a very simple system of book-keeping, the stores department is enabled to order the exact material required, and such works may be kept uniformly busy, whilst the orders last, and in half an hour it is possible to take stock of all the work in progress.

Apply the same question to some small electrical works where a variety of articles is made, and where the cost of non-productive labour is kept down to an extent which renders systemising difficult, then the answer must be—"Often."

In electrical work there is no finality of design, and, therefore, systematising remains a difficulty. The cost-keeping system, to a large extent, forms a basis for the works system; and, if the two are not in perfect harmony, the aims of both are frustrated, and their existence is no longer justified. Works managers often have occasion to look upon the cost department as their worst enemy, but it is absolutely necessary that they should assist it as much as possible to ensure their own comfort.

Where special work is taken on by contract, or repairs are being carried out, it is only necessary to have the cost of the whole job. A shop order is, therefore, issued to the works, upon which all time and material are booked; then, as soon as the work is completed, factory charges are added to the labour, the required profit put on as a percentage of the whole, and an ultimate figure, which the estimator always hopes will be below the contract price, is obtained.

The system involved in this class of work is simplicity itself; but when work is done upon a repetition basis, it is necessary to go into matters much more closely, for if finished articles are to be made even in such small numbers as hundred lots, the cost of each component should be known, and must, therefore, have its shop order number, against which material and labour are booked. It is usually advisable, however, to make the first batch of a new line upon one collective order, and subsequently issue the component orders, so as to be sure that unreliable figures are not obtained, due to the experimental stage not having been passed.

Now, in starting a system for repetition work, it seems that some start off in quite a complicated manner, by allowing a multiplicity of numbers to exist. Let us take an example of a "system" in vogue in a works we know, and let us follow the mysteries connected with the brush-holder for a certain motor, which we will call the B type. Now this is what happens.

The drawing office makes a drawing (Numbered 9,999), which is issued to the pattern maker, who numbers his pattern Z111; sometimes a metal pattern is made later which has a further number, but, anyway, the castings ultimately arrive in the stores, and become known as "Brush-holder Castings for B-type Motors." There is no need to recite all the names that this one unfortunate article receives before completion, but let it be said that the tools and jigs for machining, the shop order upon which the work is done, and, finally, the spare part list, all have different numbers according to a so-called system.

For one component it is quite sufficient to have one number, and the system which is described here seems so obvious that were it not that a multiplicity of appellations is often employed in the manner referred to above, it would hardly seem worthy of space.

After all the experimental work is completed, and, perhaps, after the first batch of these B-type motors have been completed, a specification sheet is constructed similar to Table I:—

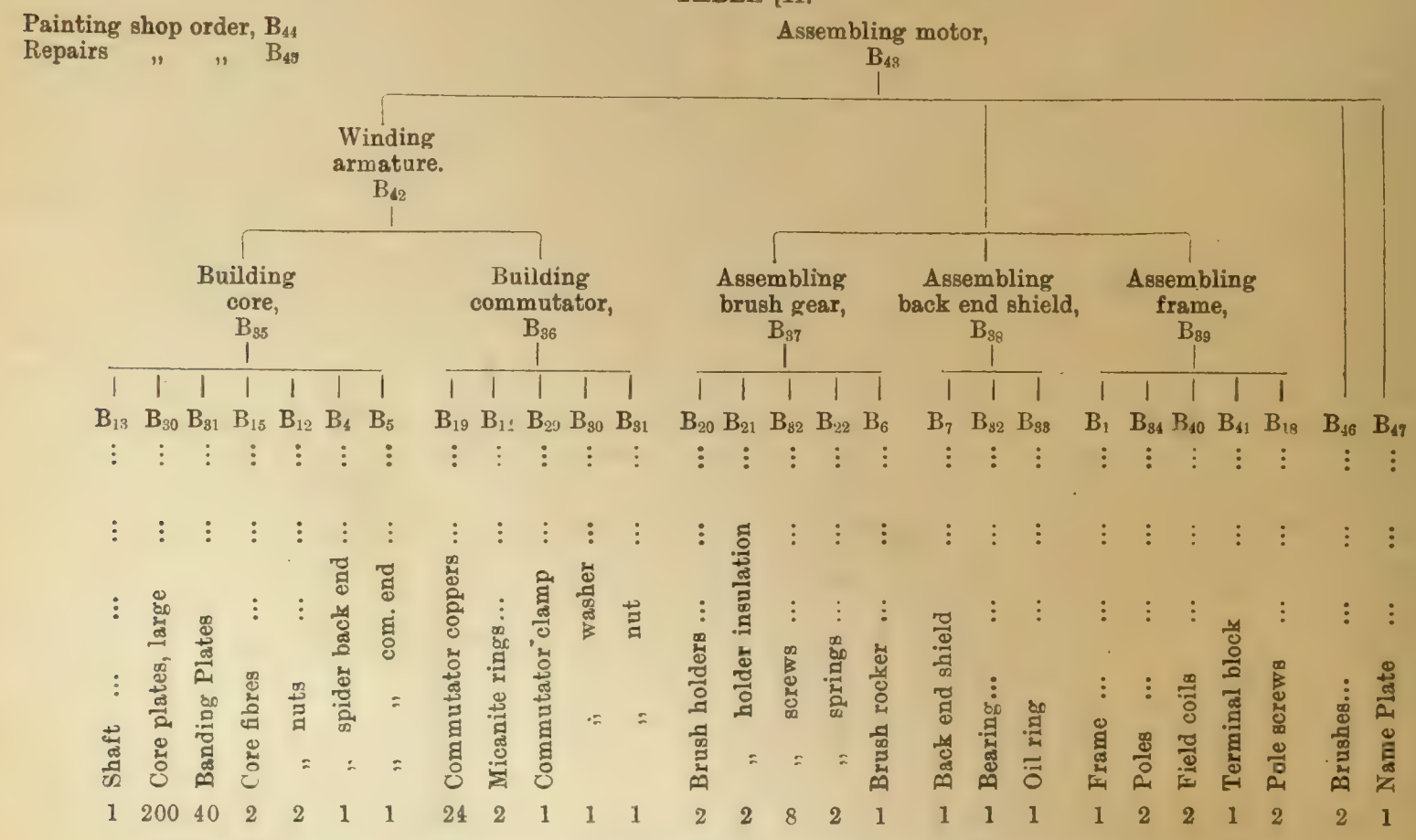
TABLE I.—Specification for B-type Motor.

S.O. No.	Description.	No. required.	Material.	Drawing No.	Remarks.
B1	Frame	1	C_1		In addition to the part or S.O. No., it is convenient to have a further No. for filing drawing; but this is for drawing office use only.
B2	Back end shield	1	C_1		
B3	Comm. end shield	1	C_1		
B20	Brush-holder	2	Brass casting		

Now each part has been given a number with an index letter B, arranged in some order for convenience—say, starting with cast-iron parts then brass casting, followed by capstan parts, and so on. The number given to the brush-holder is B20, and by this mark it is always known, even in the spare part lists sent to customers, instead of using a long description.

It would not do to make patterns and tools, and debit their cost against production; and, therefore, these should follow a simple series of numbers, so that if there are four

TABLE II.



The figures below the components are intended to represent the number required for assembling.

jigs for machining B20, the cost of each must be known. It is not sufficient to know that the tools have cost too much, without being able to drop on to the offending member if the cost is too high.

When the tools and patterns are complete, any repairs which they may require are, however, booked to maintenance and debited against the cost of production; therefore, to make a distinction between maintenance and actual production, it may be convenient to book the former on shop order BM20 (M. measuring maintenance).

The outcome of this system of numbers is that the man in the stores, or the workman in the shop, need not necessarily know the functions of the various parts, nor remember them by name. He is told to machine a hundred B1's, and provided he gets castings and tools which bear that number, he has no occasion to give more than his habitual amount of thought to the matter.

In our example, we have instanced for convenience one particular type of motor. If we now design a C-type motor, utilising some of the components, there is no disadvantage in including the latter in the new specification under their original numbers.

Such is not the case, however, with a standard range of machines where a large number of combinations is made from comparatively few parts by working out suitable ratings, and making use of whichever armature plate, magnet core, commutator, and frame are best combined for a particular design. In such cases it is advantageous to modify the classification.

In addition to the component part numbers, it is necessary to have further shop orders upon which they may be assembled. One number may be used upon which all assembling is done; but it will usually be found an advantage to divide up this part of the work.

Turning, again, to the motor for our illustration, commutator building, core building and armature winding are distinctly different operations, and should have separate numbers, and when the method of assembling has been decided upon, it has been found to greatly facilitate storekeeping and save a lot of writing on requisitions, to draw up an assembling sheet in the form of a tree, as shown in Table II. Now with a sheet of this kind, if a foreman has to build a hundred armature cores, he does not write a long requisition for 100 shafts, 20,000 core plates, and so on, but just calls for 100 sets of parts for B35. And when those armature cores are complete and returned to the stores, they are known by the number B35, and so on.

It is usually impossible to construct any system for a particular set of circumstances and then apply the same idea elsewhere, even though the conditions of work bear every similarity. The system here described has, however, been found workable and the assembling tree most useful in a case where the stores and cost departments were not thoroughly conversant with new kinds of work, as the stores could see at a glance what components were required, and the costs clerk having a partly assembled article could see immediately the parts which it includes. Table II only includes a few parts to illustrate the system, but when a sheet is drawn up for assembling a hundred or so parts, its usefulness becomes more apparent. It will readily be seen that with a sheet constructed upon these lines, the work of assessing the value of partly assembled stock becomes very simple.

ELECTRICITY AND RESPONSIBILITY FOR FIRES.

[FROM OUR LEGAL CONTRIBUTOR.]

It frequently happens that when a country mansion or other establishment is burnt down the blame is laid at the door of him who laid the cables for electric lighting. It is one of the charges "random hurled," refutation of which is not easy if the electrical installation is destroyed with the building. Whatever may be the probabilities of the case, it is often found convenient to attribute blame either to the persons who put in the electrical installation or to the supply company, especially where the premises which have been destroyed are not insured. In view of this possibility, it may be of interest to discuss some of the legal problems which arise.

The first question to consider, is whether and how far a company or local authority supplying electricity under the terms of a provisional order may be held liable for a fire upon a consumer's premises. Much appears to depend upon whether the undertakers (to use a collective word) are responsible for the actual installation on the consumer's premises.

If a company (or a local authority) carry out this work, their liability will be co-extensive with that of the independent wiring contractor, whose position has already been considered, subject to this, that a local authority will be entitled to the benefit of the Public Authorities Protection Act, 1893, which provides that an action of this kind shall be brought within six months of the date of the alleged injury, and that, if the local education authority are successful, they may be entitled to costs on a higher scale.

The liability of "undertakers" is not, however, restricted to cases in which they have supplied wires and fittings to a consumer. The Electric Lighting Acts expressly provide that they shall be liable for any negligence or nuisance in the supply of electricity, and this liability is strengthened by the Board of Trade Rule 36, which provides that:—"The undertakers shall be responsible for all electric lines, fittings and apparatus belonging to them, or under their control, which may be upon a consumer's premises, being maintained in a safe condition, and in all respects fit for supplying energy." So, if they merely hire fittings, &c., to a consumer, they are liable. Rule 37 provides that:—"In delivering the energy to consumer's terminals the undertakers shall exercise all due precautions, so as to avoid risk of causing fire on the premises."

It may be inferred, however, that undertakers are not insurers; they must be proved guilty of negligence before they can be charged. Reverting to "gas cases," we find this principle clearly established.

In Holden *v.* Liverpool Gas Co. (1846) (3 C.B. 1), a gas company, incorporated by Act of Parliament, had for some years supplied gas to a house belonging to the plaintiff, the only means of shutting it off being by a stop-cock within the house, the key of which was kept by the occupier. The last tenant, on quitting, gave notice to the company that he should not require any further supply; and one of the company's workmen, at his request, removed a chandelier from one of the rooms, leaving the end of the pipe properly secured. The internal fittings were the property of the plaintiff. Whilst the house remained untenable, the gas, by some unexplained means, escaped, and an explosion took place, by which the house was considerably damaged. In an action for damages brought against the company, alleging a breach of duty on their part in not taking proper means to prevent the influx of gas into the house, it was held that a non-suit was rightly directed on the above facts. Again, in an action against a gas company for negligently allowing the escape of gas from their mains into premises where lights were known to be burning, it was shown that the gas found entrance through an open window nearly level with the trench from the main, after a hole had been made in the main for the insertion of the service pipe. It was decided that even if the jury thought that the gas entered in the manner alleged, it was a question for them whether the company's men might reasonably have foreseen it and were bound to have the window closed.

In Burrows *v.* March Gas and Coke Co. (1872) L.R. 7 Ex. 96, the defendants, a gas company, having contracted to supply the plaintiff with a service pipe from their mains to the meter on his premises, laid down a defective pipe from which the gas escaped. A workman in the employ of a gas fitter, employed by the plaintiff to lay down the pipes leading from the meter to different parts of the premises, negligently took a lighted candle for the purpose of finding out whence the escape of gas proceeded. An explosion then took place, whereby damage was occasioned to the plaintiff's premises, to recover compensation for which the plaintiff brought his action against the defendants. It was decided that the damage was not too remote, and that the plaintiff, not being the master of the workman,

could not be construed as contributing to the damage by reason of his act, and was, therefore, entitled to recover.

In a later case (Henderson *v.* Newcastle and Gateshead Co. (1893), 37 Sol., J. 403) the plaintiff owned a new house, which was divided into two separate flats, an upper and a lower one, each flat having a separate entrance into the street. When the house was built the plaintiff laid a service pipe for gas from the street under the hall door-steps, inside the wall of the house to the upper flat. The tenant to whom the upper flat was let gave notice to the defendants, under Sec. 11 of the Gasworks Clauses Act, 1871, requiring them to give a supply of gas to the flat. The defendants thereupon made the connection by a pipe from the main under the street to the service pipe, and supplied and fixed a meter in the flat and turned on the gas. About an hour afterwards an explosion took place, caused by an escape of gas owing to a defect in the service pipe, which the plaintiff had laid, leading to the meter. In an action to recover for the damage done to the house by the explosion, the plaintiff contended that it was the duty of the defendants to see that the pipes by which they supplied the gas to the flat were fit for the purpose; that as the gas belonged to the defendants until it passed through the meter, it was not supplied to the flat until then; and that if the defendants chose to make use of a pipe not laid by themselves, it was their duty to test it to see if it was in good condition. At the trial, Mr. Justice Collins, as he then was, ruled that there was no duty on the defendants to test the service pipes, and, the jury having found that the defendants had made the connections properly, and had not caused the defect in the service pipe, judgment was entered for the defendants. On motion for a new trial, the Court of Appeal dismissed the application, holding that there was no duty on the defendants to test the service pipe laid by the plaintiff, and the case was distinguished from Burrows *v.* March Gas Co., where the service pipe was supplied and laid by the gas company.

A gas company are bound to keep up such a reasonable inspection of their mains and pipes, as may enable them to detect when there is such an escape of gas, by fracture or imperfection of pipes, as may lead to danger of an explosion; and if an explosion takes place from a fracture or defect which has existed for several days, during which time it has also been discoverable by reason of the smell of the escaped gas, and would have been discovered by proper inspection, that is evidence of negligence on the part of the company; nor is it enough to relieve them from liability that, upon notice of the escape, they sent a workman to repair the defect, he arriving too late to do so. (Moss *v.* Hastings and St. Leonards Gas Co. (1865), 4 F. and F. 324.)

Passing next to the wiring contractor, there does not appear to be any case in the law reports where a wiring contractor has been liable for a fire traced to defective insulation; it cannot therefore be stated that his legal liability has been accurately defined. Nevertheless, on general principles it is apprehended that where a man undertakes to put in wires, it is an implied term that he will see to the insulation being safe and sound. If he does not do this, he is liable for the consequences; and if it were conclusively shown that a fire was caused by a short-circuit, the wiring contractor might be held liable for the damage. In ascertaining the state of the law relating to electricity, it is often necessary to obtain assistance by referring to cases which have arisen in connection with the supply of gas. Cases of this kind are of some use in this connection. In the case of Blenkiron *v.* Great Central Gas Co. (3 L.T. 317), the plaintiff was possessor of certain premises, and the defendant was employed in laying on gas to the premises adjoining; he did the work so negligently that the gas escaped and ignited, and the plaintiff's premises were set on fire and burnt down. It was held that there was a good cause of action; that it was unnecessary to negative negligence in the owner of the adjoining house in not putting out the fire before it communicated with the plaintiff's premises. While the principle underlying this case probably applies to a man who is employed to fit up electric wires, it is, of course, clear that proof of negligence, and of the fact that the fire was started, would be much more difficult in the case of electricity, but it is submitted that an electric wiring contractor may be held liable if his negligence be proved; and this whether the current is supplied from public mains, or from a private supply.

Where electricity is thus supplied, viz., under Sec. 4 of the Electric Lighting Act, 1888, the Board of Trade rules provide that:—"The owner shall be responsible for all electric lines, fittings and apparatus belonging to him, or under his control, which may be upon a consumer's premises being maintained in a safe condition, and in all respects fit for supplying energy." The expression "owner" means any body or persons owning or using, or entitled to use, any electric lines or works, upon whom notice has been served by the Board of Trade requiring that such electric lines or works shall be continued and used only in accordance with the rules of the Board. The liability of an "owner" in these circumstances is very similar to that of an ordinary "undertaker," but here again the owner is only liable (under the rules) if the lines on the consumer's premises remain his property. Where, however, he acts as "wireman" and supplies the fittings, there will be upon him an implied obligation to provide wires and fittings which are free from defects.

While the cases above referred to make it clear that electrical undertakers may be held liable for damages caused by fire, they also appear to establish the fact that the existence of a fault must be proved.

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By Prof. G. KLINGENBERG, Dr. Ph.

(*Abstract of address delivered before the* Institution of Electrical Engineers, *December 4th*, 1913.)

There would be no demand for other forms of energy if all electric supply undertakings would fully recognise the advantages which our present-day knowledge and experience places at their disposal, and if they could rid themselves of the restrictions originally placed upon them in the supposed interests of the consumer, which restrictions are now very often found to be a hindrance to both consumer and producer.

It is the purpose of the present paper to explain the nature of these conditions and draw attention to those factors which would contribute towards a reduction in the cost of electricity and facilitate its more extensive employment.

Referring to existing conditions I have confined myself to three typical examples. The cities selected are Berlin, Chicago, and London, and the figures are based on the following years:—Berlin, 1911-12; Chicago, 1911; London, 1910-11.

In Berlin the electricity supply began with the purchase and operation of generating sets by commercial undertakings solely for their own requirements, and without intention of selling energy to outside consumers. This system was found to be convenient, as it was not necessary to lay conductors in the streets, and as complete independence of municipal authorities was possible. A number of these so-called "block stations" still exist, their combined output being estimated at nearly 40,000,000 kw.-hours. The Berliner Elektricitätswerke alone formed an exception in this respect; they were intended from the outset to supply current to outside consumers. They were also able to form a new supply area beyond the Berlin boundary, and to take financial interest in new undertakings. The price at which the current is supplied must be reduced when the net profit exceeds 12½ per cent. on the share capital. The city receives 10 per cent. of the company's gross income, and half the net profit after paying 6 per cent. on the share capital up to M.20,000,000, and again half the profit left after paying 4 per cent. above this amount. The sum paid out in this manner during the past financial year, for example, was M.7,184,000 (£350,000), which considerably exceeded the dividend paid on the company's share capital of M.64,100,000 (£3,150,000). The development of the Berliner Elektricitätswerke may be seen from the following figures for the energy sold:—

1900-1	Energy sold	= 69,700,000	kw.-hours
1905 6	„	= 126 200.000	„
1910-11	„	= 192,100,000	„
1912-13	„	= 244,300,000	„

The distribution in Berlin itself is on the continuous-current system throughout, with the exception of the suburbs and a section of the city in the north, which are fed directly with three-phase current.

In addition, a number of separate stations exist which supply energy to the underground railways and a part of the tramway system.

The Chicago electricity supply originated in a large number of small supply companies (approximately 36). In 1907 the com-

panies were amalgamated under the title of the Commonwealth Edison Co.

All the small power stations have been shut down since then, and the whole supply is obtained now from four large power stations. The concession extends over a period of 50 years, dating from the year 1897, and it stipulates the maximum rates to be charged by the company, and a payment of 3 per cent. on the annual gross receipts to the city.

The development of the company may be seen from the following figures for the energy sold :—

1900	Energy sold	=	33,700,000 KW.-hours
1905	,,	=	93,000,000 ,,
1910	,,	=	550,000,000 ,,
1912	,,	=	712,000,000 ,,

The sub-stations are fed with three-phase current at 9,000 volts, 25 cycles, and in part at 20,000 volts, 60 cycles. The distribution in the interior of the city is on the continuous-current system, while in the outlying districts three-phase current at a frequency of 60 cycles is adopted.

Electricity supply in London began, as in the case of Chicago, with a number of private companies. Their development was hampered, however, in the earlier stages by legal restrictions, which limited the concessions to a period of 21 years, and divided the current supply of the City into a number of districts corresponding to the administrative divisions, without taking into account the natural development of the distribution system. Every authorised supply undertaking was obliged to erect its own generating station and to lay out its own distributing network. An amalgamation of the different concerns was, therefore, out of the question until, in 1908, the original Act was modified by a new Bill. Since that time constant endeavours have been made to combine the numerous companies, to centralise the generation of energy, and to standardise the different distribution systems as far as possible.

I now propose to discuss the factors which determine the price of electrical energy. The cost of the plant per installed kilowatt should be mentioned in the first instance. In the power station the cost per kilowatt decreases rapidly as the size of the generating sets increases. For works with modern generating sets of 1,000 KW. capacity the installation costs are found to be approximately £15 per kilowatt, whereas for units of 20,000 KW. capacity they only amount to one-half of this sum. Bearing in mind that for large cities outputs of several 100,000 KW. are required, one will realise that units of less than 20,000 KW. capacity are unsuitable and too expensive for this purpose, and the installation of 30,000-KW. sets appears to be fully justified. In consequence of this development, the specific cost of power stations has fallen in about 10 years to nearly a quarter of its former value.

The conditions are not so favourable, as a rule, for the network. It is, nevertheless, possible to economise on the capital outlay of the distribution system. The use of higher working voltages should first be mentioned. The customary feeder cables for pressures of 6,000 to 10,000 volts no longer meet present-day requirements in large cities. Whenever extensions are contemplated, pressures of 20,000-30,000 volts should be adopted, at which it is possible to transmit outputs of more than 10,000 KW. through one cable. The cost of the feeder cable is reduced to about 2s. 6d. per kilowatt transmitted and per kilometre. A further means of reducing the cost of the network is found in the conversion of the entire system to a uniform A.C. system, by laying ring mains and by interconnecting the various sections of the city.

In my opinion, interest at 6-8 per cent. on the value of the plant represents for undertakings of this kind the lowest limit which would ensure a favourable market for the company when it requires further capital. As regards the sinking fund and other reserves, an average figure of 3-4 per cent. seems to be reasonable for power stations, sub-stations and distribution system ; for long-distance transmission lines and feeder cables in which the conducting material (copper) represents a high percentage of the total value, about 2 per cent. may be sufficient. I have therefore based the following calculations upon uniform capital charges of 10 per cent. for power stations, sub-stations, and distribution system, and 8 per cent. for transmission lines and feeder cables, and I have called the current prices calculated from this basis "normal prices."

The costs of generation are directly dependent on the size of the power station, or on the size of the generating sets. Power stations with units of 20,000 KW. capacity consume only about three-quarters of the quantity of coal at full load compared with works in which modern 1,000-KW. sets are installed and only half, or even less, of that consumed in older power stations with units of this size. The operating staff required depends chiefly upon the number of machines and not upon their size ; therefore labour costs are far more favourable in plants with large generating sets. The same applies to the sums required for repairs, stores, and general expenses. By sub-dividing the distribution system in accordance with the best engineering practice, one can effect economies. Here again attention should be drawn to the superiority of the A.C. systems over the mixed systems.

The transmission losses, which in the old plants amount to about 20 per cent. of the energy generated, and thus represent from 10 to 15 per cent. of the selling costs, can unquestionably be reduced to half this figure with the enlargement and standardisation of the plant, this being all the more the case in view of the fact that lower generating costs also reduce the cost of the losses.

The utilisation of the plant can be expressed by the following formula :—

$$n = \frac{\text{KW.-hours sold per annum}}{\text{installed capacity of plant} \times 8{,}760} = \frac{\text{average load sold}}{\text{installed capacity}}.$$

This term has been in use for some years on the Continent. I have called it the "utility factor" (u) of the plant. The use of this factor affords valuable assistance in arithmetically following up the somewhat intricate relations between the cost of the current and the utilisation of the plant.

The total selling costs per KW.-hour are found to be equal to the sum of :—

Proportion of costs referred to the power station, including capital charges.

Proportion of costs for the transmission and distribution losses, including capital charges.

Proportion of costs for the operation of the transmission system, including capital charges.

And they can be represented by a single equation—

$$K = a_1 u + a_2 u^2 + b \text{ shilling per KW.-hour sold,}$$

which is called the costs characteristic for the entire plant. With this equation one can ascertain the average energy costs for the entire plant, and one can also graduate the prices payable for the various classes of consumption in correct steps as soon as their individual influence upon the utility factor is known.

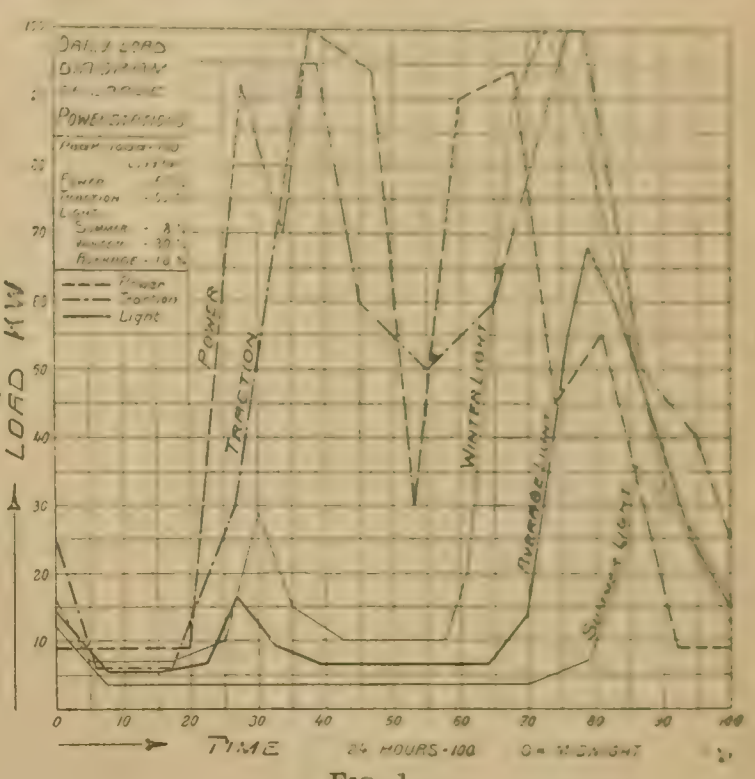


FIG. 1.

The load factor m is given for the entire plant by the ratio between the average load of the power station and the peak load, and can be expressed by the formula—

$$m = \frac{\text{KW.-hours generated per annum}}{\text{peak load} \times 8{,}760} = \frac{\text{average load}}{\text{peak load}}.$$

This value is proportional to the utility factor.

Characteristic load curves for power, traction and lighting are shown in fig. 1. The maximum load in all three cases is assumed to be 100, the day of 24 hours being divided into 100 parts, beginning at midnight. The load factors are—

Light	...	*ca.* 18 per cent. (Sundays excluded)
Power	...	*ca.* 50 ,, ,, ,,
Traction	...	*ca.* 50 ,, ,, ,,

From these standard curves we can obtain the resultant load curve, and also the resultant load factor "m," for any desired combination of lighting, power and traction consumers.

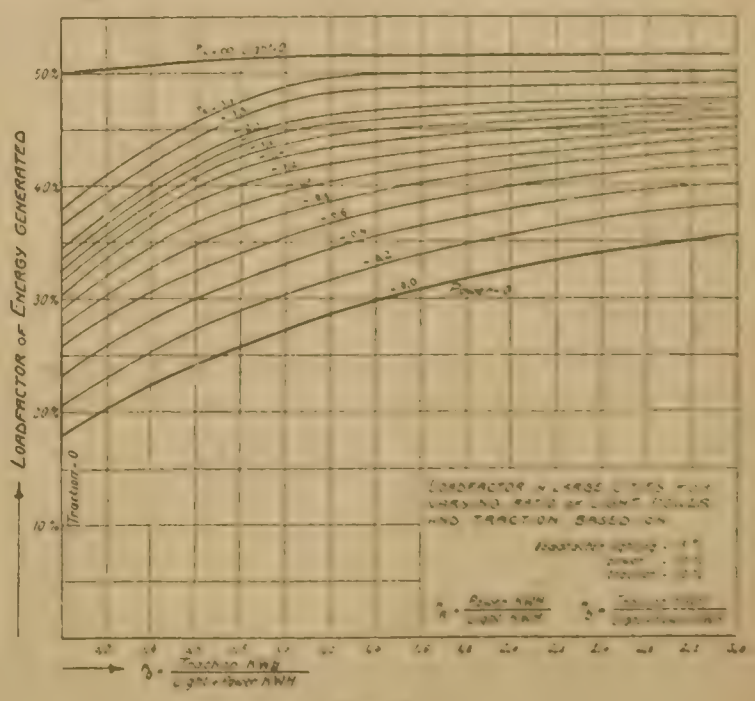


FIG. 2.

In order to include all conditions which have to be taken into account, and which are affected by various combinations of consumers and the degree of centralisation, a further diagram has been drawn up, fig. 2, based on the load curves given in fig. 1. From this

diagram the resultant load factor can be taken directly as soon as the percentages for power, traction and lighting are known. If, for instance, the KW.-hours consumed comprise 20 per cent. lighting, 12 per cent. power, and 68 per cent. traction (this approximately resembles the conditions in Chicago for 1911), then the resultant load factor lies at the intersecting point of the curve $r_k = 12/20 = 0{\cdot}6$, with the abscissa value $r_k = 68/(12 + 20) = 2{\cdot}13$, according to which a resultant load factor of 40 per cent. for the above relationship may be expected, and which approximately corresponds to the actual value obtained, namely, 41 per cent.

This diagram demonstrates the important fact that by superimposing power and traction curves (top curve $r_k = \infty$) the load factor may be improved only by 2 to 3 per cent., while, on the other hand, by combining the power and traction supply with a lighting load of about 12 per cent., the resultant power factor is not materially decreased.

Next to the load factor, the efficiency of the network has to be taken into account in determining the utility factor. This efficiency is expressed by—

$$\eta = \frac{\text{KW.-hours sold}}{\text{KW.-hours at feeder bus-bars}}.$$

This value is again in direct proportion to the utility factor.

The third point is the amount of stand-by, the utility factor being inversely proportional to the capacity of the stand-by. This percentage can be reduced with the increase in size of the total plant. The stand-by factor is—

$$r = \frac{\text{installed output}}{\text{peak load in station}},$$

where the decimals indicate the percentage in spares. The relation between utility factor, load factor, distribution efficiency and stand-by is given by the formula—

$$n = m \times \eta \times 1/r.$$

By inserting this value in the equation for the cost characteristic of the plant, the influence of any of the above factors upon the cost can be ascertained.

It is now proposed to give a summary of the operating conditions in the Berlin, Chicago and London plants. The author has succeeded, by making some assumptions, in determining the relation between working costs and utility factor, and has thus obtained the equation for the costs characteristic of all three plants. This conversion appeared to be necessary since the plants in question have totally different kinds of consumption, and therefore work with different utility factors. Any attempt to draw general conclusions on the advantages of one system over the other is bound to be misleading, unless this is done. Moreover, this analysis seemed to be the only means of obtaining a positive indication of the influence which the difference in centralisation of the three plants exercises upon the working and current costs.

(To be continued.)

Discussion.

Mr. John F. C. Snell, who opened the London discussion, said the author had indicated what any engineer would do if he were to tackle the London electricity supply problem afresh, but in London the L.C.C. had powers to purchase the companies in 1931, and no one know exactly what the terms would be, and this uncertainty made it difficult for the companies to raise money. In the case of a moderate-sized station, the cost of extension was not very high, and the production cost with modern plant was really small, so that it was a difficult matter for bulk supply to compete with extended plant. A bulk supply would always be preferable to building a new station in London, but a saving in one direction might be neutralised by conversion and transmission losses. As regarded the comparison of costs between Chicago and London, the cost of plant, &c., was, roughly, £69 per kilowatt in the first case, and £80 per kilowatt in the second. Some 700 million units were sold in Chicago, but no less than 480 millions were sold for traction at, say, '408d. per unit on a 50 per cent. load factor; this left some 230 million units for lighting, sold at an average of 2·3d. per unit. This figure compared with about 250 million units, and an average of about 2¼d. per unit for similar uses in London. In London the supply averaged about 70 units per head of population, in Chicago it was 100 units, but it was 100 units in the Marylebone area of London. In New York, 119 units, and in Boston, 110 units were sold per capita. The whole point lay in the fact that the transporation systems were not developed to the fullest extent in London. There was 310,000 KW. of generating plant installed in London, but 36 per cent. of this was reserve plant, due to the numerous small stations in use. Replacement by new bulk stations would, he estimated, enable a saving of about a million pounds per annum, or 26 per cent. in cost to the consumer, to be made. He felt that the moment when the various undertakings could have been purchased had gone by, and that consolidation was more difficult now in view of the new railway power houses, which were being put up. From personal knowledge he believed that it would pay to keep and extend eight of the existing stations; it would pay to retain seven others to a limited degree, while the other 36 stations should be gradually superseded. Including traction requirements, he looked forward to the normal addition of 150,000 KW. of plant during the next 10 years, and it would be unwise to spread this over a great number of stations. He thought, therefore, it might be wise to build a big station and gradually take over this load, the best solution being for one authority to undertake the generation and sell to the authorised distributors who would continue this work as at present. The author's proposal for colliery power stations involved difficulties with condensing water; the first cost of such a plant with transmission would be very high, and no account had been taken of battery costs, although batteries would be necessary. After reviewing the various estimates of cost for a distant and near station, and taking into account the estimated saving in cost of fuel, in the first case, he came to the conclusion, which agreed with the result of careful consideration some years previously, that any new station would be best situated not more than 10 or 15 miles from London.

Dr. Ferranti regretted that many of those whom they would have liked to have heard were at the moment precluded from speaking. Probably many business men in other countries felt that we were a curious people to put up with the conditions existing in London. These conditions originated in the preponderance of the politician over the business man and engineer; usually when the politician started out to benefit the public, the latter was nowhere. In London each area had its own little pet; in some areas it was deliberately arranged that opposing companies should supply A.C. and D.C. respectively, so the author must not imagine that the conditions were the result of considered design. The author undoubtedly showed a saving in cost, but such an argument would not, the speaker thought, be sufficient to alter the existing arrangements. There must be some great advantage to the public, such as a great cheapening of the cost of supply, and he had always felt that when electricity supply developed as it should do, the increased output would be so great as to justify the cost of making the change. Where there was combustion, there was a demand for electricity, which must be supplied from outside the town. He agreed with Mr. Snell, that in regard to distant stations the water supply was a governing factor; a station should be near the river or sea. The problem before them was to supply people with what they wanted, but in the way the supplier wanted. Any supply scheme must take account of the future demand for the whole district, and despite London's size, it could not be considered apart from the adjoining areas.

Mr. A. H. Seabrook, referring to the partnership basis existing in Chicago and Berlin, said the latter city seemed to have made the best bargain. He was glad to note that the author agreed that the surplus from lighting should be available to assist in developing "other uses." It might be as well to consider the question of gasifying coal and recovering the by-products now, and he suggested that the Kent coalfield as a site for a power station would also solve the water difficulty, being near to the sea.

Mr. Wm. C. P. Tapper thought the author's proposals were not practicable; to unify distribution systems would be most costly, and if A.C. distribution were adopted, much more copper would be required to provide against low power factors. He thought the author had overlooked the question of diversity factor, and entirely disagreed with him and Mr. Seabrook in the matter of making concessions to one class of consumer at the expense of another.

[Mr. Seabrook said his point was that a smaller profit could be accepted from a class of consumer which it was desired to encourage, and Mr. Tapper replied that he disagreed with the principle.]

The Author, in replying, said that in many ways he considered the three-phase system the best for distribution purposes, but he had only referred to high-pressure distribution to sub-stations in his paper. The effect of diversity factor has been taken into account in the paper, and could be inferred from its influence on load factor. The cost of lighting energy, owing to the expense of distribution, was bound to be greater than the cost of traction energy; the price charged must be a commercial consideration. His paper dealt with the London problem, in the abstract only; and as regarded the capital costs which had been criticised, he pointed out that he had built a station near Cologne recently, using 8,000 KW. units, and cooling towers, for 175 marks per KW., and he was quite prepared to adhere to the estimated costs given in the paper.

Prof. Klingenberg's paper was also discussed at a meeting of Scottish Local Section at Edinburgh, on Tuesday, December 9th.

Mr. F. A. Newington (Edinburgh) pointed out that while the author had taken three cities which he considered typical, London was the very worst example that could be taken in this country, because London started in the very early days of electricity, when under a benevolent government it was cut up into a large number of small areas, each supplied by one or two small undertakings, the object being to prevent a monopoly as in the case of gas. Now they saw that that was a great mistake as it had rendered it impossible to have a general supply from large stations. The author assumed that it might be possible to scrap the whole of the present stations and to build large new central stations, but he did not know how the Professor was going to get over the enormous capital difficulty. He believed the whole outlay was over £30,000,000. The existing mains the Professor thought would do, but the generating plant would have to be scrapped and that might mean writing off between four and five millions. The professor did say that the paying-off of the debt had been allowed for, but he did not show how. In his (Mr. Newington's) opinion this would very much outweigh the benefits of the new generating stations. Berlin seemed to be very fortunate, in that when the larger stations were started, he supposed the individuals who were running small private stations shut them down or still used them, but there was no question of attempting to buy up these undertakings. In Chicago they bought up the old undertakings for 10 or 15 per cent. of the cost of the new works, which was an extremely low price. The paper might be of value 20 years hence when the local authority of London, or the London County Council, would be considering the buying up of the present undertakings,

The author suggested transmitting 10,000 KW. through one cable; that, of course, with the Board of Trade Regulations as they were at present, they could not do. Further on the Professor talked about 20 per cent. loss in transmission in the other systems. With continuous-current systems at any rate that was far too high a figure —7 or 8 per cent. was a great deal nearer—and he thought that if a city was not too large for low-tension supply, the loss must be less than with high-tension supply and transformation. With the long distances they must use high-tension transmission, but the loss must be greater. Subsequently in the paper the author gave a figure of 50 per cent. load factor for power and 50 per cent. for traction; 50 per cent. for power was far too high a load factor. That was to say, that the works were operating at their full output for 12 hours a day; where did that happen? 20 to 25 per cent. was a much more likely figure than that given 50 per cent. for traction was far too high; he thought 30 per cent. would be nearer the mark. The most important point in the matter, however, had been left out, and that was the selling price. So far as he could see, the only reference to that was where the author said that the selling price in London was 13 per cent. lower, and in Berlin about the same percentage higher than the normal value. Did he take Chicago as the normal? If so, London was not doing badly.

Mr. SAM MAVOR thought there could be no doubt whatever that the association in the same power station of general plant for lighting, power and traction in large cities was a proper policy, and the economies to be derived from that were quite well brought out in the paper. The figures given for the relation of the stand-by plant to the peak load appeared to him to be very high for stations of different capacities. Even if generators only were included, the figure of 40 per cent. was extremely high; even 25 per cent. seemed to be very high for large plants unless the individual units were very large, and the size of the individual unit must have a bearing on the size of the stand-by plant. If a station with a capacity of 100,000 KW. was composed of units of 10,000 KW. it could do with less than 25 per cent. above the peak load. He thought this whole subject must remind them of the prescience of Dr. Ferranti, but his very bold scheme at Deptford unfortunately did not realise anticipations, largely because the generating plant was not at that time available to carry it out. He also missed any direct reference to the selling price, and that was a very important factor. In Glasgow they had selling costs lower than any other city he had heard of. In his own case for domestic supply the average cost for lighting, heating and other purposes amounted only to about 1¼d. per unit.

MR. W. L. SPENCE referred especially to the influence of combined load-factors upon reduction of cost of supply. He agreed with the author that it was not of importance to reduce the cost of traction supply, for two reasons: The cost of power for traction was a very small proportion of the operating cost; and in the second place, he thought electric tramways were a horrible anchronism, and they ought to be swept away for something more up-to-date. It was shown that the load factor of lighting was 18 per cent., and its influence upon the total load-factor was very small. If that was so at the present stage of electric lighting, the argument was likely to be greatly strengthened as time went on, for they were not in sight of ultimate efficiency in lighting, whereas they were in the transformation of electric energy into power and heating.

MR. SIMON disagreed with Mr. Newington as to London being a bad example to take for comparison. The conditions in the Metropolis were not at all dissimilar from those in other cities with a large population, and what applied to a large city would apply to a large area. The present conditions made it difficult for manufacturers and others to get the necessary different stocks or even to manufacture them, and this must tell on the prices. Any system which would conduce to greater uniformity and cheapening of costs must have serious and immediate consideration.

MR. SEDDON said it seemed that the question of the individual load factor was entirely wrong, for cost depended upon the station load factor. The scrapping of existing plant was a very important consideration when one had paid a large price per KW. for small plants, and the law which said they could not scrap the plants before paying for them had to be considered.

MR. HELME considered that what was wanted in London was not the limiting of the natural load factor, but better catering for the consumer in the matter of heating and cooking. Central-station engineers had been far too anxious in the past to get large individual works upon their mains; that often resulted in cutting prices to such a rate that it was debatable whether they could generate for the price secured.

The CHAIRMAN thought it was remarkable that the London stations came out so well as they did, when they considered that many of those small stations had no condensing apparatus and the transport of coal was very costly. If they deducted from the Berlin costs the amount of municipal participation, the relative costs were: London 1·024; Berlin ·612 and Chicago ·54. If London was to be taken as the best they could do in the way of developing electricty it was not a fair comparison. There were pioneer companies in London with obsolete plant, which were under legislative conditions that did not exist at all upon the Continent. The purchase conditions of the Act of 1888, which extended the period during which a company could operate an undertaking before purchase to 42 years, had never yet been defined in a court of law, and the result was that the companies in London at the present time were working towards the time when they knew they would be bought out, but they had no idea of the conditions upon which they would be bought; it might be scrap value, or it might be something better, and under these circumstances it was not to be wondered at if the companies hesitated to spend large sums of money in building more stations for bulk supply. It seemed a feasible thing to put down generating stations in a coalfield, but the nearest coalfield to London was about 60 or 70 miles off, and when they did come to the coalfields they might find that something might be wanting which was quite as important as cheap fuel in a modern power station. The turbine was dependent as much on a cheap water supply as upon a cheap coal supply, and the site of a station must be chosen where there was both cheap coal and cheap water. Dr. Klingenberg informed them that the Berlin municipality got 10 per cent. of the gross income of the supply company, and participated in the profits when a certain percentage had been earned. They heard a great deal of the wickedness of taking profits from electricity undertakings in aid of the rates, but nobody here had suggested that anything like 10 per cent. of the whole income before the profit was declared should go in aid of the city treasury. Such a charge as that, which meant in this case more than the whole coal bill, was undoubtedly a big charge against consumers, and he did not think it was a proper or fair thing to make the industry pay such a charge.

MR. LACKIE said he agreed with Mr. Newington that there was no comparison between London and Berlin and Chicago. He believed the load factors mentioned in the paper could be got with the universal supply of electricity. It was only a few years since a Glasgow firm generated as much as the city was doing, and on a load factor equal to 60 per cent. He believed that the tramway load in Glasgow had only a 36 per cent. load factor, but in Chicago the load factor over all was 41 per cent. He thought the only thing mentioned in the paper about spare plant was that there should be 1 unit spare; out of four 10,000-KW. sets there should be at least one spare. The putting down of a station near a coal mine raised a very debatable question. If they did so they were tied there, and if a coal strike took place there, where were they going to get their coal from? It was better to be so situated that they could get coal from any pit. In Chicago they were building three large stations on one site, within 20 miles of good coal, and yet they believed that it was right to build inside the city and bring the coal in. For units sold per head of the population, Greenock held the record in this country at 135, which was double what it was in Glasgow; that showed that the nature of the load was largely power. The amount of capital spent in Chicago in putting down battery substations last year was half a million pounds. They believed there that they must do everything to ensure reliability of supply, and the whole of the centre of the city could be lit from storage batteries if necessary. This meant a rise of £2 per KW. in the cost of the plant.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIA.—The Customs Authorities have issued new regulations regarding the certificates of origin required in order to obtain entry of goods under the Preferential Tariff applicable to British goods. It is now laid down that in instances where manufacturers' invoices accompany suppliers' (*i.e.*, middlemen's) invoices and it is clear from the marks and numbers or other evidence in the documents that the manufacturer was aware that the goods were destined for Australia, the certificate of origin for Preference must be made in the manufacturer's invoice if entry is desired under the tariff for British goods. Suppliers' invoices and certificates will, however, be accepted until March 1st, 1914, but importers are to be informed of this time limit in cases where manufacturers' invoices are submitted of the kind referred to above and not bearing certificates. The following new regulation has also been made:

Manufacture in United Kingdom.—Provided the conditions prescribed have been complied with, preferential treatment will be accorded to goods the manufacture of which has been partially effected outside the United Kingdom, on condition that the goods have been subjected to their finishing processes in the United Kingdom and that the total British labour calculated in accordance with the provisions set out in these Explanatory Notes represents not less than one-fourth of the works cost of the goods.

The former regulation read "providing such finishing processes represent one-fourth of the works cost of the goods."

The Customs Authorities have also issued a decision to the effect that "electrical appliances—coils, translator for telephones" shall be dutiable at the rate of 20 per cent. *ad val.* if of British origin and 25 per cent. *ad. val.* if of foreign origin.

NEW ZEALAND.—The New Zealand Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation into the Dominion; the duties are in all cases those leviable under the Preferental Tariff granted to British goods:—

Lightning protectors, switchboards, wall terminal blocks, micro-telephones and telephone head receivers, and breast transmitters, 20 per cent. ad. val.

"Delco" lighting, starting and ignition system for motor cars, consisting of an electric battery, dynamo, and switch: if imported attached to chassis, free; if imported separately, dutiable according to class by parts.

BRAZIL.—The special surtax of 2 per cent. on goods imported into Brazil via Para has been re-established to date from November 1st.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,206. "Electric night-lamp combination adaptor fitting." E. Wilson. December 8th.

28,234. "Mechanism for producing a step-by-step motion by electrical means." Eyeshed & Vevoles, Ltd., and J. C. Needham. December 8th. (Complete.)

28,267. "Sparking-plugs." M. Pognon. December 8th. (Convention date, December 31st, 1912, France.) (Complete.)

28,277. "Line or wireless telegraph systems." W. H. Shephard and A. E. McKechnie. December 8th.

28,278. "Line or wireless telegraph systems." W. H. Shephard and A. E. McKechnie. December 8th.

28,286. "Electrodes for search-lights." Geb. Siemens & Co. December 8th. (Convention date, December 7th, 1912, Germany.) (Complete.)

28,291. "Electro-mechanical switching-systems for inter-connecting telephone lines." H. Baron. December 8th. (F. Aldemdorff, Germany.) (Complete.)

28,292. "Regulating-devices for electric motors." W. G. Haywood. December 8th.

28,338. "Accumulators." H. W. van Raden. December 9th.

28,355. "Apparatus for heating liquids electrically." British Electric Heater Co., Ltd., and C. Kratt. December 9th.

28,369. "Means for the production of sparks according to Wien's method." Dr. E. F. Huth G.m.b.H. December 9th. (Convention date, December 27th, 1912, Germany.) (Complete.)

28,376. "Telephone relays and the like." W. Aitken. December 9th.

28,409. "Wireless telegraphy." F. G. Sargent. December 9th. (Complete.)

28,413. "Receivers for use in wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. December 9th.

28,415. "Apparatus for the production of electricity for use in the treatment of birds and animals." T. T. Baker. December 9th.

28,421. "Electric-lamp fixtures." R. Doi. December 9th. (Complete.)

28,423. "Machines for making fibre tubes." C. Mehlum. December 9th. (Convention date, December 26th, 1912, United States.) (Complete.)

28,444. "Process for the manufacture, isolation, and enrichment of radium and other radio-active substances. E. Ebler. December 9th. (Addition to 2,155/12. Convention date, December 11th, 1912, Germany.) (Complete.)

28,445. "Process for treating ores of radium, mesothorium, thorium, and other radio-active substances." E. Ebler. December 9th. (Convention date, February 27th, 1913, Germany.) (Complete.)

28,499. "Electric switch and gas-cock combined." E. Plumstead. December 10th.

28,502. "Switching apparatus for inter-connecting telephone lines by electro-mechanically-controlled switches." F. Aldendorff. December 10th. (Complete.)

28,527. "Electrical systems and switch mechanism therefor." R. Amberton. December 10th.

28,535. "Current-interrupting devices for electric igniting-apparatus used in internal combustion engines." P. Schroter. December 10th. (Convention date, December 11th, 1912, Germany.) (Complete.)

28,546. "Method of carrying out chemical reactions by means of ultra-violet rays." Jacoviello Soc. Anon. and J. von Kowalski-Wierusz. December 10th. (Convention date, December 11th, 1912, Germany.) (Complete.)

28,558. "Electrical accumulators or secondary batteries." H. W. van Raden. December 11th. (Addition to 25,727/13.)

28,559. "Telegraph tape transmitter." D. Murray. December 11th.

28,560. "Telegraph printer." D. Murray. December 11th.

28,578. "Enumeration of telephone calls." S. D. Williams. December 11th.

28,602. "Wireless telegraphy." E. C. Hoegerstaedt and H. S. Wescott. December 11th.

28,630. "Electrolytic converter for the transformation of alternating currents into continuous currents." A. Heinz. December 11th. (Convention date, January 21st, 1913, France.) (Complete.)

28,633. "Switching-devices for electric installations." Siemens Bros. Dynamo Works, Ltd. December 11th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

28,634. "Electric fuses for blasting purposes." Bickford-Smith & Co., Ltd., and W. N. Bickford-Smith. December 11th. (Complete.)

28,703. "Automatic control system for electric railways." B. F. Hutches. December 12th. (Complete.)

28,715. "Arrangements for destroying residual magnetism." Fried. Krupp Akt. Ges. December 12th. (Convention date, January 10th, 1913, Germany.) (Complete.)

28,734. "Galvanic cells." J. Zaruba & Co. December 12th. (Convention date, December 13th, 1912, Germany.) (Complete.)

28,746. "Terminal pieces and contacts for electric circuit interrupters." F. B. Holt. December 12th.

28,755. "Device adapted to intensify current impulses in telegraphic and other signalling." W. E. Evans. December 12th. (M. N. K. B. M. Johansen, China.)

28,757. "Manufacture of radio-active preparations." Radiogen-Ges. December 12th. (Convention date, December 13th, 1912, Germany.) (Complete.)

28,802. "Switching apparatus for telephone systems." Western Electric Co., Ltd. December 13th. (F. T Woodward, Belgium.) (Complete.)

28,822. "Arrangements for setting apparatus from a distance by electricity." Siemens Bros. & Co., Ltd. December 13th. (Siemens and Halske Akt. Ges., Germany.) (Complete.)

28,823. "Electric condensers." A. G. Bloxam. December 13th. (Robert Bosch (Firm of), Germany.) (Complete.)

28,824. "Containing-vessel for a granular mass of which the electric resistance is varied by pressure." Robert Bosch (Firm of.) December 13th. (Convention date, January 9th, 1913, Germany.) (Complete.)

28,826. "Alternating-current electric meters of the induction type." British Thomson-Houston Co., Ltd., and A. P. Young. December 13th.

28,829. "Transmitting apparatus for use with wireless telegraph or submarine sound signalling systems." W H. Shephard and A. E. McKechnie. December 13th.

28,833. "Method of inter-connecting lines by electro-mechanically controlled switches." H. Baron. December 13th. (Fritz Aldendorff, Germany.)

28,838. "Telephone or like instruments." W. H. Derriman. December 13th. (Automatic Enunciator Co., United States.) (Complete.)

28,839. "High frequency electric current generators." P. O. Pedersen. December 13th. (Convention date, December 19th, 1912, Denmark.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,209. Gas or Electrically Heated Wash-boilers, Boiling-pan, and the like. L. Schofield. September 18th. (March 18th, 1913.)

23,429. Composite Material suitable for use in the Construction of Heating Elements, Rheostats, and the like. A. C. Whish. October 14th.

26,499. Automatic Telephonic Apparatus. B. Degenhardt. November 18th. (November 18th, 1911. Patent of Addition not granted.)

26,548. Incandescence Filament Lamps. J. R. Quain. November 19th.

26,603. Self-starting Device for Motor-car and Marine Engines and the like. S. B. Seropian. November 20th.

26,752. Methods of and Apparatus for Charging Storage Batteries. D. H. Wilson. November 21st. (Convention date not granted.)

26,953. Electric Conduit Junction Boxes or like Electric Fittings. F. H. Terry, H. M. Bigwood and Brotherton Tubes & Conduits Ltd. November 23rd. (Patent of Addition not granted.)

27,312. Electrical Devices for the Distant Transmission of Positions. British Thomson-Houston Co. Allgemeine Elektricitäts Ges. November 27th

29,176. Electric Compressors. E. Morisot. December 18th.

29,268. Obtaining of Uni-directional High Tension Discharges. Sir O. J. Lodge and L. Lodge. December 19th.

29,597. Lamps for Ophthalmoscopic and Larynoscopic purposes. E. M. Wyche. December 23rd. (Cognate Application, 378/13.)

1913.

79. Electrical Terminals. S. W. Martyn. January 1st.

1,286. Shade or Globe Carrier for use with Electric Lamp-holders. M. J. Railing and G. Maurice. January 16th.

1,471. Electric Contacts. F. M. Mildey. January 18th. (Cognate Application, 4,383/13.)

2,577. Electric Furnace with Electrodes Passing through Charging Receptacles. A. Helfenstein. January 31st. (February 4th, 1912.)

3,335. Alarm Apparatus for the Protection of Conduits of all kinds, and especially of Electric Mains. A. L. Pucel. February 8th. (February 14th, 1912.)

3,864. Electric Heating and Lighting Devices. A. C. Michie & Sir R. A. S. Paget. February 14th.

3,987. Switching Arrangements for Automobile Lamps. M. S. Conner. February 17th.

5,173. Magazine Arc Lamps. A. E. Spencer, & Johnson & Phillips, Ltd. March 1st.

6,192. Wireless Clock-synchronising Apparatus. R. L. Roze des Ordons. March 12th. (March 13th, 1912.)

6,359. Lightning Arrestors. G. Giles. March 14th.

6,700. Miners' Electric Safety Lamps. P. Wolf. March 18th.

6,965. Arc Lamp Globes. S. L. Pearce and A. Wilkinson. March 22nd.

9,169. Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) April 18th.

9,264. Mounting of Carbon Brush Holders of Magneto-electric Ignition or other Machines. Robert Bosch (Firm of.) April 19th. (February 22nd, 1913.)

9,590. Enclosed Electric Furnace with Upper Charging Chutes. Helfenstein Elektro-Ofen-Ges. April 23rd. (April 27th, 1912.)

10,556. Telephone Fixtures. W. C. Ude. May 5th. (May 3rd, 1912.)

10,900. Automatic Electric Alarms, Signals, and the like. P. Dunne. May 8th.

11,430. Rotary Magnetic Separators. E. C. R. Marks (Maschinenbau-Anstalt Humbolt.) May 16th.

12,061. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. May 23rd. (May 25th, 1912.)

15,116. Reflectors. F. Holland. July 1st.

15,566. Electric Radial Selector Switches. Sterling Telephone and Electric Co., and W. Allcock. July 5th.

17,725. Dynamo-electrical Machines. D. H. Andrews and E. C. Ketchum. August 1st.

17,925. Electrodes for Electric Furnaces. Fried. Krupp Akt. Ges. August 6th. (September 18th, 1912.)

19,928. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. September 3rd. (September 11th, 1912.)

19,939. Transmitter Devices for Copying and like Telegraphic Apparatus. A. Rappenecker. September 3rd.

20,822. Multiple Telephony. H. Tietgen. September 15th.

Electric Smelting of Iron Ore.—The Swedish engineer, Director A. Grönwall, applied some time ago to the Swedish Government, for a mining concession in connection with the erection of a large electrical iron works at Küruna, in the north of Sweden. This application was approved by the mining inspector of the district. The iron ore for the projected new works will be extracted from the well-known Luossovare Mines, which are under the control of the Grängesberg Co. until 1932, when the mines will be taken over by the State, provided that the existing contract is not prolonged. The production of the new works has been estimated at 25,000 tons of pig iron per annum, for which there will be required 8,500 E.H.P. The energy will be derived from the Porjus Electrical Works, which have been erected by the State in connection with the electrification of the railway from Küruna to the Norwegian frontier. After the regulation of the river and the harnessing of the Porjus Waterfalls it was found that the supply of water, and consequently the available energy, was much larger than was anticipated, and it will thus be possible to produce energy in excess of the amount required by the railway at a very low cost. The estimates for the new electrical works are based on a cost of energy of 35s. 2d. per H.P.-year.

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